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MEMORANDUM

TO:	**Indian Wells Valley Groundwater Authority Technical Advisory Committee**
FROM:	**Stetson Engineers Inc.**
SUBJECT:	**Recycled Water Use Alternatives Analysis**
DATE:	**March 15, 2023**
JOB NO:	**2652-09**

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Introduction

The Indian Wells Valley Groundwater Authority (IWVGA), in partnership with the City of Ridgecrest (City), has adopted a Recycled Water Program. The City is proceeding with the upgrade and expansion of its wastewater treatment facility (WWTF) with secondary-level treatment technology. IWVGA's Recycled Water Program may provide funding for the design and construction of tertiary and advanced treatment facilities to treat effluent from the City's upgraded and expanded secondary-level WWTF, which is planned to be constructed by 2026. IWVGA's Recycled Water Program includes purchasing effluent generated at the WWTF from the City and potentially providing the recycled water to Recycled Water Program Participants for beneficial uses such as landscape irrigation, surface spreading, deep injection, or direct industrial use. These beneficial uses would offset groundwater extractions and reduce future imported water supply requirements.

The IWVGA Board of Directors authorized preparation of this Recycled Water Use Alternatives Analysis (Analysis) of the potential beneficial uses of recycled water. This Analysis was performed to identify the additional treatment requirements and to develop recycled water projects that not only are cost-effective but also contribute to sustainable basin management consistent with the Groundwater Sustainability Plan (GSP) for the Indian Wells Valley Groundwater Basin (Basin). The Analysis supplements the previous Recycled Water Technical Memorandum (GSP Appendix 5-C) by evaluating the use(s) that provide the greatest and most cost-effective benefits to the Basin. This Analysis will later serve as the basis for design, permitting, and environmental compliance for post-secondary treatment facilities and for infrastructure for recycled water conveyance and application.

Section 1 – Current WWTF Operations and Plans for Upgrade and Expansion

The City operates wastewater collection, treatment, and disposal facilities that serve the Ridgecrest community as well as the China Lake Naval Air Weapons Station (NAWS). The City's WWTF was originally constructed in 1946 at a location near the southeastern City limits. During the 1970s, the WWTF was relocated to the NAWS base, where it operates today. The WWTF is currently within the NAWS boundary and is located in the northeast portion of the City, approximately 3.5 miles northeast of the City center, as shown on Figure 1. The WWTF is currently designed to handle an average flow of 3.6 million gallons per day (MGD) and a peak hourly flow of 5.7 MGD. Overall, the existing WWTF is operating beyond its useful life since most of its components were constructed from 45 to nearly 75 years ago, except for the headworks which were upgraded in 2006.

Over the past ten years, the City has been working to develop a new WWTF which may provide enhanced treatment for future generation of recycled water to be used by other water purveyors. In October 2015, Provost and Pritchard Consulting Group submitted a Draft Facility Plan for WWTF upgrades. The Draft Facility Plan recommended abandoning the existing WWTF and constructing a new secondary treatment plant located at the same site as the existing WWTF. The Draft Facility Plan's recommendations for the new secondary treatment plant are summarized below:

- Phase I secondary treatment upgrades
  - 4.0 MGD secondary treatment facilities with biological nitrogen removal using two oxidation ditches and two circular clarifiers
- Phase 2 secondary treatment upgrades
  - A third oxidation ditch and clarifier to increase capacity to 5.4 MGD
- Effluent disposal to existing percolation and evaporation ponds located at the existing WWTF site
- Construction of new percolation and evaporation ponds located at the old WWTF site (near southeastern City limits) for effluent disposal

- Construction of new aerobic digesters followed by mechanical biosolids dewatering facilities
- Solids disposal at the City's alfalfa fields, with any excess solids to be disposed of at an approved landfill
- Construction of other ancillary facilities for the new WWTF
    - Influent pump station and headworks
    - Office/lab building and maintenance building
- Provisions for future construction of tertiary treatment facilities to provide 1.8 MGD of recycled water

Since development of the Draft Facility Plan, the City's plans to develop and construct a new WWTF were delayed, in part due to lease negotiations with the United States Navy (Navy) for construction of new WWTF facilities on Navy property. The City and the Navy negotiated and executed a new land lease agreement in November 2020. The following describes the current WWTF operations as well as the City's current plans for upgrading and expanding the existing WWTF.

Current WWTF Operations

According to the Draft Facility Plan, the existing WWTF has a permitted capacity of 3.60 MGD and currently treats an average annual flow of approximately 2.20 MGD. Average annual daily (AAD) flow during calendar year 2020 was approximately 2.20 MGD, with approximately 1.61 MGD (73%) attributable to the City and 0.59 MGD (27%) attributable to the NAWS. Influent biochemical oxygen demand (BOD) concentrations at the WWTF have generally ranged from 188 milligrams per liter (mg/L) to 260 mg/L for average daily maximum month (ADMM) flows between 2005 and 2018. ADMM BOD increased to 370 mg/L in 2019 and 320 mg/L in 2020[1]. A technical memorandum dated July 10, 2021, prepared by Provost & Pritchard Consulting Group (P&P Memo) suggests that the increased ADMM BOD may be the result of lower per-capita wastewater flows: Organic

[1] AAD BOD also increased in 2019 (191 mg/L) and 2020 (226 mg/L), compared to historic values. From 2005 to 2018, the maximum AAD BOD was 166 mg/L, which occurred in 2007.

matter concentrations in wastewater typically remain constant, but decreases in diluting water volumes would produce higher BOD. Additionally, the Draft Facility Plan reported influent nitrogen concentrations (as total nitrogen (N)) of 39 mg/L in 2015.

The existing WWTF provides pretreatment, primary treatment, and secondary treatment to wastewater received from both the City and the NAWS. Wastewater flows throughout the WWTF entirely by gravity, but pumps are used to convey primary sludge and digested sludge throughout the sludge treatment process. Pumps are also used to convey secondary-treated effluent for application (effluent disposal) at City-owned alfalfa fields. The City has historically applied biosolids from the WWTF to the alfalfa fields but has discontinued this practice. Currently, biosolids are stockpiled and tested before disposal at the Kettleman Hills landfill in Kings County. A process flow diagram for the existing WWTF, as documented in the Draft Facility Plan, is shown on Figure 2.

The conveyance and treatment facilities at the existing WWTF are described in detail below.

Influent Flow, Pretreatment, and Primary Treatment

A total of four (4) influent channels enter the WWTF: One City channel and three Navy channels, one of which was abandoned when the NAWS removed residential housing. WWTF influent from the City's sewer trunk is measured via a 12-inch Parshall Flume, and total plant influent from both the City's sewer trunk and the NAWS service area is measured through two (2) 18-inch throat Parshall Flumes. WWTF influent from the NAWS service area is not directly measured but is determined by subtracting the City's contribution to WWTF influent from the total measured WWTF influent. All four influent channels combine at a point before pretreatment, which consists of headworks facilities including two auger grinders, a vortex grit chamber, and a grit classifier for off-site disposal.

Grit chamber effluent flows into primary sedimentation facilities, which consist of three rectangular clarifiers (Tank No. 1, 2 & 4) and one circular clarifier (Tank No. 3). Tank No. 4 had been retired from service at the time of preparation of the Draft Facility Plan, and City staff have indicated that Tank No. 3 has also been retired from service since the Draft Facility Plan was prepared. The two other primary sedimentation tanks operate at a surface overflow rate ranging from 600 gallons per square foot per day to 1,200 gallons per square foot per day. According to the Draft Facility Plan, the primary sedimentation facilities are beyond their expected life due to concrete degradation, worker access safety concerns, and obsolete equipment.

Sludge Handling

Primary sludge from the primary clarifiers is collected via a sludge pump station and pumped to two 40-foot diameter anaerobic digesters, which are used to treat primary sludge by reducing its volatile organic compounds (VOCs) content. The anaerobic digesters are equipped with floating covers, heaters, and mixers to increase process efficiency, and digester gas is used to fuel the hot water heat exchangers. Sludge leaving the digesters is dewatered and dried on eight unlined solar sludge drying beds[2]. Historically, dried sludge has been stockpiled and tested before being either applied at the City-owned alfalfa fields or disposed at the Kettleman Hills landfill. However, as mentioned above, the City no longer applies dried sludge at the alfalfa fields.

Secondary Treatment and Effluent Disposal

The primary effluent from the clarifiers flows by gravity to secondary treatment, which is achieved via seven (7) facultative ponds that span approximately 114 acres and are clay-lined to limit infiltration and percolation. The effluent is split and diverted either to pond Unit A (Ponds 1 through 4) or pond Unit B (Ponds 5 through 7). Primary effluent diverted

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[2] During winter months when weather conditions do not support drying, the sludge drying beds provide sludge storage. According to the Draft Facility Plan, the drying beds provide sufficient drying capacity during the summer months to account for freshly digested and dewatered sludge as well as stored sludge accumulated during the winter months.

to Unit A begins in Pond 1, flows through Pond 2 and Pond 4, and is subsequently either discharged into evaporation/percolation ponds or discharged into Pond 3, which has aeration facilities, prior to application for beneficial uses. Primary effluent diverted to Unit B flows through all three Unit B ponds before being discharged into evaporation/percolation ponds. A total of four (4) evaporation/percolation ponds are located at the existing WWTF, though two of these ponds (Ponds 8 & 11) have been taken out of service. Pond 8 has been taken out of service due to decreased influent flows and due to seepage into Pond 11. Pond 11 has been taken out of service due to excessive seepage into NAWS facilities, as documented in a 1989 Cease and Desist Order (CDO 6-89-119).

Current Secondary-Treated Wastewater Beneficial Uses

Flow diverted into Pond 3 is pumped for irrigation of the City-owned alfalfa fields or irrigation of the NAWS golf course. One pump located at Pond 3 delivers Pond 3 water through a 4-mile, 20-inch diameter force main to the City-owned alfalfa fields. The force main discharges into one of four ponds from which water is pumped to a center pivot irrigation system for irrigation of approximately 33 acres of alfalfa crops.

A separate pump located at Pond 3 is operated by the Navy and used to deliver treated effluent for irrigation of the NAWS golf course. Pressure sand filters and chlorine contact structures were constructed by the Navy to provide additional treatment prior to delivery at the NAWS golf course. However, the high algae content of Pond 3 has prevented the sand filters from being operated successfully, so the sand filters are currently bypassed. The new land lease agreement between the City and the Navy requires that the City provide 325 acre-feet per year (AFY) of recycled water to the Navy for non-potable uses of recycled water at the NAWS, including for irrigation of a golf course.

One evaporation/percolation pond (Pond 10) is presumed to provide seepage flow to the nearby habitat for the endangered Mojave Tui Chub fish species. The Tui Chub habitat consists of two seeps, referred to as Lark Seep and G-1 Seep, which are connected through a series of man-made channels originally constructed during the 1950s and 1960s to divert seeping groundwater away from nearby roads and facilities. The new land lease agreement between the City and the Navy requires that the City provide 200 AFY of recycled water to the Navy for use in maintaining the Tui Chub habitat.

Plans for WWTF Upgrade and Expansion

The City's current plans to expand and upgrade the existing WWTF consist of a two-phase project. The Phase 1 WWTF will be constructed with a design AAD flow of 3.6 MGD and a maximum month (MM) flow of 4.0 MGD. The Phase 2 WWTF will be constructed with a design AAD flow of 5.4 MGD and a MM flow of 5.9 MGD. The Phase 2 project will commence at a future date in which the City's Phase 1 WWTF capacity is determined to be insufficient to serve the growing populations of both the City and the NAWS. The existing WWTF will be completely demolished and replaced with the new expanded and upgraded WWTF. Based on recent project schedules, the City currently plans to begin construction of the new WWTF by the 4th quarter of 2024 and may finish construction as soon as the 4th quarter of 2026.

At this time, the City is updating the 2015 Draft Facility Plan to develop the final list of treatment and ancillary facilities for the new WWTF site prior to design. City staff has indicated that the new WWTF will produce un-disinfected secondary effluent and that any additional treatment needed to meet specific water quality goals for Total Dissolved Solids (TDS), Total N, or Total Organic Carbon (TOC) will not be provided by the City. The City's current goal for use of secondary-treated effluent from the WWTF is to encourage water purveyors to develop new beneficial uses of the effluent (i.e. recycled water) to the greatest extent possible. As these beneficial uses are planned, designed, and constructed, the City may continue applying recycled water to its alfalfa fields for irrigation until recycled water can be physically received by the water purveyors. The City's current plan is to construct the new WWTF up to only secondary treatment unless the water purveyors can develop beneficial uses for recycled water that has undergone tertiary or full advanced treatment.

The City has also planned to develop an industrial pretreatment program to permit treatment of wastewater from potential industrial users in the WWTF service area. It is anticipated that the NAWS will be included in the City's industrial pretreatment program through agreement(s) with the City instead of through regulation. Industrial user questionnaires to be completed by the NAWS and other industrial users that must be regulated in the City's service area will be prepared as part of the pretreatment program. Industrial permit requirements such as discharge restrictions and monitoring/reporting frequency will be developed by the City based on the results of the industrial user questionnaires. The City will prepare permits for the industrial users and develop local limits for industrial pollutants for environmental compliance at its WWTF and for the protection of its wastewater system, staff, and the general public.

Section 2 – Characterization of WWTF Effluent Quantity and Quality

As discussed in Section 1, the City is currently pursuing development and construction of a new WWTF that may provide recycled water to interested parties within the Basin. The anticipated quantity and quality of effluent from the City's new WWTF (both at the time of project startup and in the future) are described below.

WWTF Effluent Quantity

A technical memorandum dated July 10, 2021 prepared by Provost & Pritchard Consulting Group (P&P Memo) details a population and flow rate analysis for current and projected influent flow rates at the new WWTF. The P&P Memo updates the analysis conducted as part of the 2015 Draft Facility Plan and serves as the most recent source of information available on City population projections, per-capita water use, and WWTF influent flow rates. As shown on Table 2-1, historic AAD influent flow rates from 2001 through 2020 ranged from a minimum of 2.18 MGD in 2015 to a maximum of 2.62 MGD in 2010. AAD influent flow in 2020 was approximately 2.20 MGD. Contributions to total WWTF influent from both the City and the NAWS are also shown on Table 2-1.

The P&P Memo provides projections for population and total WWTF influent based on 2020 U.S. Census population data for the City. Three annual population growth rates (1.8%, 1.2%, and 0.8%) were assumed to generate projections of population and WWTF influent flow through 2050 assuming a per-capita wastewater flow contribution of either 85 gallons per capita-day (gpcd) or 75 gpcd. As discussed in the P&P Memo, actual historic growth rates in the City were approximately 1.03% per year from 2000 to 2010 and approximately 0.57% per year from 2010 to 2020, but growth in the City remains highly dependent on NAWS staffing levels, which are highly variable. The population and WWTF influent flow rate projections from the P&P Memo were recreated in this analysis (see Table 2-2) to document the projections on an annual basis rather than on a 5-year basis as provided in the P&P Memo. The projections were also recreated to forecast population and WWTF influent flow rates through 2070, which corresponds to the end of the planning and implementation horizon referenced in the Sustainable Groundwater Management Act and in the IWVGA's adopted GSP. A separate set of projections (see Table 2-3) was prepared assuming an annual population growth rate of 1.0% per year, which is similar to growth trends documented in both the recycled water project discussion presented in the IWVGA's GSP as well as the City's General Plan update[3].

As shown on Table 2-3, the total projected WWTF influent flows in calendar years (CYs) 2026, 2035, and 2070 are 2,606 AF, 2,850 AF, and 4,037 AF, respectively. These years correspond to the anticipated completion dates of the new City WWTF (2026), the IWVGA's Imported Water Project (2035), and the GSP planning and implementation horizon (2070). The City is currently obliged to commit 325 AFY of secondary-treated effluent from the WWTF to the NAWS golf course and 200 AFY for maintenance of the local Tui Chub habitat. These commitments take priority over any of the recycled water alternatives evaluated in this analysis. As discussed in Section 1, the City may continue applying secondary-treated effluent to its alfalfa fields for irrigation until recycled water alternatives are fully developed. For the purpose of estimating available recycled water for the alternatives, this Analysis assumes that the City will not commit any recycled water for alfalfa field irrigation after the alternatives are fully developed, and therefore, the City's priority commitments for providing recycled water total 525 AFY. Consequently, the total projected secondary effluents available for additional treatment and/or beneficial uses that do not require additional treatment in CYs 2026, 2035, and 2070 are **2,081 AF**, **2,325 AF**, and **3,512 AF**, respectively. It should be noted that these quantities may be further reduced if significant losses are incurred during sludge generation as part of secondary treatment and, if constructed, primary clarification. The City is currently preparing an updated Facility Plan to identify the treatment facilities to be installed at the new WWTF; therefore, such losses are not estimated at this time but may be updated upon completion of the updated Facility Plan.

[3] City of Ridgecrest. *General Plan Public Draft*. Prepared by Matrix Design Group Inc. October 2008.

For alternatives such as landscape irrigation and groundwater replenishment, tertiary treatment processes that may incur additional losses of secondary-treated effluent will be required for the purpose of permitting. The losses incurred during tertiary treatment occur during media filtration, as a portion of filter discharge is typically used for backwashing to regenerate pore space between the filter media. Media filters are generally designed for a recovery of at least 95%, meaning that 5% of available secondary-treated effluent would be lost to backwashing during the filtration process[4]. For alternatives that required advanced treatment facilities for the purpose of permitting (i.e. subsurface groundwater replenishment/injection), additional losses of tertiary-treated effluent will be incurred through microfiltration (MF) and reverse osmosis (RO) brine generation. MF and RO may result in losses of available tertiary-treated effluent as high as 6% and 8%, respectively, based on target recovery rates at advanced treatment facilities for replenishment projects managed by the Water Replenishment District of Southern California. Table 2-4 summarizes the potentially available recycled water in 2026, 2035, and 2070, as well as the potential impact of treatment losses to the quantities of recycled water available for the alternatives.

WWTF Effluent Quality

Waste Discharge Requirements (WDRs) for WWTFs are typically issued by the local Regional Water Quality Control Board (Regional Board) to establish limits on pollutant concentrations in the WWTF effluent discharge for the purpose of protecting public health and beneficial uses of surface water and groundwater. The WDRs for the City's existing WWTF are documented in the Lahontan Regional Board's Order No. 6-00-56. The WDRs establish discharge limitations for effluent flow rate, BOD, Methylene Blue Active Substances, pH, and Dissolved Oxygen. The WDRs also specify that discharge into the WWTF evaporation/percolation ponds shall not violate adopted water quality standards for receiving water, as documented in the Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan)[5]. The Lahontan Basin Plan establishes water quality

[4] Crittenden, John C., et al. *MWD's Water Treatment: Principles and Design*. 3rd edition. 2012.
[5] California Regional Water Quality Control Board Lahontan Region. *Water Quality Control Plan for the Lahontan Region, North and South Basins*. With January 2016 Amendments.

standards for bacteria, general chemical constituents with maximum contaminant levels, radioactivity, and taste & odor for all groundwater basins within the Lahontan Region; no specific water quality standards for groundwater are established for the Basin. The Lahontan Regional Board has also issued separate Board Orders to the City establishing wastewater recycling requirements for use at the Navy golf course (Board Order No. 6-84-36) and for effluent disposal at the City-owned alfalfa fields (Board Order No. 6-93-85).

The City's Updated Treatment Alternatives Technical Memorandum (prepared by Provost & Pritchard Consulting Group) outlined water quality design criteria for secondary treatment for the purpose of complying with water quality objectives for protecting underlying groundwater, as specified in the Lahontan Basin Plan. These design criteria are summarized below:

1. Effluent BOD_5: 30 mg/L
2. Effluent Total Suspended Solids (TSS): 30 mg/L
3. Effluent Ammonia: 1 mg/L
4. Effluent Total Nitrogen (N): 10 mg/L

The City has indicated that its new WWTF will be designed to provide undisinfected secondary effluent and will not provide additional/advanced treatment to meet other treatment goals. The City is currently working with the Navy to determine the required water quality goals and treatment objectives for the 325 AF portion of recycled water that will be provided to the Navy for non-potable uses (i.e. golf course irrigation and Tui Chub habitat maintenance). However, the City has advised IWVGA to assume that the new WWTF will not meet any treatment goals beyond what is required in the City's WDRs and existing water recycling requirements for use at the Navy golf course and for effluent disposal at the City-owned alfalfa fields. IWVGA anticipates that the updated Facility Plan will include updated design criteria for WWTF effluent quality.

Section 3 – Identification of Alternatives

As discussed in Section 2, the quantities of projected secondary effluent that will be available for either additional treatment or for beneficial uses that do not require additional treatment are as follows:

- 2,081 AF by 2026
  - Corresponds to estimated completion date of the new City WWTF
- 2,325 AF by 2035
  - Corresponds to estimated completion date of IWVGA imported water interconnection project
- 3,512 AF by 2070
  - Corresponds to end of planning and implementation horizon for IWVGA's GSP

The recycled water project discussed in the IWVGA's GSP consisted of applying recycled water from the City's WWTF for new beneficial uses. The beneficial uses were prioritized based on their ability to directly replace groundwater demands with recycled water to offset current pumping, where available, and to mitigate overdraft conditions. Consequently, the recycled water project discussed in the IWVGA's GSP was developed with an emphasis on landscape irrigation, and any available recycled water in excess of landscape irrigation demands would be used for groundwater replenishment. The IWVGA's GSP also included provisions for additional evaluation of potential recycled water projects, including industrial use of recycled water and direct potable reuse. Based on prior discussions with the IWVGA's Technical Advisory Committee (TAC) and more recent discussions with IWVGA Staff and the City, the alternatives to be evaluated for potential uses of recycled water from the City's new WWTF are summarized below.

Alternative 1A – Landscape Irrigation

Under Alternative 1A, recycled water would be applied to irrigate the landscaping areas identified in the IWVGA's GSP. Because the quantity of recycled water available from the City's new WWTF exceeds the identified average annual recycled water demand for landscape irrigation of 1,124 AFY, implementation of Alternative 1A may result in a significant quantity of unused recycled water. If any significant additional landscaping areas within the Basin are planned to be developed in the near future, the IWVGA may coordinate with the City, the Indian Wells Valley Water District (IWVWD), and potentially the NAWS to evaluate the possibility for the additional landscaping to receive recycled water. The GSP recycled water project assumed that the recycled water distribution system for landscape irrigation would be sized with sufficient capacity to pump and convey up to 20% of total annual irrigation demands within one month, typically a summer month, to address seasonal and diurnal variance in demands, and that typical irrigation hours would be between 10:00 pm and 6:00 am. The irrigation schedule for Alternative 1A will remain unchanged from the assumptions made in the GSP planned Project No. 2, unless the City and/or the IWVWD indicate that actual practiced irrigation schedules deviate significantly from those assumed.

Alternative 1B – Landscape Irrigation with Groundwater Replenishment Component

Under Alternative 1B, recycled water would be applied to irrigate the landscaping areas identified in the IWVGA's GSP, and any available recycled water in excess of those landscape irrigation demands would be applied for groundwater replenishment through deep injection.

Alternative 2A – Groundwater Replenishment through Surface Spreading

Under Alternative 2A, all recycled water available from the City's new WWTF would be applied for groundwater replenishment through surface spreading. The IWVGA is currently finalizing Phase I of an investigative effort to identify potentially viable locations for surface spreading within the Basin. If deemed possible, the IWVGA would pursue groundwater replenishment with recycled water through surface spreading due to the anticipated costs for advanced treatment facilities; otherwise, application of recycled water through deep injection would be pursued.

Alternative 2B – Groundwater Replenishment through Deep Injection

Under Alternative 2B, all recycled water available from the City's new WWTF would be applied for groundwater replenishment through deep injection. The IWVWD has developed a conceptual plan for recycled water injection in the northeast vicinity of the IWVWD's Southwest Well Field, as the IWVWD has characterized this location as suitable in terms of underlying geology and separation (at least 0.5 miles) from water supply wells.

Alternative 3 – Direct Non-Potable Industrial Use

The following non-potable industrial uses of recycled water will be considered as potential alternatives in this alternatives analysis:

a) Delivery to Searles Valley Minerals (SVM) to replace groundwater demands at mineral extraction/processing facilities

b) Delivery to NAWS to replace groundwater demands associated with Navy missions

Alternative 4 – Direct Potable Reuse through Treated Drinking Water Augmentation

California Water Code §13561(b) defines direct potable reuse (DPR) as "the planned introduction of recycled water either directly into a public water system or into a raw water supply immediately upstream of a water treatment plant." DPR methods may include the following methods:

- Raw water augmentation
    - The planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system
- Reservoir water augmentation
    - The planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply for a public water system, or into a constructed system conveying water to such a reservoir
- Treated drinking water augmentation
    - The planned placement of recycled water into the water distribution system of a public water system

Under Alternative 4, the IWVGA would pursue a DPR project to introduce recycled water into existing water systems in the Basin, likely that of the IWVWD which owns and operates the largest public water system in the Basin. As mentioned in the GSP, neither the IWVGA nor the IWVWD currently own or operate a drinking water treatment plant or a raw surface water reservoir. The water supply distribution system of the IWVWD includes arsenic wellhead treatment facilities and treated water storage tanks, but the system does not include either a drinking water treatment plant or a raw surface water reservoir. Therefore, the IWVGA's options for a DPR project are limited to only treated drinking water augmentation.

At time of adoption of the IWVGA's GSP, the State Water Resources Control Board (SWRCB) had not adopted regulatory criteria for DPR projects in California, so the GSP included provisions to continue evaluating the feasibility of a potential DPR project as those regulations are developed and codified. Assembly Bill (AB) 574, passed in October 2017, requires that the SWRCB adopt uniform water recycling criteria for DPR through raw water augmentation by December 31, 2023. The SWRCB released a draft framework for regulating DPR in California (Framework) in March 2021, after the IWVGA's GSP was adopted, and released a revised version of the Framework in August 2021. The Framework is currently undergoing additional review in coordination with a SWRCB-established expert review panel tasked with making findings as to whether the criteria in the Framework will adequately protect public health. The Framework presents an early draft of anticipated criteria for the use of treated municipal wastewater (i.e. recycled water) to augment a source of supply for a water treatment plant or to augment a drinking water distribution system, and therefore applies to all three DPR methods listed in California Water Code §13561(b). In this Analysis, the IWVGA will use the Framework to consider and evaluate a DPR project through treated drinking water augmentation.

Preliminary Ranking of Alternatives

During development of the recycled water project included in its GSP, the IWVGA prioritized the replacement of existing groundwater demands for non-potable uses with recycled water in order to directly offset pumping. At that time, the IWVGA had concluded that landscape irrigation was the only non-potable use that could receive recycled water: Feedback received by the IWVGA's TAC and other stakeholders had suggested that other non-potable uses—namely for industrial practices at SVM—would require a water supply with similar quality to that of drinking water, as well as a separate dedicated recycled water distribution system. Consequently, due to the high anticipated costs of treating recycled water to potable standards and constructing a separate dedicated distribution system, the IWVGA's GSP did not include a project involving delivery of recycled water to SVM's mineral processing facilities. IWVGA Staff attended a tour of SVM's water supply and delivery facilities in August 2021. The information provided on the tour indicated that the layout of SVM's existing delivery facilities requires that all groundwater pumped from the Basin by SVM be treated to potable standards. SVM's water delivery system provides water for plant industrial uses (such as for use in cooling towers, wash-downs, industrial cleaning operations, restrooms, etc.) but simultaneously provides the local residential communities with a drinking water supply, so all water introduced into the system must meet potable water quality standards. Since then, sufficient information asserting that SVM can receive tertiary-treated recycled water for their plant industrial uses has not been provided to IWVGA Staff.

For the purpose of public engagement, a preliminary ranking (listed below from highest to lowest priority) of the recycled water use alternatives was developed based solely on the degree to which information is currently available to potentially pursue design and construction, as well as the anticipated benefits that would be provided to the Basin to achieve groundwater sustainability and mitigate undesirable results, as defined in the IWVGA's GSP. This preliminary ranking was used as a guide for the extent to which the preliminary investigations and detailed evaluations of each alternative, as described in Task 6 of the scope of work, were performed.

i. Alternative 2B – Groundwater Replenishment through Deep Injection

ii. Alternative 1B – Landscape Irrigation with Groundwater Replenishment Component

iii. Alternative 1A – Landscape Irrigation

iv. Alternative 4 – Direct Potable Reuse

v. Alternative 2A – Groundwater Replenishment through Surface Spreading

vi. Alternative 3 – Direct Non-Potable Industrial Use

Section 4 – Regulatory, Permitting, Environmental & Legal Requirements

In general, statewide water recycling regulatory criteria are codified in the California Code of Regulations (CCR) Title 22, Division 4, Chapter 3. A portion of the regulatory criteria for indirect potable reuse projects are codified in CCR Title 22, Division 4, Chapter 17, Article 9. In addition, cross-connection control regulations that address the protection of public water supplies from cross-connection with non-potable systems are codified in CCR Title 17, Subchapter 1, Group 4. Additional requirements are described in SWRCB's adopted Water Quality Control Policy for Recycled Water (Recycled Water Policy), which was adopted in 2009 to encourage the safe use of recycled in a manner that implements state and federal water quality laws and also protects public health and the environment. For each of the potential recycled water alternatives presented in Section 3 of this analysis, the IWVGA has identified the relevant regulatory, permitting, environmental, and legal compliance requirements from the CCR and the Recycled Water Policy.

General Regulatory Requirements

Lahontan Basin Plan Objectives

The Lahontan Basin Plan designates beneficial uses for surface water and groundwater throughout the Lahontan Regional Board's jurisdiction and also establishes narrative and numeric water quality objectives that must be attained or maintained to protect existing and potential beneficial uses. For groundwater basins designated with municipal and domestic water supply beneficial uses (i.e. the Basin, although a portion of the Basin was de-designated for those uses), the Lahontan Basin Plan establishes regional water quality objectives for bacteria, general chemical constituents with maximum contaminant levels, radioactivity, and taste & odor for the Lahontan Region; no specific water quality standards for groundwater are established for the Basin. These regional water quality objectives are listed below:

- Coliform Bacteria
    - The median concentration of coliform organisms over any seven-day period shall be less than 1.1 / 100 mL.
- Chemical Constituents
    - In general, groundwaters shall not contain concentrations of chemical constituents that adversely affect the beneficial uses. The concentration of certain chemical constituents shall not exceed the primary or secondary Maximum Contaminant Levels (MCLs) based upon the following drinking water standards specified in Title 22 of the CCR:
        - Table 64431-A (Inorganic Chemicals)
        - Table 64431-B (Fluoride)
        - Table 64444-A (Organic Chemicals)
        - Table 64449-A (Secondary Maximum Contaminant Levels – Consumer Acceptance Limits)
        - Table 64449-B (Secondary Maximum Contaminant Levels – Ranges)
- Radioactivity
    - The concentrations of radionuclides shall not exceed the limits specified in Table 4 of § 64443 of Title 22 of the CCR.
- Taste and Odor
    - Groundwater shall not contain taste or odor-producing substances in concentrations that cause nuisance or that adversely affect beneficial uses. At a minimum, concentrations shall not exceed SMCLs specified in Table 64449-A and Table 64449-B of Title 22 of the CCR.

The future alternative beneficial use(s) of recycled water in the Basin shall not adversely affect the Basin’s existing water quality conditions and shall not cause the Basin (at a local level or at a Basin-wide level) to fall out of compliance with the regional water quality objectives established in the Lahontan Basin Plan.

Anti-degradation Policy

In 1968, the SWRCB adopted the Statement of Policy with Respect to Maintaining High Quality Waters of California (Anti-degradation Policy), which is documented in SWRCB Resolution No. 68-16. The Anti-degradation Policy generally requires that high-quality water bodies (including groundwater) be maintained to the maximum extent possible. The Anti-degradation Policy allows for lowering of existing high-quality water only if the change is consistent with maximum benefit to the people of the state, does not unreasonably affect present and potential beneficial uses, and does not result in water quality lower than applicable standards (i.e. primary and secondary MCLs).

As pertaining to the potential recycled water alternatives in the Basin, the Anti-degradation Policy would require in general that recycled water generated at the City's WWTF receive sufficient treatment such that the Basin's local and overall quality shall not degrade upon receiving the recycled water through irrigation percolation, replenishment, septic tank runoff, etc.

Salt & Nutrient Management Plan

The Recycled Water Policy established by the SWRCB requires that a salt and nutrient management plan (SNMP) be prepared for each groundwater basin in California. SNMPs characterize basin-wide salt and nutrient loadings to demonstrate the preservation or attainment of the relevant basin water quality objectives. A SNMP for the Basin was approved by the Lahontan Regional Board in 2018. The SNMP employed a GIS-based model to estimate loading of salts (Total Dissolved Solids) and nutrients (i.e. nitrate) in the Basin using land use characteristics and existing water use practices. The SNMP concluded that the Basin as a whole has assimilative capacity for salts and nitrate, though localized salinity issues in specific portions of the Basin were not addressed.

The SWRCB's Recycled Water Policy requires that SNMPs include an anti-degradation analysis demonstrating that existing and reasonably foreseeable future projects (including beneficial uses of recycled water) will cumulatively satisfy the requirements of the Anti-degradation Policy. The IWVGA (or other appropriate agency) in the Basin will need to update the Basin's current SNMP to prepare an updated salt and nutrient balance that accounts for loadings resulting from the selected recycled water alternative.

<u>CEQA/NEPA Environmental Compliance</u>

Recycled water projects in general must adhere to the requirements of the California Environmental Quality Act (CEQA). Preparation of an Environmental Initial Study (Initial Study) would begin the CEQA process through a preliminary evaluation of the potential environmental impacts resulting from the recycled water project. The Initial Study would determine whether a CEQA Negative Declaration or an Environmental Impact Report would serve as appropriate environmental consideration for the project. The Initial Study would be prepared concurrent with supplemental technical investigations such as cultural and biological resource studies.

For recycled water projects requiring a federal agency to take a major federal action, compliance with the National Environmental Policy Act (NEPA) would be required. As an example, NEPA compliance may be required if the IWVGA's recycled water project would involve alteration of federally managed lands in the Basin. NEPA compliance would commence with preparation of an Environmental Assessment, which would determine whether a NEPA Finding of No Significant Impact or an Environmental Impact Statement would serve as appropriate environmental consideration for the project.

Requirements for Landscape Irrigation (Alternatives 1A & 1B)

The recycled water regulations in Title 17, Division 1, Chapter 5 and Title 22, Division 4, Chapter 3 of the CCR establish the required levels of treatment, facilities, and the restrictions on recycled water projects for landscape irrigation. The SWRCB – Division of Drinking Water (DDW) has identified four recycled water categories for landscape irrigation, all of which are described below. DDW has also established regulated non-potable beneficial uses and use area requirements for each respective recycled water category.

Disinfected Tertiary Recycled Water

Disinfected tertiary recycled water refers to a filtered and subsequently disinfected wastewater. Regulated non-potable beneficial uses for disinfected tertiary recycled water include: food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop; parks and playgrounds; school yards; residential landscaping; unrestricted access golf courses; and any other irrigation use not specified in Title 22, Division 4, Chapter 3, Article 3, § 60304 and nor prohibited by other sections of the CCR.

For disinfected tertiary recycled water, no irrigation shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

- A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.
- The well contains an annular seal that extends from the surface into the aquitard.
- The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.
- The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.
- The owner of the well approves of the elimination of the buffer zone requirement.

Disinfected Secondary – 2.2 Recycled Water

Disinfected secondary – 2.2 recycled water refers to recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probably number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. Regulated non-potable beneficial uses of disinfected secondary – 2.2 recycled water include irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water. For disinfected secondary – 2.2 recycled water, no irrigation shall take place within 100 feet of any domestic water supply well.

Disinfected Secondary – 23 Recycled Water

Disinfected secondary – 23 recycled water refers to recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a MPN of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period. Regulated non-potable beneficial uses of disinfected secondary – 23 recycled water include irrigation of cemeteries, freeway landscaping, restricted access golf courses, ornamental nursery stock and sod farms where access by the general public is not restricted, pasture for animals producing milk for human consumption, and any non-edible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground, or school yard. For disinfected secondary – 23 recycled water, no irrigation shall take place within 100 feet of any domestic water supply well.

Undisinfected Secondary Recycled Water

Undisinfected secondary recycled water refers to oxidized wastewater. Regulated non-potable beneficial uses of undisinfected secondary recycled water include irrigation of:

- Orchards where the recycled water does not come into contact with the edible portion of the crop
- Vineyards where the recycled water does not come into contact with the edible portion of the crop
- Nonfood-bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public)
- Fodder and fiber crops and pasture for animals not producing milk for human consumption
- Seed crops not eaten by humans
- Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans
- Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public

For undisinfected secondary recycled water, no irrigation shall take place within 150 feet of any domestic water supply well.

Other Requirements

All publicly accessible areas in which recycled water is used shall include signs that are visible to the public, in a size no less than 4 inches high by 8 inches wide, that include the following wording: "RECYCLED WATER - DO NOT DRINK".

Permitting Requirements

The City has been issued WDRs for the evaporation/percolation ponds at its WWTF, as well as separate Regional Board Orders for recycled water use at the Navy golf course and for disposal at the City-owned alfalfa fields. Should landscape irrigation be pursued as a beneficial use of recycled water, the City would need to apply for new WDRs that would establish limits on pollutant concentrations for the purpose of protecting public health as pertaining to landscape irrigation. The City would need to submit a Report of Waste Discharge Form (Form 200) and the necessary supplemental information with the Lahontan Regional Board at least 120 days prior to commencing irrigation activities. The Regional Board would review the application for completeness and may request additional information. Upon completion of the application, the Regional Board will determine whether it should adopt WDRs, prohibit the discharge, or waive the WDRs. If WDRs should be issued, the Regional Board will prepare the proposed WDRs and distribute them to persons and public agencies with known interest in the project for a minimum 30-day comment period. The Regional Board may modify the proposed WDRs based upon the comments received from the discharger and interested parties. The Regional Board will then hold a public hearing with at least a 30-day public notification. At the public hearing, the Regional Board may adopt the proposed WDRs or modify them and adopt them via majority vote.

Requirements for Indirect Potable Reuse – Surface Applications (Alternative 2A)

Title 22, Division 4, Chapter 3, Article 5.1 of the CCR contains regulations for projects (i.e. Groundwater Replenishment Reuse Projects, or GRRPs) involving groundwater recharge/replenishment with recycled water via surface applications such as spreading grounds. Recycled water used for surface applications must meet disinfected tertiary recycled water quality, as defined above. DDW has established the following regulatory criteria that must be met by a GRRP using surface applications to demonstrate regulatory compliance.

Pathogenic Microorganism Control

A GRRP shall be designed and operated such that the recycled water used for recharge receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e. virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1-log reduction. Additional log virus reduction credits may be granted based on the amount of underground retention time demonstrated by the GRRP.

Underground Retention Time

Underground retention time in an aquifer serves two purposes: (1) provide time to respond to potential system failures; and (2) allow for reduction of microbial and chemical contaminants. For each month of retention time underground, the GRRP can be credited with an additional 1-log virus reduction. A minimum retention time of 2 months is required to allow sufficient response time to identify treatment failures and implement appropriate corrective measures, but the actual retention time must be justified and submitted to the SWRCB for approval. For the purpose of siting a GRRP location during project planning, underground retention time can be determined using either analytical modeling, numerical modeling, or a tracer study. If numerical modeling is employed to estimate underground retention time, then the GRRP will be credited with only half the underground residence time as shown by the model. For example, if numerical modeling results indicate 4 months of underground retention time, then a GRRP will be credited for only 2 months. If a tracer study using an added tracer is performed to determine underground retention time, then a GRRP will be credited for the same time as shown by the tracer study.

Response Retention Time

The recycled water applied by a GRRP must be retained underground for a period of time necessary to allow for sufficient response time to identify treatment failures and implement appropriate corrective actions. During planning, the response retention time is determined based on the method used to establish underground retention time. If numerical groundwater modeling is used for establishing underground retention time, then the GRRP will be credited with only half the underground residence time as shown by the model. If a tracer study is performed using an added tracer, then the response retention time will be the same as the underground retention time determined by the tracer study.

Recycled Water Contribution

As defined by § 60301.705 of the CCR, recycled water contribution (RWC) is the fraction equal to the quantity of recycled municipal wastewater applied at the GRRP divided by the sum of the quantity of the recycled municipal wastewater and credited diluent water. CCR § 60301.190 defines diluent water as water which meets the diluent requirements of Title 22, Division 4, Chapter 3 of the CCR and is used for reducing the recycled water contribution over time. Examples of diluent water include stormwater runoff, imported water, and groundwater basin underflow. The initial RWC of a GRRP shall not exceed 20% based on the total volume of recycled water and credited diluent water for the preceding 120 months. A GRRP may operate with an increased RWC if the increased RWC does not exceed the quotient of 0.5 mg/L and the maximum TOC concentration of the recycled water before application. Hence, if the TOC concentration is 1 mg/L, then the RWC cannot exceed 0.5 mg/L divided by 1 mg/L, or 50%.

Permitting Requirements

As required by the CCR, various planning-phase documents must be submitted to and approved by the SWRCB, DDW, and/or the Lahontan Regional Board for GRRPs using surface applications. The submittals may include a Title 22 Engineering Report, a Section 1211 Petition for changes to permitted discharge locations, a Section 1602 Lake and Streambed Alteration Agreement, a Background Water Quality Monitoring Program, an Operation Optimization Plan, and a Report of Waste Discharge Form for issuance of WDRs. These documents are briefly summarized below.

The Title 22 Engineering Report provides an overall description of the recycled water system/uses, the means for compliance with CCR monitoring requirements and regulatory criteria (including a Monitoring Plan), and a contingency plan which assures that no untreated or inadequately treated wastewater will be delivered for beneficial use(s). The Title 22 Engineering Report must also include a hydrogeologic assessment of the GRRP's setting. The hydrogeologic assessment must include the following items:

- Qualifications of individual(s) preparing the assessment
- General description of the geologic and hydrogeologic setting of groundwater basins that will potentially be affected by the GRRP
- Stratigraphic description of aquifers that will potentially be affected by the GRRP including composition, extent, and physical properties
- Description of seasonal impacts to potentially affected aquifers (based on 4 rounds of consecutive quarterly monitoring)
- Existing hydrogeology and anticipated hydrogeology as a result of the GRRP
- Maps showing quarterly groundwater elevation contours, vector flow directions and hydraulic gradients

A Section 1211 Petition is submitted by the owner of a WWTF to the SWRCB to document a diversion of water away from a previously permitted discharge point that will experience a decrease in flow. A Section 1211 Petition may be required for the IWVGA's recycled water project because the use of recycled water in the Basin may decrease existing discharges to evaporation/percolation ponds that provide seepage flow to the local Tui Chub habitat. Submittal of the Section 1211 Petition is typically followed by a public notice issuance, protest period, public hearing or field investigation, and SWRCB Order.

The California Department of Fish and Wildlife (CDFW) must be notified if a recycled water project involves activities that may divert or obstruct natural surface water flows; change or use any material from a surface water body; or dispose of materials into any surface water body. Section 1602 Lake and Streambed Alteration Agreement must be submitted to CDFW if a recycled water project activity substantially adversely affects fish and wildlife (i.e. Tui Chub) resources.

A Background Water Quality Monitoring Plan (BWQMP) must be submitted to DDW and the Lahontan Regional Board for review and approval prior to GRRP background water quality monitoring. The BWQMP would document the methodology for establishing baseline Basin water quality conditions, particularly in the vicinity of the GRRP, as well as estimated budgets and schedules for implementing the background water quality monitoring. Potential monitoring items that may be addressed in the BWQMP include streamflow and water quality of surface water bodies; water levels and water quality at existing production and monitoring wells; locations for new monitoring wells to aid in GRRP monitoring; and soil conditions in the vicinity of the replenishment location.

An Operation Optimization Plan must be submitted to DDW for review and approval prior to GRRP start-up. The Operation Optimization Plan identifies and describes the operation, maintenance, analytical methods, and monitoring necessary for the GRRP to meet the relevant regulatory requirements for GRRPs using surface applications, and the reporting of monitoring results to DDW and the Regional Board.

As discussed previously, if a GRRP using surface applications is pursued as a beneficial use of recycled water, the City would need to apply for new WDRs that would establish limits on pollutant concentrations for the purpose of protecting public health as pertaining to groundwater replenishment. The City would need to submit a Report of Waste Discharge Form (Form 200) and the necessary supplemental information with the Lahontan Regional Board.

Requirements for Indirect Potable Reuse – Subsurface Applications (Alternatives 1B & 2B)

Title 22, Division 4, Chapter 3, Article 5.2 of the CCR contains a set of regulations for GRRPs involving groundwater recharge with recycled water via subsurface applications such as deep injection wells. Recycled water used for subsurface applications must not only meet disinfected tertiary recycled water quality but also undergo advanced treatment through reverse osmosis and advanced oxidation. DDW has established the following regulatory criteria that must be met for a GRRP using subsurface applications to demonstrate regulatory compliance.

Pathogenic Microorganism Control

Similar to GRRPs using surface applications, GRRPs using subsurface applications must be designed and operated such that the recycled municipal wastewater used as recharge water receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e. virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1-log reduction. Additional log virus reduction credits may be granted based on the amount of retention time demonstrated by the GRRP.

Underground Retention Time

As described previously, underground retention time requirements for surface applications also apply to subsurface applications.

Response Retention Time

As described previously, response retention time requirements for surface applications also apply to subsurface applications.

Recycled Water Contribution

For GRRPs using subsurface applications, the initial maximum RWC may be up to 100% but will be based on, though not limited to, DDW's review of the Title 22 Engineering Report, information obtained from public hearings, and demonstration that the treatment processes will reliably achieve TOC concentrations no greater than 0.5 mg/L. The RWC may be increased from the initial maximum if the RWC does not exceed the quotient of 0.5 mg/L divided by the maximum TOC concentration of the recycled water before application. Hence, if the TOC concentration is 1 mg/L, then the RWC cannot be greater than 0.5 mg/L divided by 1 mg/L, or 50%.

Permitting Requirements

As described previously, planning-phase documents to be submitted to the SWRCB, DDW, and/or the Lahontan Regional Board for GRRPs using surface applications also must be submitted for GRRPs using subsurface applications.

Requirements for Direct Non-Potable Industrial Reuse (Alternative 3)

Available information regarding the potential non-potable industrial uses of recycled water in the Basin (i.e. SVM and/or NAWS) and their water quality and other requirements remain limited at this time. Consequently, the IWVGA is not currently in a position to determine what provisions of the CCR or other regulatory documents may apply for these potential uses.

Requirements for Direct Potable Reuse (Alternative 4)

California Water Code §13561(b) defines direct potable reuse (DPR) as “the planned introduction of recycled water either directly into a public water system or into a raw water supply immediately upstream of a water treatment plant.” DPR methods may include the following methods:

- Raw water augmentation
  - The planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system
- Treated drinking water augmentation
  - The planned placement of recycled water into the water distribution system of a public water system

As mandated by Senate Bill (SB) 918 and SB 322, DDW completed an investigation of the feasibility of developing uniform water recycling criteria for DPR in December 2016. DDW submitted a report to the State of California Legislature with its investigative findings and recommendations, and in 2017, DDW was tasked with developing uniform DPR water recycling criteria that protect public health. Under AB 574 (California Water Code, Division 7, Chapter 7.3), DDW is required to adopt uniform water recycling criteria for DPR through raw water augmentation on or before December 31, 2023.

DDW released a draft framework for regulating DPR in California (Framework) in March 2021 and released a revised version of the Framework in August 2021. The draft Framework is currently undergoing additional review in coordination with a SWRCB-established expert review panel tasked with making findings as to whether the criteria in the draft Framework will adequately protect public health. The draft Framework presents an early draft of anticipated criteria for the use of recycled water to augment a source of supply for a water treatment plant or to augment a drinking water distribution system, and therefore applies to both DPR methods listed in California Water Code § 13561(b). The criteria in the draft Framework are planned to be added to CCR Title 22, Division 4, Chapter 17. For the purposes of this section, the draft Framework represents a snapshot view of potential regulatory criteria for DPR but does not represent the final regulatory criteria that will be developed and met in the future.

Pathogen Control

A DPR project shall ensure that the municipal wastewater receives continuous treatment prior to entering the distribution system as drinking water through a treatment train that shall achieve at least 20-log enteric virus reduction, 14-log Giardia cyst reduction, and 15-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least four separate treatment processes each for enteric virus, Giardia, and Cryptosporidium. A separate treatment process may be credited with no more than 6-log reduction, with at least four processes each being credited with no less than 1-log reduction. A single treatment process may receive log reduction credits for one or more pathogens. In addition, the treatment train shall utilize at least three diverse treatment mechanisms. The treatment train must utilize at least one physical separation mechanism, one chemical disinfection mechanism, and one ultraviolet (UV) disinfection mechanism. The microorganism log reduction achieved by each treatment process must be validated by a study.

Chemical Control

A DPR project shall ensure that the municipal wastewater receives treatment prior to its distribution as drinking water through a treatment train that consists of at least three separate treatment processes, using diverse treatment, for chemical reduction. The treatment train shall include an ozone/biological activated carbon (ozone/BAC) process, a reverse osmosis membrane process, and an advanced oxidation process.

With SWRCB approval, a continuous blending process that provides a municipal wastewater contribution (WWC) less than or equal to 10% can be used to satisfy the ozone/BAC treatment process. For a continuous blending process with an approved WWC greater than 10% but less than or equal to 50%, treatment shall be applied to a percentage of the municipal wastewater flow equal to or greater than:

$$100 - \frac{\left(\frac{1}{WWC} - 1\right)}{0.09}$$

To demonstrate a sufficient ozone/BAC treatment process has been designed for implementation, testing shall be conducted to demonstrate that an ozone/BAC treatment process will provide no less than 1.0 log (90 percent) reduction for each of the following indicators: formaldehyde, acetone, and n-nitrosodimethylamine (NDMA).

Permitting Requirements

The draft Framework describes a permit application that must be submitted by a direct potable reuse responsible agency (DiPRRA) prior to DPR operations. The DiPRRA assumes overall responsibility for treating municipal wastewater, monitoring treatment barrier operations, and providing DPR water for transmission to either a water treatment plant (prior to distribution) or directly to a distribution system. Consequently, **the draft Framework requires that the DiPRRA leading the DPR project effort should be a**

public water system. The permit application at a minimum must include a DPR Engineering Report; a Joint Plan; a demonstration of technical, managerial, and financial (TMF) capacity; and an initial/amended domestic water supply permit for the DiPRRA. Other submittals may be required by the SWRCB on a project-specific basis.

Similar to the Title 22 Engineering Report required for Indirect Potable Reuse projects for groundwater replenishment, a DPR Engineering Report must be submitted to demonstrate compliance with appropriate regulatory criteria for DPR (i.e. the draft Framework) and to demonstrate that all participating agencies listed on the Joint Plan possess the adequate TMF capacity to assure compliance with the regulatory criteria. The Engineering Report must characterize the quality of source wastewater, describe the feed quality that the DPR treatment system is capable of reliably treating, and provide treatment goals for the DPR treatment system regarding chemicals discussed in the draft Framework.

The Joint Plan describes the wastewater management agency(-ies), wastewater collection agency(-ies), public water system(s), and other partner agency(-ies) involved in the DPR project; the roles and responsibilities of the partner agency(-ies) involved in the DPR project; the legal authority of each agency to fulfill its role; and the overall organizational structure involved in implementing the Joint Plan. The Joint Plan must also document the procedures and corrective actions that will be taken in the event of treatment failures or other inability to supply DPR water, and how alternative water supplies will be made available to replace DPR water.

Additionally, before a permit can be issued for a DPR project, at least one (1) public meeting must be held by the SWRCB (facilitated by the DiPRRA) to provide a public opportunity for the SWRCB to review relevant and comment on information related to the DPR project. Prior to the public meeting, the DiPRRA must provide to the SWRCB (and to the public through public notification and various online postings) information that includes DPR Project descriptions, identification of wastewater sources, a treatment process summary, monitoring plans, contingency plans, etc.

At this time, the draft Framework establishes requirements for several other planning-phase documents and submittals that must be made to and approved by appropriate regulatory agencies, including the independent advisory panel discussed previously, prior to DPR project operations. These submittals include a Water Safety Plan, an Operations Plan, a Pathogen & Chemical Control Point Monitoring and Response Plan, and a Monitoring Plan, all of which are briefly summarized below.

A Water Safety Plan addressing risk assessment and risk management must be developed and submitted for review by the independent advisory panel to determine whether all hazards have been considered by the DiPRRA. The Water Safety Plan must include a comprehensive hazard analysis of all steps in the drinking water supply chain (from wastewater source to consumer) and the associated necessary risk management controls such as treatment effectiveness, critical limits, monitoring, corrective actions, and operations plans.

An Operations Plan must be submitted describing the regular operations, maintenance, and monitoring necessary for the DiPRRA to meet requirements of the draft Framework, as well as reporting to SWRCB. The Operations Plan must demonstrate the certifications and qualifications of the treatment operations personnel and include a staffing plan for each treatment plant associated with the DPR project. The Operations Plan must also describe how the DPR SDADA system and other systems associated with project function, control, and communications will be secured and protected from unauthorized access and cyberattack.

A Pathogen & Chemical Control point Monitoring and Response Plan must be submitted describing the monitoring and response for each treatment process used to comply with the required pathogen log reductions specified under the draft Framework. Examples of the content to include in this plan include identification of pathogen and chemical control points; quantified critical limits for each pathogen and chemical control point; processes to identify pathogen and chemical removal failures; and quantified response times to address removal failures.

A Monitoring Plan must be submitted describing the monitoring activities conducted pursuant to the draft Framework, including monitoring conducted to support regulated contaminant control, source control, treatment process operations, and other monitoring required by SWRCB on a project-specific basis. The Monitoring Plan must include several items including, but not limited to:

- Organization charts with staff roles/responsibilities and contact information
- Monitoring schedules, with sample handling/processing procedures
- Laboratories used and lab turn-around times to receive analytical results
- Analytical methods for each constituent monitored
- Quality Assurance Project Plan (QAPP) with measurement and data quality objectives that support the monitoring objectives/goals in the DPR Engineering Report
- Procedures to track sampling status, review analytical results, and reporting/notification of analytical results to the SWRCB

The Monitoring Plan should also describe the follow-up actions that will be taken if laboratory analysis identifies a concentration above a MCL or Notification Level in water sampling collected after the advanced treatment processes.

Section 5 – Evaluation, Screening, and Comparison of Alternatives

This section serves to document the evaluation, screening, and comparison process and conclusions for the recycled water alternatives, pursuant to the recycled water Technical Team meeting held on April 6, 2022.

Preliminary Screening

A preliminary screening was performed to eliminate from detailed evaluation the alternatives that are conceptually infeasible or unfavorable due to any combination of the following:

- Inability to obtain adequate information to evaluate engineering needs and perform preliminary design
- Anticipated lack of public acceptance
- Difficulty in implementation based on results of preliminary investigations
- Inability to maximize use of “new water” and minimize losses

The following alternatives were eliminated from consideration through the preliminary screening for the reasons discussed below.

Alternative 1A – Landscape Irrigation

The IWVGA’s GSP identified existing landscaped areas that may be irrigated with recycled water and estimated a total irrigation demand of approximately 1,124 AFY of recycled water. The estimated landscape irrigation water demands do not fully utilize the 2,081 AFY that is projected to be available from the City’s new WWTF in 2026 (see Section 2). Consequently, this alternative is considered unfavorable because of its inability to maximize the use of “new water” by itself.

Alternative 1B – Landscape Irrigation with Groundwater Replenishment Component

The IWVGA's discussed a conceptual recycled water project that would include serving the landscape irrigation water demands discussed in Alternative 1A above and would add the additional treatment and groundwater replenishment facilities to use the recycled water generated in excess of irrigation demands for groundwater replenishment. The Technical Team has determined that this alternative will encounter significant difficulties in implementation. Due to the large variation in seasonal water demands for landscape irrigation, the recycled water distribution system would need to be sized to meet peak irrigation demands in summer, and the replenishment infrastructure would need to be sized to recharge all available recycled water during wet seasons, when landscape irrigation demands are minimal, if nonexistent. This alternative would therefore require infrastructure to be constructed with the capacity to convey recycled water as if each beneficial use were implemented in full, but the groundwater replenishment facilities would be greatly underused, or not used at all, during peak irrigation demand periods. The Technical Team has determined that this alternative is unfavorable because it would not be cost-effective compared to the single purpose alternatives for landscape irrigation and for groundwater replenishment.

Alternative 2A – Groundwater Replenishment through Surface Spreading

In early 2021, the IWVGA began a reconnaissance-level investigation to identify potentially viable locations for surface spreading in the Basin based on a review of land ownership, geology, depth to groundwater, and prior literature and technical studies. The investigation made findings for a preferred surface spreading site but indicated that additional hydrogeologic field investigations and pilot testing would be required in the future to assess physical viability for surface spreading. At its meeting on January 6, 2022, IWVGA Staff presented these findings to IWVGA's TAC, and based on information presented in the investigation, the TAC members concluded that surface spreading is not currently viable in the Basin due to significant uncertainty as to where and how the water recharged through spreading will percolate into the aquifers that are used for pumping. Consequently, this alternative is considered infeasible and unfavorable for the purpose of starting engineering design.

Alternative 3 – Direct Non-Potable Industrial Use

SVM and NAWS have been previously identified as potential users of recycled water for non-potable industrial uses. To date, the IWVGA has not received adequate information indicating SVM's potential recycled water demands, water quality requirements, and conveyance infrastructure. Additionally, at a January 6 TAC meeting, the NAWS TAC representative indicated that industrial uses of recycled water on the NAWS were not likely because of the Navy's stringent water quality requirements for its industrial water purposes. These water quality requirements have yet to be provided by NAWS. At this time, IWVGA does not have adequate information to evaluate engineering needs and perform design for any potential non-potable industrial uses of recycled water; therefore, these uses are currently considered unfeasible and unfavorable.

Alternative 4 – Direct Potable Reuse through Treated Drinking Water Augmentation

As stated in Section 4, DDW is required to adopt uniform water recycling criteria for DPR through raw water augmentation on or before December 31, 2023. DDW has not specified a timetable for adopting criteria for DPR through treated drinking water augmentation, though the Draft Framework discussed in Section 4 does apply to both raw water augmentation and treated drinking water augmentation. The Technical Team has also noted that even though criteria may be adopted by 2023, several needed project components will extend the already uncertain timeline for pursuing DPR, including:

- Approval of manufacturer treatment technologies
- Coordination with regulatory agencies, such as DDW, on permitting requirements and technical reporting prior to project construction and startup
- Coordination with regulatory agencies, such as DDW, to demonstrate treatment efficacy and meeting log removal and other water quality standards
- Public outreach and acceptance of recycled water to directly augment drinking water supplies

Consequently, DPR is considered to be Infeasible and unfavorable at this time because of anticipated implementation issues and a highly uncertain implementation timeline.

Secondary Screening

A secondary screening was included in the Analysis scope of work to further refine the list of alternatives by eliminating those that are technically unfavorable due to any combination of the following:

- Limited impact on Basin water balance, water levels, and imported water requirements

- Potential adverse impacts to groundwater quality
    - Movement of poor-quality groundwater to pumping centers
    - Introduction of new contaminants to Basin water chemistry
- Potential environmental impacts
    - Disturbance of species, habitats, drainage features, cultural resources, etc.

Only one alternative (Alternative 2B – Groundwater Replenishment through Deep Injection) remains viable after the preliminary screening. Therefore, a secondary screening was not performed.

Comparison and Selection

The Analysis scope of work included a comparison process to further evaluate the alternatives that passed the primary and secondary screening through an analysis of facility requirements/layouts and construction costs, followed by use of a comparison matrix to score the alternatives based on determined cost criteria and non-cost criteria. Similar to the secondary screening, the Technical Team has determined that a comparison process was not needed because only one alternative (Alternative 2B – Groundwater Replenishment through Deep Injection) remains viable after the preliminary screening. Therefore, this Analysis has determined Alternative 2B is the most feasible and favorable alternative for recycled water use.

Section 6 – Conclusion and Next Steps

Alternative 2B – Groundwater Replenishment through Deep Injection was determined to be the most feasible and favorable alternative for recycled water use in the Basin. As discussed in Section 2, the City's WWTF is anticipated to provide 2,606 AFY of secondary effluent upon completion in 2026. Consistent with SWRCB's "Recycled Water Policy", IWVGA included the construction of a water recycling plant (WRP) as a critical sustainability measure within the GSP. The proposed WRP will consist of tertiary and full advanced treatment facilities and is in the early planning stages with construction currently slated to be concurrent with the City's WWTF. The WRP is anticipated to provide approximately 1,709 AFY of full advanced treated water available for Deep Injection in 2026, after losses (see Table 2-4). The WRP is planned to utilize a combination of MF/RO, UV/Hydrogen Peroxide disinfection in order to provide advanced treated water which meets SWRCB standards for injection into the Basin.

United States Bureau of Reclamation – Title XVI Feasibility Study

In early 2022, the Capital Core Group (Capital Core) conducted a preliminary scoping meeting with the United States Bureau of Reclamation (BOR) staff to determine potential eligibility for BOR funding for the planning activities associated with IWVGA's WRP. The BOR's Title XVI programs provide funding for planning, design, and construction of water reclamation and reuse projects. These preliminary scoping meetings are designed to determine preliminary eligibility, determine if the project meets the Title XVI programs' stated goals, and provide insights and direction as to next steps in receiving eligibility. The preliminary scoping meeting determined that IWVGA's WRP is eligible under the Title XVI Reclaim and Reuse Program.

The Water Infrastructure Improvements for the Nation Act of 2016 (WIIN) requires projects seeking Title XVI eligibility to conduct a Feasibility Study containing prescribed requirements for approval by BOR. In general, the Title XVI Feasibility Study consists of the following:

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

BOR has an established “review team” within the Office of Water Resources and Planning which considers each submitted Title XVI Feasibility Study. Submittals received and determined in a calendar year are reported to Congress, hence providing decisions for project authorization, under the biennial Reclamation Projects Authorization and Adjustments Act and appropriation under the annual Interior and Related Agencies Appropriations Act. Projects requiring multi-year appropriations for planning and construction activities may require Congressional authority (allowance for BOR to accept the project) through the Authorization and Adjustments Act or stand-alone legislation. This Congressional authorization is only sought after BOR has approved the Title XVI Feasibility Study.

IWVGA has authorized Stetson to conduct the Title XVI Feasibility Study for the WRP with Groundwater Replenishment through Deep Injection. The Title XVI Feasibility Study will also further evaluate two (2) of the alternatives evaluated in this Analysis: Landscape Irrigation with tertiary treated water and Groundwater Replenishment through Surface Spreading to meet the Title XVI Feasibility Study requirements to include an analysis of project alternatives. Most of the evaluation performed for the Analysis will be used for the Title XVI Feasibility Study along with additional consideration of cost, economics, environmental considerations, and institutional requirements. Stetson will be supported by Trussell Technologies (Trussell) to assist with advanced treatment details, cost estimates, and identification of research needs, as required for the Title XVI Feasibility Study. Trussell will also assist Stetson with identifying the appropriate location for the IWVGA WRP. The Title XVI Feasibility Study will provide more up to date information regarding cost estimates for each of the three (3) alternatives evaluated and is anticipated to be completed in early 2023 in order to ensure that BOR considers the IWVGA WRP for Title XVI funding in 2023.

Next Steps

IWVGA has recently conducted an evaluation of the IWVWD's recommended Well 36 (IWVWD – 36) for suitability as an injection well. The area located south of IWVWD-36 is vacant. This area is located between Bowman Road to the south and Ridgecrest Boulevard to the north, the Little Dixie Wash to the west and Highway 395 to the east. Though limited, existing pumping test data indicates that this area has favorable hydrogeologic conditions for developing an injection well with similar design specifications to IWVWD – 36. A further investigation of a potential injection well site located south of IWVWD – 36 (within the vacant area) is recommended.

In addition to evaluating deep injection well site(s), IWVGA will identify and evaluate potential locations for the WRP. Once the locations of the potential injection well(s) and WRP are determined, IWVGA will begin an initial environmental review as well as develop a preliminary design for the WRP including tertiary treatment and full advanced treatment facilities, deep injection wells, monitoring wells, and conveyance facilities.

FIGURES

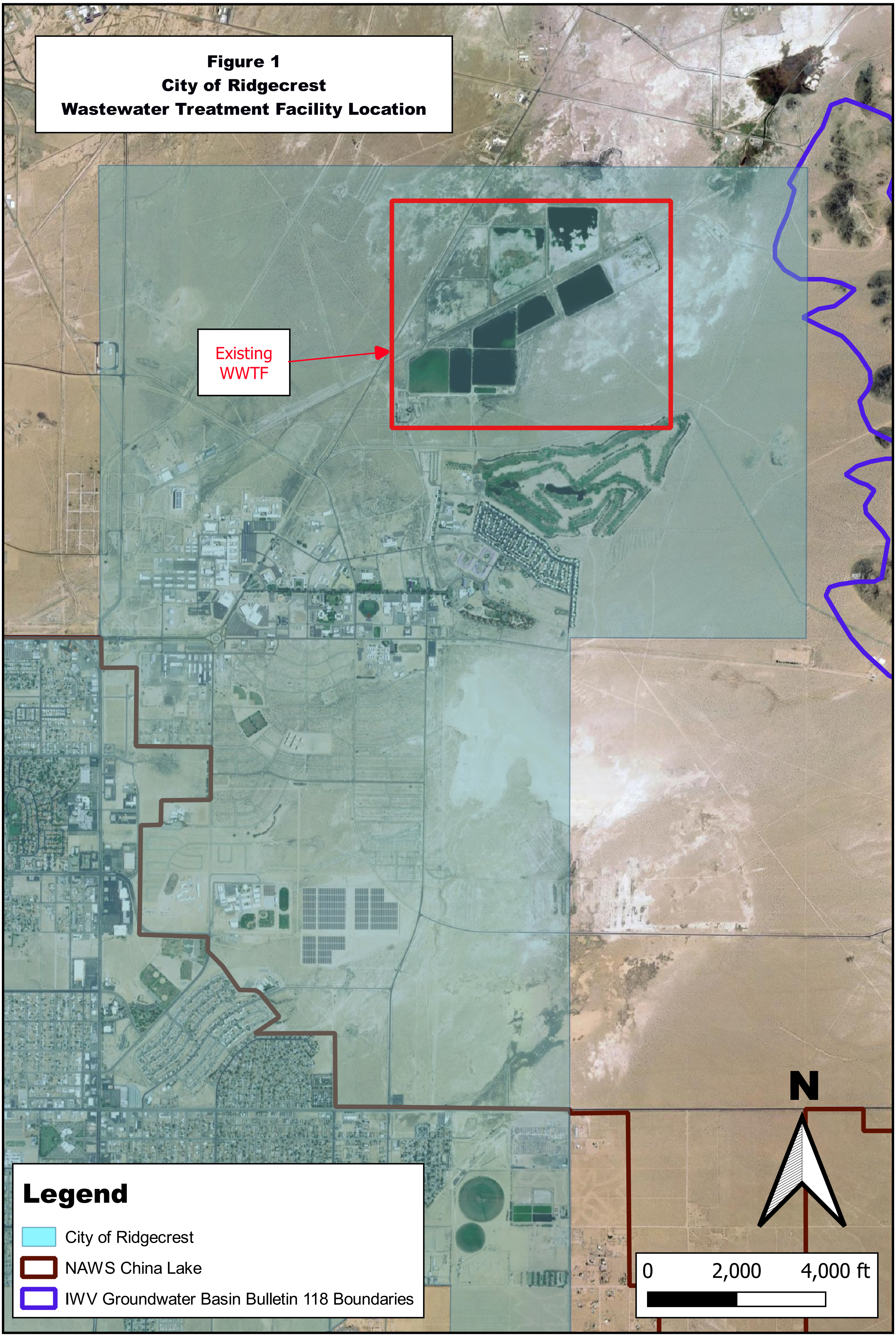
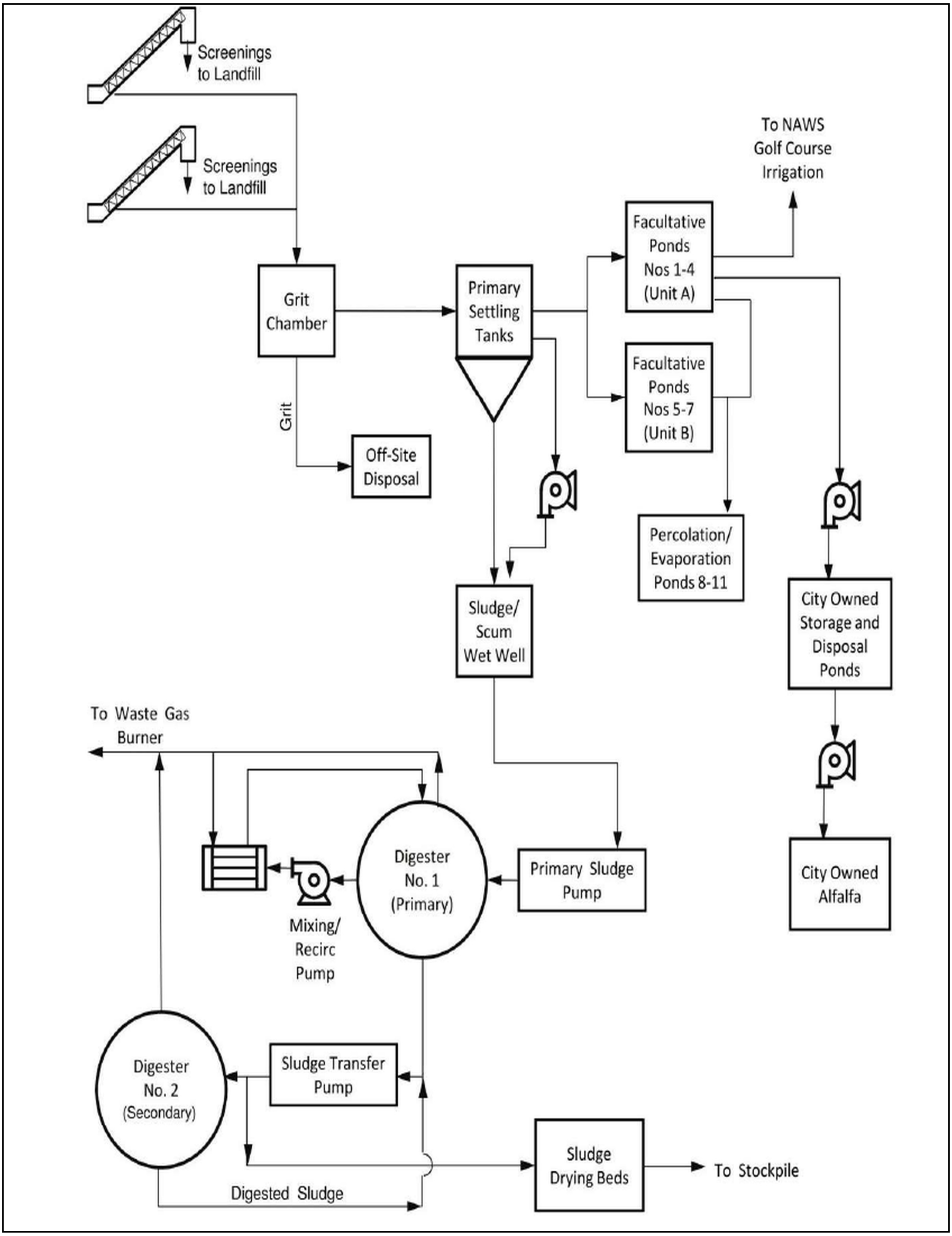


Figure 1
City of Ridgecrest
Wastewater Treatment Facility Location
Existing
WWTF
Legend
City of Ridgecrest
NAWS China Lake
IWV Groundwater Basin Bulletin 118 Boundaries
N
0
2,000
4,000 ft

Figure 2
City of Ridgecrest
Wastewater Treatment Facility Process Flow Diagram



From Wastewater Treatment Plant Facility Plan, 2015. Prepared by Provost & Pritchard Consulting Group.

TABLES

Table 2-1
Historic City of Ridgecrest WWTF Average Annual Daily (AAD) Flows

Year	Total Influent Flow		NAWS Contribution			City Contribution		
	[MGD]	[AFY]	[MGD]	[AFY]	[%]	[MGD]	[AFY]	[%]
2001	2.52	2,823	-	-	-	-	-	
2002	2.52	2,823	-	-	-	-	-	
2003	2.58	2,890	-	-	-	-	-	
2004	2.52	2,823	-	-	-	-	-	
2005	2.51	2,812	-	-	-	-	-	
2006	2.57	2,879	-	-	-	-	-	
2007	2.49	2,789	-	-	-	-	-	
2008	2.57	2,879	-	-	-	-	-	
2009	2.55	2,856	0.747	837	29.3%	1.803	2,020	70.7%
2010	2.62	2,935	0.709	794	27.1%	1.911	2,141	72.9%
2011	2.46	2,756	0.756	847	30.7%	1.704	1,909	69.3%
2012	2.50	2,800	0.843	944	33.7%	1.657	1,856	66.3%
2013	2.30	2,576	0.636	712	27.7%	1.664	1,864	72.3%
2014	2.31	2,588	-	-	-	-	-	
2015	2.18	2,442	0.657	736	30.1%	1.523	1,706	69.9%
2016	2.25	2,520	0.693	776	30.8%	1.557	1,744	69.2%
2017	2.44	2,733	0.609	682	25.0%	1.831	2,051	75.0%
2018	2.25	2,520	0.494	553	22.0%	1.756	1,967	78.0%
2019	2.21	2,476	0.537	602	24.3%	1.673	1,874	75.7%
2020	2.20	2,464	0.586	656	26.6%	1.614	1,808	73.4%

Table 2-2

City of Ridgecrest WWTF: Average Annual Daily (AAD) Influent Flow Rate Projections

Year	Projected Population Growth Rate of 1.80% per Year					Projected Population Growth Rate of 1.20% per Year					Projected Population Growth Rate of 0.80% per Year				
	Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)		Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)		Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)	
		[MGD]	[AFY]	[MGD]	[AFY]		[MGD]	[AFY]	[MGD]	[AFY]		[MGD]	[AFY]	[MGD]	[AFY]
2005	26,272	2.23	2,501	1.97	2,207	26,272	2.23	2,501	1.97	2,207	26,272	2.23	2,501	1.97	2,207
2010	27,616	2.35	2,629	2.07	2,320	27,616	2.35	2,629	2.07	2,320	27,616	2.35	2,629	2.07	2,320
2015	28,417	2.42	2,706	2.13	2,387	28,417	2.42	2,706	2.13	2,387	28,417	2.42	2,706	2.13	2,387
2020	29,217	2.48	2,782	2.19	2,455	29,217	2.48	2,782	2.19	2,455	29,217	2.48	2,782	2.19	2,455
2021	29,743	**2.53**	2,832	2.23	2,499	29,568	**2.51**	2,815	2.22	2,484	29,451	**2.50**	2,804	**2.21**	2,474
2022	30,278	**2.57**	2,883	2.27	2,544	29,923	**2.54**	2,849	2.24	2,514	29,687	**2.52**	2,827	**2.23**	2,494
2023	30,823	**2.62**	2,935	2.31	2,589	30,282	**2.57**	2,883	2.27	2,544	29,924	**2.54**	2,849	**2.24**	2,514
2024	31,378	**2.67**	2,988	2.35	2,636	30,645	**2.60**	2,918	2.30	2,575	30,163	**2.56**	2,872	**2.26**	2,534
2025	31,943	**2.72**	3,041	2.40	2,684	31,013	**2.64**	2,953	2.33	2,605	30,404	**2.58**	2,895	**2.28**	2,554
2026	32,518	2.76	3,096	2.44	2,732	31,385	2.67	2,988	2.35	2,637	30,647	2.60	2,918	2.30	2,575
2027	33,103	2.81	3,152	2.48	2,781	31,762	2.70	3,024	2.38	2,668	30,892	2.63	2,941	2.32	2,595
2028	33,699	2.86	3,209	2.53	2,831	32,143	2.73	3,060	2.41	2,700	31,139	2.65	2,965	2.34	2,616
2029	34,306	2.92	3,266	2.57	2,882	32,529	2.76	3,097	2.44	2,733	31,388	2.67	2,989	2.35	2,637
2030	34,924	**2.97**	3,325	2.62	2,934	32,919	**2.80**	3,134	2.47	2,766	31,639	**2.69**	3,012	**2.37**	2,658
2031	35,553	3.02	3,385	2.67	2,987	33,314	2.83	3,172	2.50	2,799	31,892	2.71	3,037	2.39	2,679
2032	36,193	3.08	3,446	2.71	3,041	33,714	2.87	3,210	2.53	2,832	32,147	2.73	3,061	2.41	2,701
2033	36,844	3.13	3,508	2.76	3,095	34,119	2.90	3,249	2.56	2,866	32,404	2.75	3,085	2.43	2,722
2034	37,507	3.19	3,571	2.81	3,151	34,528	2.93	3,287	2.59	2,901	32,663	2.78	3,110	2.45	2,744
2035	38,182	**3.25**	3,635	2.86	3,208	34,942	**2.97**	3,327	2.62	2,936	32,924	**2.80**	3,135	**2.47**	2,766
2036	38,869	3.30	3,701	2.92	3,265	35,361	3.01	3,367	2.65	2,971	33,187	2.82	3,160	2.49	2,788
2037	39,569	3.36	3,767	2.97	3,324	35,785	3.04	3,407	2.68	3,006	33,452	2.84	3,185	2.51	2,810
2038	40,281	3.42	3,835	3.02	3,384	36,214	3.08	3,448	2.72	3,042	33,720	2.87	3,211	2.53	2,833
2039	41,006	3.49	3,904	3.08	3,445	36,649	3.12	3,489	2.75	3,079	33,990	2.89	3,236	2.55	2,856
2040	41,744	**3.55**	3,975	3.13	3,507	37,089	**3.15**	3,531	2.78	3,116	34,262	**2.91**	3,262	**2.57**	2,878
2041	42,495	3.61	4,046	3.19	3,570	37,534	3.19	3,574	2.82	3,153	34,536	2.94	3,288	2.59	2,901
2042	43,260	3.68	4,119	3.24	3,634	37,984	3.23	3,617	2.85	3,191	34,812	2.96	3,315	2.61	2,925
2043	44,039	3.74	4,193	3.30	3,700	38,440	3.27	3,660	2.88	3,229	35,090	2.98	3,341	2.63	2,948
2044	44,832	3.81	4,269	3.36	3,766	38,901	3.31	3,704	2.92	3,268	35,371	3.01	3,368	2.65	2,972
2045	45,639	**3.88**	4,345	3.42	3,834	39,368	**3.35**	3,748	2.95	3,307	35,654	**3.03**	3,395	**2.67**	2,995
2046	46,461	3.95	4,424	3.48	3,903	39,840	3.39	3,793	2.99	3,347	35,939	3.05	3,422	2.70	3,019
2047	47,297	4.02	4,503	3.55	3,973	40,318	3.43	3,839	3.02	3,387	36,227	3.08	3,449	2.72	3,043
2048	48,148	4.09	4,584	3.61	4,045	40,802	3.47	3,885	3.06	3,428	36,517	3.10	3,477	2.74	3,068
2049	49,015	4.17	4,667	3.68	4,118	41,292	3.51	3,932	3.10	3,469	36,809	3.13	3,505	2.76	3,092
2050	49,897	**4.24**	4,751	3.74	4,192	41,788	**3.55**	3,979	3.13	3,511	37,103	**3.15**	3,533	**2.78**	3,117

Table 2-2
City of Ridgecrest WWTF: Average Annual Daily (AAD) Influent Flow Rate Projections

Year	Projected Population Growth Rate of 1.80% per Year					Projected Population Growth Rate of 1.20% per Year					Projected Population Growth Rate of 0.80% per Year				
	Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)		Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)		Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)	
		[MGD]	[AFY]	[MGD]	[AFY]		[MGD]	[AFY]	[MGD]	[AFY]		[MGD]	[AFY]	[MGD]	[AFY]
2051	50,795	4.32	4,836	3.81	4,267	42,289	3.59	4,026	3.17	3,553	37,400	3.18	3,561	2.81	3,142
2052	51,709	4.40	4,923	3.88	4,344	42,796	3.64	4,075	3.21	3,595	37,699	3.20	3,589	2.83	3,167
2053	52,640	4.47	5,012	3.95	4,422	43,310	3.68	4,124	3.25	3,639	38,001	3.23	3,618	2.85	3,192
2054	53,588	4.55	5,102	4.02	4,502	43,830	3.73	4,173	3.29	3,682	38,305	3.26	3,647	2.87	3,218
2055	54,553	4.64	5,194	4.09	4,583	44,356	3.77	4,223	3.33	3,726	38,611	3.28	3,676	2.90	3,244
2056	55,535	4.72	5,288	4.17	4,666	44,888	3.82	4,274	3.37	3,771	38,920	3.31	3,706	2.92	3,270
2057	56,535	4.81	5,383	4.24	4,750	45,427	3.86	4,325	3.41	3,816	39,231	3.33	3,735	2.94	3,296
2058	57,553	4.89	5,480	4.32	4,835	45,972	3.91	4,377	3.45	3,862	39,545	3.36	3,765	2.97	3,322
2059	58,589	4.98	5,578	4.39	4,922	46,524	3.95	4,430	3.49	3,909	39,861	3.39	3,795	2.99	3,349
2060	59,644	5.07	5,679	4.47	5,011	47,082	4.00	4,483	3.53	3,955	40,180	3.42	3,826	3.01	3,376
2061	60,718	5.16	5,781	4.55	5,101	47,647	4.05	4,537	3.57	4,003	40,501	3.44	3,856	3.04	3,403
2062	61,811	5.25	5,885	4.64	5,193	48,219	4.10	4,591	3.62	4,051	40,825	3.47	3,887	3.06	3,430
2063	62,924	5.35	5,991	4.72	5,286	48,798	4.15	4,646	3.66	4,100	41,152	3.50	3,918	3.09	3,457
2064	64,057	5.44	6,099	4.80	5,381	49,384	4.20	4,702	3.70	4,149	41,481	3.53	3,949	3.11	3,485
2065	65,210	5.54	6,209	4.89	5,478	49,977	4.25	4,758	3.75	4,199	41,813	3.55	3,981	3.14	3,513
2066	66,384	5.64	6,321	4.98	5,577	50,577	4.30	4,816	3.79	4,249	42,148	3.58	4,013	3.16	3,541
2067	67,579	5.74	6,434	5.07	5,677	51,184	4.35	4,873	3.84	4,300	42,485	3.61	4,045	3.19	3,569
2068	68,795	5.85	6,550	5.16	5,780	51,798	4.40	4,932	3.88	4,352	42,825	3.64	4,077	3.21	3,598
2069	70,033	5.95	6,668	5.25	5,884	52,420	4.46	4,991	3.93	4,404	43,168	3.67	4,110	3.24	3,627
2070	71,294	6.06	6,788	5.35	5,989	53,049	4.51	5,051	3.98	4,457	43,513	3.70	4,143	3.26	3,656

Notes

1) Values in **red** correspond to WWTF Influent AAD Flow Projections through 2050, as shown in Table 4 of Provost & Pritchard report dated July 10, 2021.

Table 2-3
City of Ridgecrest WWTF: Average Annual Daily (AAD) Influent Flow Rate Projections

Year	Projected Population Growth Rate of 1.00% per Year				
	Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)	
		[MGD]	[AFY]	[MGD]	[AFY]
2005	26,272	2.23	2,501	1.97	2,207
2010	27,616	2.35	2,629	2.07	2,320
2015	28,417	2.42	2,706	2.13	2,387
2020	29,217	2.48	2,782	2.19	2,455
2021	29,509	2.51	2,810	2.21	2,479
2022	29,804	2.53	2,838	2.24	2,504
2023	30,102	2.56	2,866	2.26	2,529
2024	30,403	2.58	2,895	2.28	2,554
2025	30,707	2.61	2,924	2.30	2,580
2026	31,014	2.64	2,953	2.33	**2,606**
2027	31,324	2.66	2,982	2.35	2,632
2028	31,637	2.69	3,012	2.37	2,658
2029	31,953	2.72	3,042	2.40	2,684
2030	32,273	2.74	3,073	2.42	2,711
2031	32,596	2.77	3,104	2.44	2,738
2032	32,922	2.80	3,135	2.47	2,766
2033	33,251	2.83	3,166	2.49	2,793
2034	33,584	2.85	3,198	2.52	2,821
2035	33,920	2.88	3,230	2.54	**2,850**
2036	34,259	2.91	3,262	2.57	2,878
2037	34,602	2.94	3,295	2.60	2,907
2038	34,948	2.97	3,327	2.62	2,936
2039	35,297	3.00	3,361	2.65	2,965
2040	35,650	3.03	3,394	2.67	2,995
2041	36,007	3.06	3,428	2.70	3,025
2042	36,367	3.09	3,463	2.73	3,055
2043	36,731	3.12	3,497	2.75	3,086
2044	37,098	3.15	3,532	2.78	3,117
2045	37,469	3.18	3,568	2.81	3,148
2046	37,844	3.22	3,603	2.84	3,179
2047	38,222	3.25	3,639	2.87	3,211
2048	38,604	3.28	3,676	2.90	3,243
2049	38,990	3.31	3,712	2.92	3,276
2050	39,380	3.35	3,749	2.95	3,308

Table 2-3
City of Ridgecrest WWTF: Average Annual Daily (AAD) Influent Flow Rate Projections

Year	Projected Population Growth Rate of 1.00% per Year				
	Population	WWTF Influent Flow (assuming per-capita contribution of 85.0 gpcd)		WWTF Influent Flow (assuming per-capita contribution of 75.0 gpcd)	
		[MGD]	[AFY]	[MGD]	[AFY]
2051	39,774	3.38	3,787	2.98	3,341
2052	40,172	3.41	3,825	3.01	3,375
2053	40,574	3.45	3,863	3.04	3,409
2054	40,980	3.48	3,902	3.07	3,443
2055	41,390	3.52	3,941	3.10	3,477
2056	41,804	3.55	3,980	3.14	3,512
2057	42,222	3.59	4,020	3.17	3,547
2058	42,644	3.62	4,060	3.20	3,583
2059	43,070	3.66	4,101	3.23	3,618
2060	43,501	3.70	4,142	3.26	3,655
2061	43,936	3.73	4,183	3.30	3,691
2062	44,375	3.77	4,225	3.33	3,728
2063	44,819	3.81	4,267	3.36	3,765
2064	45,267	3.85	4,310	3.40	3,803
2065	45,720	3.89	4,353	3.43	3,841
2066	46,177	3.93	4,397	3.46	3,879
2067	46,639	3.96	4,441	3.50	3,918
2068	47,105	4.00	4,485	3.53	3,957
2069	47,576	4.04	4,530	3.57	3,997
2070	48,052	4.08	4,575	3.60	**4,037**

Table 2-4
Estimated Quantities of Recycled Water Available for Beneficial Uses

(all values in Acre-Feet Per Year)

Item	CY 2026	CY 2035	CY 2070
Total WWTF Influent Flow	2,606.0	2,850.0	4,037.0
Treatment Losses - Primary/Secondary Clarifiers	0.0%	0.0%	0.0%
Total Secondary Effluent Flow	2,606.0	2,850.0	4,037.0
City Recycled Water Commitment (Golf Course)	325.0	325.0	325.0
City Recycled Water Commitment (Tui Chub Habitat Maintenance)	200.0	200.0	200.0
City Recycled Water Commitment (Alfalfa Fileds)	0.0	0.0	0.0
Total Secondary Effluent available for Beneficial Uses	2,081.0	2,325.0	3,512.0
Treatment Losses - Media Filtration	5.0%	5.0%	5.0%
(in AF)	104	116	176
Media Filtration Effluent Flow	1,977	2,209	3,336
Treatment Losses - Microfiltration (MF)	6.0%	6.0%	6.0%
(in AF)	119.0	133.0	200.0
MF Effluent Flow	1,858.0	2,076.0	3,136.0
Treatment Losses - Reverse Osmosis (RO)	8.0%	8.0%	8.0%
(in AF)	149.0	166.0	251.0
RO Effluent to Post-Treatment and Distribution	**1,709.0**	**1,910.0**	**2,885.0**