

# IWVGA ADMINISTRATIVE OFFICE

*STAFF REPORT*

---

**TO:** IWVGA Board Members

**DATE:** June 18, 2020

**FROM:** IWVGA Staff

**SUBJECT: Agenda Item No. 11 – Board Consideration and Adoption of Engineer’s Report for the Adoption of a Basin Replenishment Fee, Authorize The Mailing of Notices on the Same and Setting Hearing For August Board Meeting**

## **DISCUSSION**

As the Board is aware, the Basin’s Sustainable Yield is insufficient to meet the water needs of the Basin that could/should be classified as permanent needs and as such the IWVGA must rely on imported supplies. Additionally, it has been determined that the decades of severe overdraft and inaction have already damaged the Basin significantly and recent Basin model runs have demonstrated the need for urgent and significant actions to preserve the community and bring the Basin into Sustainability as required by SGMA. In fact, the Baseline Model run projects that without action to cure the severe overdraft, the Basin’s infrastructure will not be able to produce the needed groundwater in less than 45 years (2065).

The attached Engineer’s Report provides for, and recommends, the adoption of a \$2,130 per acre foot Basin Replenishment Fee (Replenishment Fee). The proposed Replenishment Fee is a composite volumetric charge that will fund the first phase for the IWVGA’s Groundwater Augmentation Project, which is the purchase costs estimated at \$2,112 per acre foot over five years and the associated Shallow Well Mitigation Project costs which are estimated to be \$17.50 per acre foot until import supplies are brought on line.

As also provided for in the Report, De Minimis extractors and Federal extractors are exempt from the Replenishment Fee, as well as those that have permission to extract unused portions of the Navy’s estimated Federal Reserve Water Right interest (carryover extractions discussed below).

The purchase costs are a one-time cost and they are correlative per acre foot so increases, or decreases, in the final project size do not affect the per acre foot cost analysis. Accordingly, the actual amount of needed import supply could be less if those holding what are believed to be a permanent needs obtain water from a source other the Basin’s groundwater. As example, if Searles Valley Mineral is able to lower its presumed demand and/or use water from a source other than this Basin, then Searles Valley Mineral’s total costs would be reduced and the IWVGA will not need, and will not purchase as much import water.

Accordingly, the only true estimate for the potential import demands is to set the fee at the actual costs and then adjust the ultimate import needs based on actual pumping that occurs. The IWVGA has already experienced a situation with the GSP Fee which was originally based on reported pumping needs that never actually materialized. In fact, one pumper (Meadowbrook Dairy) has expressly stated that it lowered

their demands because of the GSP Fee. As a result, it would be prudent to set the fee at the amount needed and then adjust the importation purchase as dictated by the rate payers' willingness to rely on import water or reductions in their needs.

If an entity needing import supplies would like the benefit of a ramp up or extended payment period that entity could, and probably should, immediately seek outside financing to achieve that goal. Importantly, such an action will not only lower the initial impacts of fees, it will most likely lower the initial purchase costs which are likely to only increase in the coming months and years as basins throughout the State adjust to SGMA.

Also, because the cost per acre foot for imported water is correlative, the size of the project is irrelevant to the per acre foot charge and any increase, or decrease, in the amount of water needed will be adjusted without any need to change the estimated analysis in the report. To illustrate the point, let's presume an import supply of only 100 acre feet per year is needed. In that case, the cost calculation would be as follows:  $100/.62$  (needed 100 af divided by the State reliability factor of .62) x \$6,500 (estimated purchase cost based on actual recent sales) = \$1,048,387 (total purchase cost). The total purchase cost of \$1,048,387 is then divided by the 100 acre foot need and the five year payment period for a total of \$2,097 per acre foot ( $\$1,048,387/100/5 = \$2,097$ ). The additional \$15 in the Report to achieve \$2,112 per acre foot is reflected in five years' worth of administration costs.

As noted in the Report, the Navy has asserted that its water needs include the off-Station demands for its workforce and their dependents, so it is presumed that the Navy will supply water to its workforce through those off-Station water providers in accordance with the following chart.

<b>Pumping Group</b>	<b>Current Est Pumping</b>	<b>Navy Use/Carryover</b>	<b>Augment Supply Need</b>
<b>Navy</b>	<b>1,450</b>	<b>1,450</b>	<b>0</b>
<b>De Minimis Wells</b>	<b>800</b>	<b>800</b>	<b>0</b>
<b>City of Ridgecrest</b>	<b>373</b>	<b>373</b>	<b>0</b>
<b>Kern County</b>	<b>18</b>	<b>18</b>	<b>0</b>
<b>IWVWD</b>	<b>6,507</b>	<b>4,390</b>	<b>2,117</b>
<b>Inyokern CSD</b>	<b>102</b>	<b>102</b>	<b>0</b>
<b>Small Mutuals</b>	<b>300</b>	<b>300</b>	<b>0</b>
<b>Trona DM</b>	<b>217</b>	<b>217</b>	<b>0</b>
<b>SVM</b>	<b>2,413</b>	<b>0</b>	<b>2,413</b>
<b>Total</b>	<b>12,180</b>	<b>7,650</b>	<b>4,530</b>

If the Navy's on-Station needs increase the carryover will decrease accordingly and additional augmentation supplies will be needed. As example, the Navy has reported a near term future growth plan which will bring the on-Station need to 2,041 af. If, and when, that growth comes about the carryover will decrease by 591 af and the needed augment supply will increase to 5,121 af. The carryover has not been adjusted on a proportional basis because the Basin's "commercial" demands are almost exclusively found within the IWVWD.

Qualified groundwater extractors not listed on the chart will have the opportunity to either take part in the

Transient Pool Program, the Fallowing Program or continue their use through the payment of the Replenishment Fee. New groundwater extractors and/or those that have not qualified for the Transient Pool Program and the Fallowing Program may continue to extract groundwater from the Basin subject to the payment of the Replenishment Fee.

**RECOMMENDED BOARD ACTION(S)**

Therefore, it is recommend that the Board set the Replenishment Fee \$2,130 per acre foot for notice purposes, direct staff to prepare and mail notice, and set a public hearing on the same for the August 20<sup>th</sup> Board meeting.

*The page intentionally blank*

**DRAFT**

**Indian Wells Valley Groundwater Authority**

**Engineer's Report For the**

**Adoption of a**

**Basin Replenishment Fee**

**June 18, 2020**



---

Table of Contents

Definitions ..... 4

1.0 Purpose ..... 5

    1.1 General Summary..... 6

2.0 Basin Background ..... 7

    2.1 Basin Location ..... 7

    2.2 Basin Water Supplies ..... 8

    2.3 Basin’s Sustainable Yield of 7,650 af..... 10

    2.4 Basin’s Current Condition..... 11

    2.5 Navy Federal Reserve Water Right ..... 13

    2.6 Navy Federal Reserve Water Right Transfer..... 15

3.0 Indian Wells Valley Groundwater Authority ..... 15

    3.1 Formation..... 15

    3.2 Mission ..... 16

    3.3 Organizational Structure ..... 16

    3.4 Jurisdiction ..... 17

4.0 Authority Costs and Revenues..... 17

    4.1 Historic Costs and Revenues ..... 17

    4.2 Groundwater Extraction Fee ..... 17

    4.3 Post GSP Revenue Authority ..... 19

5.0 Groundwater Supplies and Sustainability..... 21

    5.1 Existing Water Supply Facilities ..... 21

    5.2 Augmentation Management Action ..... 22

    5.3 Alternatives to Augmentation Project ..... 24

        5.3.1 Basin Mining ..... 24

        5.3.2 Wastewater Recycling ..... 25

6.0 Augmentation Project Costs..... 25

    6.1 Purpose ..... 25

    6.2 Revenue Requirements ..... 26

    6.3 Imposition and Exclusions ..... 26

7.0 Shallow Well Mitigation Project ..... 27

7.1	Purpose .....	27
7.2	Revenue Requirements .....	28
7.3	Imposition and Exclusions .....	29
8.0	Basin Replenishment Fee .....	29
8.1	Purpose .....	29
8.2	Imposition and Exclusions .....	30
8.3	Fee Structure.....	30
9.0	Parcel Identification.....	30

**Figures**

Figure 2-1: Authority General Location

Figure 2-2: IWVWD and NAWS China Lake Historical Groundwater Production

Figure 2-3: IWVWD and NAWS China Lake Historical Groundwater Production Compared to Sustainable Yield

Figure 2-4: Authority Jurisdictions and Boundaries

Figure 6-1: NAWS China Lake Area De-Designated for Municipal/Domestic Water Use

**Exhibits**

Exhibit A: Report on the Indian Wells Valley Groundwater Basin’s Sustainable Yield of 7,650

Exhibit B: Indian Wells Valley Groundwater Authority Water Marketing Strategy Technical Memo, August 2019

Exhibit C: Navy Letter Subj Groundwater Resources, February 20, 2019

**Appendices**

Appendix A: 2019 Equalized Tax Roll for Kern County

Appendix B: 2019 Equalized Tax Roll for Inyo County

Appendix C: 2019 Equalized Tax Roll for San Bernardino County

## Definitions

**Augmentation Project** = Project described in Section 6.0

**Authority** = Indian Wells Valley Groundwater Authority

**Basin** = Indian Wells Valley Groundwater Basin

**De Minimis Extractors** = A person who extracts, for domestic purposes, two acre-feet or less of groundwater per year (California Water Code Section 10721(e))

**GSA** = Groundwater Sustainability Agency

**GSP** = Groundwater Sustainability Plan

**IWVGA** = Indian Wells Valley Groundwater Authority

**IWVGB** = Indian Wells Valley Groundwater Basin

**Mitigation Project** = Project described in Section 7.0

**Replenishment Fee** = Fee described in Section 8.0

**SGMA** = Sustainable Groundwater Management Act

**Sustainable Yield Report** = Report on the Indian Wells Valley Groundwater Basin's Sustainable Yield of 7,650" (draft of which is included and incorporated as Exhibit A)

**Water Marketing Memo** = Indian Wells Valley Groundwater Authority Water Marketing Strategy Technical Memo of August 2019

## 1.0 Purpose

This Engineer's Report (Report) is prepared in accordance with California and Federal law. Its purpose is to provide for, and describe, the estimated costs to be funded by the Indian Wells Valley Groundwater Authority's (IWVGA or Authority) Basin Replenishment Fee (Replenishment Fee). The proposed Replenishment Fee is a composite volumetric charge that will fund the IWVGA's Groundwater Augmentation Project (Augmentation Project) and Shallow Well Mitigation Project (Mitigation Project).

The Augmentation Project will bring imported surface water into the Indian Wells Valley Groundwater Basin (IWVGB or Basin), while the Mitigation Project will mitigate the impacts to shallow wells from the continued overdraft of the Basin during the purchase, design and construction phase of the Augmentation Project. For simplicity and efficiency, it is recommended that these two separate costs centers, which are properly charged to the same individuals on the same per acre foot basis, be combined into the one composite charge named the Basin Replenishment Fee.

California law requires that the costs of these Projects be identified and equitably distributed in accordance with, and proportionate to, the special benefits derived from the projects and, as such, the costs and funds for each Project will be accounted for and analyzed separately.

As more thoroughly provided for in the IWVGA's "Report on the Indian Wells Valley Groundwater Basin's Sustainable Yield of 7,650" (Sustainable Yield Report)(a draft of which is included and incorporated as Exhibit A), De Minimis extractors, as defined by the Sustainable Groundwater Management Act (SGMA), and Federal extractors will not be charged the Replenishment Fee. Federal law prohibits the IWVGA from regulating and/or charging the Federal extractors, regardless of the special benefits provided to those lands. De Minimis extractors are exempted because SGMA has excluded them from extraction fees by excluding them the metering and reporting requirements of SGMA.

## 1.1 General Summary

The IWVGA is the exclusive Groundwater Sustainability Agency (GSA) for the Basin. As such, the Sustainable Groundwater Management Act (SGMA) requires IWVGA to adopt, monitor, and implement a Groundwater Sustainability Plan (GSP) that achieves Basin sustainability by no later than 2040.

After considerable public examination of the technical data by the IWVGA Board and two separate committees, it has been determined that the Basin's sustainability cannot be achieved through pumping reductions alone because the annual sustainable yield of 7,650 acre-feet (af) is insufficient to meet the Basin's most minimal needs; let alone the possible and/or probable needs of the Basin, which require an anticipated minimum importation of at least 5,000 af annually.

The Augmentation Project costs reflect the anticipated costs to provide imported water supplies to those lands that must rely in part, or in whole, on imported water supplies. In general, the Augmentation Project costs can be naturally broken down into two phases; the first phase is the water purchase component and the second phase is the transportation infrastructure component. This Report focuses on the water purchase component. The transportation infrastructure component is presently uncertain and not addressed because there are two possible construction alternatives and it's anticipated that grant funding, and/or possibly voluntary federal funding, will help mitigate the ultimate construction costs. Accordingly, this Report estimates a total purchase cost of \$52,422,500 million dollars for the needed 5,000 af import supply. Given the urgency and the current and anticipated water markets, it is highly recommend that the IWVGA obtain this water purchase before no later than the end 2025 and even sooner if at all possible as it is highly likely that the costs of water will only increase in coming years as Basin's adjust to SGMA. The related costs for Project administration/negotiation/legal is estimated to be at least \$377,500 over the five year period, bringing the total estimated costs to \$52,800,000; which, when split over a five year period, equates to a per acre foot extraction charge of \$2,112.

The Mitigation Project costs reflect the anticipated costs to provide the necessary funds to mitigate the impacts on shallow wells as a result of the continued over drafting of the Basin. While this is a separate fee with a separate cost analysis, this Fee is paid by the same group as the Augmentation Fee and the anticipated costs are rather linear and generally increase in direct correlation to the amount of overdraft pumping. This report estimates that the costs of the described Mitigation Project equates to a per acre foot extraction charge of \$17.50.<sup>1</sup>

While these two cost centers represent separate fees that must be tracked and accounted for separately, for charging simplicity and efficiency, this Report recommends that these two separate costs centers be combined into one composite charge named the Basin Replenishment Fee, which should be set at \$2,130 per acre foot of groundwater extracted from the Basin.

De Minimis extractors and Federal extractors are exempt from the Replenishment Fee. Likewise, those that have permission to extract unused portions of the Navy's estimated Federal Reserve Water Right interest (carry over extractions) shall not be subject to this Replenishment Fee for those carry over extractions.

## 2.0 Basin Background

### 2.1 Basin Location

The Basin, as depicted in Figure 2-1, is remotely located in the northwestern part of the Mojave Desert in southern California. The Basin boundaries, which are determined by the State of California (State) in Bulletin 118, underlie approximately 382,000 acres or approximately 600 square miles of land area. The boundaries of the Basin are primarily within the County of Kern but they also extend into portions of Inyo and San Bernardino Counties.

The Basin 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

---

<sup>1</sup> While those taking part in the Transient Pool program are subject to these costs, they will pay for them as part of their Transient Pool agreement and as such they will not be charged the Replenishment Fee.

Paso Mountains. Surface water flow from the surrounding mountain ranges drains to China Lake, a large dry lake, or playa, located in the central north-east part of the Basin. U.S. Route 395 and State Route 14 are the major vehicular arteries through the Indian Wells Valley area.

## 2.2 Basin Water Supplies

The Basin presently lacks the needed infrastructure to provide landowners with access to imported water supplies for either direct use and/or in lieu groundwater recharge. **As a result, Basin water users must rely upon groundwater as their sole water source.**

Residents of the Indian Wells Valley area are served groundwater through private domestic wells and/or by a connection to one of the two public agency water purveyors: the Indian Wells Valley Water District and the Inyokern Community Services District. Present estimates provide that this pumping equates to approximately twenty-three percent (23%) of the Basin's total current groundwater production, while the private domestic wells are estimated to account for roughly three percent (3%) of the total Basin groundwater production. The Indian Wells Valley Water District is the largest supplier of potable water in the Basin supplying roughly 14,000 service connections with potable water needs.

Searles Valley Minerals Inc. produces groundwater from the Basin for use in its minerals recovery and processing operations in the Searles Valley (located east of the Basin boundaries) and for ancillary 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 area rely on the Basin's water supplies for their agricultural operations, including Meadowbrook Dairy, Mojave Pistachios, Simmons Ranch, Quist Farms, and other smaller farms.

The United States Navy has produced water from the Basin since the development of the Naval Ordnance Test Station in 1943. The development included the construction of hundreds of industrial and residential buildings, roads, runways, and other necessary

infrastructure components. As development by the Navy continued, more groundwater wells were drilled to supply the increased water demands. Most of the Indian Wells Valley's new permanent residents were associated with the naval operations and lived on Navy property during the 1940s, and into the 1970s. The growth of the naval operations led to the incorporation of the City of Ridgecrest in 1963.

The Navy has reported to the IWVGA that it made a "strategic divestiture" to spur Ridgecrest development and rapid Navy population shifts off-Station in 1970. Since then, the Navy has reported a reduction of nearly ninety-five percent (95%) of its on-Station family dwelling units from 2,916 units in 1972 to 192 units in 2019. This drastic and purposeful population shift off-Station transferred Navy water demands from personnel living quarters on-Station to the off-Station water providers in the Ridgecrest community and those individuals that invested in their own wells to meet their own domestic needs off-Station.

The following Figure 2-2 graphically illustrates the shift in water demands from the Navy to the Ridgecrest Community, through the depiction of water demands by the Indian Wells Valley Water District.

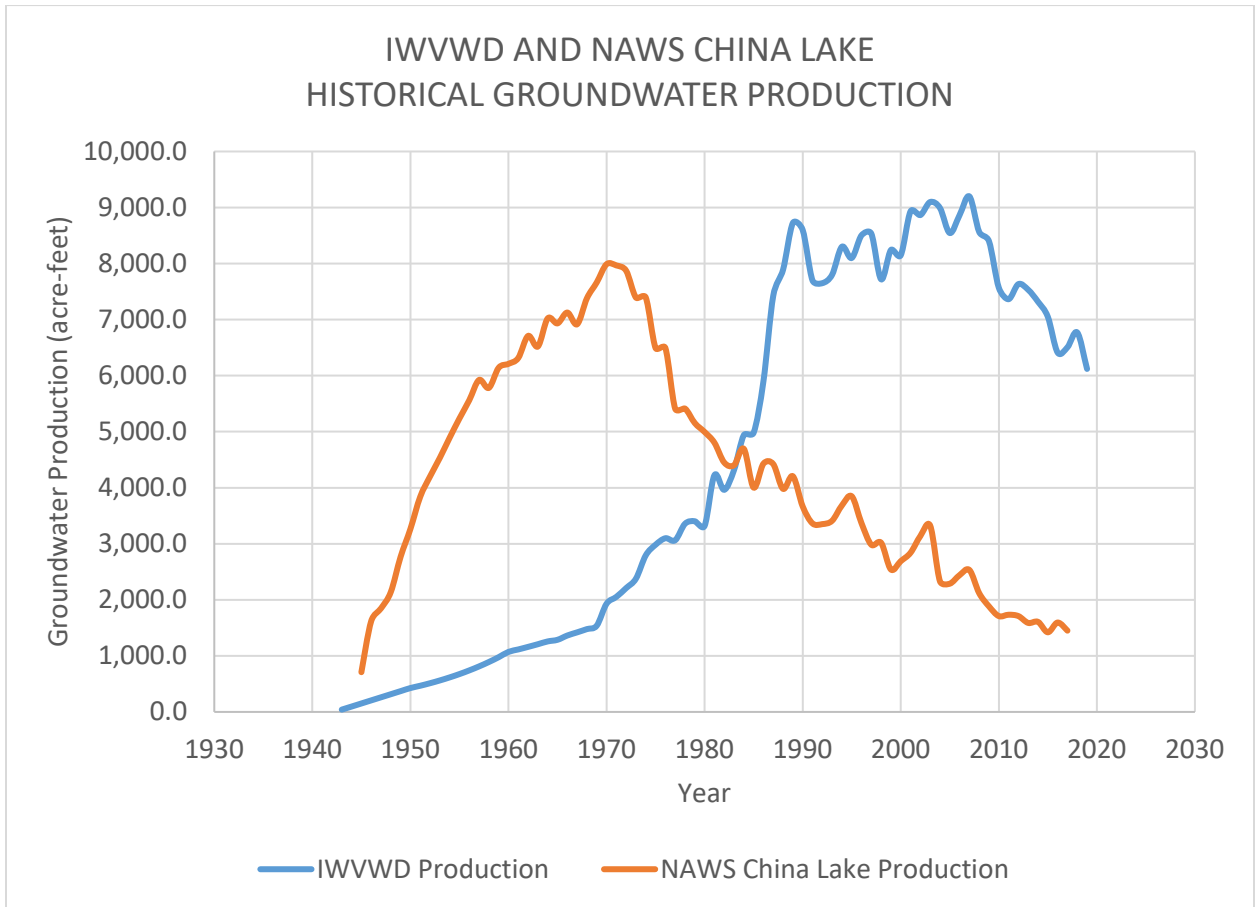


Figure 2-2: IWWVD and NAWS China Lake Historical Groundwater Production

### 2.3 Basin's Sustainable Yield of 7,650 af

Streams and other surface waters in the Basin are generally ephemeral due to low annual precipitation in the Indian Wells Valley area, and Basin recharge occurs as mountain block recharge. Consequently, surface water resources in the Basin are limited, if not nonexistent.

After considerable public examination of the technical data by the IWVGA Board and two separate committees, the IWVGA has determined that the Basin's sustainable yield is 7,650 acre-feet (af).

## 2.4 Basin's Current Condition

The Basin has been significantly studied and voluntary pumping documentation has occurred over the last 70 years. For roughly the 20 years preceding SGMA, the Basin was monitored by the Indian Wells Valley Cooperative Groundwater Management Group.

As graphically shown below in Figure 2-3, the sustainable yield of 7,650 af has been exceeded for nearly 60 years by the pumping demands of the Navy and the Indian Wells Valley Water District alone.

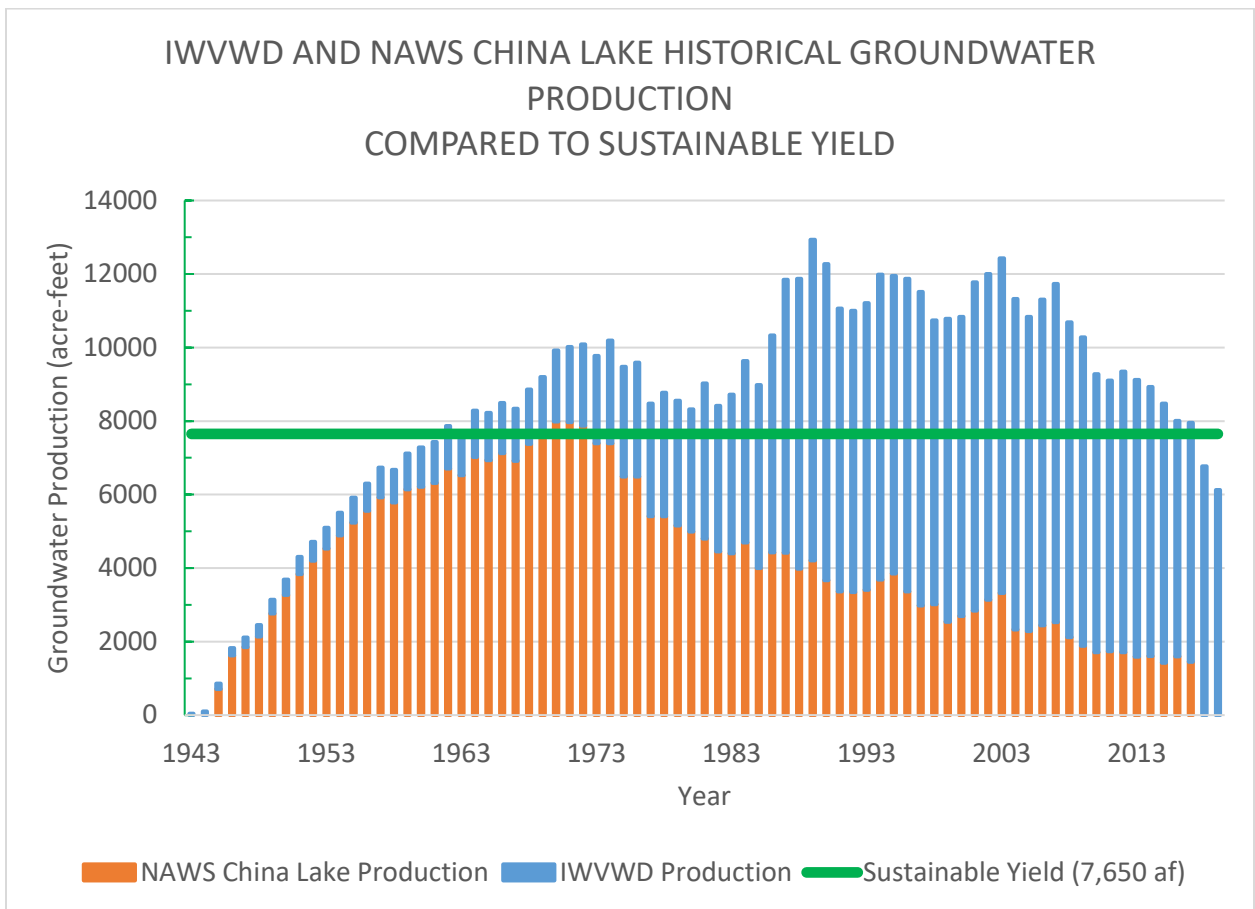


Figure 2-3: IWWVD and NAWS China Lake Historical Production Compared to Basin Sustainable Yield.

The results of the prolonged overdraft have already manifested themselves through various undesirable results, primarily the chronic lowering of groundwater levels, the degradation of water quality, and the reduction of groundwater in storage throughout the Basin. Undesirable results have manifested themselves throughout the Basin, including:

- Reduction of buffer from loss of production for deeper wells, both for municipal/domestic use, industrial use, and agriculture use
- Impacts to shallow wells due to lowering of groundwater levels and/or degraded water quality, which would require deepening, replacement, well abandonment, or treatment
- Encroachment on mission of NAWS China Lake
- Damage to infrastructure including high value sensitive facilities at NAWS China Lake (For example, the SNORT alignment)
- Jeopardy to beneficial uses due to lowering of groundwater levels and degraded water quality including environmental uses, domestic supplies, industrial supplies, and agriculture supplies which could result in fallowing of agricultural land
- Financial impacts to all groundwater users and well owners for mitigation costs and supplemental supplies (including De Minimis groundwater users and members of disadvantaged communities)
- Increase of impacts caused by dust and desertification caused by declining water tables.

These severe overdraft conditions have existed for several decades as a result of historical groundwater pumping that exceeds the Basin's natural replenishment. The unregulated overdraft has resulted in Basin groundwater levels dropping in some areas by approximately 0.5 to 2.5 feet annually. With these stark historical conditions widely

known and understood, the Basin's severe burdens were further heightened by the recent addition of a new groundwater user that listed pumping needs almost equaling the Basin's entire sustainable yield and asserting that its water rights were superior to the needs of the Ridgecrest community.

The adopted GSP Baseline model run projects that, without change, the Basin's groundwater infrastructure will not be able to produce the needed groundwater by 2065.

## 2.5 Navy Federal Reserve Water Right

As more thoroughly provided for in the IWVGA's Sustainable Yield Allocation Report, long-standing principles of American jurisprudence and federalism, prohibit the IWVGA from charging, regulating and/or even investigating Navy claims, and/or the claims of any other Federal extractor in the Basin. As a result, the IWVGA is unable to charge these federal lands with any of the costs associated with an importation or mitigation project regardless of whether or not these lands are benefited. Additionally, the IWVGA has no legal authority to challenge any assertions, or lack thereof, made by the Navy.

Additionally, SGMA expressly recognizes that the IWVGA has no legal authority to require that the Navy provide any pumping information under existing law in Water Code section 10720.3(c), which expressly provides that any participation by the Navy shall be voluntary. SGMA further recognizes the Navy's Federal Reserve Water Right (FRWR) as distinct from water rights that are based in state law and directs that the FRWR be respected in full. Moreover, SGMA expressly provides that federal law shall prevail in the case of any conflict between federal and state law (Water Code Section 10720.3(d)). SGMA also directs that the IWVGA consider the interests of all beneficial uses and users of groundwater, listing the federal government, including, but not limited to, the military and managers of federal lands among those interests (Water Code Section 10723.2).

Given these legal principals, the IWVGA has been limited to repeatedly asking that the Navy provide its FRWR to assist in the determinations related to fees. The Navy has repeatedly declined to provide the requested information asserting its complete immunity

from regulation by the IWVGA. On June 17, 2019, the Navy again expressly rejected the IWVGA request and instead provided a report titled Navy Demographics and Water Requirements at Naval Air Weapons Station (NAWS), China Lake, CA (Navy Water Requirements Report), which makes the following assertions related to its FRWR:

- 1) The FRWR *IS NOT* limited to the current on-Station demand of 2,041 af.
- 2) The FRWR dates back to the establishment of the base in 1943.
- 3) The FRWR would likely be established, if ever, through litigation.
- 4) The water requirements of the Navy cannot be determined solely by the Navy's recent direct production amounts.
- 5) Since the Navy mission at NAWS China Lake requires its workforce, the full Navy water requirements are the combination of the on-Station requirements and those of the Navy workforce and their dependents off-Station.

Additionally, the provided report listed detailed historical pumping records which show that the Navy's extractions alone exceeded the Basin's sustainable yield for each of the four years between 1969 and 1972. Moreover, the provided report detailed that for nine years within the 11-year time period between 1964 and 1974, annual Navy extractions exceeded 7,000 af and for nearly two decades the Navy's extractions exceeded 6,000 af annually. As further discussed in the Sustainable Yield Allocation Report, and as shown above in Figures 2-2 and 2-3, Navy extractions only began to diminish once the Navy deliberately moved its personnel and the corresponding water use off base.

Accordingly, the Sustainable Yield Report concluded that the IWVGA is required to find that all groundwater extractors in the Basin, with the exclusion of De Minimis extractors and Federal extractors, are specially benefited by IWVGA's overdraft mitigation and augmentation projects, and therefore they will be subject to the costs for those

projects, unless an extractor obtains a court order showing they have quantifiable production rights superior to the Navy's.

## 2.6 Navy Federal Reserve Water Right Transfer

The Navy has expressly asserted in the Navy Water Requirements Report that the NAWS China Lake mission requires its workforce and as a result the full Navy water requirements are the combination of the on-Station requirements and those of the Navy workforce and their dependents off-Station. Accordingly, it is presumed that the Navy will provide its unused FRWR to those that supply water to its workforce through agreements with those water providers.

## 3.0 Indian Wells Valley Groundwater Authority

### 3.1 Formation

Due to the Basin's designation in 2016 as a critically overdrafted groundwater basin of medium priority<sup>2</sup>, the local agencies with jurisdiction in the Basin were required to establish a Groundwater Sustainability Agency (GSA) and publish an adopted GSP for the Basin by January 31, 2020. Accordingly, the Authority was formed on December 8, 2016, as a joint powers agency (JPA) among its General Members:

- City of Ridgecrest
- Indian Wells Valley Water District
- County of Kern
- County of Inyo
- County of San Bernardino

The formation of the JPA provided the IWVGA with all the authorities and powers provided to the three County General Members under California law and SGMA.

---

<sup>2</sup> The Basin has since been identified as a critically overdrafted basin of **high** priority, as documented in the *Sustainable Groundwater Management Act 2018 Basin Prioritization: Process and Results*, published by the California Department of Water Resources in January 2019.

The United States Department of the Interior Bureau of Land Management (BLM) and the United States Navy Naval Air Weapons Station China Lake (NAWS China Lake) serve as Associate Members (non-voting) to the JPA. These non-voting members have no authority within the operations of the JPA and are provided no voting powers.

### 3.2 Mission

The IWVGA is the exclusive GSA for the Basin, and as such, it has jurisdiction over the non-federal lands within the Basin (see Figure 2-4) and it is required to adopt, monitor, and implement a Groundwater Sustainability Plan (GSP) that achieves Basin sustainability by 2040.

### 3.3 Organizational Structure

The IWVGA is governed and administered by a five member Board of Directors (Board), which is composed of one voting seat per General Member. BLM and NAWS China Lake each hold a non-voting Associate Member position on the Board. Although they do not have the power to vote on any Board action or proposal, nor may they attend closed sessions of the Board, the Associate Members are entitled to full participation in public Board meetings and discussions.

The Board Chairperson, Vice-Chairperson and General Counsel duties annually rotate in January, between the Board members representing the County of Kern, the City of Ridgecrest, and, the Indian Wells Valley Water District. At the time of this Report, the Chairperson and General Counsel duties are held by the County of Kern, and the Vice-Chairperson duties are held by the City of Ridgecrest.

The Board established a Policy Advisory Committee (PAC) and a Technical Advisory Committee (TAC) for the purpose of making recommendations to the Board on the Authority's daily activities. The PAC advises the Board on policy-related matters while the TAC advises on technical matters. Both the PAC and the TAC are comprised of members from local constituent groups (both private and public) that have an interest in the operations and decisions of the Authority.

### 3.4 Jurisdiction

The IWVGA's boundaries extend across the entire Basin and thus they include all of the non-federal and federal lands that overly the Basin. With that said, as is more thoroughly explained in the Sustainable Yield Report, the Supremacy Clause of the United States Constitution prohibits the IWVGA, and the State, from regulating federal lands and federal extractions and therefore the BLM and NAWS China Lake are exempt from any Basin projects charges, regardless of the project benefits provide to the those projects.

## 4.0 Authority Costs and Revenues

### 4.1 Historic Costs and Revenues

To date, the operations and costs of the IWVGA have almost exclusively been attributable to the adoption of the GSP. These operations have been funded by:

- 1) Initial member dues;
- 2) In-kind services provided by the General Members and the Navy;
- 3) Loans from the County of Kern and the Indian Wells Valley Water District;
- 4) State Grant funding through Proposition 1 and Proposition 68; and,
- 5) A Groundwater Extraction Fee of \$30 per acre foot.

### 4.2 Groundwater Extraction Fee

The IWVGA adopted the existing Groundwater Extraction Fee (GEF) under the authority of California Water Code Section 10730 on July 19, 2018. The GEF was specifically established to fund the costs of developing and adopting the Authority's GSP.

The GEF is presently charged at \$30.00 per acre-foot extracted and it is imposed on all groundwater extractions in the Basin, with the exception of De Minimis groundwater

extractors, which SGMA expressly excludes, and Federal groundwater extractors, which are excluded by federal law.

In accordance with California law, the existing GEF may only be used to cover the costs it was adopted for; in this case, the development of the IWVGA's GSP and as such it is often referred to as the GSP Fee.

It is acknowledged that the IWVGA has already funded some efforts to import water into the Basin, including efforts to achieve Federal funding for the needed importation infrastructure costs. These efforts, while initially needed in part for development and adoption of the GSP, are more appropriately charged to the importation project itself. As such, the costs for these efforts, which have been relatively minor, are, and have been, tracked and monitored by the IWVGA's General Manager and they are being funded through funds provided to the IWVGA by the Indian Wells Valley Water District. Likewise, the costs to provide this Report are being funded with non-GEF fees and they will be recouped from revenues from the Replenishment Fee.

The GEF was purposely set at a rate that was not expected to provide for the full costs of the GSP by the date of the GSP's adoption. The initial projections aimed for a GSP funding completion date of roughly the end of the 2020 water year. For reasons yet to be fully determined, the GEF has not met expectations because the reported pumping by several pumpers has been less than their claimed water demands and/or historic pumping levels.

Additionally, there have been some pumpers that have failed to meet their reporting and payment obligations under Ordinance 02-18. For the most part, the IWVGA has determined that these are relatively small pumpers with the notable exception of one; Mojave Pistachio which reported and paid for considerable pumping over several months only upon notice that the Board was about to considering removing their representative from the PAC and TAC. The IWVGA efforts to cure this defect have been understandably slowed in recent months, but in a 4 to 1 vote, with the Water District's Board member being the sole dissenting vote, the IWVGA Board voted to remove Mojave Pistachio's representative from the PAC and TAC at the April 2020 Board meeting.

Additionally, three significant pumpers in the Basin have threatened suit against the IWVGA's GSP and tolling agreements have been executed to delay such filings. In accordance with California Law, the costs for defending those claims and possible lawsuits will be funded with the GEF. As a result, the Board will be addressing needed increases in the GEF fee in a separate item to provide for both original assumption shortfalls, such as the reported/anticipated pumping shortfall, and the need to fund the anticipated litigation.

### 4.3 Post GSP Revenue Authority

SGMA provides for the collection of extraction fees to fund Authority projects. In particular, Water Code section 10730.2 expressly provides that:

- 1) A groundwater sustainability agency may impose fees on the extraction of groundwater from the basin to fund the costs of groundwater management, including, but not limited to, the following costs:
  - a. Administration, operation, and maintenance, including a prudent reserve.
  - b. Acquisition of lands or other property, facilities, and services.
  - c. Supply, production, treatment, or distribution of water.
  - d. Other activities necessary or convenient to implement the plan.
- 2) Fees imposed pursuant to this section shall be adopted in accordance with subdivisions (a) and (b) of Section 6 of Article XIII D of the California Constitution.
- 3) Fees imposed pursuant to this section may include fixed fees and fees charged on a volumetric basis, including, but not limited to, fees that increase based on the quantity of groundwater produced annually, the year in which the production of groundwater commenced from a groundwater extraction facility, and impacts to the basin.

- 4) The power granted by this section is in addition to any powers a groundwater sustainability agency has under any other law.

The relevant provisions of Section 6 of Article XIII D of the California Constitution provide both procedural and substantive requirements for the imposition of charges and fees. The procedural requirements are generally summarized as follows:

- 1) The parcels to be charged shall be identified.
- 2) The amount of the fee shall be calculated.
- 3) Notice shall be mailed to the record owners at least 45 days prior to the hearing.
- 4) The mailed notice shall provide:
  - a. The reason for the fee
  - b. Amount of the fee
  - c. The basis for the fee's cost calculations
  - d. The date, time and location of the public hearing
- 5) At the public hearing, the agency shall consider all protests against the proposed fee.
- 6) If written protests against the proposed fee are presented by a majority of landowners, the agency shall not impose the fee.

The substantive requirements of Section 6 of Article XIII D are generally summarized as follows:

- 1) Revenues derived from the fee may not exceed the funds required for the project.
- 2) Revenues derived from the fee may not be used for any purpose other than that for which the fee or charge was imposed.
- 3) The fee may not exceed the proportional for the project.
- 4) The fee may not be imposed for a service unless that service is actually used by, or immediately available to, the owner of the property. Fees based on potential or future use of a service are not permitted.

Accordingly, the Authority must identify the specific projects it desires to fund, estimate their costs, and, apply the charge to only those landowners that are conferred a “special benefit” by the specific project.

California law generally provides that a “special benefit” is defined per Article XIII, Section 2(i) of the California Constitution as “a particular and distinct benefit over and above general benefits conferred on real property located [within the Authority’s boundaries] or to the public at large.” Accordingly, general benefits, such as an increase in property value because an importation project allows further community development, are not chargeable under California law. In order to be subject to the costs of an importation project, the payer must directly benefit from the project.

Although there are many ancillary benefits to the Augmentation and Mitigation Projects, the primary benefits for parcels in the Authority’s jurisdiction is the ability to use water over and above the sustainable yield of the Basin. As previously mentioned, the IWVGA has determined that the Navy, an entity that the IWVGA cannot regulate or charge in anyway, has historical pumping demands that have exceeded the Basin’s sustainable yield. As a result, a volumetric pumping fee on all non-Federal extractors will meet both the proportionality and availability prongs of the California law.

## 5.0 Groundwater Supplies and Sustainability

### 5.1 Existing Water Supply Facilities

As previously mentioned, the Basin has been significantly studied and voluntary pumping documentation has occurred over the last 70 years. Additionally, for the roughly 20 years preceding SGMA, the Basin was monitored by the Indian Wells Valley Cooperative Groundwater Management Group.

As discussed in Section 2.4, it is undeniable that the Basin’s groundwater resources have not been sustainably managed and the results of the severe overdraft have already manifested themselves through various undesirable results such as the chronic lowering of groundwater levels, which have shown a decline of 0.5 to 2.5 feet annually in areas. Additionally, the severe overdraft has and will lead to the degradation

of water quality and the reduction of groundwater in storage throughout the Basin. Most importantly, the severe overdraft has lead the GSP Baseline model run to project that the groundwater infrastructure will be unable to produce the needed groundwater by 2065.

These severe overdraft conditions have existed for several decades as a result of historical groundwater pumping that exceeds the Basin's natural replenishment. With the exception of the Baseline model run, these stark historical conditions have been widely known and understood. And yet, the Basin's severe burdens were further heightened by the recent addition of a new groundwater user that listed pumping needs almost equaling the Basin's entire sustainable yield and asserting that its water rights were superior to the needs of the Ridgecrest community.

While the Indian Wells Valley Water District has in the past studied various options for augmenting the District's water supplies, to date there have been no sustained efforts to bring import supplies to the Basin. Notably, while the analysis was not the focus of this Report, the *IWVWD Board of Directors Alternative Water Supply Workshop of September 2012* provided an estimate for imported supplies that is in line the analysis and cost estimates in this Report.<sup>3</sup>

In sum, the Basin's supplies cannot meet the Basin's most minimal needs and there is presently no Basin infrastructure for importation. Adding additional complexity, the required infrastructure for importation could cost a hundred million dollars, or more, to build depending on the ultimate project and it's currently estimated to take 15 years to complete the needed infrastructure, or roughly one third of the forty-five (45) year period documented in the Baseline model run.

## 5.2 Augmentation Management Action

To mitigate the historical and existing conditions of Basin overdraft, the Authority has adopted a GSP (in accordance with SGMA) with a defined sustainability goal of: preserving the character of the communities relying on the Basin; preserving the quality

---

<sup>3</sup> It should be noted that the water market and the urgency in obtaining supplies has only worsened since 2010 and therefore the cost increases are not just increase from 2010 to 2020 dollars

of life of those that rely on the Basin; and, sustaining the mission at Naval Air Weapons Station (NAWS) China Lake. Accordingly, the Authority's GSP was developed with the intent to mitigate local reliance on the Basin for all water supplies through the procurement of imported water supplies for either direct use and/or for in direct use through groundwater recharge. After considerable public examination of the technical data and careful consideration by the IWVGA, it has been determined that the Basin needs an importation infrastructure capable of bringing at least 5,000, and potentially as much as 20,000 af, of water to the Basin annually.

This level of importation reflects what is believed to be the minimum amount of water needed to achieve sustainability and sustain the community. As more thoroughly discussed in the Sustainable Yield Report, this level of water importation presumes the cessation of large-scale agricultural uses in the Basin but it does not prohibit or hinder such a use. In fact, future agricultural users are treated the same as all other, non-Federal users in the Basin.

The Authority currently does not own or operate any existing water supply facilities; therefore, the procurement of imported water supplies will require the acquisition of physical water supplies (with all required contractual and/or appurtenant water rights), as well as obtaining access to existing potable water conveyance facilities that are operated by agencies outside the Authority's jurisdiction. The Authority must then oversee the construction of new water supply infrastructure to provide the Authority's acquired water supplies to the Basin and it is estimated that such construction will take 15 years with import supplies not becoming available for use in the Basin until 2035.

It is anticipated that during the construction phase (roughly 2025 to 2035), the Authority will optimize the use of its purchased supplies through short-term transfers to willing purchasers with the monetary gains being used to assist in the construction funding. Alternatively, those purchased supplies could be held in storage for future use in the Basin once the importation project comes online.

Procuring an imported water supply will also require access to existing water conveyance facilities and the construction of additional infrastructure to bring imported

water to the Basin. The Los Angeles Department of Water and Power (LADWP) operates the Los Angeles Aqueduct (LA Aqueduct), which extends through the western portion of the Basin near the Freeman-Dixie Wash and the El Paso subarea. The LA Aqueduct conveys surface water runoff from the Eastern Sierra Nevada Mountains in Inyo County, as well as groundwater from the Mono Basin, to LADWP's service area in the City of Los Angeles. In addition, Antelope Valley East Kern Water Agency (AVEK) operates a potable water transmission pipeline (California City Pipeline) that terminates near California City, located approximately 15 miles south of the Basin boundaries and 50 miles south of the City of Ridgecrest.

### 5.3 Alternatives to Augmentation Project

#### 5.3.1 Basin Mining

Some have asserted that groundwater storage is the sole factor of importance and deepening impacted wells is the sole solution. The underlying premise in the assertion is that the Basin can be sensibly mined and damaged for a prolonged period of time. Assuming that sensible standard can be met, it is undeniable that deepening cannot go on forever and at some point imported infrastructure will be required. Additionally, such an unwarranted and indefinite mining of the Basin would jeopardize the approval of the GSP because SGMA expressly provides that the chronic lowering of groundwater levels is an undesirable result. In short, this assertion will gain some time for the direct benefit of a few (presumably a few that will then leave the Basin) but it will add millions in costs to the ultimate solution.

With that said, it is undeniable that the importation project mines the Basin for an estimated period of 15 years, albeit at a much reduced rate of overdraft, with the damages being mitigated through funded projects. Likewise, as set forth in the Transient Pool report, it is undeniable that the transient pool will mine the Basin in amount roughly equally to the amount of mining that will occur through the importation project and damages will be mitigated through funded projects. Importantly, without the reductions provided for in these programs, when the importation project begins water deliveries in 2035, the GSP

Baseline model would project that the Basin's groundwater infrastructure could only produce the needed water for 30 more years.

### 5.3.2 Wastewater Recycling

The Authority does not have any regulatory control over waste water treatment facilities in the Basin. As a result, the Authority cannot, and does not, include any cost analysis for recycled water projects in this Report. If and to the extent, the owners of a wastewater treatment facility are able to make use of the water treated in those plants to decrease their extractions from the Basin, they will naturally receive the benefit of that endeavor through lower extractions from the Basin and by extension lower fees. Moreover, the owners of the wastewater treatment facility can sell that treated water to others in the Basin who would in turn receive the same benefit.

## 6.0 Augmentation Project Costs

### 6.1 Purpose

The Augmentation Project has been developed to address the Basin's urgent need for augmented supplies to address the severe overdraft conditions and the Basin's inability to cure the overdraft through voluntary pumping reductions alone. After careful consideration and public examination by both the PAC and TAC, it has been determined that the Basin will need *at least* 5,000 af of imported water per year. Additionally, it has been determined that a permanent supply entitlement is needed because the types of uses reflected in the 5000 af need cannot rely on temporary and/or one time purchases.

As explained in the Indian Wells Valley Groundwater Authority Water Marketing Strategy Technical Memo of August 2019 (Water Marketing Memo), which is attached hereto and incorporated herein as Exhibit B, and the 2017 Department of Water Resources State Water Project Delivery Capability Report, the long term reliability of State Water Project deliveries is sixty-two percent (62%). Therefore, in order to achieve actual deliveries of 5000 af, the Augmentation Project would need to obtain permanent allocation of 8,065 af of water.

## 6.2 Revenue Requirements

The revenue requirements for the Augmentation Project can be naturally broken down into two separate phases. The first phase, which is the focus of this Report, is the actual purchase of the need water supplies. As previously mentioned, in order to obtain the needed delivery of 5,000 af, the IWVGA will need to purchase 8,065 af of permeant State Water Project allocation.

As set forth the Water Market Memo, given the recent transactions and trends it is assumed for the purposes of this Report that a permanent allocation will costs \$6,500 per acre foot. Therefore, the required revenue to purchase a permanent supply is assumed to be \$52,422,500. Given the urgency and the current and anticipated water markets in coming years due to SGMA implementation, it is highly recommend that the IWVGA obtain this water purchase before no later than the end 2025, and even sooner if at all possible as it is highly likely that the costs of water will only increase in coming years as Basin's adjust to SGMA.

In addition to the purchase costs, the administration/negotiation/legal costs for the Project will need to be funded. It is assumed that said costs will be at least \$377,500 over the five year period for an annual estimate of \$75,500 per year.

In sum, it is assumed for the purposes of this Report that the Augmentation Project revenue needs will total \$52,800,000, which, when split over a five year period, equates to a per acre foot extraction charge of \$2,112.<sup>4</sup>

## 6.3 Imposition and Exclusions

For the reasons more thoroughly described in the Sustainable Yield Report, the Augmentation Project costs shall be imposed on all groundwater extractors in the Basin with the exception De Minimis and Federal Extractors. Likewise, those that have permission to extract unused portions of the Navy's estimated FRWR (carry over extractions) shall not be subject to the Augmentation Project costs for those carry over

---

<sup>4</sup> The funds collected for the Augmentation Project may also be used to fund the IWVGA Following Program which will preserve Basin supplies and in effect equate to a purchase of water supplies.

extractions. Transient Pool extractors by definition will not be subject to these costs as they will not need or use augmented supplies.

## 7.0 Shallow Well Mitigation Project

### 7.1 Purpose

As stated in SGMA, the IWVGA is required to mitigate locally defined undesirable results that are due to unsustainable groundwater management that has occurred in the Basin since 2015, and/or will occur in the future. The purpose of the Mitigation Fee is to fund shallow well mitigation efforts in order to mitigate the undesirable results occurring from the basin-wide chronic lowering of groundwater levels, reduction of useable groundwater in storage, and degradation of water quality.

Historically, groundwater levels near the primary Basin pumping area have been in decline. Groundwater levels in other locations such as those near recharge and discharge zones, as well as in the El Paso area (which is separated from the primary Basin aquifer by a fault) remain more stable. In areas where groundwater levels have been steadily declining, shallow wells have been impacted to the extent that well deepening and/or redrilling is required, or the shallow well must be abandoned as a water source. Additionally, shallow wells have been historically impacted due to the migration of poor-quality groundwater in areas with previously high-quality groundwater.

An analysis was conducted for approximately 872 shallow wells in the Basin (832 domestic/private wells, 40 mutual water company wells, and community service district wells) for potential impacts during the implementation of the GSP. The shallow well impact analysis results indicated that most shallow wells would experience minimal drawdown, but that approximately 22 shallow wells would require mitigation due to the chronic lowering of groundwater levels and reduction of groundwater in storage in the Basin within the GSP planning horizon. These 22 shallow wells are anticipated to be impacted within the next few years. Additionally, shallow wells may require mitigation due to the migration of poor-quality groundwater to areas with previously high-quality groundwater.

The IWVGA will prepare a Shallow Well Mitigation Plan to address the approximately 872 shallow wells in the Basin that have been or may later be impacted by the lowering of regional and local groundwater elevations, the reduction of useable groundwater in storage, the migration of poor-quality groundwater to areas with previously high-quality groundwater, or a combination of these factors. The Shallow Well Mitigation Plan will develop criteria to characterize the degree of shallow well impacts and develop an evaluation process to assess the viability of the impacted shallow wells. The Shallow Well Mitigation Plan will also outline the process by which individual well owners can apply and submit their wells for evaluation and consideration for mitigation by the Authority, including the evaluation and review process that the Authority's Water Resources Manager will follow to process the applications and make recommendations on mitigation options to the Authority Board.

Following adoption of the Shallow Well Mitigation Plan, shallow wells will be evaluated based on the adopted criteria and categorized into specific areas/zones for development of effective mitigation options. Some shallow wells may be proposed to be abandoned (not mitigated) based on an evaluation of impacts. The wells recommended for mitigation will be placed on an Impacted Shallow Well Priority List and will be scheduled for mitigation. Specific improvements will be identified for each impacted shallow well, such as deepening the well, replacing the well, connecting the well owner to other existing water systems, or other mitigation measures. The estimated cost for the mitigation measures proposed for each impacted shallow well will also be identified.

## 7.2 Revenue Requirements

The revenue requirements for the Mitigation Project reflect the anticipated costs to mitigate shallow wells impacts that will occur due to ongoing overdraft while the Augmentation Project is being brought online. It is anticipated that the Augmentation project will be brought online by 2035, at the latest, and during that time those that will ultimately receive augmented water will overdraft the Basin by 64,000 af, while the

Transient Pool is estimated to overdraft the Basin by a maximum of 51,000 af, leading to a total overdraft of 116,000 af.

As provided for in the GSP, it is anticipated that the mitigation costs will total \$2,020,000. This reflects anticipated costs of \$70,000 in development/engineering work and \$1,650,000 in implementation/capital costs for the rehab and/or replacement of 22 impacted wells. Per year costs of \$20,000 for 15 years, for a total of \$300,000 is assumed for reviewing shallow well applications and reporting to the IWVGA Board.

Dividing estimated total costs of \$2,020,000 by the anticipated overdraft of 116,000 af leads to a per acre foot extraction charge of \$17.50. Because the anticipated damages are rather linear, any reduction in the amount of the overdraft should correlate to an equal reduction in the total estimated costs; therefore the \$17.50 charge should not need modification if there is less overdraft than anticipated. With that said, these costs and revenues will be monitored and if need be adjusted downward if need be.

### 7.3 Imposition and Exclusions

The costs for the Shallow Well Mitigation Project shall be imposed all groundwater extractors in the Basin, with the exclusion of De Minimis and Federal Extractors, for the reasons more thoroughly describe in the Sustainable Yield Report, which is incorporated by this reference. While those taking part in the Transient Pool program are subject to these costs, they will pay for them as part of their Transient Pool agreement and as such they will not be charged the Replenishment Fee.

## 8.0 Basin Replenishment Fee

### 8.1 Purpose

The Basin Replenishment Fee is imposed to provide the necessary funds to bring imported water into the Basin and mitigate the damages caused by the continued overdraft as those supplies are being obtained. As such, the Replenishment Fee is a composite of two separate project costs: the "Groundwater Augmentation Project" and, the "Shallow Well Mitigation Project".

The Augmentation Project will bring imported surface water into the Basin, while the Mitigation Project will mitigate the impacts to shallow wells from the continued overdraft of the Basin during the purchase, design and construction phase of the Augmentation Project. For simplicity and efficiency, it is recommended that these two separate costs centers, which are properly charged to the same individuals on the same per acre foot basis, be combined into the one composite charge named the Basin Replenishment Fee.

## 8.2 Imposition and Exclusions

The Replenishment Fee shall be imposed all groundwater extractors in the Basin, with the exclusion of De Minimis and Federal Extractors, for the reasons more thoroughly describe in the Sustainable Yield Allocation Report, which is incorporated by this reference.

## 8.3 Fee Structure

Initially, the Replenishment Fee will be charged monthly based on the volumetric extraction data but the Authority reserves the right to modify the collection term in the future if need be and such a change will not impact the findings and recommendations in this Report. The total Replenishment Fee reflects the needed Augmentation Project costs of \$2,112 per acre foot extraction and the Mitigation Project costs per acre foot extraction charge of \$17.50 for a total per acre foot extraction fee of \$2,130.

## 9.0 Parcel Identification

As all parcels within the Basin could become subject to the Replenishment Fee if they choose to extract groundwater outside of the express exception provided to De Minimis extractors, notice and the opportunity to protest these fees will be provide to all parcels as determined by the last equalized tax rolls.

# FIGURES

# **TABLES**

*The page intentionally blank*

# Indian Wells Valley Groundwater Authority



## Indian Wells Valley Groundwater Authority Water Marketing Strategy Technical Memo August 2019

Technical Memo Prepared by:



CAPITOL  
**CORE**  
GROUP

Educate • Advocate • Win

## Table of Contents

Section 1: Introduction	1
Section 2: Executive Summary	2
Section 3: How Water Works in California	3
Section 4: Single Year Transfers	8
Section 5: Multi-Year Transfers	11
Section 6: Permanent Transfers	15
Section 7: Water Banking	16
Section 8: Potential Cost Scenarios	19
Section 9: Potential Transfer Partners	28
Section 10: Considerations and Recommendations	32
<b>Technical Appendices:</b>	
A. Historical Surface & Groundwater Water Data	Attached
B. Basin Map	Attached
C. Metropolitan Water District Historical Wheeling Fees	Attached
D. Hypothetical State Water Project Purchase Amortization Tables	Attached

## Section 1: Introduction

The Indian Wells Valley Groundwater Authority is a Groundwater Sustainability Agency covering parts of Kern, San Bernardino and Inyo Counties in southeastern California. The region currently relies entirely on groundwater supplies and has no access to imported water supply or infrastructure necessary to deliver imported water. However, the Indian Wells Valley Basin which the Authority regulates is in a condition of critical overdraft and must take steps to address this as a result of the implementation of the California Sustainable Groundwater Management Act. The Authority estimates that it will need approximately 3-5,000 acre-feet of imported water annually to bring the basin into sustainability.

The Authority retained the Capitol Core Group in March 2019 to assist them in three main goals:

1. Finding potential imported water supply opportunities that the Authority could use to provide supplemental water to the basin and alleviate some of the groundwater pumping
2. Assisting the Authority and its retained engineer, Stetson, to assess the viability and pros and cons of the two potential transfer partners that the Authority could work with including the Antelope Valley East Kern Water Agency (AVEK) and the Los Angeles Department of Water and Power (LA DWP)
3. Determining and securing potential funding resources that the Authority could use to pay for the infrastructure needed for importing water

The initial research and review of the first two goals resulted in the completion of this Technical Memo (Task 1B in the Capitol Core Scope of Work). Capitol Core has also conducted its initial due diligence in Washington, D.C. to determine funding potential funding sources, and will complete its due diligence for potential state funding resources in Sacramento in September. Capitol Core will provide a Funding Sources Strategic Plan (Task 3B) that outlines both state and federal potential funding sources for the Authority's review in October.

After the Board has had an opportunity to review the contents of this Technical Memo, we would respectfully request that the Board provide Capitol Core with direction on whether the Authority would like to pursue any of the water supply options that we have presented in this memo, as well as the Board's direction on which transfer partner it would like to begin discussions with.

## Section 2: Executive Summary

In the first 4 months of the project assignment, the Capitol Core Group conducted research and a series of meetings with water suppliers across the state to determine potential water supplies that the Authority could consider for providing imported water supplies to the Basin. The water resources we have identified come from different sources, and are generally in three categories:

- 1) **Single Year Transfers:** These water transfers, as the name implies would occur over a single year. The buyer would have to either use that water in the year that the water is transferred or bank/store it in a facility to which it has access. In 2019, the wet hydrologic conditions presented multiple opportunities to purchase water from sellers including:
  - a. Napa County Flood Control and Water Conservation District
  - b. Mojave Water Agency
  - c. State Water Project “Article 21 Water”
  
- 2) **Multi-Year Transfers:** Multi-year transfers can vary in length from a few years to as many as 30, depending on the willingness of the seller to enter into an agreement. These agreements vary in price depending on the seniority of the underlying water rights, the ease of transfer, and the reliability of the water supply. Depending on the type of transaction and whether they qualify as “State Project Water,” their transferability in a given year may depend on conveyance capacity and hydrologic conditions. Some potential multi-year water supplies that may be available include:
  - a. “Nickel Water”
  - b. Plumas County
  - c. Antelope Valley East Kern Water Agency
  - d. Butte Water District
  
- 3) **Permanent Transfers:** Permanent transfers, in the case of water supplies that we have identified, usually pertain to the transfer of State Water Project “Table A” entitlement that would transfer from one State Water Contractor to another. These transactions usually involve purchasing land within a district that has underlying water rights but under-utilized land and transferring the water right from the property to another State Water Contractor. These transactions are subject to the approval of the Department of Water Resources and the State Water Contractor where the seller’s land is. Some potential areas that may have available water rights include:
  - a. State Water Project entitlement from landowners within the Tulare Lake Basin Water Storage District
  - b. Potential “fallow transfer” programs in other districts

In addition to these water supplies, we discuss other potential water resources that may become available in the future as well as banking opportunities that the Authority may consider storing water in wet years such as this when excess water is available on the open market. We also

provide select historical prices for each of these water supply categories, as well as potential future areas where water may become available.

Next, we provide a series of ten water supply scenarios to supply the Authority with 3,000 acre-feet of water annually with estimated costs for each scenario. **For these scenarios, the average price for the first ten years range between approximately \$3.4 million and \$5.2 million annually depending on the water supply sources.** We discuss the background data and the assumptions that we used to arrive at these costs. Finally, we provide the Authority with a series of considerations and recommendations for the Board to consider as it implements the imported water program.

### **Section 3: How Water Works in California**

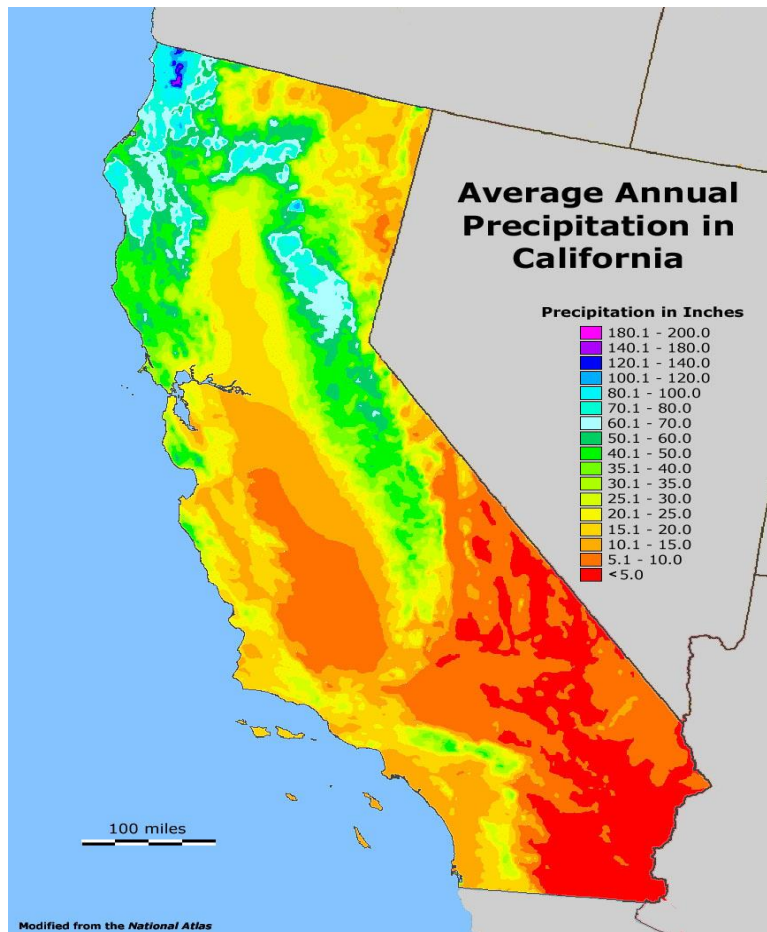
#### **Introduction**

Water in California is an incredibly complex subject and describing the nuances of all types of rights would take up much more volume than the length of this Technical Memo will allow. For the purposes of this document, we will generally describe surface rights, how the citizens and agricultural districts in California get water, and how these rights and conveyance systems may pertain to the Groundwater Authority's goals.

#### **The Challenge of Delivering Water in California**

Since the formation of the state, California faced the primary challenge of moving water from where it is abundant to the population centers. About 60% of California's population lives in Southern California, and the primary agricultural areas are within the Central Valley. However, the majority of the precipitation in the state falls in the northern and mountainous parts of the state, which are generally away from the population and agricultural centers. The state must move vast amounts of water from the northern half of the state, where most of the water resources are, to the population centers in the south. To accomplish this, the state relies on a series of water conveyance systems including the State Water Project and Central Valley Project.

### Average Annual Precipitation in California



### Surface Water Supplies

Water as we mentioned is most abundant in the northern part of the state. Most of the water the state harvests comes from runoff that originates from melting snow in the mountains in the northern part of the state. While many areas have groundwater resources, very few areas have enough groundwater resources to supply its customers without adverse effects to the water table. This fact has been a particular focus as basins across the state look to implement the regulations mandated under SGMA. As such, most areas in California and the western United States rely at least to some extent from water that accumulates in rivers when snow melts. Aqueducts and river diversions capture this water and store it in large reservoirs and lakes. As the population centers need water, the state has a series of aqueducts that sends water from these reservoirs in the northern half of the state to the south. There are three major storage and conveyance systems where California gets the vast majority of its water resources, and where the IWVGA may be able to get water resources from. We will describe these in further detail in the next section.



**State Water Project (SWP):** The State Water Project is a system of reservoirs and aqueducts that delivers water from northern California to customers in central and southern California. There are 29 state water contractors (please see the section on wholesalers below) that have access to this water. The maximum amount of water that the SWP can deliver is approximately 4.2 million acre feet. About 70% of the SWP supply goes to urban uses, and the remaining 30% goes to agricultural uses.

**Central Valley Project (CVP):** The Central Valley Project is similar to the State Water project, though it differs in its size and its end users. Its 22 reservoirs have a combined storage of 11 million acre-feet, of which 7 million acre-feet is delivered in an average year. In comparison, the SWP's 20 major reservoirs can hold 5.8 million acre-feet, with annual deliveries averaging up to 3 million acre-feet. CVP water irrigates more than 3 million acres of farmland and provides drinking water to nearly 2 million consumers. In comparison to the SWP, farms and agriculture use about 70% of the water the project delivers, with the remaining 30% going towards urban uses.

**Other Surface Water Rights:** In addition to the state and federally owned water projects, there are a plethora of water districts across the state that have access to surface water rights off of the rivers in California. California's water laws generally follow the "[First in time, first in right](#)" rule, which means that the oldest established water rights have a higher "seniority" over more junior rights, and have the first claim to diversions on a particular river. These "senior" rights usually command higher prices, due to their more reliable water rights. For example, the "Nickel Water" that we discuss in the multi-year transfers section (Section 5) has pre-1914 rights on the Kern River that represent a senior right and are therefore considered a reliable supply. As such, because of the firmness of these rights and the lower probability of variable deliveries (versus water from the State Water Project for example, which is a more junior water right), these rights can command a higher price. For a further discussion of water rights in California and how they are administered, please see the State Water Resources Control Board's page [here](#).

### **The Three Levels of Governance with Relation to Water Conveyance in California**

Individual households, businesses and farms do not make purchases directly from the three water projects we discussed above. Rather, there is a series of government agencies that provide the infrastructure to get the water from these projects to the people and businesses that use it. We will next discuss the roles these government agencies play in this process:

**Importers:** Importers purchase water directly from the State Water Project or other major water delivery systems in California. For example, the Metropolitan Water District is the importer for much of Southern California, including the most populous City of Los Angeles. The importers own and maintain major infrastructure pipelines that move water regionally, and large-scale reservoirs. These reservoirs in some instances (like Diamond Valley Lake for example which Metropolitan Water District owns) can hold enough water to supply water to close to a million homes for six months. The importers sell water directly to wholesalers.

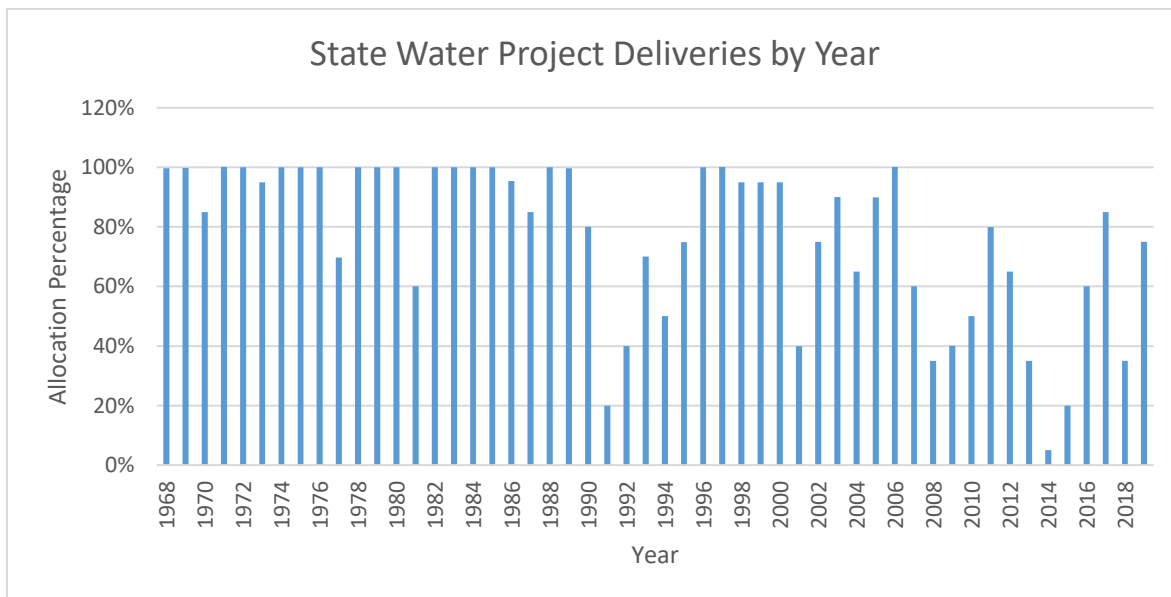
**Wholesalers:** The water wholesalers in the state act as an intermediary between the importers and the retailers. They purchase water directly from the importers, and in some instances have contracts to purchase water directly from the various water projects. They also maintain regional infrastructure. This regional infrastructure may include regional pipelines and reservoirs that move and store water from the main state aqueducts to the regional facilities. An example of a wholesaler in California is the Inland Empire Utilities Agency, which provides service to parts of western San Bernardino County. The wholesalers sell water directly to the retailers.

**Retailers:** The water retailers are the final segment in the system of water conveyance in California. The retailers are usually a water company or a municipality, and they are the level of government with which citizens have the most direct interaction. The retailers purchase water directly from the wholesalers. They maintain the local infrastructure of reservoirs and water lines to provide service directly to individual homeowners and businesses. The retailers also collect payments directly from the consumers.

## Challenges to the Long-Term Supply of these Projects

Between the three public water projects we discussed above, the State of California has theoretical access to about 15 million acre feet of water per year. Rarely, if ever, do the major water projects deliver this amount of water to its end users in a given year. For example, in 2019, despite one of the wettest winters on record in the state, the State Water Project is providing [a 75% allocation](#) to its contractors this year. There are serious impediments to the state ever delivering nearly the amount of water that it theoretically could through its major public water projects. There are a few reasons why this is the case:

- 1) Each water project relies on snowfall for its supply, and snowfall is unreliable and varies significantly from year to year:** All the water resources in California rely on a sizeable snowpack. However, the amount of snowfall that the western United States varies widely from year to year, and the amount of water that water districts can receive from the public projects varies accordingly. Each year, the California Department of Water Resources will survey the snowpack. The department will compare the year's snowpack to historical averages and make a determination of how much water it will grant to the state water contractors. Please see the table below for the historical yields that the State Water Project actually delivers.



The last year that the State Water Project provided a 100% allocation year was in 2006. In 2014, at the height of the drought, the State Water Project only delivered [a 5% allocation](#). For example, the Kern County Water Agency in a 100% allocation year has 982,730 acre-feet of entitlement. In 2014, it received only 49,137 AF of supply. However, each State Water Contractor has to pay certain annual operations and maintenance charges associated with the facilities operations regardless of whether the Project delivers 100% or 0% in a given year.

- 2) Environmental challenges currently slow the pace of water transfers:** Regardless of how one may feel about environmental issues, the fact is that environmental regulations decrease the amount of water that California can send through some of the most crucial parts of its conveyance system. Almost all of the imported water coming from northern California must pass through the Bay Delta, a series of canals and pipelines in an environmentally sensitive area east of San Francisco Bay. In the past few years, the courts have ruled on a series of cases to limit the amount of water pumped through the delta in order to protect the Delta Smelt, an endangered fish and other species in the estuary. These fish migrate and spawn during the same times when water is prevalent in the system and project operators would like to maximize water diversions. For example, the [\*Sacramento Bee\*](#) reported in 2016 that the state received sizeable amounts of rainfall in the winter which could have helped to reverse the water losses in reservoirs during the 2012-15 drought. However, due to pumping restrictions in the Delta, 1.1 million acre-feet of water was diverted between January 1<sup>st</sup> and March 31<sup>st</sup>, but 3.6 million acre-feet of water flowed to the ocean in the Delta during the same time period. These factors will likely continue to limit the water availability from the state's various projects in the future.

## Section 4 – Single Year Transfers

As the name implies, single year transfers allow contractors within the State Water Project to transfer water between different contractors in a given year. Many of these transactions happen between two agricultural districts where a landowner has land within both districts, and the farmer may need more water in a given year in a district than his contract may allow. However, there has also been a higher prevalence of agricultural/rural to urban district transfers as population centers look for new water resources.

There has been a steady rise in the cost per acre-foot in the one year transfers over the past 2 decades. The biggest jump was during the State of California's recent 3-year drought conditions. In 2014 and 2015, farming interests paid up to \$1,100 per acre foot for one year transfers when the CVP and SWP allocation were at or near 0%. In 2016 the drought restrictions remained in place, albeit not as extreme, and prices for one year transfers dropped more than 40% from the prior year level. Please see Appendix A for select single year historical transfer costs.

On the other side of the coin, 'Wet year' water can come at a significantly lower price. These supplies typically are declared by the State Water Project under their contract 'Article 21'. The State Water Project contract Article 21 provides for sale of "surplus water" available in the State Water Project system during periods of heavy flow and could be at a price that is lower than other single year water supplies.

Capitol Core Group presented these options below at the Board at the June Board meeting. At the direction of the Board, they decided not to pursue these options in 2019. However, as the Authority continues to consider water supplies for the future, Capitol Core recommends that the

Authority consider taking advantage of these potential supplies. While wet hydrologic years do not happen often, they present water districts with opportunities to purchase water at prices that are generally much lower than prices in a drier hydrologic year.

## 2019 Single Year Water Supplies

### State Water Project Contractors Single Year Transfers

The current hydrologic year is providing for plentiful water supplies. The large snowpack as well as significant rain into May have provided the state with ample water supplies. The state's two largest reservoirs Lake Shasta and Lake Oroville are both at 88% capacity as of July 31<sup>st</sup> (for an up-to-date map of the state's reservoirs and status, click [here](#)) and the State Water Project increased allocations to 75% this year. As such, a few State Water Contractors have water available for sale in 2019 on a single year purchase agreement. These water supplies are subject to both the allocations on the State Water Project and the will of their respective Boards to sell water in any given year. These water resources are available this year, but there are no guarantees that water from these sources will be available in future years.

**Napa County Flood Control and Water Conservation District:** The Napa County Flood Control and Water Conservation District is a State Water Contractor that provides surface water deliveries to the cities of Napa, American Canyon and Calistoga. Their State Water Project allocation provides them with 29,025 acre-feet of Table A entitlement. Table A entitlement is the amount of water given to a contractor in a 100% allocation year. Any sale of water from the District requires approval from the three member agency cities. **In 2019, our initial discussions with the District indicate that they have approximately 10,000 acre-feet of water available for sale this year, subject to an exchange agreement detailed in the notes below.** The district seems willing to structure a deal similar to the exchange agreement that they completed with the Kern Westside Districts in June 2018. For the water that was delivered (see the note below with details of the exchange agreement), the Kern Westside Districts paid \$267 per AF. Wheeling charges and the other costs enumerated in the note below are in addition to the cost cited here.

**Mojave Water Agency:** Mojave Water Agency is a State Water Contractor that provides water to the northwestern portion of San Bernardino County. The Agency holds Table A rights of 85,800 acre-feet in a 100% delivery year. **This year, the Agency expects to have approximately 5,000 AF of water available, subject to an exchange agreement detailed in the notes below.** In our initial discussions with the Agency, they seem willing to structure a deal similar to the exchange agreement that they completed with the Central Coast Water Authority in 2019. For the water that was delivered (see the note below with details of the exchange agreement), the Central Coast Water Authority paid \$320 per AF. Please see the attached term sheet for further details of the agreement. Wheeling charges and the other costs enumerated in the note below are in addition to the cost cited here.

**Notes:** There are a few important notes associated with all State Water Project water available this year. First, since the Authority and Indian Wells Valley Water District currently have no direct access to surface water, this water would have to be stored in a water bank for future use, and there are costs associated with banking supplies. We discuss potential water banking options in a later section. Second, the State Water Project Members' contracts currently only allow for "water exchanges" of Table A water whereby the buyer returns some water to the seller at a given ratio at some point in the future. For example, Napa County completed the exchange agreement with the Westside Kern buyers on a 3:1 deal in 2018. For every 3 AF of water that the Westside Districts purchased, they will have to return 1 AF of water to Napa Valley in a future year and time acceptable to both parties. Mojave Water Agency completed a deal at 4:1 with the Central Coast Water Authority in 2019. **The cost of returning that water to the seller is an additional cost that the buyer pays for.** While the State Water Contractors are currently working out contract amendments that may allow outright water transfers, these amendments are subject to the final approval of the State Water Contractors and will not be finalized in time for water purchases this year. Finally, while the IWVGA is within the jurisdiction of the Kern County Water Agency (KCWA), it is not yet a member agency. The Authority (or the ultimate entity that would retain the water supplies) would need to become or have an agreement with KCWA to become a member agency.

Of note, the Mojave Water Agency also provided us with some ideas as to how we may be able to work together in getting the State Department of Water Resources to allow an outright transfer rather than an exchange. The Mojave Water Agency's service area extends far up into the northwest portion of San Bernardino County, and their service area partially overlaps with the Indian Wells Basin's boundaries. Mojave Water Agency said that we could potentially make an argument that a water transfer between Mojave Water Agency and IWVGA could be considered an intra-basin transfer, potentially allowing an outright sale. We want to stress that this argument is only a possibility, not a hard and fast rule with the Department of Water Resources, and is subject to DWR's ultimate interpretation and approval.

**Other Anticipated Single Year Water Available in 2019 - Article 21 Water:** In hydrologically wet years such as this, there is an ample amount of water in the system, and the State Water Project may be able to deliver more water than anticipated. If the State Water Project meets these criteria, the Project's administrators may declare Article 21 water conditions and provide more water available for sale beyond the Contractors' amounts granted in that year. Any State Water Contractor can request Article 21 water when it is available. If there is more water available than orders, then the orders are fulfilled as they are received. If there are more orders than Article 21 water available, then the orders are filled on a pro-rata basis by entitlement amounts. For a full discussion of how Article 21 water is administered, click [here](#).

Article 21 water has some important benefits but also limitations. This water usually has a lower cost associated with it, sometimes only costing the associated wheeling, O&M and administrative fees to deliver it. However, there are some important limitations. First, only State Water

Contractors have access to this water. Second, the water must be delivered immediately when water becomes available, and there is usually little warning when the Department of Water Resources will declare Article 21 conditions. As such, the end user will need either the ability to use that water right away or have access to storage facilities where it can be used later.

## **Section 5 – Multi-Year Transfers**

Multi-year transfers, like single year transfers, can occur between a variety of districts and usually range in duration from between 2 and 30 years. In the early 2000s, longer multi-year contracts were more prevalent because there were less demand on the water system than there currently is, and the pumping system had less environmental restrictions on it (and therefore generally more capacity). However, multi-year transfers still occur and can be considered as part of the Authority's potential water portfolio.

In reviewing a proposed long-term transfer, the State Water Resources Control Board must provide public notice and an opportunity for a hearing on the proposed transfer. In California, long-term transfers are also subject to the requirements of the California Environmental Quality Act ("CEQA"), which means environmental documentation must be completed. Such documentation, depending on the circumstances, can be a simple declaration of no significant environmental impacts or as complicated as a full Environmental Impact Report.

There are also a few important considerations and distinctions between potential transfers. First, transfers are subject to water availability in a given hydrologic year. In a year such as 2014 where the State Water Project only delivered 5% of contracted supplies, there may not have been enough water in the system to complete some transfers. Second, there is a distinction between water transfers of State Water Project entitlement and non-Project entitlement. Transfers of State Water Project water are conveyed first through the system. Non-Project water will be conveyed only if there is sufficient transfer capacity within the system. Therefore, non-project water transfers usually occur in dryer years where this excess capacity available in the system to move water.

Capitol Core Group has identified the following areas where the Board might consider multi-year transfers:

### **Currently Available Multi-Year Water Supplies**

**Antelope Valley East Kern Water Agency (AVEK):** The Antelope Valley East Kern Water Agency covers parts of northern Los Angeles County and southeastern Kern County. The Agency has the 3<sup>rd</sup> largest State Water Project entitlement of 144,844 acre-feet, only behind Metropolitan Water District and Kern County Water Agency in terms of size. Its geographic area covers parts of the Indian Wells basin, particularly in the southwest corner. We have had initial discussions with the Agency, and they have expressed support in potentially delivering water to the Authority. There are a few important considerations to their proposal. First, if AVEK is going to deliver water directly to the Authority, AVEK can only deliver treated water. The water pipeline that serves its

northeastern customers including California City and Edwards Air Force Base only delivers treated water, and there are no plans at this time to construct untreated distribution to that area. **As such, with treatment costs factored in, water delivered to the Phillips Lab Edwards Air Force Base turnout currently costs \$1,375 per acre-foot.** Any further infrastructure costs including the pipeline that would need to be constructed to tie into the Groundwater Authority's system and any further wheeling costs would be in addition to these charges. Second, if this is an option that the Authority wants to consider, engineering would have to verify whether there is currently enough treatment capacity in AVEK's existing infrastructure to provide the Authority with the final amount of water deemed necessary for the Basin's needs. A full breakdown of AVEK's 2019 water charges can be viewed [here](#).

**Plumas County:** Plumas County Flood Control and Water Conservation District is a small State Water Contractor in northern California with an annual entitlement of 2,700 acre-feet. Capitol Core has had initial discussions with the District, and they anticipate that they will have in the range of 1,000 to 1,200 acre-feet of water available annually for sale. Prices and terms are negotiable. Further, the District is in a financially challenged position, and needs to consider revenue options in order to continue to fund operations. At the [December 18, 2018](#) Plumas County Board of Supervisors meeting, the manager of the District had to request a \$100,000 loan from the County General Fund to pay for obligations due to the Department of Water Resources for the State Water Project (see Item 2B in the link above). Without the loan, the District would not have the cash flow to be able to cover the obligations by the end of the year. A December 2018 article in the [Plumas News](#) reports that the District has requested a total of \$493,000 in loans over the past few years because the District does not collect enough revenue in water sales to cover its fixed costs. As such, the District is in a financial position where they are looking for potential water buyers, and this could present an opportunity for the Authority to begin discussions with them on a water sale.

**“Nickel Water” (Purchased through the Tejon Ranch Company):** The Tejon Ranch Company is a large master plan developer of land primarily located in southern Kern County and northern Los Angeles County. As a result of the plans for significant development on the ranch, the company purchased and leased a series of water rights from a variety of sources to support the proposed development. In 2013, the Tejon Ranch Company purchased leasing rights to Kern River water known as the “Nickel Water,” named after the holder of the water rights, the Nickel Family LLC. The Nickel Family has farming operations in Kern County and retains control of these rights. The Tejon Ranch contract with the Nickel Family allows them to lease 6,693 acre-feet of water annually through 2044 (please see a full discussion of the contract [on page 86 of this link](#)). The purchase cost for Tejon Ranch of this water was \$717 per acre-foot in 2017 and \$738 per acre-foot in 2018.

Tejon Ranch needed to purchase water prior to the certification of their Environmental Impact Report (EIR), so they needed water rights regardless of whether the project is built or not. While the developer intends to build out the project over the long-term, it is our understanding that

the prior downturn in real estate slowed the pace of their building plans. As such, Tejon Ranch has between 1,000-3,000 AF of water available for sale from 2019 to 2023. The water would be delivered to the Tupman Turnout in Kern County, and the purchaser would be responsible for the costs associated with wheeling it from this point, banking (if necessary) and other associated costs. Payment for purchased water is due in February of each year. The asking price for the available water is as follows:

Nickel Water, From Tejon Ranch	
Asking Prices Per AF	
Years	Price per AF
2019-2020	\$1,000
2021-2022	\$1,225
2022-2023	\$1,325

This water has some pros and cons. This water is more expensive than other potential options we have found. However, it is available over a multi-year period. Also, the Nickel Family have “senior water rights” on the Kern River, and therefore the rights have a higher priority than junior water rights. As such, they are less likely to get curtailed in a year of drought. For this reason, other urban water agencies such as the San Geronio Pass Water Agency (SGPWA) in the Beaumont area have considered Water Supply Agreements with this seller.

#### Other Potential Multi-Year Transfers in the Future

**Mojave Water Agency:** In addition to the single year water supplies that the Agency has available, we have also had initial discussions with the Agency about providing the Authority with a long-term water supply. Initial discussions with them have been positive regarding this topic. The Agency covers parts of the Indian Wells Basin, and as discussed in Section 4, there may be a way for the Agency to sell water to the Authority outright rather than through the return agreements that are currently normal for water transfers. Prices and terms for this water will be negotiable. However, as a reference point, the Mojave Water Agency provides supplemental water to pumpers within its boundaries that pump more water than their allocation allows in a given year. **The current 2019 Supplemental Water rate is \$636 per acre-foot.**

**Butte Water District:** The Butte Water District is an agricultural water district which covers parts of Butte and Sutter Counties in northern California. The District has access to groundwater wells and approximately 134,000 acre-feet of annual surface water entitlement off of the Feather River. The State Department of Water Resources supplies this water, but they are not a State Water Project member. As such, this water is transferrable, but the transfer water has a lower priority than State Project water. In extremely wet years such as this, the State Water Project system is operating at nearly full capacity, and the amount of Project water leaves no room for non-Project water transfers. However, in years where the allocation is lower, there may be room for non-Project Water transfers, and the District has the ability to sell between 5-10,000 AF of

water when it is available. They can complete these water transfers in one of two ways: either through a groundwater substitution program where they pump groundwater and send surface water, or through a land following program. The District has sold water to a variety of customers in the last few years including the Kern County Water Agency. Sales prices have ranged generally between \$350 and \$700 per acre-foot, depending on the hydrologic conditions of the given year.

**Napa County Flood Control and Water Conservation District:** In our discussions with Napa County, the District is waiting to see the outcome of the proposed amendments currently before the State Water Contractors Association that would make water transfers easier. Under the newly proposed (but not yet agreed to) rules, State Water Contractors would be allowed to make outright sales of water to another district without a return obligation, which is currently the case. If these rules are amended, Napa would be willing to consider a longer-term contract in the future, as the District usually has excess State Water Project entitlement available in a given year.

**Metropolitan Water District/San Gabriel Valley Municipal Water District Carson Recycling Project:** The Metropolitan Water District of Southern California is planning to expand its water recycling capacity in order to use the treated water for basin recharge. The project is referred to as the [Regional Recycled Water Advanced Purification Center](#). For this project at proposed buildout, Metropolitan Water District will build a regional wastewater treatment facility that is capable of treating up to 150 million gallons per day. This water will be treated to a high enough purity where it is able to be recharged back into the ground. The water will be pumped east and spread into multiple areas including the Main San Gabriel Basin, where the San Gabriel Valley Municipal Water District is located (see the map below). While the project is still in the conceptual phases, districts such as San Gabriel could conceivably purchase some of this recycled water, freeing up its imported water entitlement to send to outside districts. **The project estimates that full buildout will take approximately 16 years to design and build, and the water will be at an estimated cost of \$1,830 per AF.**

### Carson Project Location



**Note** – Stetson Engineers provided Capitol Core Group with the lead on this opportunity, and Stetson has provided engineering services for the San Gabriel Valley Municipal Water District.

## Section 6 - Permanent Transfers

In California the term ‘Permanent Transfer’ of water typically refers to the purchase of State Water Project ‘Table A’ entitlement, or Central Valley Project Water contracts. The State Water Project delivers water to one of 29 State Water Contractors across the state. Contracts are take-or-pay, meaning the Contractor pays the fixed costs regardless of delivery amount. The delivery amounts (Table A Entitlement) are regulated through the Department of Water Resources and are announced annually based on hydrological conditions. For example, the State Water Project this year will deliver 75% of the total contract amount. However, even though the Project is delivering only 75%, each Contractor has to pay for its full share of fixed costs associated with the Project.

Permanent transfers can theoretically be completed between any two State Water Contractors, but are subject to a series of approvals. The following is a general description of how permanent transfers take place. The specific steps to finalize an approval may vary depending on the districts involved in the transaction. The Board of Directors first has to sign off on the agreement. In agricultural districts, the Board is usually made up of the landowners, and Board membership is based on the percentage of land in the district that a Member holds. In some instances such as the Tulare Lake Basin Water Storage District, members of the District have a 30 day “first right of refusal” which allow in-District members to match the purchase price of the water should they choose. If no one exercises the first right of refusal, then the next steps in the transfer process can proceed.

Next, the Department of Water Resources has to review and approve the transfer proposal as well as the environmental documents associated with the transfer. This includes a public comment period on the transfer and environmental documents. There may be outstanding assessments that need to be paid either to the district or to the State prior to a transfer. Once their review is complete, the transfer can proceed.

There are also some political considerations related to permanent water exchanges to be aware of. In the past, agricultural districts have sometimes been opposed to permanent transfers because of the potential long-term economic impacts of reduced farming activity. These were especially highlighted when large urban agencies such as the Mojave Water Agency bought large blocks of permanent entitlement, as they did when they purchased 14,000 acre-feet of permanent SWP entitlement from the Dudley Ridge Water District in 2009. This risk may remain an impediment in the future to transferring water.

## Historical Costs and Current Examples

Permanent State Water Project supplies have varied in price dramatically over the last 20 years or so that we have transaction data, but prices have generally increased over time. The most recent data points that we have for large blocks of permanent SWP supply came from 2016, when Table A was purchased for between \$5,000 and \$6,000 per AF, assuming a 100% allocation year. Please see Appendix A for details on the historical costs for permanent SWP transactions. Further, the San Geronio Pass Water Agency created a capacity fee study (which can be accessed [here](#)) that included a broker's opinion of value (BOV) on the cost of State Water Project supplies in 2015. The BOV concluded that the cost of purchasing Permanent SWP supplies at that point would be in approximately \$6,200 per AF.

## Current Transactions

In terms of current transactions, there is a property in the Tulare Lake Basin Water Storage District owned by the Priest Valley Cattle Company that is offering approximately 936 acres of farmland that has access to the State Water Project for \$7,703,040. The Tulare Lake Basin Water Storage District allows permanent water transfers, if approved, to strip .64 acre-feet of water per acre that has entitlement in an out-of-district transfer. In this instance, the new owner, if approved would be able to transfer approximately 617 acre-feet of entitlement ( $936 \times .64 = 617$ ). **If the property transacts at the asking price, the SWP entitlement would cost approximately \$12,500 per acre-foot.** The asking price of this water is significantly higher than other comparable recent sales. For example, a 640 acre parcel in the Angiola area with approximately 410 acre-feet of SWP entitlement sold in late 2016 for \$2,100,000 or about \$5,100 per acre-foot. This 2016 example is more in-line with the historical trends seen to date, and we would expect that if the seller is realistic about price, the transaction would occur at a figure closer to these comparable sales. However, the price and status of this property for sale as well as the market is dynamic and subject to change.

## Section 7 – Water Banking Opportunities

As we have discussed in prior sections, water supplies may vary considerably depending on the hydrologic year. It may behoove a water district that needs a steady annual supply of water to explore water banking opportunities for a few reasons. First, banked water allows the district to deliver water regardless of hydrologic conditions, making it easier to deliver a reliable water supply. Having designated capacity in a water bank also allows the district to purchase water supplies during a wet year when they are generally cheaper than other years. As such, we recommend that the Board consider potential water banking options over the long-term as a way to diversify your water portfolio and potentially increase reliability. This section will discuss potential water banking partners as well as some future projects that the Authority may consider.

## Currently Banked Water Available for Sale and Water Banking Options

**Rosedale Rio Bravo Water Storage District:** The Rosedale Rio Bravo Water Storage District is a Kern County Water Agency member agency and water bank operator in the Bakersfield area. We met with their General Manager Eric Averett, and he provided us with two potential options that the Authority may wish to consider. First, the District has already-banked water from a variety of sources that they have received. The District has a storage account, and takes advantage of its banking operations to purchase water in wet years when it is available. **The District has water available this year, and the asking price is in the \$800 per acre-foot range.**

In addition to already-banked water, the District is willing to entertain the potential of an outside entity such as the Authority purchasing water and storing it in the District's facilities, in exchange for monetary compensation, water, or some combination of both. As a Kern County member agency, this option may also provide less logistical challenges than other storage options. If the Authority wishes to bank water in Rosedale and wants to limit the amount of up-front cash it would have to provide, Rosedale offers a program where it will take water in-lieu of payment at a 2 for 1 rate. The user would send 2 acre-feet to the District and be eligible to extract 1 acre-foot at a future date.

**Semitropic Water Storage District:** The Semitropic Water Storage District is a water wholesaler and water bank based out of Wasco. The District stores both water for its agricultural operators as well as outside entities such as the Metropolitan Water District. Individual farming entities can also maintain accounts. Semitropic sells shares that allow the holder a certain amount of recharge, storage and recovery space within the system. We have identified a large farming operation that has both stored water and excess storage rights that they are willing to lease. In the scenario of a sale of water already stored, the rights to that water would transfer to IWVGA. In the scenario of leasing storage space, the owner of the shares would allow IWVGA to bring in its outside water supply and bank it within the share system that the farming operation currently owns. **The seller has approximately 2-3,000 AF of stored water for sale and approximately 5,000 to 7,500 AF of unused storage capacity available for lease.** Both the price of pre-banked water and leasing of storage space is negotiable, but subject to an agreement between the buyer and the farming operation, and the buyer and the Semitropic Board. The buyer would assume the maintenance costs associated with the ongoing operation of the Bank, which are enumerated below.

- Each Share allows 1 AF per year of recovery, 3 AF of storage and 1 AF per year of recharge
- Management fees are \$6.17 per share per year
- Maintenance fees are \$8 per share per year
- Recharge fees are \$20.55 per AF when delivered to the District
- Recovery fees are \$123.32 per AF plus actual energy costs when returned to the California Aqueduct

### **Other Potential Water Banking Options**

In addition to the water banks listed above, there are a few other projects that the Authority could consider in the future, including:

**Antelope Valley East Kern Water Agency:** The Antelope Valley East Kern Water Agency is currently building and will operate a groundwater recharge and recovery program referenced as the High Desert Water Bank (the Project). The Project will be implemented on an approximately 1,500-acre site in Los Angeles County within the AVEK District boundaries. The Project area consists of undeveloped and fallowed agricultural land surrounded by the Tehachapi and San Gabriel mountain ranges to the north, south, and west. The California Aqueduct will be the source of water for recharge operations and the point of delivery for return flow operations for the Project. The Project area is also situated south of an existing groundwater bank owned and operated by another Agency.

Based on outside consultant's assessments, AVEK projects the ability to store 280,000-acre feet within the groundwater bank. The source of water to be stored in the groundwater bank will consist of SWP water from various State Water Contractors and other partnering agencies throughout the State of California including AVEK. The Groundwater Bank is projected to store approximately 70,000-acre feet per year of SWP surface water conveyed to the site via the California Aqueduct. Recharge operations are planned during wet weather years when SWP allocations exceed demands. AVEK then proposes to recover 90% of the stored water with up to an estimated 70,000-acre feet per year returned during dry and critical weather years when SWP allocations are low or disrupted. The Groundwater Bank would allow the AVEK and its partners to rely primarily on the water stored in the groundwater bank as their primary source of water during dry weather years.

**Mojave Water Agency:** The Mojave Water Agency is also considering building a water bank within the Mojave Basin. MWA currently has [an agreement](#) with the Metropolitan Water District in which Metropolitan sends water to MWA and stores it in the Mojave Basin. The Mojave Basin currently has no extraction wells that are able to return water to the California Aqueduct or other conveyance facilities. To return water to Metropolitan, MWA sends like amounts of its SWP entitlement through an exchange. In the future, MWA is considering the construction of further banking facilities and extraction wells that would allow the Agency to return water to the California Aqueduct. The Agency expects to release an RFP for a feasibility study and initial design on this project in late 2019.

## Section 8 - Potential Cost Scenarios for Hypothetical Water Purchases for the Indian Wells Valley Groundwater Authority

In this section, Capitol Core Group will provide the Authority with a series of hypothetical scenarios whereby the Authority can receive the annual amount of water that it requires to bring the basin into sustainability. This chapter will outline the details of each scenario, the assumptions we made to reach these cost estimates, as well as the research and data we used to base our projections. Each scenario will show 10-year projections based on these initial estimates.

**Important Note Regarding these Estimates:** Please note that the projected financial data that we provide in this section are cost estimates based on the assumptions and research outlined in this chapter. Projections of costs for later years are based on long-term averages of key figures to determine cost inflation rates. Water markets in California are dynamic, particularly in this time period when many agencies are beginning to look for water to fulfill SGMA obligations. These figures represent estimates only and actual costs may vary at the point when the Authority is ready to purchase supplies. Further, these estimates include the costs delineated in each line item such as wheeling or storage costs. Unforeseen costs not included in these projections, other items negotiated during an actual purchase, or a change in hydrologic conditions may change these cost estimates. These costs also do not include the amortization of local infrastructure needed to supply water in the basin. As such, these figures should only be used a general guide for what water supplies may cost, recognizing that a host of factors could change the final costs.

**Assumptions:** Capitol Core Group used the following assumptions to determine the costs for each scenario –

- 1) **Amount of Water Delivered:** While the estimate for the amount of water needed for the basin has changed over the time of the project, we used an estimate of 3,000 acre-feet of imported water needed annually for the basin.
- 2) **Water Supplies:** The following cost assumptions were used to form the basis of the cost for service for each of the water supplies listed:
  - a. **Antelope Valley East Kern Water Agency:** As mentioned in the multi-year transfers discussion in Section 5, the Antelope Valley East Kern Water Agency only delivers treated water to the service area that is closest to the Indian Wells Valley Basin (such as Edwards Air Force Base). As such, our cost assumption is based on the Agency's cost for services to Base area for 2019 (see item a-4 in the link [here](#)). The cost of treated water service to Phillips Lab at Edwards Air Force Base is \$1,375/AF. **We assume that the cost to pump water to the Indian Wells Valley Basin would be another \$100/AF, so the first year cost of water is estimated at \$1,475/AF.** We assume a 4% increase in costs annually (justified in Section 3 below regarding wheeling).

- b. **Plumas County Flood Control and Water Conservation District:** Plumas County could potentially provide the District with between 1,000 and 1,200 AF annually. Plumas is a North-of-Delta water provider, so we used comparative comps for other water providers in the area to get a range of pricing. As we discussed in the section regarding single year transfers, North-of-Delta State Water such as from Napa County is available this year for less than \$300 per acre-foot. In drought years, water transfers can be significantly higher. According to a 2015 article in the [Sacramento Bee](#), a consortium of water districts including Metropolitan Water District had the rights to purchase up to 115,000 acre-feet of water in 2014 and 2015, at the height of the drought from agricultural districts that receive water from the Feather River. Butte Water District, one of the districts that we cite in the single-year transfer section, was also a participant in the 2014-15 deal. Metropolitan paid \$500/AF for water in 2014 and \$700/AF in 2015. **We used the mid-point between the highs and lows of the North-of-Delta suppliers and used a figure of \$500/AF in year 1.** We escalated the price by 4% annually over the 10-year projection.
- c. **Permanent State Water Project (SWP) Supplies: We assume a cost of \$6,500 per acre-foot to purchase permanent Table A supplies.** Permanent State Water Project supplies have varied in price dramatically over the last 20 years or so that we have transaction data, but prices have generally increased over time. The most recent data points that we have for large blocks of permanent SWP supply came from 2012, when Table A was purchased for between \$5,000 and \$6,000 per AF, assuming a 100% allocation year. Please see the discussion in Section 6 and the transaction tables laid out in Appendix A for more details. Further, the San Geronio Pass Water Agency created a capacity fee study (which can be accessed [here](#)) that included a broker's opinion of value (BOV) on the cost of State Water Project supplies in 2015. The BOV concluded that the cost of purchasing Permanent SWP supplies at that point would be in approximately \$6,200 per AF.

Also as discussed in Section 6, the allocations on the State Water Project can vary dramatically from year to year depending on hydrologic conditions. In the past 15 years, the State Water Project has provided 100% of supplies in 2006, to only 5% at the height of the drought in 2014. To determine the amount of water that the Authority would need to purchase to provide 1,000 acre-feet over the long-term we used the projections in the most recent 2017 Department of Water Resources *State Water Project Delivery Capability Report* (which can be viewed [here](#)). The study projects that the State Water Project can deliver water with 62% reliability over the long-term. The study determines this figure by dividing the long-term annual estimate of deliveries of 2,571,000 acre-feet (on Page 2) by the total potential deliveries for the State Water Project in a full allocation of 4,172,786 acre-feet. Using this 62% figure, if the Authority would like to deliver 1,000 acre-

feet of water average over the long-term, then it will have to purchase 1,613 acre-feet of SWP water ( $1,000/.62=1,613$ ).

To arrive at the annual costs for the SWP supplies, we completed amortization tables for a 30-year loan to purchase this amount of water at assuming a 5% interest rate and quarterly interest payments. Please see Appendix D for the amortization tables.

- d. **Nickel Water:** We provide a scenario where the Authority theoretically purchases the Nickel Water 5-year contract from the Tejon Ranch Company. The prices quoted are from the contract terms that Tejon Ranch proposed.
- e. **Mojave Water Agency:** Mojave Water Agency's (MWA) service area as discussed covers part of the Basin. While the Agency has not finalized the cost of water delivery service that they would propose to the Authority, Mojave has a robust set of water data to show their costs for supplemental water delivered to their service area. Since the basin was adjudicated, the Mojave Water Agency has provided Supplemental Water, which is imported State Water Project supplies provided to groundwater rights holders that pump more water in a given year than their allocation allows. **The 2019 cost per acre-foot of Supplemental Water delivered to the Basin is \$636/AF.** This figure is *inclusive* of the wheeling fees associated with brining the water to the MWA service area. As such, we did not add further wheeling fees associated with this water for two reasons. First, should this water be sent directly to one of our transfer partners rather than directly to MWA, the wheeling fees likely would not be significantly different. The largest component of wheeling fees to deliver water to any State Water Project Contractor south of the Tehachapi Mountains is usually the electricity costs associated with the Edmontson Pumping Plant, which lifts water almost 2,000 feet over the Tehachapi Mountains. The [Water Education Foundation](#) points out that this pumping plant alone uses on average 40% of the total electricity used in the State Water Project, and any State Water Contractor south of this point (AVEK, MWA and Metropolitan included) would be subject to these costs. Further, MWA and Metropolitan have a banking agreement in place whereby Metropolitan can send and bank water in the Mojave Basin in exchange for State Water Project supplies at a later time. While it is still to be determined whether the Authority could utilize a similar approach, there are mechanisms in place to allow such a transaction.
- f. **Banking Costs:** As noted in Section 7, there are a variety of water banks that utilize a share system and associated expenses to run the bank operations. These options, such as the Semitropic Water Storage District, require significant up-front capital costs to purchase share participation in the bank. Considering the financial position of the Authority, we sought a banking option that would limit the amount of up-front costs associated with banking. We used the model of the Rosedale Rio-Bravo Water Storage District where the District would take water in lieu of shares

or an up-front payment to store water. Rosedale offered a 2:1 model (the Authority delivers 2 AF of water and Rosedale returns 1 at a later date with no up-front payment to Rosedale), and the scenarios with banking are modeled as such. The Authority would be required to pay for the electricity costs for recovering the water, which is assumed at \$80/AF and escalated at 2.5% per year.

- g. **Wheeling Costs:** To provide a reference point as to the cost associated with the operations and maintenance of the State Water Project and wheeling (conveying) water to Southern California, particularly an area south of the Tehachapis, we used Metropolitan Water District’s wheeling fees. **The 2019 per-acre-foot wheeling fee is \$522** and consists of the following:

<b>Metropolitan Water District 2019 Per-Acre-Foot Wheeling Charges</b>	
System Access Rate	\$326
Water Stewardship Rate	\$69
System Power Rate	\$127
<b>Total Per-Acre-Foot Charge</b>	<b>\$522</b>

Each fee rate is used for the following (taken from *Water Rates and Charges*, a publication of the Municipal Water District of Orange County, Met member agency and accessible [here](#)):

**System Access Rate:** Recovers the costs to support MET’s water conveyance and distribution system, including capital costs associated with average demand and operations and maintenance.

**System Power Rate:** Recover’s MET’s average cost of energy to pump water on the State Water Project

**Water Stewardship Rate:** Provides Revenue to support MET’s Water Use Efficiency programs including conservation and local resource programs.

Metropolitan Water District provides data on these wheeling fees going back to 2003. The average annual increase in wheeling costs over this time is 4.27%, so we use this figure as an annual cost escalator for our future year wheeling estimates.

**\*Note:** In the scenarios where we describe wheeling costs for the State Water Project, we include the per-acre-foot cost for the entire projected allocation for each scenario (for example, we assume that the Authority would have to purchase 1,613 AF of SWP supplies to receive 1,000 AF over the long-term). The State Water Project follows a “take or pay” system whereby some annual charges are fixed regardless of whether the water rights holder takes delivery of the water or if the Project can deliver it in a given year.

**Description of Scenarios:** Capitol Core Group ran the following cost scenarios to provide the Authority with 3,000 acre-feet of water annually to the Basin. Each scenario provides the cost

estimates for the first ten years after purchase. Please see the table in each scenario for a full breakdown of estimated costs by year.

**Scenario 1:** The Authority purchases 3,000 AF of treated water annually from the Antelope Valley-East Kern Water Agency. The water is directly delivered from AVEK, and assumes that they will be the Authority’s transfer partner. Water costs follow the assumptions described earlier.

Scenario 1: Antelope Valley East Kern Water District Treated Water Supply (Direct Delivery to Ridgecrest)										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
Cost per AF	\$1,475	\$1,534	\$1,572	\$1,612	\$1,652	\$1,693	\$1,736	\$1,779	\$1,823	\$1,869
<b>Total Cost of Supplies</b>	<b>\$4,425,000</b>	<b>\$4,602,000</b>	<b>\$4,717,050</b>	<b>\$4,834,976</b>	<b>\$4,955,851</b>	<b>\$5,079,747</b>	<b>\$5,206,741</b>	<b>\$5,336,909</b>	<b>\$5,470,332</b>	<b>\$5,607,090</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$5,023,570</b>									

**Scenario 2:** Scenario 2 describes a hypothetical purchase of enough State Water Project permanent supply to provide the Authority with a long-term average of 3,000 AF of water deliveries. To provide this amount of water over the long-term, we use the projected 62% reliability that the State Water Project assumes (as described in the assumptions) to calculate the amount of permanent supplies the Authority would have to purchase. Using this 62% figure, if the Authority would like to deliver 3,000 acre-feet of long term supplies, then it will have to purchase 4,839 acre-feet of permanent water entitlement ( $3,000 / .62 = 4,839$ ) at \$6,500 per AF. The scenario has the following cost components:

**SWP Annual Note Repayment:** Assumes the cost of purchasing the permanent SWP supply will be repaid over 30 years at a 5% interest rate.

**SWP Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

Scenario 2: Purchase 4,839 AF of Permanent SWP Supplies for 3,000 AF Annual Long-Term Delivery										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
SWP Annual Note Repayment	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698	\$2,029,698
SWP Wheeling Fee	\$2,525,958	\$2,633,816	\$2,746,280	\$2,863,547	\$2,985,820	\$3,113,314	\$3,246,253	\$3,384,868	\$3,529,402	\$3,680,107
<b>Total Cost of Supplies</b>	<b>\$4,555,656</b>	<b>\$4,663,514</b>	<b>\$4,775,978</b>	<b>\$4,893,244</b>	<b>\$5,015,518</b>	<b>\$5,143,012</b>	<b>\$5,275,951</b>	<b>\$5,414,566</b>	<b>\$5,559,100</b>	<b>\$5,709,805</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$5,100,634</b>									

**Scenario 3:** Scenario 3 assumes that the Authority will receive 1,000 AF annually from the each of the three following supplies: The purchase of permanent State Water Project supplies, a long-term contract with Plumas County and a long-term contract with Mojave Water Agency. The scenario has the following cost components:

**SWP Annual Note Repayment:** Using the 62% long-term reliability figure, if the Authority would like to deliver 1,000 acre-feet of long term supplies, then it will have to purchase 1,613 acre-feet of permanent water entitlement ( $1,000/.62=1,614$ ) at \$6,500 per AF. Assumes the cost of purchasing the permanent SWP supply will be repaid over 30 years at a 5% interest rate.

**SWP Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**Plumas Water:** First year cost is assumed at \$500/AF, and escalated at 4% annually.

**Plumas Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**Mojave Water Agency Supplemental Water:** First year cost is \$636/AF and escalated at 6.27% annually.

Scenario 3: Purchase 1,613 AF Permanent SWP Supplies, 1,000 AF Annual from Plumas County, 1,000 AF Annual From Mojave Water Agency										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
SWP Annual Note Repayment	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566
SWP Wheeling Fee	\$841,986	\$877,939	\$915,427	\$954,516	\$995,273	\$1,037,771	\$1,082,084	\$1,128,289	\$1,176,467	\$1,226,702
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$542,880	\$564,595	\$587,179	\$610,666	\$635,093	\$660,497	\$686,916	\$714,393	\$742,969
Mojave WA Supplemental Water	\$636,000	\$675,877	\$718,255	\$763,289	\$811,148	\$862,006	\$916,054	\$973,491	\$1,034,529	\$1,099,394
<b>Total Cost of Supplies</b>	<b>\$3,176,552</b>	<b>\$3,293,262</b>	<b>\$3,415,643</b>	<b>\$3,543,982</b>	<b>\$3,678,582</b>	<b>\$3,819,763</b>	<b>\$3,967,861</b>	<b>\$4,123,228</b>	<b>\$4,286,240</b>	<b>\$4,457,287</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$3,776,240</b>									

**Scenario 4:** Scenario 4 assumes that the Authority will purchase 3,000 AF annually from the Nickel Water contract for the first five years when it is available, and then purchase already-banked water from a supplier at an assumed rate of \$1,000 per acre-foot. The following cost assumptions are used:

**Nickel Water:** Costs follow the proposed contract terms which are:

Nickel Water, From Tejon Ranch Asking Prices Per AF	
Years	Price per AF
2019-2020	\$1,000
2021-2022	\$1,225
2022-2023	\$1,325

**Nickel Water Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**Banked Water Purchase:** As discussed in Section 7, there are already-banked water supplies currently available from banks such as Rosedale Rio-Bravo Water Storage District for \$800/AF. Since this water supply in this scenario would not be purchased until Year 6, we assume a cost of \$1,000 per AF, or a 25% escalation from current costs.

**Banked Water Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

Scenario 4: Nickel Water First 5 Years, Buy Banked Banked Water at \$1,000/AF										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Nickel Water Purchase	\$3,000,000	\$3,000,000	\$3,675,000	\$3,675,000	\$3,975,000	\$0	\$0	\$0	\$0	\$0
Nickel Water Wheeling	\$1,566,000	\$1,632,868	\$1,702,592	\$1,775,292	\$1,851,097	\$0	\$0	\$0	\$0	\$0
Banked Water Purchase	\$0	\$0	\$0	\$0	\$0	\$3,000,000	\$3,120,000	\$3,244,800	\$3,374,592	\$3,509,576
Banked Water Wheeling	\$0	\$0	\$0	\$0	\$0	\$1,930,139	\$2,012,556	\$2,098,492	\$2,188,098	\$2,281,530
<b>Total Cost of Supplies</b>	<b>\$4,566,000</b>	<b>\$4,632,868</b>	<b>\$5,377,592</b>	<b>\$5,450,292</b>	<b>\$5,826,097</b>	<b>\$4,930,139</b>	<b>\$5,132,556</b>	<b>\$5,343,292</b>	<b>\$5,562,690</b>	<b>\$5,791,105</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$5,261,263</b>									

**Scenario 5:** Scenario 5 assumes that the Authority will purchase 1,000 AF annually each from Plumas County and Mojave Water Agency, and then bank enough water every 5 years to provide 1,000 AF annually to the Authority. To do this, the Authority would have to purchase 10,000 AF every five years to complete the 2-for-1 deal that we describe in the assumptions. This amount of water purchased would leave the Authority with 5,000 AF, enough to deliver 1,000 AF annually and round out the 3,000 AF total annual delivery. The following cost assumptions are used:

**Plumas Water:** First year cost is assumed at \$500/AF, and escalated at 4% annually.

**Plumas Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**Mojave Water Agency Supplemental Water:** First year cost is \$636/AF and escalated at 6.27% annually.

**Banked Water:** 10,000 of banked water would be purchased every 5 years at \$300 per acre-foot.

**Recovery Charge:** The electricity cost to recover the banked water is estimated at \$80/AF.

**Banked Water Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

Scenario 5: 1000 Annual Plumas, 1000 Annual Mojave, bank 10,000 AF Every 5 Years at \$300/AF, Deliver 1,000 AF Banked Water Per Year										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$542,880	\$564,595	\$587,179	\$610,666	\$635,093	\$660,497	\$686,916	\$714,393	\$742,969
Mojave WA Supplemental Water	\$636,000	\$675,877	\$718,255	\$763,289	\$811,148	\$862,006	\$916,054	\$973,491	\$1,034,529	\$1,099,394
Bank 10,000 AF (2 for 1 with partner)	\$3,000,000	\$0	\$0	\$0	\$0	\$3,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
<b>Total Cost of Supplies</b>	<b>\$5,260,000</b>	<b>\$2,365,047</b>	<b>\$2,475,230</b>	<b>\$2,590,816</b>	<b>\$2,712,080</b>	<b>\$5,839,318</b>	<b>\$2,972,838</b>	<b>\$3,112,965</b>	<b>\$3,260,045</b>	<b>\$3,414,437</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$3,400,278</b>									

**Scenario 6:** Scenario 6 has all the same assumptions as Scenario 5, but the banked water is purchased at \$500 per acre-foot.

Scenario 6: 1000 Annual Plumas, 1000 Annual Mojave, bank 10,000 AF Every 5 Years at \$500/AF, Deliver 1,000 AF Banked Water Per Year										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$542,880	\$564,595	\$587,179	\$610,666	\$635,093	\$660,497	\$686,916	\$714,393	\$742,969
Mojave WA Supplemental Water	\$636,000	\$675,877	\$718,255	\$763,289	\$811,148	\$862,006	\$916,054	\$973,491	\$1,034,529	\$1,099,394
Bank 10,000 AF (2 for 1 with partner)	\$5,000,000	\$0	\$0	\$0	\$0	\$5,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
<b>Total Cost of Supplies</b>	<b>\$7,260,000</b>	<b>\$2,365,047</b>	<b>\$2,475,230</b>	<b>\$2,590,816</b>	<b>\$2,712,080</b>	<b>\$7,839,318</b>	<b>\$2,972,838</b>	<b>\$3,112,965</b>	<b>\$3,260,045</b>	<b>\$3,414,437</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$3,800,278</b>									

**Scenario 7:** Scenario 7 has all the same assumptions as Scenarios 5 and 6, but the banked water is purchased at \$700 per acre-foot.

Scenario 7: 1000 Annual Plumas, 1000 Annual Mojave, bank 10,000 AF Every 5 Years at \$700/AF, Deliver 1,000 AF Banked Water Per Year										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$542,880	\$564,595	\$587,179	\$610,666	\$635,093	\$660,497	\$686,916	\$714,393	\$742,969
Mojave WA Supplemental Water	\$636,000	\$675,877	\$718,255	\$763,289	\$811,148	\$862,006	\$916,054	\$973,491	\$1,034,529	\$1,099,394
Bank 10,000 AF (2 for 1 with partner)	\$7,000,000	\$0	\$0	\$0	\$0	\$7,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
<b>Total Cost of Supplies</b>	<b>\$9,260,000</b>	<b>\$2,365,047</b>	<b>\$2,475,230</b>	<b>\$2,590,816</b>	<b>\$2,712,080</b>	<b>\$9,839,318</b>	<b>\$2,972,838</b>	<b>\$3,112,965</b>	<b>\$3,260,045</b>	<b>\$3,414,437</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$4,200,278</b>									

**Scenario 8:** In this scenario, the Authority would purchase 1,000 AF annually from Plumas County, bank 10,000 AF of water every five years (same as in scenarios 5-7) and purchase enough State Water Project entitlement to deliver 1,000 AF of water over the long-term (as in scenarios 2 and 3). The following cost assumptions are used:

**Plumas Water:** First year cost is assumed at \$500/AF, and escalated at 4% annually.

**Plumas Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**Banked Water:** 10,000 of banked water would be purchased every 5 years at \$300 per acre-foot.

**Recovery Charge:** The electricity cost to recover the banked water is estimated at \$80/AF.

**Banked Water Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

**SWP Annual Note Repayment:** Using the 62% long-term reliability figure, if the Authority would like to deliver 1,000 acre-feet of long term supplies, then it will have to purchase 1,613 acre-feet of permanent water entitlement ( $1,000/.62=1,614$ ) at \$6,500 per AF. Assumes the cost of purchasing the permanent SWP supply will be repaid over 30 years at a 5% interest rate.

**SWP Wheeling Fee:** Assumed at a Year 1 rate of \$522/AF, and escalated at 4.27% per the assumptions.

Scenario 8: 1000 Annual Plumas, bank 10,000 AF Every 5 Years at \$300/AF, Deliver 1,000 AF Banked Water Per Year, Purchase 1,613 AF Permanent SWP										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
Bank 10,000 AF (2 for 1 with partner)	\$3,000,000	\$0	\$0	\$0	\$0	\$3,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
SWP Annual Note Repayment	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566
SWP Wheeling Fee	\$841,986	\$875,665	\$910,692	\$947,120	\$985,005	\$1,024,405	\$1,065,381	\$1,107,996	\$1,152,316	\$1,198,409
<b>Total Cost of Supplies</b>	<b>\$6,142,552</b>	<b>\$3,242,810</b>	<b>\$3,347,169</b>	<b>\$3,455,797</b>	<b>\$3,568,870</b>	<b>\$6,686,569</b>	<b>\$3,809,086</b>	<b>\$3,936,618</b>	<b>\$4,069,371</b>	<b>\$4,207,559</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$4,246,640</b>									

**Scenario 9:** Scenario 9 has all the same assumptions as Scenario 8, but the banked water is purchased at \$500 per acre-foot.

Scenario 9: 1000 Annual Plumas, bank 10,000 AF Every 5 Years at \$500/AF, Deliver 1,000 AF Banked Water Per Year, Purchase 1,613 AF Permanent SWP										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
Bank 10,000 AF (2 for 1 with partner)	\$5,000,000	\$0	\$0	\$0	\$0	\$5,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
SWP Annual Note Repayment	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566
SWP Wheeling Fee	\$841,986	\$875,665	\$910,692	\$947,120	\$985,005	\$1,024,405	\$1,065,381	\$1,107,996	\$1,152,316	\$1,198,409
<b>Total Cost of Supplies</b>	<b>\$8,142,552</b>	<b>\$3,242,810</b>	<b>\$3,347,169</b>	<b>\$3,455,797</b>	<b>\$3,568,870</b>	<b>\$8,686,569</b>	<b>\$3,809,086</b>	<b>\$3,936,618</b>	<b>\$4,069,371</b>	<b>\$4,207,559</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$4,646,640</b>									

**Scenario 10:** Scenario 10 has all the same assumptions as Scenarios 8 and 9, but the banked water is purchased at \$700 per acre-foot.

<b>Scenario 10: 1000 Annual Plumas, bank 10,000 AF Every 5 Years at \$700/AF, Deliver 1,000 AF Banked Water Per Year, Purchase 1,613 AF Permanent SWP</b>										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
AF Supplied	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Plumas Water	\$500,000	\$520,000	\$540,800	\$562,432	\$584,929	\$608,326	\$632,660	\$657,966	\$684,285	\$711,656
Plumas Wheeling Fee	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
Bank 10,000 AF (2 for 1 with partner)	\$7,000,000	\$0	\$0	\$0	\$0	\$7,000,000	\$0	\$0	\$0	\$0
Recovery Charge	\$80,000	\$82,000	\$84,050	\$86,151	\$88,305	\$90,513	\$92,775	\$95,095	\$97,472	\$99,909
Wheel Banked Water	\$522,000	\$544,289	\$567,531	\$591,764	\$617,032	\$643,380	\$670,852	\$699,497	\$729,366	\$760,510
SWP Annual Note Repayment	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566	\$676,566
SWP Wheeling Fee	\$841,986	\$875,665	\$910,692	\$947,120	\$985,005	\$1,024,405	\$1,065,381	\$1,107,996	\$1,152,316	\$1,198,409
<b>Total Cost of Supplies</b>	<b>\$10,142,552</b>	<b>\$3,242,810</b>	<b>\$3,347,169</b>	<b>\$3,455,797</b>	<b>\$3,568,870</b>	<b>\$10,686,569</b>	<b>\$3,809,086</b>	<b>\$3,936,618</b>	<b>\$4,069,371</b>	<b>\$4,207,559</b>
<b>Average Annual Cost First 10 Years</b>	<b>\$5,046,640</b>									

## Section 9 -Potential Transfer Partners

The Indian Wells Valley basin currently relies entirely on groundwater as the source for its water needs and has no direct access to imported water supplies. Although the basin has three California State Water Contractors that cover parts of it (Kern County Water Agency and Antelope Valley East Kern Water Agency cover the areas of the basin in Kern County and the Mojave Water Agency covers parts of the basin that is in San Bernardino County), the Indian Wells Valley Water District is not currently a member of any of these agencies. As such, the basin will need to build infrastructure to access imported water supplies and reach agreements with potential transfer partners to provide them with imported water conveyance. The Authority has identified two potential transfer partners who could theoretically deliver water resources to the basin: The Antelope Valley East Kern Water Agency (AVEK) and the Los Angeles Department of Water and Power (LA DWP).

Imported water supplies for the Indian Wells Valley will likely come from sources in Northern California or the Central Valley. The State Water Project's California Aqueduct has a turnout that connects it directly to both potential transfer partners, and could provide the selected transfer partner with this water through an exchange agreement. This section will address the background for each potential water partner, and items for the Board to consider as they provide direction on their preferred partner.

### Antelope Valley-East Kern Water Agency

**Background:** The Antelope Valley-East Kern Water (AVEK) is the third largest State Water Project (SWP) Contractor in the State of California. It encompasses 2,300 square miles in the Mojave Desert area of California, northeast of Los Angeles, and includes over twenty municipal users as well as Edwards AFB, Palmdale Air Force (Plant 42) and U. S. Borax.

Because groundwater resources were severely overdrafted, AVEK contracted for a supplemental supply of municipal and industrial water (141,400 acre-feet) from the California State Water

Project. Of the 141,400-acre-foot annual entitlement, the municipal and industrial, and agricultural water customers are currently using about 75,000-acre feet per year.

**Retail Water Deliveries:** The bulk of the water imported by AVEK is treated and delivered to customers throughout its service area through Domestic-Agricultural Water Network (DAWN) Project facilities. AVEK's entitlement also provides for delivery of untreated irrigation water from the Aqueduct and AVEK turnouts to Antelope Valley farmers.

The DAWN Project consists of more than 100 miles of water distribution pipeline; Four Water Treatment Plants; Four 8-million-gallon water storage reservoirs near Mojave, and one 3-million-gallon capacity reservoir at Vincent Hill Summit. AVEK currently sends water to the Edwards Air Force Base in the far north east region of its district boundaries. AVEK also delivers water to California City, a delivery point further north than the Edwards Air Force Base. Of note, the pipeline that delivers water to the eastern sections of the District where the IWVGA could conceivably tie into delivers only treated water.

**Facilities Needed for delivery to Indian Wells Valley:** The Indian Wells Valley lies roughly 60 miles to the North/Northeast of AVEK's current pipeline infrastructure in California City. The water delivered to California City (as well as Edwards Air Force Base) is 'treated' water and ready to serve customers. This means any pipeline connection to AVEK for the purpose of delivering water to the Indian Wells Valley will carry treated water.

Engineer's estimates for the facilities needed include the 60 +-miles of 28-inch steel pipeline as well as 2 pump stations and a 1-million-gallon steel tank. The new facilities could connect directly into the IWVWD facilities and thereby alleviate some of the current groundwater pumping by the IWVWD. **The total estimated cost of the infrastructure to tie into AVEK's system (per Stetson Engineers) is approximately \$177 million.**

### **Los Angeles Department of Water and Power**

**Background:** In an average year, the LADWP Water System draws 18 percent of its water from the Eastern Sierra and purchases 71 percent from the Metropolitan Water District of Southern California (MWD). Water pumped from groundwater wells provides an additional 10 percent. To supplement these sources, Los Angeles uses recycled water for industrial and irrigation purposes—representing about 1 percent of the total supply.

The LA Department of Water and Power has two imported water facilities that are pertinent to the Groundwater Authority. The Los Angeles Aqueduct provides water supplies from the Eastern Sierras and runs through eastern Kern County, on its way to Los Angeles. The closest point of potential tie-in to the Los Angeles Aqueduct for the Groundwater Authority is in the western section of the Basin near Inyokern. Second, the Metropolitan Water District has access to the State Water Project through deliveries from the California Aqueduct. This aqueduct brings water supplies from Northern California, and could conceivably deliver water that the Authority purchases from the sources addressed in the scenarios in Section 8. There is an intertie where

the two aqueducts meet and allows more delivery flexibility for water supplies, depending on hydrologic conditions.

**Facilities Need for delivery to Indian Wells Valley:** The Los Angeles Aqueduct currently runs through the Indian Wells Valley Basin on its way to Los Angeles. The aqueduct follows the base of the Sierra Nevada Mountains on the western portion of the Indian Wells Valley Basin. As this scenario would tie into a different water system than AKEK, the amount and type of facilities needed differ between the two. Also, unlike the AVEK scenario, the LA Aqueduct would provide untreated water to the Authority.

For the LA DWP transfer partnership scenario, the Authority would have to build the following infrastructure to deliver water: A turnout from the LA Aqueduct, approximately 53,300 linear feet of 28" pipeline, a spreading grounds facility to recharge the water estimated at 400 acres, 5 recovery wells, chlorination facilities and a 1 million gallon steel tank. **The total estimated cost of the infrastructure to tie into LA DWP's system (per Stetson Engineers) is approximately \$55 million.**

#### **Considerations for Each Potential Transfer Partner**

In order to determine which potential Transfer Partner best fits the Indian Wells Valley, several factors should be considered including financial, political and overall feasibility of each transfer partner. Once the Board provides feedback and direction on the preferred proposed transfer partner, the process of negotiation will begin to establish the framework and development for the agreements necessary to connect to the facilities of the potential partner as well as the delivery of water from the potential partner.

The concept of an agreement for the IWVGWA, regardless of which transfer partner is chosen, is to provide the transfer partner with imported water supplies from other areas of the state in exchange for like amounts of water from the transfer partner. The transfer partner would deliver the new, imported supply through infrastructure that the IWVGA builds. As such, the IWVGA would not increase water deliveries from the transfer partner's own sources to offset IWVGA's water use.

In drafting this agreement, the Authority should address the following issues and questions:

1. How much water will be transferred to the transfer partner?
2. What will the transfer partner want in compensation for this agreement?
3. Where will this water be delivered? How?
4. When will the transfer partner give water to Indian Wells?

These issues will be virtually the same for both potential transfer partners. The IWVGWA will have to weigh the factors listed below to determine the best fit for the potential transfer partner.

## Financial

**AVEK:** The engineer's estimates for the infrastructure needed for the transfer partnership with AVEK is roughly \$177,975,000. This number does not include the purchase of any water supply.

**LADWP:** The engineer's estimates for the infrastructure needed for the transfer partnership with LADWP is roughly \$55,046,000. This number does not include the purchase of any water supply.

## Political

**AVEK:** The politics surrounding the potential partnership with AVEK should be limited to two areas: the local AVEK sphere of influence and other State Water Contractors.

Within the AVEK District, management has expressed interest in working with the Groundwater Authority on a transfer partnership, provided that the District is willing to pay for the water, infrastructure and maintenance costs associated with tying into their system. One challenge that AVEK expressed is ensuring that the other State Water Contractors that cover parts of the Indian Wells Basin are supportive of AVEK providing the Authority water service. As discussed, AVEK, Kern County Water Agency and the Mojave Water Agency all cover parts of the basin. As a general rule, one State Water Contractor is not allowed to provide water to another State Water Contractor without the consent of the other party. The main population center of the Indian Wells Basin (Ridgecrest) is within the geographic sphere of the Kern County Water Agency. As such, the Authority would need to coordinate with both Kern County Water Agency and Mojave Water Agency to ensure that they are supportive of AVEK providing the Basin's water supplies.

**LADWP:** The politics of a potential partnership with LADWP are more complex than those with a transfer partnership with AVEK. Capitol Core Group met members of the Inyo County delegation including Supervisor Matt Kingsley and Jon Vallejo in late June to discuss their concerns about the project. Inyo County has expressed concerns that the Indian Wells Valley Basin will take water from the LA Aqueduct, and cause an increased reliance and burden on imported water supplies from the Eastern Sierras. These concerns should be considered as the Board determines its preferred transfer partner. It is our intention that any water that the Authority would receive from the LA Aqueduct, should the Board choose LA DWP as their transfer partner, would not increase the overall amount of water that LA DWP transfers from Inyo County and the Eastern Sierras. For example, if the Authority needs 3,000 acre-feet and gets that water delivered from the LA Aqueduct, the Authority would replace that amount of water with 3,000 acre-feet of water from another Northern California source, leading to no increase in the aggregate amount of water that LA DWP exports from the Owens Valley.

At the State level, any new supply of water to be procured on behalf on Indian Wells Valley Basin will have to pass through State Water Project Aqueduct and transferred to LA DWP via the intertie connection in the Antelope Valley. Because LA DWP is not an SWP contractor, the proposed exchange agreements could include IWVGWA, Metropolitan Water District (for LA DWP) and the local SWP contractor (AVEK, Mojave or Kern County Water Agency, depending on who eventually

holds the water rights). Multi-Agency agreements run the risk of greater scrutiny for the communities of each of the agencies that are a party to the agreement.

### **Overall Feasibility**

**AVEK:** The proposed transfer partnership with AVEK presents complications on the financial feasibility as well as the physical feasibility of the proposed infrastructure. The estimated infrastructure costs to tie into AVEK's system are approximately 3 times the amount of the cost estimates for LA DWP. Any time a pipeline of any substantial size and distance will be constructed in the State of California, the environmental requirements of such a large construction project would not only add to the financial impacts but could face substantial resistance from the environmental community.

**LADWP:** The proposed partnership with the LA DWP is more viable on the financial and physical infrastructure side. However, the political complexities discussed could affect the overall feasibility of the partnership. The IWVGWA will have to take all of these factors into consideration as it determines that transfer partner the Board wishes to pursue.

## **Section 10: Considerations and Recommendations**

As the Groundwater Authority continues to complete its Groundwater Sustainability Plan (GSP) for submittal to the Department of Water Resources at the end of January 2020, it is in our opinion vital for the Board to continue to consider and act on potential water supplies that Capitol Core has identified. The Authority will likely face competition for limited water supplies available in the State of California, as more basins try to address the water shortfalls that SGMA is forcing them to address. The Indian Wells Basin is one of 21 basins that the Department of Water Resources identified as in critical overdraft. All of these basins will have to submit plans at the same time as Indian Wells Valley and will also likely look to imported water supplies to alleviate some of the groundwater resources that will no longer be available to them.

Some of the initial draft plans that water districts have released for public comment show that other critically overdrafted basins are facing significantly higher pumping deficits than Indian Wells. For example, the [Merced Groundwater Sub-basin GSP](#) draft released in July estimates that the basin has an average groundwater overdraft of 192,000 acre-feet *per year*. The [McMullin Area GSP](#), which covers a portion of the Kings Basin, estimates an annual average overdraft of 91,000 acre-feet per year. In Kern County, according to the [Bakersfield Californian](#), officials estimate that up to 185,000 acres of currently-active farmland could have to become fallow as a result of SGMA implementation. As such, water districts across California will continue to face competition to secure water resources and mitigate the impact of reduced groundwater pumping for the farms, citizens and businesses that they serve.

Capitol Core understands that the Authority faces financial challenges as it creates its GSP and looks to build infrastructure to support imported water supplies. The following considerations include options that the Authority could explore that may allow it to purchase water now and

either reduce the cost burden until it is ready for water deliveries, or mitigate those costs by leasing its potential purchased water resources in the short-term. We will address each recommendation in further detail below.

### **Consideration 1: Determine What Entity Will be the “Holder” of IWVGA’s Water Rights and Contracts**

The Indian Wells Valley Basin is in a unique position in the fact that three State Water Contractors cover parts of the basin. Please see Appendix B for a detailed map of the areas that each contractor covers. The main population center of Ridgecrest and the immediate surrounding areas is under the geographic area of the Kern County Water Agency. Southwestern portions of the basin that lie within Kern County are under the geographic area of the Antelope Valley East Kern Water Agency. Finally, portions of the basin that are in northern San Bernardino County are in the geographic area of the Mojave Water Agency.

Neither the Indian Wells Valley Water District nor the Groundwater Authority is currently a member agency of any of these State Water Contractors. However, the Authority must become a member agency of one of these organizations in order to receive imported water and convey it to the Authority or to a transfer partner by means of an exchange. As such, we encourage the Authority to consider which entity would make the most sense to work with in order to “house” the Authority’s water rights and assist the Authority in contracting with other agencies to deliver water.

Each one of the potential options presents both opportunities and challenges. In terms of challenges, as addressed in Section 9 (Transfer Partners), usually there are provisions within the State Water Contractors’ operating procedures that prohibit one contractor from selling water to another contractor’s member agency without the consent of the second contractor. In this instance, the Authority is not a member agency of any of the three contractors, but their geographic spheres overlap parts of the basin. The Authority will have to coordinate with the contractors that cover their area to ensure that there is communication between them as to the water resource plans.

There may also be opportunities to make transfers easier between the contractors that cover the area. For example, the Mojave Water Agency has the potential to provide water over a single year and possibly over a longer-term contract with the Authority. As discussed in Section 4 (Single Year Transfers), the current rules governing transfers between two State Water Contractors requires them to complete an exchange (whereby the buyer returns a negotiated amount of water back to the seller within a determined period of time) rather than an outright sale. However, the Agency said that since their district covers parts of the Indian Wells Valley Basin, it may be able to send water to the Authority through an outright transfer rather than through an exchange, even if it is not the holder of the Authority’s water rights or contracts. The interpretation is subject to legal review and the ultimate approval of the State Department of Water Resources, but it could present a way to streamline the process of transfers.

**Note:** For Consideration 1, Capitol Core Group is not an attorney and cannot provide legal advice as to the appropriateness or legal implications of selecting a particular entity to be the legal holder of the Authority's water rights. The Consideration is for discussion purposes only. Capitol Core Group can assist the Authority's legal team in making this determination, but it will be the purview of the legal team to make a final determination on the appropriateness of the choice that the Board decides on.

### **Consideration 2: Multiple Sources May Provide the Basin with a More Reliable Supply**

In Section 8, Capitol Core outlined a series of 10 potential scenarios whereby the Authority could provide the water resources necessary to deliver an estimated 3,000 AF of water annually to the Basin. While some potential scenarios such as contracting with AVEK or purchasing State Water Project entitlement could potentially provide the District with enough water for its needs, we recommend that the District consider multiple sources to supply the district over the long-term. Relying on one single source for water supplies opens the Authority to the risk that the water supply might be curtailed on a given year, which happened to even more senior water rights during the drought in 2013-2015. In 2014, the State Water Project initially provided a [zero percent allocation](#) to all contractors, though it was eventually moved up to 5%. In June 2015, the State Water Resources Control Board took the unprecedented step of [issuing curtailment notices](#) to some "senior water rights" holders (those with water rights established prior to 1914) in the Sacramento-San Joaquin Delta Watershed. The entities that were forced to curtail surface water diversions either relied on banked water supplies of their own, purchasing expensive outside banked water supplies, or relying solely on groundwater pumping which will be curtailed in future years because of SGMA. In a few extreme cases, farming operations paid up to [\\$2,200 per acre-foot](#) for 3,200 acre-feet of water that the Madera Irrigation District made available for sale.

The point in citing these instances is that drought planning remains a factor for communities across California. If the Groundwater Authority needs to have water delivered each year, then it might consider some of the banking options that are laid out in the Section 8 scenarios. Banked water is available to the user regardless of hydrologic conditions, and could assist the Authority in providing water through drought conditions. But regardless, a more diversified portfolio of water assets could mitigate some of the hydrologic risks that a single source of water supply poses.

### **Consideration 3: Putting an Option on Water in the Short-Term**

Capitol Core recognizes that the Authority faces financial challenges as it begins the process of building infrastructure and finding water resources to satisfy the needs of the GSP. Further, we recognize that there may be a period of years initially where the Authority would not be ready to deliver water due to the planning and construction of infrastructure necessary to deliver imported water. However, as discussed in the introduction of this section, other water districts and groundwater agencies will likely be looking for water resources at the same time as the IWVGA. Waiting to buy water supplies may limit the available water options once the Authority

has completed infrastructure construction. With that in mind, considerations 2 and 3 address potential ways that would allow the Authority to purchase/control water rights while limiting the amount of up-front capital it would have to outlay before it is ready to deliver water.

Consideration 2 explores putting an option on purchasing water supplies in the short term. The purchase of State Water Project entitlement usually involves property that is either already fallowed or will be fallowed to transfer water from the current property to the new owner. In a few instances, the seller has allowed the buyer to place an option payment on the land and water rights to secure the needed water for a future date. While the allowance of an option payment is subject to the agreement of the selling property owner, the Authority could explore this possibility should it be interested in securing SWP water. Please see the case study below for how the option was structured.

#### **Case Study: Castaic Lake Developer Option Payment for SWP Entitlement**

In 2014 the planning process began for a large housing project in Castaic, California. The developer, DACA-Castaic, LLC proposed a single-family housing project with roughly 450 units. As part of the entitlement process, the property needed to be annexed into the service area of the existing water district that bordered the property of the project. During the annexation process through the Local Formation Commission (LAFCO), the proposed water service provider—Castaic Lake Water Agency (now Santa Clarita Valley Water Agency, an SWP Contractor) included in the 'conditions of approval' to serve water to the project that the development had to provide a permanent supply of water. The Agency specifically conditioned that the developer purchase State Water Project (SWP) Table A entitlement and grant that water to the District in exchange for the will serve letter.

The developer (through its water resources consultant) was able to secure a 548-acre foot Table A entitlement located within the Tulare Lake Basin Water Storage District (a SWP Contractor). The transaction was structured so that the developer could contract with the seller for the purchase of the Table A Entitlement (as well as roughly 640 acres of fallowed farmland) but delay the close of escrow and provide the seller an annual option payment. The proposed purchase price of the water was roughly \$3 million dollars (roughly \$5,500 per acre-foot of water) and the annual option payment was \$100,000, or 3% of the purchase price. The seller agreed to a two-year option with an available annual extension that increased the option amount by \$50,000 for each year the option was extended.

#### **Consideration 4: Leasing out Purchased Water While Infrastructure Construction is Finalized**

In addition to the possibility of finding permanent water resources where the Authority could place an option on the water, Capitol Core recommends that the Authority explore the possibility of leasing out water that the Authority purchases while infrastructure construction is finalized. In the introduction of this section, we discussed why it would be in the best interest of the Authority to consider securing water soon to mitigate the likely competition for water resources from other GSAs across the state. However, we also recognize the financial challenges the Authority faces as

it forms the mechanisms to pay for the water and infrastructure needed to support the basin. We also recognize that the infrastructure construction will likely take an estimated 5-7 years, and the Authority will not be able to deliver water to the Basin during that time.

Considering these factors, one strategy that the Authority could pursue is to purchase water contracts/rights in the near future, and lease the water out to another agency/entity while the construction takes place. If for example, the Authority is able to secure a long-term agreement with one of the suppliers that we discuss in Section 8, the Authority could look to another entity that also needs water in the short term to lease the water while the district completes its construction projects. There are two potential candidates that might be interested in a short-term water deal like this. First, there are agricultural groups that are often looking for water supplies, particularly permanent tree crop growers. Almond trees for example have a 20-25 year life cycle, and farmers try to tailor their water resources to the life cycle of the trees. There may be farmers who have trees nearing the end of their life cycle, and want to get a short-term supplemental water supply to maximize the crops from the trees while they still bear fruit. Farming operations like this may be interested in a short-term lease that may fit into the timeframe that the Authority would need to finish construction.

Second, there are other urban water districts who need supplemental supplies to either support new development, or provide replenishment water to bring their basin back into sustainability. Large areas of population centers in Southern California, for example, overlay adjudicated basins where court orders define the amount of water that can be pumped out of the basin annually. In many cases if the aggregate amount of pumping exceeds the court-ordered amount in a given year, the water master or governing authority must go onto the open market and purchase “makeup water” to account for the over-pumping. Districts like this may also be candidates for a short-term lease of water that the Authority may have.

#### **Consideration 5: Potentially Collaborate with the US Navy and Department of Defense on Water Supplies**

As we discussed in our June Technical Memo and in Section 7 of this document, there are military installations in the state including Vandenberg Air Force and Lemoore Naval Air Station that have quantified State Water Project entitlements. Lemoore Naval Air Station is a member agency of the County of Kings State Water Contractor, and has an allocation of 5,000 acre-feet. Vandenberg Air Force Base is a member of the Central Coast Water Authority, which receives their State Water Project allocation through the Santa Barbara County Flood Control and Water Conservation District, the area’s State Water Contractor. Vandenberg Air Force Base has a State Water Project allocation of 6,050 acre-feet. The Base also has access to a banking/exchange program completed with the Palmdale Water District. (For details of the Base’s water entitlement click [here](#).)

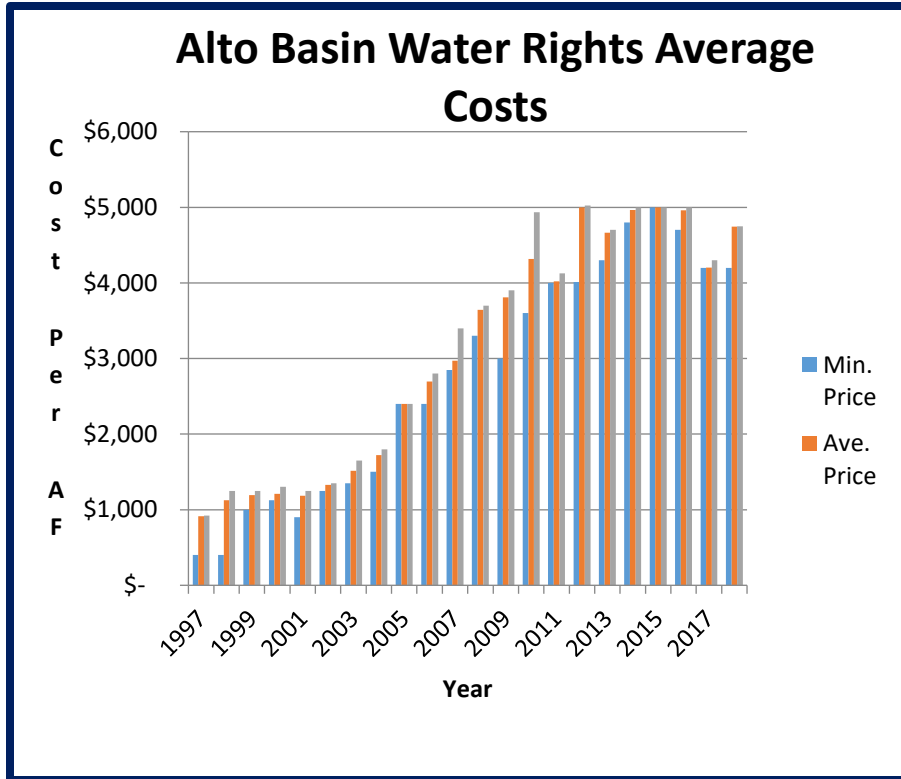
There is a precedent for other military bases across the state to have surface water rights. China Lake Naval Air Warfare Center will continue to need water resources to support the mission on

the base. While we are certainly not suggesting that China Lake ask to take water resources that other military installations have, we would like to explore whether there is a possibility of the Department of Defense setting up a pool of water resources for the bases in California to collectively use and manage. Three Naval bases in the state, including China Lake, Lemoore NAS and NAS Point Mugu in Ventura County all are in basins that the state has designated in critical overdraft. Having a collective pool of water resources may allow the bases to bank or store water in years where water resources are plentiful, and then manage it in dry years to fulfill their mission requirements. Establishing a pool such as this and building water resources for China Lake may also help to alleviate some of the pumping demands that the Base puts on the Indian Wells Basin.

#### **Consideration 6: Establishing a Groundwater Market within the Basin**

Finally, the basin may wish to consider establishing a groundwater market that allows parties that have a determined allocation to sell or lease their rights to other parties. In a particular basin, a pumper's water usage may vary from year to year depending on their particular needs, hydrologic conditions, etc. There may be years where a particular pumper needs more water than they have a right, and vice versa. A groundwater trading market would allow a pumper who needs water in a given year to purchase water from a pumper that has not used their full allotment. This mechanism can provide an efficient and effective approach to getting water to the pumpers that need water without going over the maximum aggregate amount of allocation allowed in the basin.

There are established water trading markets across the state, and other basins are establishing programs to use as a way to address groundwater pumping under the new SGMA requirements. The Mojave Water Agency (MWA) in San Bernardino County, for example, has managed water rights through a groundwater market within the five sub-basins that cover a majority of its service area since 1999. The groundwater market allows for both the leasing and permanent transfer of water rights within the basin. Please see the chart below for a chart of permanent water rights transactions by year within Mojave's main Alto Basin (the area that covers parts of Hesperia, Adelanto, Victorville and Apple Valley) since 1999. Both the leasing and permanent transactions market within the Agency's service area have seen robust activity since the formation of the market.



The [Fox Canyon Groundwater Management Agency](#) implemented a groundwater trading platform in July 2018 to allow pumping rights to be transferred between parties in the basin that have excess, and those that need it. The [Rosedale-Rio Bravo Water Storage District](#) in Kern County began a similar program in July 2019. All of these programs facilitate the movement of water between parties that have extra water in a given year and those that need it, all within the parameters of a maximum amount of aggregate pumping within the basin. Implementing a similar program in the Indian Wells Basin may be beneficial to the basin and its water rights users.

*The page intentionally blank*



**DEPARTMENT OF THE NAVY**  
NAVAL AIR WEAPONS STATION CHINA LAKE  
1 ADMINISTRATION CIRCLE  
CHINA LAKE, CA 93555-6100

IN REPLY REFER TO:

5800

June 17, 2019

Board of Directors  
Indian Wells Valley Groundwater Authority (IWVGA)  
Ridgecrest, CA 93555

Dear Members of the Board:

This letter serves to formally respond to requests from you, your Policy Advisory Committee, and your Technical Advisory Committee for data regarding the Navy's personnel and historic water use in the Indian Wells Valley. This data is provided to assist you in developing a Groundwater Sustainability Plan (GSP), as required by the Sustainable Groundwater Management Act (SGMA). Requests include the amount of water needed to sustain the Navy's current and future mission on Naval Air Weapons Station China Lake (NAWSCL), the Navy workforce (military, civilians, contractors, and dependents) at the installation, and data regarding the Navy's historic water consumption.

In November 2018, the Navy provided a figure of 2,041 acre-feet per year as the amount of water the installation could agree to use under a GSP. Be advised, however, that the Navy's Federal Reserve Water Right (FRWR) is not limited to 2,041 acre-feet per year. The Navy's FRWR dates back to the establishment of the base in 1943, and as you are well aware, SGMA does not impact FRWRs. The Navy's actual FRWR would likely be established through litigation, which the Navy hopes to avoid by having all pumpers in the Basin agree to an allocated amount.

Enclosure (1) contains data that should assist you as you formulate the GSP, including the Navy's workforce trends and Navy water production. The information contained in enclosure (1) is provided for planning purposes only and, again, does not constitute the Navy's FRWR.

The Navy appreciates the IWVGA's effort in implementing SGMA. Our ability to recruit and retain talented personnel at NAWSCL is tied to our workforce's ability to access economically viable potable water. Water sustainability is critical to NAWSCL's mission accomplishment.

  
P. M. DALE  
Captain, U.S. Navy  
Commanding Officer

Enclosures: 1. Navy Demographics and Water Requirements at Naval Air Weapons Station (NAWS), China Lake, CA

**Navy Demographics and Water Requirements  
at Naval Air Weapons Station (NAWS),  
China Lake, CA**

by  
Matthew L. Boggs  
*NAVAIR Ranges*

**MAY 2019**

**NAVAL AIR WARFARE CENTER WEAPONS DIVISION  
CHINA LAKE, CA 93555-6100**



**DISTRIBUTION STATEMENT A.** Approved for public release; distribution is unlimited.

# Naval Air Warfare Center Weapons Division

---

## FOREWORD

This report analyzes the historic workforce demographics trends of the Navy mission at China Lake, CA for the period 1945 through 2017, and relates these trends to corresponding requirements for water. This analysis quantifies the effects of maturization of the Navy affiliated workforce through the rapid development of the China Lake community and technical mission, as well as the divestment of community from Navy ownership to private ownership in the adjoining City of Ridgecrest and unincorporated areas. Through this analysis, clear trends were seen—a persistent mission and workforce, punctuated by the mission affiliated surges and reductions associated with the conflicts, and peacetime of the period.

The work of this report was conducted as part of the Naval Air Warfare Center Weapons Division (NAWCWD) Range Sustainment Office's continuing efforts to define and mitigate potential mission encroachment impacts to the NAWCWD China Lake Research, Development, Test, and Evaluation (RDT&E) mission.

This report was reviewed by J. E. Walters, M. G. Finnell, and S. A. Bork.

Approved by  
T. DOWD, *Director*  
NAVAIR Ranges  
23 May 2019

Under authority of  
W. S. DILLON  
RDML, U.S. Navy  
*Commander*

Released for publication by  
J. L. JOINSON  
*Director for Research and Engineering*

## NAWCWD Technical Publication 8842

Published by..... Technical Communication Office  
Collation..... Cover, 15 leaves  
First printing..... 9 paper, 4 electronic media

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to the Department of Defense, Executive Service Directorate (0704-0188). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ORGANIZATION.</b>					
1. REPORT DATE (DD-MM-YYYY) 23-05-2019		2. REPORT TYPE Analysis report		3. DATES COVERED (From - To) 1 June 2017 – 1 April 2019	
4. TITLE AND SUBTITLE Navy Demographics and Water Requirements at Naval Air Weapons Station (NAWS), China Lake, CA (U)			5a. CONTRACT NUMBER N/A		
			5b. GRANT NUMBER N/A		
			5c. PROGRAM ELEMENT NUMBER N/A		
6. AUTHOR(S) Matthew L. Boggs			5d. PROJECT NUMBER N/A		
			5e. TASK NUMBER N/A		
			5f. WORK UNIT NUMBER N/A		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Air Warfare Center Weapons Division 1 Administration Circle China Lake, California 93555-6100			8. PERFORMING ORGANIZATION REPORT NUMBER NAWCWD TP 8842		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Air Warfare Center Weapons Division NAVAIR Ranges (Code 52000MD) 130 Easy Rd Stop 3002 China Lake, CA 93555-6109			10. SPONSOR/MONITOR'S ACRONYM(S) NAWCWD		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>DISTRIBUTION STATEMENT A.</b> Approved for public release; distribution is unlimited.					
13. SUPPLEMENTARY NOTES None.					
14. ABSTRACT <p>(U) This report analyzes the historic workforce demographics trends of the Navy mission at China Lake, CA, for the period 1945 through 2017, and relates these trends to corresponding requirements for water. This analysis quantifies the effects of maturation of the Navy affiliated workforce through the rapid development of the China Lake community and technical mission, as well as the divestment of community from Navy ownership to private ownership in the adjoining City of Ridgecrest and unincorporated areas. Through this analysis, clear trends are seen—a persistent mission and workforce, punctuated by the mission affiliated surges and reductions associated with the conflicts, and peacetime of the period.</p>					
15. SUBJECT TERMS China Lake Workforce Demographics, Water Requirements					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 28	19a. NAME OF RESPONSIBLE PERSON M. L. Boggs
a. REPORT UNCLASSIFIED	b. ABSTRACT UNCLASSIFIED	c. THIS PAGE UNCLASSIFIED			19b. TELEPHONE NUMBER (include area code) (760) 939-4404

**UNCLASSIFIED**

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

## CONTENTS

1.0 Background.....	3
1.1 Mission and Community Groundwater Reliance.....	3
2.0 Navy Workforce Trends .....	4
3.0 Change in Navy Community .....	5
4.0 Navy Water Production Trends .....	7
5.0 Navy Affiliated Water Requirements.....	8
6.0 Summary of Navy Water Requirements.....	9
7.0 References .....	10
8.0 Acronyms .....	11
Appendixes:	
A. China Lake Navy Staffing Data.....	A-1
B. China Lake Staff and Dependent Water Requirement Data .....	B-1
C. Navy Water Production Data.....	C-1
Figures:	
1. China Lake Organization, Consolidation, and Divestures.....	4
2. Navy Workforce and Dependents 1945 Through 2017.....	5
3. 1982 Demolition of 500 Navy Housing Units.....	6
4. Navy Water Production: 1945 Through 2016.....	7
5. Workforce and Dependent Water Consumption.....	8
Tables:	
1. NAWS Total Annual Water Requirements.....	9

This page intentionally left blank.

## **1.0 BACKGROUND**

In 1943, the U.S. Navy developed the largest consolidated facility for weapons and armament research, development, test, and evaluation (RDT&E), located in the sparsely populated upper Mojave Desert at China Lake, CA. At the time of the Station's founding in 1943, it was estimated that the Indian Wells Valley had a population smaller than 200 (Reference 1). This facility combines the Navy's largest RDT&E laboratory complex with the Navy's largest RDT&E range to allow for rapid development and test of weapon systems used by the Navy as well as all services and allied nations. Due to its remote location, the Navy was required to develop facilities capable of attracting national-class scientists and engineers to fulfill its mission, resulting effectively in a defense-oriented "company town" similar to specialized, peer facilities and communities such as Los Alamos, NM. Unlike many of these other World War II (WWII) defense "company boom towns," the Navy planned China Lake from the start for permanence, developing its facilities with master plans developed by the architecture and engineering firm of Stafford, Davies, and Gogerty, one of the leading firms of the Los Angeles area known for their mid-century modern designs. Today, the personnel and dependents of the Navy mission no longer live on board the base as they did for the first three decades following establishment, although the tie between mission and staff and community remains as tightly coupled as ever.

### **1.1 MISSION AND COMMUNITY GROUNDWATER RELIANCE**

As expected in this desert locale, no surface water is locally available as a water supply for the Navy and surrounding community. At the time that the area opened under the Homestead Act in the early 20th Century, plans were proposed to divert surface water from the Owens River located to the north in Inyo County. The proposition put forth by the Bureau of Reclamation aimed to develop desert lands for agricultural use primarily in the Owens Valley, but also in the Indian Wells Valley. These proposals were not realized, with the water of the Owens River instead diverted to Los Angeles in the 1910s via the Los Angeles Aqueduct built between 1908 and 1913 (References 2 and 3). Upon the Navy's arrival at China Lake in 1943, it was clear that the Navy would need a reliable source of water to supply its newly formed research facilities and corresponding community. To address this need, the Navy developed a water system supplied by wells tapping into the Indian Wells Valley aquifer, though an emergency connection to the Los Angeles Aqueduct was also developed (but abandoned in the 1970s) (Reference 4). As the population shifted from on board the Navy base to the adjoining Ridgecrest area, groundwater sources on the civil side were developed and offset the gradual reduction of Navy water pumping.

2.0 NAVY WORKFORCE TRENDS

The Navy affiliated population demonstrates a largely stable trend since 1943, though it has experienced periodic growth and downsizing, typically associated with major military conflicts. The most extreme of these downsizings followed the end of the Cold War, which resulted in a large shedding of personnel and the start of a nearly decade-long hiring freeze. The general trend of China Lake has demonstrated a net growth and consolidation in mission to China Lake, rather than a trend of divestment, as seen in Figure 1.

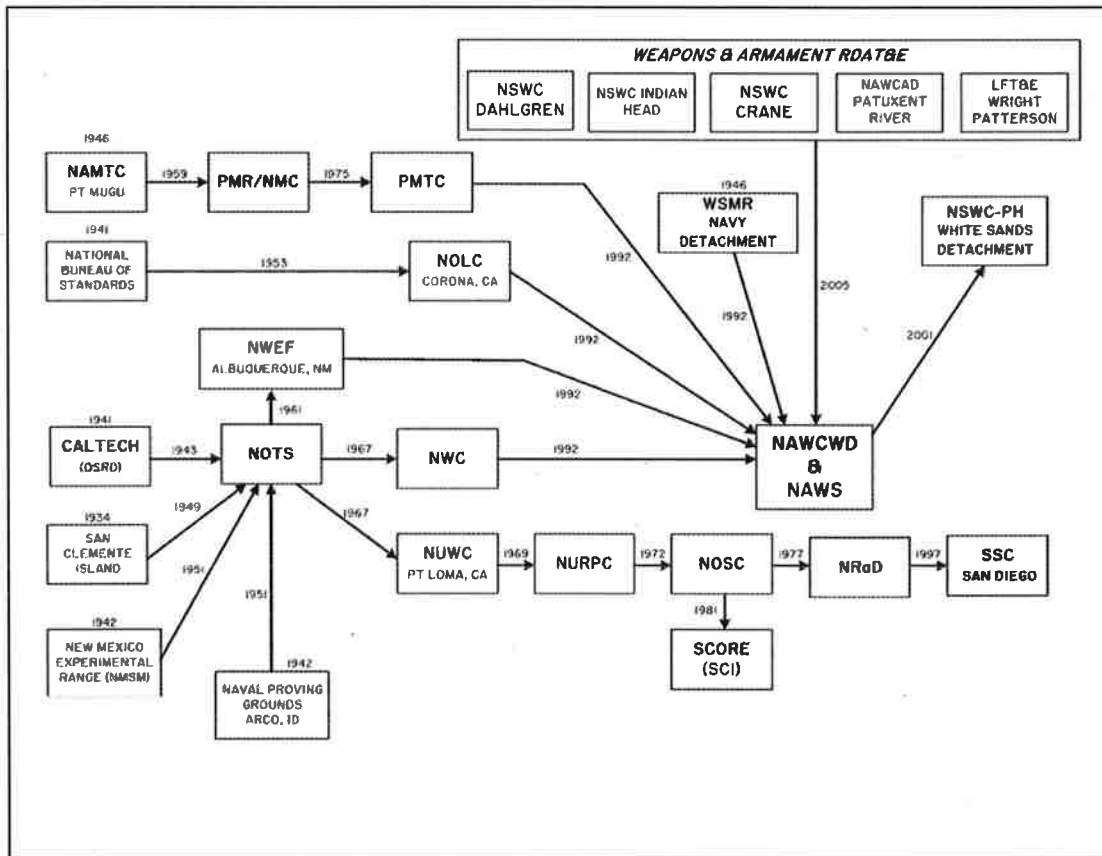


FIGURE 1. China Lake Organization, Consolidation, and Divestures.

The generally stable and permanent nature of the Navy workforce at China Lake is depicted in Figure 2. The role of dependents in Navy demographics represents the unique nature of the Navy mission at China Lake where a community is maintained to attract and retain scientific and engineering staff that would not otherwise be found at such a remote location. The stable nature of the scientific and engineering staff results in a corresponding trend in its dependents, often reflecting the mass hiring of staff, followed by the establishment and maturization of family units. A change in trend is seen associated with the staff divestment and hiring freeze of the 1990s, whereupon the level of dependents reduces as families mature and dependent children leave home, and are not offset by incoming younger families associated with the long hiring freeze of this period.

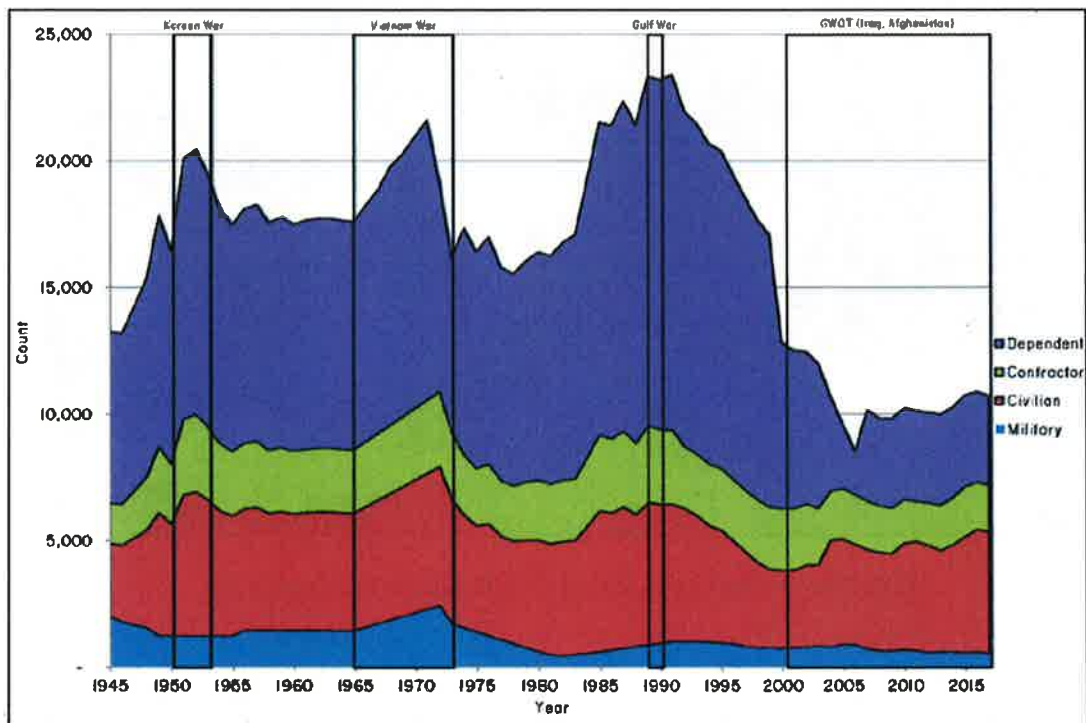


FIGURE 2. Navy Workforce and Dependents 1945 Through 2017.

### 3.0 CHANGE IN NAVY COMMUNITY

The first three decades of the Navy at China Lake were characterized by a Navy owned and built community infrastructure for both the military and civilian staff and dependents. This is consistent with the wartime experience that built new government boomtowns where nothing had been before. The Navy formally defined China Lake as a permanent facility in 1968 (Reference 5), enabling the underwriting of home loans by the Federal Housing Administration. This formal definition acted as a major event in the Navy's long

term plans dating to 1963 to divest itself of managing a community in support of China Lake. Unlike Department of Energy (DOE) laboratories at venues such as Los Alamos, NM, in the case of China Lake, this resulted in an exodus from the base and a surge in private ownership within Ridgecrest and the surrounding unincorporated areas. Subsequently, Navy housing was demolished, as seen in Figure 3. In contrast, the DOE at Los Alamos chose not to divest its community via exodus, but instead simply redefined its boundaries and privatized its existing community infrastructure (Reference 6).



FIGURE 3. 1982 Demolition of 500 Navy Housing Units.

The result of this divestiture is clear. Following the 1968 Navy “statement of permanence,” coupled with strategic divestitures of 116.77 acres of Navy property in 1970 to spur the development of Ridgecrest, the population shift occurs rapidly. In contrast to a community that included 2,916 family dwelling units in 1972 (Reference 1), the China Lake on-base community consists of only 192 family units at the present time. This exodus of staff housing represents a simple shift from government owned housing to private ownership. This shift also represents a change where the Navy staff and dependents receive their water supply. Whereas the Navy population previously relied on the Navy water infrastructure, upon moving to Ridgecrest or the unincorporated areas of the Indian Wells Valley, the population now began to rely upon civil or private water sources. This led to increased diversity of water sources to include the Indian Wells Valley Water District (IWVWD), small mutual water companies, and private wells. In all cases, these non-Navy water supply sources still rely on groundwater from the Indian Wells Valley aquifer.

#### 4.0 NAVY WATER PRODUCTION TRENDS

The Navy developed water system acted as the dominant water supply system for the Indian Wells Valley's population in the post-WWII period, driven by the Navy's development at China Lake. This Navy water system increased production from inception until 1970, with a maximum annual production volume of 7,988 acre-feet. Following the 1970 peak, the Navy water production reduces as the Navy staff moves off-Station to Ridgecrest and the unincorporated areas of Indian Wells Valley. Additional water use reductions are currently taking place on the Naval Air Weapons Station (NAWS) through conservation measures to include removal of irrigated landscapes in favor of xeriscaping and the removal of some artificial landscaping entirely. These production trends are presented in Figure 4.



FIGURE 4. Navy Water Production: 1945 Through 2016.

### 5.0 NAVY AFFILIATED WATER REQUIREMENTS

Given the move of the Navy staff and dependents off-Station, water requirements of the Navy cannot be determined solely by the Navy’s recent direct production amounts. Modern Navy production amounts only reflect the water volume required by the industrial aspect of the mission and the requirements of the remaining military residences on Station. Since the Navy mission at China Lake requires its workforce, the full Navy water requirements are the combination of the on-Station requirements and those of the Navy workforce and their dependents off-Station. Historic staffing trends of the Navy workforce can inform these requirements with a long trend baseline.

As a proxy for direct measurement of the total Navy staff and dependent water usage, total usage may be calculated as a product of the Navy demographics and the California Department of Water Resources (DWR) values for per capita water use for the Indian Wells Valley Water District (Reference 7), the largest civil supplier of domestic water for Navy staff and dependents. The resulting plot of calculated Navy staff and the dependent water requirement is shown in Figure 5. This calculation does apply modern consumption values (including the effects of modern water conservation efforts) to the historic staffing trend, resulting in a lower value of staff and dependent water consumption than probably realized at the time. As shown in Figure 5, the peak water use by Navy staff and dependents was 4,562 acre-feet in 1990, and the average use by Navy staff and dependents from 1945 to the present is 3,228 acre-feet per year.

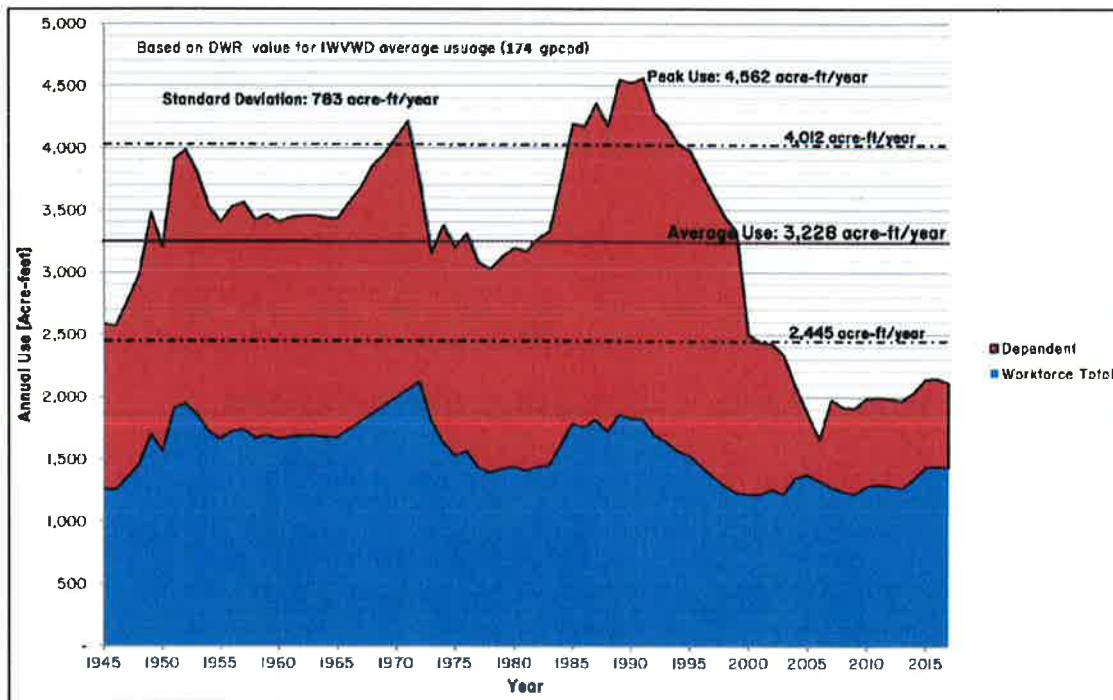


FIGURE 5. Workforce and Dependent Water Consumption.

As a major component of the Navy water requirements for China Lake, workforce and dependent consumption must be added to the water requirements associated with the industrial aspects of NAWS. The industrial component can be calculated by subtracting the on-center housing consumption from the total production values; using fiscal year (FY) 2017 values, this indicates an annual Navy industrial water requirement of 1,213 acre-ft. This value must be added to the Navy staff and dependent requirements to yield a total Navy requirement value. This yields a peak water use by Navy of 5,775 acre-feet in 1990, and an average use from 1945 to the present of 4,441 acre-feet per year. Since fluctuations in requirements are expected in response to changes in military demand in war and peace as seen in the historic data, Navy requirements can be determined by applying the standard staffing data's standard deviation (783 acre feet per year) to the average values, yielding a baseline requirement of 5,224 acre-feet per year.

## 6.0 SUMMARY OF NAVY WATER REQUIREMENTS

Based on the analysis described in Section 5.0, Navy annual water requirements are presented in Table 1, noted as "Baseline" values. Referencing the China Lake 2016 Legislative Environmental Impact Statement (Reference 8), a 25% growth in the Navy mission should be analyzed as well. This results in a baseline annual Navy water requirement at China Lake of 5,224 acre-feet, with a potential growth requirement of 6,530 acre-feet.

TABLE 1. NAWS Total Annual Water Requirements.

	Baseline, acre-ft	25% Growth Over Baseline, acre-ft
Navy Requirements	5,224	6,530

## 7.0 REFERENCES

1. 1972 Installation Survey Report, Naval Weapons Center, China Lake, California. Naval Inspector General, Office of the Chief of Naval Operations. 6 October 1972.
2. Complete Report on Construction of the Los Angeles Aqueduct, Department of Public Service of the City of Los Angeles. 1916.
3. William L. Kahrl, *Part I: The Politics of California Water: Owens Valley and the Los Angeles Aqueduct, 1900-1927*, 6 Hastings West Northwest J. of Environmental Law & Policy 239 (2018).
4. 1973 Installation Survey Report, Naval Weapons Center, China Lake, California. Naval Inspector General, Office of the Chief of Naval Operations. 1 November 1973.
5. SECNAV Memo: "Statement of Permanency, Naval Weapons Center, China Lake, California." 28 August 1968.
6. Jon Hunner. *Inventing Los Alamos: The Growth of an Atomic Community*. University of Oklahoma Press, Norman, Oklahoma, 2004.
7. California Department of Water Resources.  
[https://www.waterboards.ca.gov/water\\_issues/programs/conservation\\_portal/docs/2018sept/uw\\_supplier\\_data090418.xlsx](https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/2018sept/uw_supplier_data090418.xlsx). Retrieved 3/10/2019.
8. Environmental Impact Statement/Legislative Environmental Impact Statement for Renewal of Naval Air Weapons Station China Lake Public Land Withdrawal, California. 2016. U.S. Navy.

**8.0 ACRONYMS**

CALTECH	California Institute of Technology
DOE	Department of Energy
DWR	California Department of Water Resources
FY	fiscal year
gpcpd	gallons per capita per day
IWVCGMG	Indian Wells Valley Cooperative Groundwater Management Group
NAMTC	Naval Air Missile Test Center
NAWS	Naval Air Weapons Station
NCCOSC	Naval Command, Control and Ocean Surveillance Center
NM	New Mexico
NMSM	New Mexico School of Mines
NOLC	Naval Ordnance Laboratory, Corona
NOSC	Naval Ocean Systems Center
NOTS	Naval Ordnance Test Station
NRaD	RDT&E Division
NSWC	Naval Surface Warfare Center
NSWC-PH	Naval Surface Warfare Center Port Hueneme Detachment
NUWC	Naval Underwater Weapons Center
NWC	Naval Weapons Center
NWEF	Naval Weapons Evaluation Facility
OSRD	Office of Scientific Research & Development
PMR/NMC	Pacific Missile Range/Naval Missile Center
PMTC	Pacific Missile Test Center
RDT&E	Research, Development, Test, and Evaluation
WSMR	White Sands Missile Range
WWII	World War II

This page intentionally left blank.

**Appendix A**  
**CHINA LAKE NAVY STAFFING DATA**

This page intentionally left blank.

	1945	1946	1947	1948	1949	1950	1951	1952	1953
<b>Military</b>	1,987 <sup>18</sup>	1,798 <sup>3</sup>	1,657 <sup>3</sup>	1,551 <sup>3</sup>	1,232 <sup>4</sup>	1,232 <sup>4</sup>	1,232 <sup>4</sup>	1,232 <sup>4</sup>	1,232 <sup>4</sup>
<b>Civilian</b>	2,915 <sup>17</sup>	3,018 <sup>17</sup>	3,442 <sup>17</sup>	3,857 <sup>17</sup>	4,864 <sup>17</sup>	4,417 <sup>17</sup>	5,568 <sup>17</sup>	5,687 <sup>17</sup>	5,384 <sup>17</sup>
<b>Contractor</b>	1,573 <sup>1</sup>	1,628 <sup>1</sup>	1,857 <sup>1</sup>	2,081 <sup>1</sup>	2,624 <sup>1</sup>	2,283 <sup>1</sup>	3,004 <sup>1</sup>	3,068 <sup>1</sup>	2,905 <sup>1</sup>
<b>Dependent</b>	6,784 <sup>2</sup>	6,753 <sup>2</sup>	7,288 <sup>2</sup>	7,847 <sup>2</sup>	9,137 <sup>2</sup>	8,416 <sup>2</sup>	10,273 <sup>2</sup>	10,465 <sup>2</sup>	9,976 <sup>2</sup>
<b>Total</b>	13,259	13,197	14,244	15,335	17,858	16,448	20,077	20,452	19,497

	1954	1955	1956	1957	1958	1959	1960	1961	1962
<b>Military</b>	1,232 <sup>4</sup>	1,232 <sup>4</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>	1,447 <sup>5</sup>
<b>Civilian</b>	4,938 <sup>17</sup>	4,745 <sup>17</sup>	4,805 <sup>17</sup>	4,857 <sup>17</sup>	4,630 <sup>17</sup>	4,700 <sup>16</sup>	4,608 <sup>16</sup>	4,660 <sup>16</sup>	4,681 <sup>16</sup>
<b>Contractor</b>	2,664 <sup>1</sup>	2,560 <sup>1</sup>	2,592 <sup>1</sup>	2,620 <sup>1</sup>	2,498 <sup>1</sup>	2,536 <sup>1</sup>	2,486 <sup>1</sup>	2,514 <sup>1</sup>	2,525 <sup>1</sup>
<b>Dependent</b>	9,257 <sup>2</sup>	8,945 <sup>2</sup>	9,267 <sup>2</sup>	9,351 <sup>2</sup>	8,985 <sup>2</sup>	9,909 <sup>2</sup>	8,950 <sup>2</sup>	9,034 <sup>2</sup>	9,067 <sup>2</sup>
<b>Total</b>	18,091	17,482	18,112	18,276	17,560	17,781	17,491	17,655	17,721

	1963	1964	1965	1966	1967	1968	1969	1970	1971
<b>Military</b>	1,447 <sup>5</sup>	1,417 <sup>19</sup>	1,440 <sup>19</sup>	1,502 <sup>6</sup>	1,563 <sup>6</sup>	1,625 <sup>6</sup>	1,686 <sup>6</sup>	1,933 <sup>6</sup>	2,179 <sup>6</sup>
<b>Civilian</b>	4,687 <sup>16</sup>	4,675 <sup>16</sup>	4,650 <sup>16</sup>	4,732 <sup>6</sup>	4,814 <sup>6</sup>	4,896 <sup>6</sup>	4,978 <sup>6</sup>	4,428	4,962 <sup>7</sup>
<b>Contractor</b>	2,529 <sup>1</sup>	2,522 <sup>1</sup>	2,509 <sup>1</sup>	2,553 <sup>1</sup>	2,597 <sup>1</sup>	2,641 <sup>1</sup>	2,686 <sup>1</sup>	2,389 <sup>1</sup>	2,677 <sup>1</sup>
<b>Dependent</b>	9,077 <sup>2</sup>	9,010 <sup>2</sup>	9,010 <sup>2</sup>	9,207 <sup>2</sup>	9,343 <sup>2</sup>	9,771 <sup>2</sup>	9,797 <sup>2</sup>	9,168 <sup>2</sup>	10,288 <sup>2</sup>
<b>Total</b>	17,740	17,641	17,609	17,993	18,317	18,933	19,147	17,917	20,105

	1972	1973	1974	1975	1976	1977	1978	1979	1980
<b>Military</b>	2,425 <sup>20</sup>	1,704 <sup>21</sup>	1,547 <sup>8</sup>	1,389 <sup>8</sup>	1,232 <sup>8</sup>	1,075 <sup>8</sup>	918 <sup>8</sup>	760 <sup>8</sup>	603 <sup>16</sup>
<b>Civilian</b>	5,496 <sup>20</sup>	4,924 <sup>21</sup>	4,446 <sup>16</sup>	4,196 <sup>16</sup>	4,415 <sup>16</sup>	4,089 <sup>16</sup>	4,057 <sup>16</sup>	4,257 <sup>16</sup>	4,408 <sup>16</sup>
<b>Contractor</b>	2,965 <sup>1</sup>	2,657 <sup>1</sup>	2,399 <sup>1</sup>	2,264 <sup>1</sup>	2,382 <sup>1</sup>	2,206 <sup>1</sup>	2,189 <sup>1</sup>	2,297 <sup>1</sup>	2,378 <sup>1</sup>
<b>Dependent</b>	8,300 <sup>20</sup>	6,900 <sup>21</sup>	8,949 <sup>2</sup>	8,570 <sup>2</sup>	8,971 <sup>2</sup>	8,422 <sup>2</sup>	8,368 <sup>2</sup>	8,730 <sup>2</sup>	9,007 <sup>2</sup>
<b>Total</b>	19,186	16,185	17,340	16,420	17,000	15,792	15,531	16,044	16,397

	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Military</b>	487 <sup>16</sup>	444 <sup>16</sup>	499 <sup>16</sup>	537 <sup>16</sup>	604 <sup>9</sup>	672 <sup>9</sup>	739 <sup>9</sup>	806 <sup>9</sup>	873 <sup>9</sup>
<b>Civilian</b>	4,386 <sup>16</sup>	4,512 <sup>16</sup>	4,511 <sup>16</sup>	5,038 <sup>16</sup>	5,566 <sup>16</sup>	5,426 <sup>11</sup>	5,582 <sup>11</sup>	5,222 <sup>11</sup>	5,627 <sup>11</sup>
<b>Contractor</b>	2,366 <sup>1</sup>	2,434 <sup>1</sup>	2,434 <sup>1</sup>	2,718 <sup>1</sup>	3,003 <sup>1</sup>	2,927 <sup>1</sup>	3,012 <sup>1</sup>	2,817 <sup>1</sup>	3,036 <sup>1</sup>
<b>Dependent</b>	9,009 <sup>2</sup>	9,385 <sup>2</sup>	9,642 <sup>2</sup>	10,953 <sup>2</sup>	12,348 <sup>2</sup>	12,927 <sup>2</sup>	13,037 <sup>2</sup>	12,582 <sup>2</sup>	13,807 <sup>2</sup>
<b>Total</b>	16,248	16,775	17,085	19,246	21,521	21,403	22,369	21,427	23,343

	1990	1991	1992	1993	1994	1995	1996	1997	1998
<b>Military</b>	941 <sup>9</sup>	1,008 <sup>10</sup>	1,001 <sup>10</sup>	1,006 <sup>10</sup>	982 <sup>10</sup>	954 <sup>10</sup>	917 <sup>10</sup>	807 <sup>10</sup>	770 <sup>10</sup>
<b>Civilian</b>	5,486 <sup>11</sup>	5,430 <sup>11</sup>	5,250 <sup>11</sup>	4,969 <sup>11</sup>	4,602 <sup>11</sup>	4,448 <sup>11</sup>	4,049 <sup>11</sup>	3,741 <sup>11</sup>	3,348 <sup>11</sup>
<b>Contractor</b>	2,960 <sup>1</sup>	2,929 <sup>1</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>	2,448 <sup>11</sup>
<b>Dependent</b>	13,829 <sup>2</sup>	14,039 <sup>2</sup>	13,258 <sup>2</sup>	13,052 <sup>2</sup>	12,650 <sup>2</sup>	12,563 <sup>2</sup>	12,054 <sup>2</sup>	11,552 <sup>2</sup>	11,076 <sup>2</sup>
<b>Total</b>	23,215	23,406	21,957	21,475	20,413	20,413	19,468	18,548	17,682

	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Military</b>	756 <sup>10</sup>	750 <sup>10</sup>	768 <sup>10</sup>	784 <sup>10</sup>	830 <sup>10</sup>	787 <sup>10</sup>	898 <sup>10</sup>	880 <sup>10</sup>	708 <sup>10</sup>
<b>Civilian</b>	3,106 <sup>11</sup>	3,061 <sup>11</sup>	3,051 <sup>11</sup>	3,238 <sup>11</sup>	3,209 <sup>11</sup>	4,221 <sup>11</sup>	4,152 <sup>11</sup>	3,961 <sup>11</sup>	3,926 <sup>13</sup>
<b>Contractor</b>	2,464 <sup>11</sup>	2,443 <sup>11</sup>	2,438 <sup>11</sup>	2,430 <sup>11</sup>	2,224 <sup>11</sup>	1,935 <sup>11</sup>	2,009 <sup>11</sup>	1,976 <sup>11</sup>	1,916 <sup>14</sup>
<b>Dependent</b>	10,767 <sup>2</sup>	6,583 <sup>12</sup>	6,262 <sup>12</sup>	6,011 <sup>12</sup>	5,735 <sup>12</sup>	3,750 <sup>12</sup>	2,533 <sup>12</sup>	1,709 <sup>12</sup>	3,605 <sup>12</sup>
<b>Total</b>	17,093	12,837	12,519	12,463	11,998	10,693	9,592	8,526	10,154

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Military</b>	637 <sup>10</sup>	627 <sup>10</sup>	678 <sup>10</sup>	636 <sup>10</sup>	567 <sup>10</sup>	591 <sup>10</sup>	597 <sup>10</sup>	565 <sup>10</sup>	587 <sup>10</sup>	538 <sup>10</sup>
<b>Civilian</b>	3,890 <sup>13</sup>	3,855	4,204 <sup>15</sup>	4,324 <sup>15</sup>	4,226 <sup>15</sup>	4,008 <sup>15</sup>	4,221 <sup>15</sup>	4,571 <sup>15</sup>	4,850 <sup>15</sup>	4,785 <sup>15</sup>
<b>Contractor</b>	1,855 <sup>14</sup>	1,795	1,734 <sup>15</sup>	1,580 <sup>15</sup>	1,687 <sup>15</sup>	1,792 <sup>15</sup>	1,871 <sup>15</sup>	1,987 <sup>15</sup>	1,860 <sup>15</sup>	1,879 <sup>15</sup>
<b>Dependent</b>	3,457 <sup>12</sup>	3,537 <sup>12</sup>	3,618 <sup>12</sup>	3,584 <sup>12</sup>	3,574 <sup>12</sup>	3,596 <sup>12</sup>	3,579 <sup>12</sup>	3,610 <sup>12</sup>	3,592 <sup>12</sup>	3,500 <sup>12</sup>
<b>Total</b>	9,840	9,814	10,205	10,247	10,184	10,117	10,445	10,984	11,009	10,859

## Notes:

- 1) Based on average contractor to civilian ratio, 1992-2017.
- 2) Based on 1972 dependent to military/civilian ratio.
- 3) Linear interpolation between 1945 and 1949 values.
- 4) Based on 1956 numbers minus VX-5 count.
- 5) Plus-up from arrival of VX-5; based on 1964 count.
- 6) Linear interpolation between 1965 and 1972 values.
- 7) Linear interpolation between 1970 and 1972 values.
- 8) Linear interpolation between 1973 and 1980 values.
- 9) Linear interpolation between 1984 and 1991 values.
- 10) Defense Manpower Data Center Reporting System (DMDCRS), "Active Duty Family Sponsors & Eligible Dependents Report by Base."
- 11) Naval Air Warfare Center (NAWC) Human Resources (HR) Data.
- 12) Department of Defense (DoD) Dependent Data: DoD Population in Zip Codes 93527 and 93555 By Year, Person Type Code, and Personnel Category Code, Source: *DEERS Point in Time Extract*.
- 13) Linear interpolation between 2006 and 2009 values.
- 14) Linear interpolation between 2006 and 2010 values.
- 15) Naval Air Weapons Station (NAWS) demographic data.
- 16) Naval Ordnance Test Station (NOTS)/Naval Weapons Center (NWC) annual command histories.
- 17) Figure 1-4, *NOTS Technical Program Review 1958*.
- 18) "NOTS 20 Years," *Rocketeer*, 8 Nov 1963.
- 19) "Capt. Hardy Tells NOTS' Impact on Kern Economy," *Rocketeer*, 15 Jan 1965.
- 20) *1972 Installation Survey Report*, Naval Weapons Center, China Lake, California. Naval Inspector General, Office of the Chief of Naval Operations. 6 October 1972.
- 21) *1973 Installation Survey Report*, Naval Weapons Center, China Lake, California. Naval Inspector General, Office of the Chief of Naval Operations. 1 November 1973.

This page intentionally left blank.

**Appendix B**

**CHINA LAKE STAFF AND DEPENDENT WATER REQUIREMENT DATA**

This page intentionally left blank.

China Lake Staff and Dependent Water Requirement Data, based on 2018 Department of Water Resources (DWR) value of 176 gallons per capita per day (gpcpd) for the Indian Wells Valley Water District (IWVWD).

**China Lake Staff and Dependent Water Requirements (acre-ft).**

	1945	1946	1947	1948	1949	1950	1951	1952	1953
<b>Military</b>	387	350	323	302	240	240	240	240	240
<b>Civilian</b>	568	588	671	752	948	861	1,085	1,108	1,049
<b>Contractor</b>	307	317	362	406	511	464	585	598	566
<b>Dependent</b>	1,322	1,316	1,421	1,529	1,781	1,640	2,002	2,040	1,944
<b>Total</b>	2,584	2,572	2,776	2,989	3,481	3,206	3,913	3,986	3,800

	1954	1955	1956	1957	1958	1959	1960	1961	1962
<b>Military</b>	240	240	282	282	282	282	282	282	282
<b>Civilian</b>	962	925	937	947	902	916	898	908	912
<b>Contractor</b>	519	499	505	511	487	494	485	490	492
<b>Dependent</b>	1,804	1,744	1,806	1,823	1,751	1,773	1,744	1,761	1,767
<b>Total</b>	3,526	3,407	3,530	3,562	3,423	3,466	3,409	3,441	3,454

	1963	1964	1965	1966	1967	1968	1969	1970	1971
<b>Military</b>	282	276	281	308	336	363	390	418	445
<b>Civilian</b>	914	911	906	930	953	977	1,001	1,024	1,048
<b>Contractor</b>	493	492	489	502	514	527	540	552	565
<b>Dependent</b>	1,769	1,759	1,756	1,823	1,877	1,991	2,023	2,090	2,157
<b>Total</b>	3,458	3,438	3,432	3,562	3,681	3,858	3,954	4,084	4,215

	1972	1973	1974	1975	1976	1977	1978	1979	1980
<b>Military</b>	473	332	301	271	240	209	179	148	118
<b>Civilian</b>	1,071	960	867	818	861	797	791	830	859
<b>Contractor</b>	578	518	468	441	464	430	427	448	464
<b>Dependent</b>	1,618	1,345	1,744	1,670	1,748	1,641	1,631	1,701	1,756
<b>Total</b>	3,739	3,154	3,380	3,200	3,313	3,078	3,027	3,127	3,196

	1981	1982	1983	1984	1985	1986	1987	1988	1989
<b>Military</b>	95	87	97	105	118	131	144	157	170
<b>Civilian</b>	855	879	879	982	1,085	1,058	1,088	1,018	1,097
<b>Contractor</b>	461	474	474	530	585	571	587	549	592
<b>Dependent</b>	1,756	1,829	1,879	2,135	2,407	2,413	2,541	2,452	2,691
<b>Total</b>	3,167	3,269	3,330	3,751	4,195	4,172	4,360	4,176	4,550

	1990	1991	1992	1993	1994	1995	1996	1997	1998
<b>Military</b>	183	196	195	196	191	186	179	157	150
<b>Civilian</b>	1,069	1,058	1,023	968	897	867	789	729	653
<b>Contractor</b>	577	571	477	477	477	477	477	477	485
<b>Dependent</b>	2,695	2,736	2,584	2,544	2,466	2,449	2,349	2,252	2,159
<b>Total</b>	4,525	4,562	4,280	4,186	4,031	3,979	3,794	3,615	3,446

	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Military</b>	147	146	150	153	162	153	175	172	138
<b>Civilian</b>	605	597	595	631	625	823	809	772	765
<b>Contractor</b>	480	476	475	474	433	377	392	385	373
<b>Dependent</b>	2,099	1,283	1,220	1,172	1,118	731	494	333	703
<b>Total</b>	3,332	2,502	2,440	2,429	2,338	2,084	1,869	1,662	1,979

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Military</b>	124	122	132	124	111	115	116	110	114	105
<b>Civilian</b>	758	751	819	843	824	781	823	891	945	933
<b>Contractor</b>	362	350	338	308	329	349	365	387	363	366
<b>Dependent</b>	674	689	705	699	697	701	698	704	700	682
<b>Total</b>	1,918	1,913	1,989	1,997	1,985	1,972	2,036	2,141	2,146	2,116

This page intentionally left blank.

**Appendix C**  
**NAVY WATER PRODUCTION DATA**

This page intentionally left blank.

## Navy Water Production (acre-ft).

	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
Volume	709 <sup>1</sup>	1,620 <sup>1</sup>	1,847 <sup>1</sup>	2,139 <sup>1</sup>	2,768 <sup>1</sup>	3,265 <sup>1</sup>	3,839 <sup>1</sup>	4,201 <sup>1</sup>	4,533 <sup>1</sup>	4,892 <sup>1</sup>	5,236 <sup>1</sup>	5,561 <sup>1</sup>	5,923 <sup>1</sup>	5,782 <sup>1</sup>

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Volume	6,141 <sup>1</sup>	6,211	6,316 <sup>1</sup>	6,709 <sup>1</sup>	6,521 <sup>1</sup>	7,022 <sup>1</sup>	6,933 <sup>1</sup>	7,126 <sup>1</sup>	6,917 <sup>1</sup>	7,381 <sup>1</sup>	7,663 <sup>1</sup>	7,988 <sup>1</sup>	7,967 <sup>1</sup>	7,872 <sup>1</sup>

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Volume	7,392 <sup>2</sup>	7,395 <sup>2</sup>	6,492 <sup>2</sup>	6,494 <sup>2</sup>	5,410 <sup>2</sup>	5,413 <sup>2</sup>	5,154 <sup>3</sup>	4,995 <sup>3</sup>	4,804 <sup>3</sup>	4,450 <sup>3</sup>	4,402 <sup>3</sup>	4,694 <sup>3</sup>	4,002 <sup>3</sup>	4,430 <sup>3</sup>

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Volume	4,422 <sup>3</sup>	3,980 <sup>3</sup>	4,205 <sup>3</sup>	3,667 <sup>3</sup>	3,364 <sup>3</sup>	3,351 <sup>3</sup>	3,411 <sup>3</sup>	3,684 <sup>3</sup>	3,848 <sup>3</sup>	3,367 <sup>3</sup>	2,983 <sup>3</sup>	3,018 <sup>3</sup>	2,541 <sup>3</sup>	2,690 <sup>3</sup>

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Volume	2,840 <sup>3</sup>	3,138 <sup>3</sup>	3,325 <sup>3</sup>	2,331 <sup>3</sup>	2,288 <sup>3</sup>	2,440 <sup>3</sup>	2,533 <sup>3</sup>	2,119 <sup>3</sup>	1,883 <sup>3</sup>	1,710 <sup>3</sup>	1,734 <sup>3</sup>	1,710 <sup>3</sup>	1,588 <sup>4</sup>	1,607 <sup>4</sup>

	2015	2016	2017
Volume	1,421 <sup>4</sup>	1,595 <sup>4</sup>	1,450 <sup>4</sup>

## Notes:

- 1) Naval Ordnance Test Station (NOTS)/Naval Weapons Center (NWC) data.
- 2) From Figure 6 Berenbrock & Martin.<sup>\*</sup> Digitized from plot.
- 3) As reported to the Indian Wells Valley Cooperative Groundwater Management Group (IWVCGMG).
- 4) Naval Air Weapons Station (NAWS) data.

<sup>\*</sup>C. Berenbrock and P. Martin. 1991. *The Ground Water Flow System in the Indian Wells Valley, Kern, Inyo, and San Bernardino Counties, California*. USGS Water Resources Investigations Report 89-4191.

This page intentionally left blank.

**INITIAL DISTRIBUTION**

- 1 Office of Counsel, Navy Region Southwest, Sand Diego CA, (Faryan, M.)
- 1 Code K70000E, Point Mugu, CA, (Bouvier, C.)
- 1 Defense Technical Information Center, Fort Belvoir, VA

---

**ON-SITE DISTRIBUTION**

- 2 Code 4F0000D (archive copies)
- 1 Code 4G0000D (file copy)
- 5 Code 52000MD (Boggs, M.)
- 2 Commander, Naval Air Weapons Station, China Lake, CA
  - Benson, CDR (1)
  - Dale, CAPT (1)

*The page intentionally blank*



**DEPARTMENT OF THE NAVY**  
NAVAL AIR WEAPONS STATION  
1 ADMINISTRATION CIRCLE  
CHINA LAKE CA 93555-6100

IN REPLY REFER TO:

1000

Ser N00/034

20 Feb 19

Board of Directors  
Indian Wells Valley Ground Water Authority (IWVGWA)  
Ridgecrest, California 93555

Dear Members of the Board:

Subj: GROUNDWATER RESOURCES

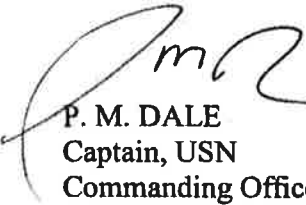
1. This letter serves to formally communicate that Commander Navy Region Southwest (CNRSW), in consultation with U.S. Navy commands located within the Indian Wells Valley, deems groundwater resources as the number one encroachment concern/issue which has the potential to impact missions enabled on and around Naval Air Weapons Station China Lake (NAWSCL). Water sustainability is critical to NAWSCL's mission accomplishment.
2. The Navy's human capital and its ability to recruit and retain talented personnel is integral to these critical national defense missions. We must emphasize the importance of Navy civilian and military personnel's continued access to economically viable potable water as critical to the IWVGWA's implementation of the Sustainable Groundwater Management Act (SGMA).
3. The Navy has leaned forward for decades, reducing water consumption on the installation by 54 percent since 2007, funding the Desert Research Institute modeling effort that the IWVGWA is now utilizing, and voluntarily providing reports of its groundwater extractions to assist the basin in understanding the Navy's current water use. NAWSCL engages in these initiatives as a matter of comity and as a good neighbor, rather than state law and local ordinance mandates. The purpose of this cooperative posture is to help the IWVGWA with comprehensive planning efforts to achieve groundwater sustainability as directed by the SGMA.
4. NAWSCL relies entirely upon groundwater as its sole source of potable water. In implementing SGMA, the Department of Water Resources (DWR) classified the Indian Wells Valley (IWV) groundwater basin as "Critically Over Drafted" in January 2016. Therefore, an imbalance between pumping and recharge associated with the basin creates growing concern, despite the efforts and cooperation of community stakeholders.
5. NAWSCL has engaged in consistent, proactive, and cooperative advocacy since the standup of the IWVGWA via a Joints Powers Agreement, with formal recognition as Ex-Officio non-voting Liaison on the IWVGA Board, active participation on the Technical Advisory Committee, Public Advisory Committee, SKYTEM, and other data gathering efforts to supplement the modeling effort. In addition, NAWSCL has committed, per my letter to you dated February 12, 2019, to submitting proposed projects for higher headquarters' consideration as applicable under FY19 NDAA. NAWSCL has a vested interest in participating in the SGMA effort with

Subj: GROUNDWATER RESOURCES

IWVGWA as lead and responsible for developing a plan for the groundwater basin to achieve a sustainable yield in 20 years.

6. The Navy appreciates that IWVGWA recognizes the unique position of NAWSCL's Federal Reserve Water Rights (FRWR) dating back in time to when the base was established in 1943. The SGMA statute itself recognizes that FRWRs shall be respected in full, and in the case of any conflict, federal law will prevail. CA Water Code Section 10720.3(d). IWVGWA has also recognized the fact that there is no waiver of sovereign immunity subjecting the Navy to GW regulation, pumping limitations, or fee assessment. Despite these unique federal legal limitations, NAWSCL intends to continue to be a good neighbor and work cooperatively with the IWVGWA.

7. In summary, we appreciate the magnitude of the task ahead for the IWVGWA.



P. M. DALE  
Captain, USN  
Commanding Officer

*The page intentionally blank*