Appendix E

Groundwater Impact Assessment

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Proposed Ridgecrest WWTP Improvements

City of Ridgecrest, California

April 2016

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Ridgecrest, CA

Prepared for:

The City of Ridgecrest

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Bakersfield, California

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ACRONYMS AND ABBREVIATIONS

AAF	Average Annual Flow
ADWF	average dry weather flow
AGR	Agriculture Supply beneficial use
Basin Plan	Water Quality Control Plan for the Lahontan Region
BNR	biological nutrient removal
BOD	biochemical oxygen demand
BPCT	best practical control technology
BQO	Basin Quality Objective
CCC	criterion continuous concentration
CMC	criterion maximum concentration
DAF	dissolved air flotation
DDW	SWRCB Division of Drinking Water
DO	dissolved oxygen
EC	electrical conductivity
FRSH	Freshwater Replenishment - beneficial use
IND	Industrial Service Supply - beneficial use
IWVWD	Indian Wells Valley Water District
MCL	maximum contaminant level
MGD	million gallons per day
mg/L	milligram/liter
MPN	most probable number
MUN	Municipal and Domestic Water Supply beneficial use
NAWS	Naval Air Weapons Station China Lake
NTU	Nephelometric Turbidity Unit
POTWs	publicly owned treatment works
RWQCB	Regional Water Quality Control Board
SAR	sodium adsorption ratio
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
US EPA	United States Environmental Protection Agency
WWTP	wastewater treatment plant
WWTF	wastewater treatment facility
µg/L	microgram/liter (same as parts per billion, ppb)
µmhos/cm	micromhos/cm

1 EXECUTIVE SUMMARY

This Groundwater Impact Assessment (Report) evaluates the environmental impacts to groundwater that could result from the disposal, recycling and storage of treated wastewater effluent discharged from the new City of Ridgecrest wastewater treatment plant (WWTP). Groundwater is the receiving water as there will be no surface discharge to drainage courses or to surface water. The potential growth of the City and Naval Air Weapons Station China Lake, along with the poor condition of the existing WWTP has led the City to initiate the design and construction of a new WWTP. The current WWTP has been in operation since 1974 and has reached the end of its functional service life and would need to be completely upgraded to restore its rated capacity of 3.6 mgd. The current average annual flow (AAF) of the existing plant is 2.1 mgd.

Growth at the China Lake NAWS is expected to drive complementary growth in the City, which will increase wastewater flows above the current WWTP capacity. A new treatment facility will need to be constructed in order to service the growing community and to replace the existing WWTP which is in poor condition. The City anticipates a two-phase construction approach, with an initial plant capacity of 3.6 mgd AAF, expandable to 5.4 mgd AAF, which will accommodate expected demands through 2050.

The new WWTP will be designed to initially produce undisinfected secondary effluent that will be discharged to four primary points of use: existing percolation evaporation ponds located on the NAWS China Lake site, existing ponds located on the City site (and subsequently to alfalfa crop irrigation), new ponds located on the City site and, after disinfection, to the China Lake Golf Course. The WWTP process will be designed to remove nitrogen to a concentration of less than10 mg/L. An upgrade to the WWTP to produce disinfected tertiary recycled water is planned to be implemented in a future phase of this project. NAWS China Lake will continue to use a portion of the effluent for irrigation of the China Lake Golf Course.

1.1 Water Quality Standards

Water quality objectives for the effluent were developed based on the Water Quality Control Plan for the Lahontan Region (Basin Plan). Both municipal (MUN) and agricultural (AGR) beneficial uses were considered, and water quality thresholds for various uses, as provided on the State Water Resources Control Board (SWRCB) website. The Basin Plan objectives generally require that constituents in the discharge not be present in concentrations that affect beneficial uses of the receiving groundwater.

In its most recent Basin Plan Update, the Lahontan Water Board removed the MUN objective from the groundwater within a designated area of the NAWS site, including the site of the WWTP facilities and existing disposal ponds, while leaving it in place for the remainder of the Indian Wells Valley. For this project, that means that only the AGR beneficial use will apply in analysis of discharge and percolation at the NAWS site, while both AGR and MUN beneficial uses will apply to the analysis of discharges and percolation at the City WWTF site. Further, AGR requirements will be analyzed in the

context of the planned cropping, which is turf grass at the China Lake Golf Course and alfalfa at the City WWTP site.

1.2 Groundwater Characterization

Existing groundwater quality within the Indian Wells Valley varies significantly depending on location and depth. The deeper groundwater, pumped by NAWS China Lake and Indian Wells Valley Water District for drinking water supply is characterized by moderate TDS averaging less than 400 mg/L. The shallow groundwater is a separate aquifer and would be the receiving water. It is characterized by TDS ranging from an average of 760 mg/L at the City WWTP site to 1,360 mg/L at the NAWS pond site. The shallow groundwater is, accordingly, not desirable for drinking water or irrigation purposes and is not currently used for any beneficial purposes. The percolation ponds at the City and NAWS sites are above the shallow aquifer and the proposed effluent is of higher quality than the shallow groundwater in almost every respect. More detailed analysis follows in subsequent chapters.

1.3 Impact of Proposed Operations on Receiving Water

The proposed operation represents a continuation of the City's WWTP effluent disposal that has been going on for more than fifty years. Additional disposal sites are being considered, in order to add disposal capacity, and proposed performance of the new treatment plant will result in higher-quality effluent, particularly with respect to nitrogen removal. In the discussions that follow, the shallow groundwater below the NAWS site and below the City site is similar enough that it is in many cases discussed together. Where there are meaningful differences in either groundwater quality between the locations, or in the standards used for analysis, the two sites receive separate discussions.

Some of the constituents in the local groundwater are present at levels that are below the drinking water maximum contaminant levels (MCLs), but the shallow groundwater is considered of poor quality for chloride, TDS and arsenic. With the following exceptions, the effluent produced by the WWTP is expected to be of higher quality than the groundwater and will not degrade the quality of the existing groundwater. The impacts for those constituents are considered to be Less Than Significant.

1.3.1 Nitrogen

Nitrogen is the sole constituent considered that will vary depending upon the alternative selected. In the current condition, and under the No Project alternative, nitrogen is not removed from the WWTP effluent. Resulting nitrogen concentrations are above the high-quality background at the City site, where the MUN beneficial use applies, and can be above the MCL. Average value is 9 mg/L but test results range as high as approximately 13.5 mg/L. The NAWS site, subject only to the AGR beneficial use, is not subject to nitrogen limitations.

The design of the new WWTP process envisioned for both Alternatives 1 and 2 will include biological nitrogen removal, and will produce nitrate at concentration levels below the MCL but above the concentration found in the groundwater. The current WWTP does not provide nitrogen removal, so the proposed effluent represents a quality improvement over the status quo. Despite that improvement, there will still be ongoing degradation of the existing high-quality groundwater with respect to nitrogen, though the resultant nitrogen concentration will be below the MCL and the MUN groundwater quality objectives. Minor incremental degradation of the groundwater nitrate concentration, which is currently less than 2.5 mg/L (as N), will occur from percolation of effluent and where effluent is applied for irrigation. Consequently, the ongoing impacts are considered to be **Significant and Unavoidable** for the City site and **Less than Significant** for the NAWS site because it does not have MUN beneficial use designation.

1.3.2 Boron

The concentration of boron in the source municipal water ranges from 0.18 mg/L to 2.1 mg/L, according to reporting from the Indian Wells Water District, the City's water purveyor. Boron concentration in the Navy water system is unknown. Shallow groundwater has not been tested for boron in routine groundwater sampling. The effluent concentration for boron comes from semi-annually testing done at the NAWS site in the existing Pond #3. Boron concentrations vary but have averaged just over 1.0 mg/L.

Groundwater in both the NAWS and City WWTP areas has not been tested for boron. Because the boron concentration in the underlying groundwater is unknown, it is presumed to be of high quality. The anticipated boron concentration of the effluent, 1.1 mg/L, is based on the average concentration in the NAWS site Pond 3. The effluent boron concentration is slightly above the notification level of 1.0 mg/L for drinking water and below the 2.0 mg/L maximum concentration for moderately-sensitive agricultural crops. It does not appear that the discharge will cause degradation with respect to boron. Because any minor degradation caused by the effluent will not result in groundwater exceeding the BQOs, this impact is considered **Less Than Significant**.

1.3.3 Total Dissolved Solids (TDS)

The Total Dissolved Solids (TDS) of the treated wastewater effluent is projected to be about 675 mg/L based on routine sampling of effluent in Pond 3 at the NAWS site. Chloride ranges from 140 to 150 mg/L with sulfate ranging from 50 to 75 mg/L. The TDS lies between the "recommended" and "upper" secondary MCL for drinking water and thus will have no detrimental impact on suitability for the MUN beneficial use when discharged to groundwater via percolation. Chloride and sulfate are both well below the recommended secondary MCL of 250 mg/L and thus will not impair the beneficial use.

The Lahontan Basin Plan water quality objective for water used for agriculture irrigation is a narrative objective without specific numeric limits. It simply states that water

designated as AGR shall not contain concentrations of chemical constituents that adversely affect the water for beneficial uses. Because of the variability of both water quality and crops grown, it is applied on a case by case basis, based on local conditions. The effluent TDS concentration will be substantially less than the groundwater TDS concentration at both the NAWS site and the City site. Therefore, no further degradation of the groundwater will take place as a result of effluent percolation at the City WWTP and NAWS ponds, and the impact is considered **Less Than Significant**.

When the effluent TDS concentration is increased in the root zone by evapo-transpiration by irrigating the golf course or the alfalfa, the concentration in the percolate past the root zone will be higher than the background at both the NAWS and City sites, degrading the quality of the groundwater with respect to TDS, at both the NAWS golf course and at the City alfalfa fields. The concentration of TDS in the groundwater leaving the root zone will exceed the AGR and MUN basin quality objectives for TDS. The addition of the TDS from the recycled water will incrementally increase the TDS of the underlying groundwater over a period of time at both the NAWS and City sites, which are **Significant and Unavoidable** Impacts. At the current time, it is highly unlikely that agriculture production will occur at the NAWS site that would utilize the shallow groundwater aquifer.

1.3.4 Coliform Bacteria

The proposed WWTP will not disinfect effluent. Natural disinfection resulting from subsurface transport down through the soil will effectively remove Coliform bacteria from both the incidental percolate and the alfalfa percolate at the City WWTP site, resulting in **Less Than Significant** impacts for coliform at this location.

At the NAWS site, disinfection performed locally by the Navy prior to irrigating the golf course will effectively remove Coliform from both the golf course percolate, resulting in **Less Than Significant** impacts for coliform at that location.

The very shallow groundwater at the NAWS site may not provide sufficient underground transport for full natural disinfection of the incidental percolation at the NAWS ponds. However there is no water quality objective for the AGR beneficial use and thus the impact is considered **Less than Significant**.

1.3.5 Conclusions

Based on the water quality assessment, the project will degrade some high quality waters in certain respects, which is a mandatory finding of significance. However, it will not affect present and anticipated beneficial uses of the water, and will not result in water quality less than the prescribed water quality objectives, except where such water is already present.

2 INTRODUCTION

The City of Ridgecrest operates a wastewater treatment and disposal facility (WWTF) that services both the City of Ridgecrest and NAWS China Lake. The wastewater treatment facility is located on an easement at the NAWS site granted to the City by the US Navy. The WWTF currently provides primary treatment followed by discharge to facultative ponds that provide supplemental treatment. Wastewater effluent is currently disposed and/or re-used at three locations:

- Percolation/evaporation ponds located on the NAWS China Lake site covering approximately 285 acres.
- Approximately 80 acres of the China Lake Golf Course
- Percolation, evaporation/storage ponds located on the City site, 4 miles south of the WWTF.
- Alfalfa crop irrigation using center pivot irrigation of approximately 33 acres at the City site.

Average dry weather WWTP flows are currently approximately 2.1 mgd. The current flow has declined over the past five years from an average of 2.7 mgd in 2010. The current waste discharge permit allows a maximum flow of 3.6 mgd. The new WWTP is proposed to have an average annual flow (AAF) capacity of 3.6 mgd with a 4.0 mgd maximum month average daily flow (MMADF). Water balances prepared for the project indicate a need to provide additional capacity to dispose of the AAF of 3.6 mgd.

The new WWTP will be designed to produce secondary undisinfected effluent with biological nitrogen removal (BNR). A future project is planned to produce Title 22 recycled water for unrestricted use for park and landscape irrigation. Initially, new percolation ponds will be constructed at the City site to provide additional disposal capacity. All existing disposal facilities, including the NAWS ponds, China Lake Golf Course and the City pond and alfalfa irrigation site will remain in full operation. ,

The project alternatives considered in this analysis include:

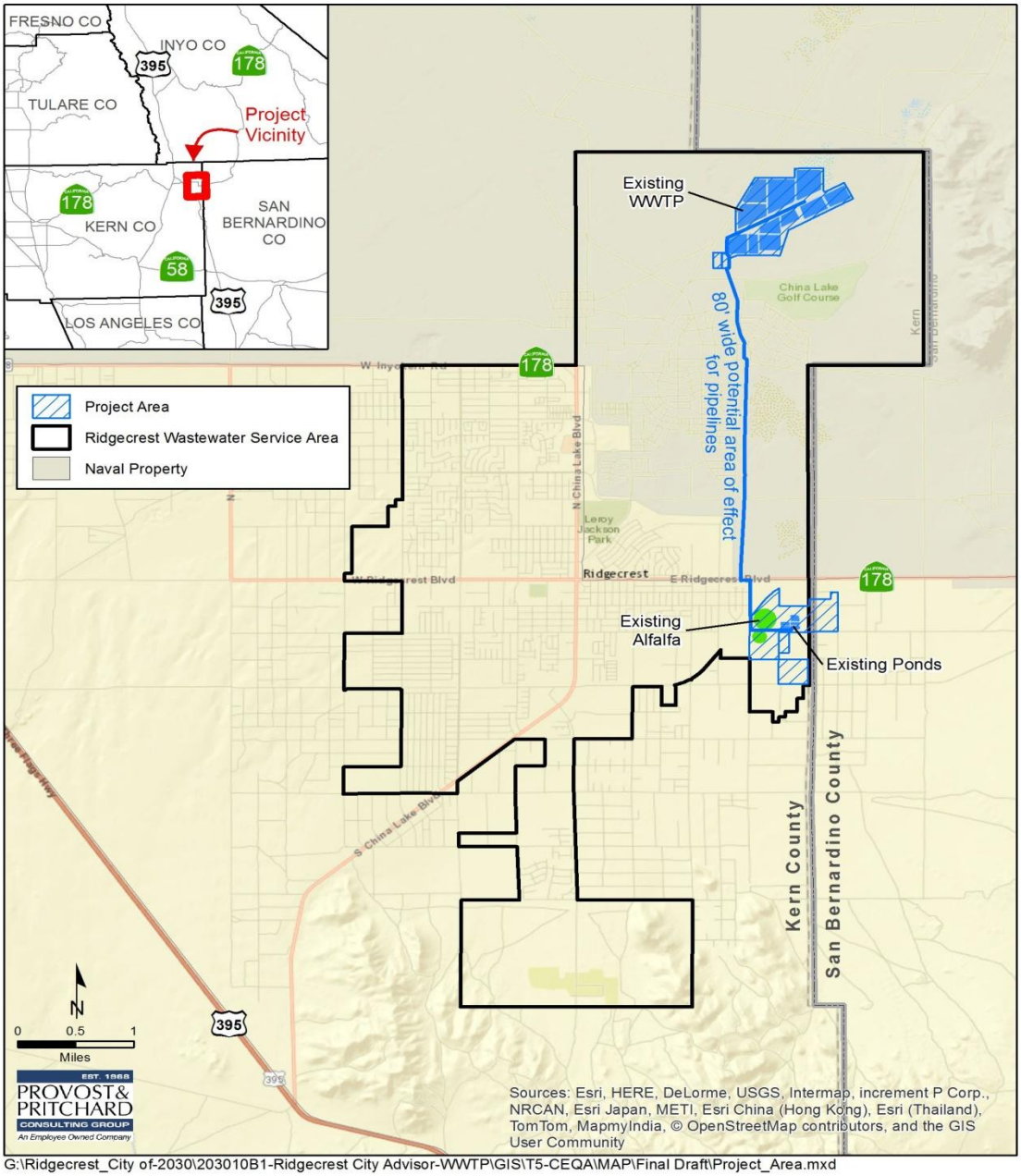
- <u>No project</u>: All existing treatment and disposal facilities will remain “as is”.
- <u>Alternative 1</u>: New WWTF built on the NAWS China Lake site with disposal occurring on the NAWS site and City site. All existing disposal facilities described above will remain in place and new percolation ponds will be constructed at the City site.
- <u>Alternative 2</u>: New WWTF built on the City site with disposal occurring on the NAWS site and City site. All existing disposal facilities described above will remain in place and new percolation ponds will be constructed at the City site.

With respect to wastewater effluent disposal and reuse, the latter two alternatives are identical. The annual quantity of effluent produced from the proposed WWTP at the 3.6 mgd capacity is 4,033 acre-feet per year. Initial operation, beginning in about 2020, will produce approximately 2,353 acre-feet/year.

SECTION TWO

The analysis in this report evaluates the potential groundwater impacts associated with the storage and use of effluent for each of the disposal/re-use sites.

Figure 1. Project Area



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3 REGULATORY SETTING

The Porter-Cologne Water Quality Control Act ("Porter-Cologne") provides for the regulation of water quality within the State of California. Its provisions apply to waters of the state, which is defined to mean any surface water or groundwater within the boundaries of the state. Porter-Cologne requires regional water quality control boards to adopt water quality control plans, and such plans are to include the beneficial uses of the waters to be protected, the water quality objectives necessary to reasonably protect beneficial uses, and a program of implementation. (See Water Code §§13050(j), and 13240 et seq.). Water quality control plans are otherwise referred to as "Basin Plans".

In addition to establishing water quality control plans, the State Water Resources Control Board (SWRCB) has also adopted other applicable policies. These policies include the State's Statement of Policy with Respect to Maintaining High Quality of Waters in California ("Resolution 68-16, also known as the "anti-degradation policy"), and the State's Recycled Water Policy, which was adopted in 2009. The State's anti-degradation policy in Resolution 68-16 applies to the disposal/re-use of effluent for all land discharges. The Recycled Water Policy provides direction to regional water quality control boards and others in issuing permits for recycled water projects.

Other applicable policies include the Water Quality Control Plan for the Lahontan Basin (Lahontan Basin Plan), and requirements set by the Division of Drinking Water in Title 22, Sections 60301 et seq., in the California Code of Regulations. These policies are summarized below.

3.1 State Anti-degradation Policy and Guidance

Resolution No. 68-16 was adopted by the State Water Board in 1968 and it is intended to protect the State's high quality waters. Specifically, with this policy, it was the intent and purpose of the State Water Board "that such higher quality (waters) shall be maintained to the maximum extent possible consistent with the declaration of the Legislature." The operative provisions of the policy state, in part:

1. *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.*

2. *Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not*

occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

The analysis provided herein is intended to demonstrate that the proposed discharge, storage and re-use of wastewater effluent and recycled water from the proposed City of Ridgecrest WWTF complies with Resolution No. 68-16.

3.2 State Recycled Water Policy

Adopted in 2009, the primary purpose of the State's Recycled Water Policy is to increase the use of recycled water from municipal wastewater sources in a manner that implements state and federal water quality laws. When recycled water is used in compliance with the Recycled Water Policy, Title 22 and all applicable state and federal water quality laws, the State Water Board finds that "recycled water is safe for approved uses, and strongly supports recycled water as a safe alternative to potable water for such approved uses." (Recycled Water Policy, p. 2.) The State Water Board further finds that the use of recycled water in accordance with the Policy, "which is sufficiently treated so as not to adversely impact public health or the environment and which ideally substitutes for use of potable water, is presumed to have a beneficial impact. Other public agencies are encouraged to use this presumption in evaluating impacts of recycled water projects on the environment as required by the California Environmental Quality Act (CEQA)." (Recycled Water Policy, pp. 2-3.)

With respect to the application of Resolution 68-16 to landscape irrigation, the Recycled Water Policy finds that landscape irrigation with recycled water in accordance with the policy is to the benefit of the people of the State of California, and this finding is an important component of the environmental impact analysis of a project such as this one.

The analysis presented in this report indicates that the proposed Project complies with the applicable provisions of the Recycled Water Policy.

3.3 Lahontan Basin Plan

The Implementation chapter of the Lahontan Basin Plan includes various policies with respect to wastewater reclamation. As included in the Basin Plan, the *Wastewater Reuse Policy* is as follows:

The State Board adopted a Recycled Water Policy (Res. No. 2009-0011, amended by Res. No. 2013-0003) that indicates the State and Regional Boards will exercise their authorities to the fullest extent to encourage the use of recycled water, consistent with state and federal water quality laws. The Regional Board encourages the reuse of treated domestic wastewater, and desires to facilitate its reuse. . . The need to develop and use recycled water is one factor the Regional Board will evaluate when considering exemption requests to waste discharge prohibitions. Other considerations, including potential impacts of nutrients in recycled water on aquatic life and the assimilative capacity of groundwater basins for salts and nutrients, will also apply.

The proposed Project is consistent with the *Wastewater Reuse Policy* contained in the Basin Plan.

3.4 Title 22 Recycled Water Criteria

The water recycling regulations dictating recycled water quality criteria are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Water Recycling Criteria. The regulations are intended "… to establish acceptable levels of constituents of recycled water and to prescribe means for assurance of the reliability in the production of recycled water in order to ensure that the use of recycled water for the specified purposes does not impose undue risks to health."

The State Water Resources Control Board, Division of Drinking Water has established four levels of recycled water quality that are appropriate for different end uses. The differing qualities require different levels of treatment. Article 3 of the Water Recycling Criteria details the acceptable uses of recycled water and the corresponding quality of water required for each use.

The Project proposes to produce denitrified, undisinfected secondary effluent. Denitrified secondary treated water is defined as wastewater that has been treated using oxidation, settling and clarification, and has been biologically reacted to remove nitrogen, producing an effluent with less than 10 mg/L nitrogen and low levels of BOD and TSS (typically less than 30 mg/L of each), though with no requirements as to Coliform concentration. The recycled water produced from the proposed new WWTP will meet these requirements.

Secondary treated, disinfected, water may be used as recycled water for the irrigation of limited-access access golf courses. Disinfection is not required for irrigation of fodder and non-food crops, or for percolation and incidental recharge. The Navy disinfects a portion of the effluent after it leaves the WWTP, and uses that water to irrigate the China Lake Golf Course. This practice is planned to continue.

4 WATER QUALITY STANDARDS

In California, water quality standards are based on the beneficial uses and water quality objectives established within the applicable Basin Plan. The Lahontan Basin Plan establishes water quality standards for the groundwater underlying the Project and the proposed sites for recycled water irrigation.

4.1 Groundwater Beneficial Uses and Objectives

Groundwater beneficial uses designated for this Indian Wells Valley portion of the Lahontan Basin are contained in the Basin Plan and include agricultural (AGR), municipal (MUN), Industrial Service Supply (IND) and Freshwater Replenishment (FRSH) uses. IND designates water supply that does not depend primarily on water quality and thus it will not be affected by the project. FRSH is water used for natural or artificial maintenance of surface water quantity or quality. The high TDS in the groundwater and the absence of surface water in the area makes this beneficial use unlikely. In any case the impact analysis would be similar and analogous to the AGR use.

In 2015 the MUN (municipal) use was removed from the groundwater underlying the a portion of the NAWS site, including the site of the existing WWTP and disposal ponds, so the criteria for evaluating discharges at the NAWS site and at the City WWTP site are different. Water quality objectives for groundwater as included in the Basin Plan and are summarized in **Table 1.**

Table 1. Groundwater Quality Objectives (1)

Parameter	AGR/FRSH/IND Objective	MUN Objective
Bacteria (as Coliform organisms)	No numeric limit	1.1 MPN/100 ml (7 day average)
Chemicals:		
Chemical constituents	Not present in concentrations that adversely affect beneficial uses.	Shall not exceed MCLs and secondary MCLs in Title 22.
Radioactivity	No stated limits	Shall not exceed secondary MCLs in Cal Title 22. Table 4 of Section 64443, Title 22 of CA Code of Regulations
Tastes / odors	Shall not contain concentrations that cause nuisance or adversely affect beneficial uses	Shall not exceed secondary MCLs in Title 22

(1) These objectives apply to all groundwater.

Potential constituents of concern for AGR include, chloride, sodium, boron, TDS, and specific chemical constituents related to AGR suitability of the water. The MUN Basin

Objective is set to limit constituents in excess of the drinking water MCL for primary and secondary contaminants listed in Title 22. Thus, potential constituents of concern for MUN include Coliform bacteria, chloride, sulfate, arsenic, and TDS. Boron has also been considered a constituent of concern because of the SWRCB DDW Notification Level of 1 mg/L.

Waters designated AGR are not to contain concentrations of chemical constituents that adversely affect agricultural use. Current agricultural uses in the Indian Wells Valley include alfalfa and pistachio trees. There is limited agricultural production in the Indian Wells Valley because of the lack of water supply coupled with very high evapo-transpiration rates. Because of the location in the "high" Mojave Desert, with elevation of approximately 2,200 to 2,300 feet, it is subject to hard freezes, further limiting crop alternatives. Each crop will have various specific agricultural water quality limitations. These limitations also may vary depending on the irrigation application method, with sprinkler irrigation being the most restrictive. Additional groundwater quality objectives for agricultural use are presented in **Table 2**. This table is based on agricultural guidelines of water quality for irrigation with unrestricted use, based on Ayers and Westcot (1985). Some relaxed objectives are also available with certain levels of restricted use, with some crops being more tolerant than others.

Table 2. Agricultural Groundwater Quality Objectives

Parameter	Criteria/Objective[1] Unrestricted Use	Slight to Moderate Restriction
Boron	0.7 mg/L	0.7 to 3.0 mg/L
Chloride	<140 mg/L	140 to 350 mg/L
Trace elements	varies	varies
Sodium adsorption ratio (SAR)	<3	3-9
Total Dissolved Solids (TDS)	450 mg/L	450 to 2000 mg/L
Electrical conductivity (EC)	700 µmhos/cm	700 to 3000 µmhos/cm

1. From Irrigation with Reclaimed Municipal Wastewater A Guidance Manual, SWRCB, July 1984, Chapter 3, by Ayers & Westcot.

The major constituents of concern in assessing the quality of water for agriculture are salinity (as measured by TDS or EC), boron, chloride and SAR. In general, human and animal uses are less sensitive than crops for these constituents. Salinity reduces crop growth by decreasing the ability of plant roots to absorb water. The salt tolerance of crops also depends on the frequency and type of irrigation. Sprinkler irrigation is most restrictive due to foliar absorption of salt. Absorption and foliar injury are further influenced by high temperature, low humidity, drying winds, type of sprinkler, and timing of irrigation.

Boron is an essential element but can become toxic to some plants when concentrations in water even slightly exceed the amount required for optimal growth. Like salt tolerance, boron tolerance varies with the climate, the soil, and the crop. While boron sensitivity appears to affect a wide variety of crops, sodium and chloride toxicities are mostly limited to tree crops and woody perennials (e.g., citrus, stone-fruit, and vineyards). A predominance of sodium relative to other ions in irrigation water (measured by SAR) may disperse soil aggregates, which in turn, affects virtually all crops by decreasing the permeability of the soil by water and air.

In determining the concentrations of salinity, boron, chloride, and sodium in groundwater associated with no adverse affects on agricultural beneficial use in the area, multiple criteria apply. The most stringent concentrations for crops that may be grown commercially in an area become the constraining criteria, and therefore the water quality objectives. Utilizing an extensive constituent list and water quality based assessment thresholds based on the Basin Plan, California primary and secondary maximum contaminant levels (MCL), and water quality standards for agriculture, numeric objectives for the narrative objectives shown in **Table 1** and **Table 2** were determined.

4.2 Thresholds of Significance

The following thresholds of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, a project will normally have significant adverse impacts associated with water quality if it would do any of the following:

a) Violate any water quality standards or waste discharge requirements.

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

c) Otherwise substantially degrade water quality.

In evaluating the effects of the proposed percolation and irrigation with effluent upon the shallow groundwater, two characteristics are of primary importance. First, for MUN drinking water use, the Maximum Contaminant Level, or MCL and the secondary MCL of each constituent, as set by the US EPA and the State of California, and second, the Basin Quality Objectives for the beneficial uses identified for the groundwater by the Lahontan Regional Water Quality Control Board in the Lahontan Basin Plan.

Each constituent found in groundwater subject to the MUN objective was compared with the MCL for that constituent. If the concentration of the constituent found in the groundwater was less than the MCL, the groundwater was determined to be of high quality with respect to that constituent, worthy of particular attention to degradation.

If the constituent concentration in the effluent was below the MCL, the potential impact was considered to be less than significant, even if the concentration was above that of the groundwater. If the constituent concentration in the effluent was above the MCL, then the proposed discharge was considered to be of potential significance, depending upon the constituent concentration in the groundwater. See **Table 3**.

Each constituent found in groundwater subject to the AGR objective was compared with the recommended limits for slight-to-moderate sensitivity agricultural usage, appropriate to the proposed turf grass and alfalfa crops, which is how the Basin Plan identifies Basin Quality Objectives for the AGR beneficial use. If the concentration of the constituent found in the groundwater was less than the recommended limit, the groundwater was determined to be of high quality with respect to that constituent.

If the constituent concentration in the effluent was below the recommended limit, the potential impact was considered to be less than significant, even if the concentration was above that of the groundwater. If the constituent concentration in the effluent was above the recommended limit, then the proposed discharge was considered to be of potential significance, depending upon the constituent concentration in the groundwater. See **Table 3**.

Constituent concentrations were compared with Basin Quality Objectives in the same manner as they were with MCLs. Significance was determined based on the relationship of the concentrations in the effluent and the groundwater. These criteria are tabulated in matrix format in **Table 3**.

Table 3 Matrix of Significance Criteria

	Effluent Concentration below MCL (MUN) or Basin Quality Objective (AGR)	**Effluent Concentration above MCL (MUN) or Basin Quality Objective (AGR)**
Groundwater Concentration below MCL (MUN) or Basin Quality Objective (AGR)	Less Than Significant	Significant and Unavoidable
Groundwater Concentration above MCL (MUN) or Basin Quality Objective (AGR)	Less Than Significant	Less Than Significant if below Groundwater Concentration Significant and Unavoidable if above Groundwater Concentration

5 SUMMARY OF AVAILABLE WATER QUALITY DATA

Because the Project is a reconstruction and expansion of the existing Ridgecrest WWTP, there are a great deal of data on the existing groundwater, source water and influent wastewater available and all will remain the same after the new plant is constructed. The new WWTP will be different from the existing plant in several respects. First, it will be designed from the outset to include biological nitrogen removal. Second, the new plant will perform more effectively in removal of BOD and TSS. No disinfection is proposed, except as separately provided by the Navy prior to golf course irrigation, so no specific level of Coliform bacteria will be targeted.

In lieu of evaluating existing recycled water data as would be done with an existing treatment plant, the quality of the intended surface water supply and estimates of potential recycled water quality based on the proposed level of treatment at the WWTP have been used to compare to applicable water quality objectives. Based on this comparison, as well as identifying constituents known to be of concern to the Water Board, this analysis then determined if the proposed Project will degrade local groundwater below water quality objectives, or degrade high quality waters for these constituents of concern.

This section summarizes the available water quality data that was used to estimate recycled water quality, as well as data that was used to determine if the proposed use of recycled water for agricultural and golf course irrigation will degrade groundwater quality below applicable water quality objectives, or degrade existing high quality waters. The assembled data are summarized in **Table 4** through **Table 8** below.

5.1 Source Water Supply Quality

Source water for the City of Ridgecrest and NAWS China Lake consists entirely of groundwater supplied by either the Indian Wells Valley Water District (IWVWD) or the US Navy.

Table 4 presents a summary of water quality for selected constituents in the potable source water that is supplied by IWVWD to City residents and water customers in its consumer confidence report. Similar data was not available from the Navy, but the groundwater quality is generally similar. As can be seen in the table, none of the constituents in the source water surpass their MCLs. Prior to 2011 the City of Ridgecrest was experiencing high levels of arsenic in their drinking water. Following the 2006 change in the MCL of arsenic to 10 µg/L, IWVWD installed arsenic-removal treatment facilities to remove the arsenic and decrease the levels to below the MCL. Since that time, the levels have consistently been below the revised MCL.

Table 4. Potable Water Supply Data Summary – Indian Wells Valley Water District

Constituent	Average Concentration	Range	Units
Regulated (Primary MCL)			
Arsenic	3.3	2.0-7.9	µg/L
Nitrate (as NO_3)	5.8	ND-12.0	mg/L
Nitrate + nitrite (as N)	1.35	ND-2.7	mg/L
TTHMs	2.7	ND-5.8	ppb
Fluoride	0.7	0.4-1.4	mg/L
Secondary MCLs			
TDS	347	210-890	mg/L
Electrical Conductivity (EC)	558	330-1600	µmhos/cm
Chloride	81.3	22-410	mg/L
Sulfate	38.4	20-67	
Calcium	24	3.4-37	mg/L
Unregulated Substances			
Boron	0.63	0.18-2.1	mg/L
Hardness	71.9	8.5-110	mg/L
Magnesium	2.9	ND-5.8	mg/L
Sodium	71.8	39-260	mg/L
pH	8.1	7.5-8.9	su

Listed concentrations are taken from the 2014 Consumer Confidence Report published by the Indian Wells Water District for the City of Ridgecrest water system and are considered representative of the 2014 average quality of supply water. Data for NAWS China Lake is not available.

Copper and lead tests were also performed on the water; the results of these tests can be seen below in **Table 5**.

Table 5. Source Water Copper and Lead Tests

Substance	Unit	Year	Violation	AL	PHG	Amount Detected
Copper	mg/L	2012	No	1.3	0.3	0.05
Lead	µg/L	2012	No	15	0.2	ND

Listed concentrations are taken from the 2014 Consumer Confidence Report published by the Indian Wells Water District for the City of Ridgecrest water system.

Copper and lead concentrations are presumed to result from corrosion of household plumbing systems, particularly copper water services and lead plumbing fixtures, which are predominantly found in older housing units. Other sources can include the erosion of natural deposits and discharges from industrial manufacturers. The reported copper concentrations are low at roughly one-sixth of the Public Health Goal and the impact they have on the overall water quality is therefore considered insignificant. No lead was detected in the source water tests, and therefore no significant impact was found.

5.2 WWTF Effluent Quality

The presumed water quality with respect to inorganic chemicals and metals is based on semi-annual monitoring of Pond 3 at the existing WWTP. Pond 3 is a facultative pond that receives primary effluent from the WWTF prior to discharging water for golf course irrigation, pumping to the city site alfalfa irrigation site and discharge to the NAWS disposal ponds. Pond 3 is essentially a composite of wastewater effluent received over the prior month of discharge. A summary of Pond 3 selected water quality parameters for 2012 through 2015 is summarized in **Table 6**. With respect to BOD, TSS and total nitrogen, the presumed water quality is based on the design performance of the WWTP.

Table 6. Pond 3 Effluent

Date	Boron (mg/L)	TDS (mg/L)	Cl (mg/L)	As (µg/L)	Na (mg/L)	$S0_4$ (mg/L)
7/6/12	1.1	680	160	7.0	190	65
2/13/12	1.1	640	150		170	54
7/31/13	1.1	690	160	6.4	180	67
1/21/13	0.9	700	140		170	53
7/23/14	1.2	690	160	4.9	180	75
1/22/14	0.97	660	150		160	50
7/20/15	0.98	630	140	6.2	160	60
1/20/15	1.1	700	150		160	54
12/31/15	1.0	670	140		170	67
Average	**1.1**	**673**	**150**	**6.1**	**171**	**61**

5.3 Shallow Groundwater Quality Summary

The Indian Wells Valley groundwater basin is described as a closed internally drained basin. The surrounding mountains slope toward China Lake, a dry lakebed. The valley fill consists of unconsolidated alluvial deposits that are about 2,000 feet thick in the southwestern part of the valley. In the eastern and central part of the valley, the lithology varies greatly. The valley is considered to have two main aquifers: a shallow aquifer that is about 300 feet deep and a deep aquifer. The shallow aquifer overlies the deep aquifer in the eastern part of the valley. The deep aquifer is about 1,000 feet thick and is the primary source of drinking water. The shallow groundwater is of poor quality, being very high in arsenic, chlorides and TDS.

The City maintains seven groundwater monitor wells in the shallow aquifer, four on the NAWS site and three at the City site. These monitor wells have been sampled semi-annually since August 2000 as required by the RWQCB monitoring and reporting program. Constituents sampled are shown in **Table 7**.

Table 7. Analytical Suite for Groundwater Monitoring

Parameters	Units	Frequency
Anions and General Parameters	mg/L	Semi-annually
Ammonia	mg/L	Semi-annually
Chloride	mg/L	Semi-annually
Methylene Blue Active Substances (surfactants)	mg/L	Semi-annually
Nitrate as Nitrogen	mg/L	Semi-annually
Total Kjeldahl Nitrogen	mg/L	Semi-annually
Total Dissolved Solids	mg/L	Semi-annually
Organic Compounds		
Base/Neutral/Acid Extractable Organics	mg/L	Annually
Purgeable Halocarbons	mg/L	Annually
Polycyclic Aromatic Hydrocarbons	mg/L	Annually
Metals		
Arsenic		
Cadmium	mg/L	Annually
Chromium	mg/L	Annually
Copper	mg/L	Annually
Lead Mercury	mg/L	Annually
Molybdenum	mg/L	Annually
Nickel	mg/L	Annually
Selenium	mg/L	Annually
Silver	mg/L	Annually
Zinc	mg/L	Annually

Wastewater Treatment Facility, Ridgecrest, CA., Wastewater Discharge Permit Nos. 6B150116001 and 6B159101001

A review of the 14 years of sample results indicates that the constituents of concern for the NAWS site with the AGR beneficial use are TDS and chloride (BSK Winter 2014 Groundwater Monitoring Report, City of Ridgecrest Wastewater Treatment Facility, February 2014). . Boron is not required to be sampled and there is no data on boron. Chloride in the groundwater exceeds the unrestricted criteria objective (**Table 2**) for all monitor wells but is within the acceptable use range for crop irrigation with slight to moderate restriction. Chloride levels in the latest sample event ranged from 170 mg/L to 390 mg/L. TDS in the groundwater at the NAWS site ranges from 1,100 to 1,500 mg/L, both well above the criteria objective for unrestricted AGR use (**Table 2**) of 450 mg/L. It is, however, within the criteria objective of 450 to 2,000 mg/L for use with slight to moderate restriction.

At the City site, both the MUN and AGR beneficial uses apply. The underlying groundwater exceeds the MCL for arsenic, exceeds the recommended secondary MCL of 500 mg/L for TDS, but is less than the upper limit of 1,000 mg/L. It exceeds the recommended limit for chloride in one monitor well and is within the limit in the other two monitor wells. With the exception of arsenic, all metals were well below their respective

drinking water MCLs or action limits. The groundwater is of high quality with respect to all other drinking water standards. For AGR use, the groundwater falls within the slight to moderate restriction.

Quality results can be seen in **Table** 8**8** below, reproduced from Table 1-1 of the Facility Plan Update. Location of the groundwater wells is shown on the following page on **Figure 2** from the BSK Groundwater Monitoring Report.

Table 8. Groundwater Quality

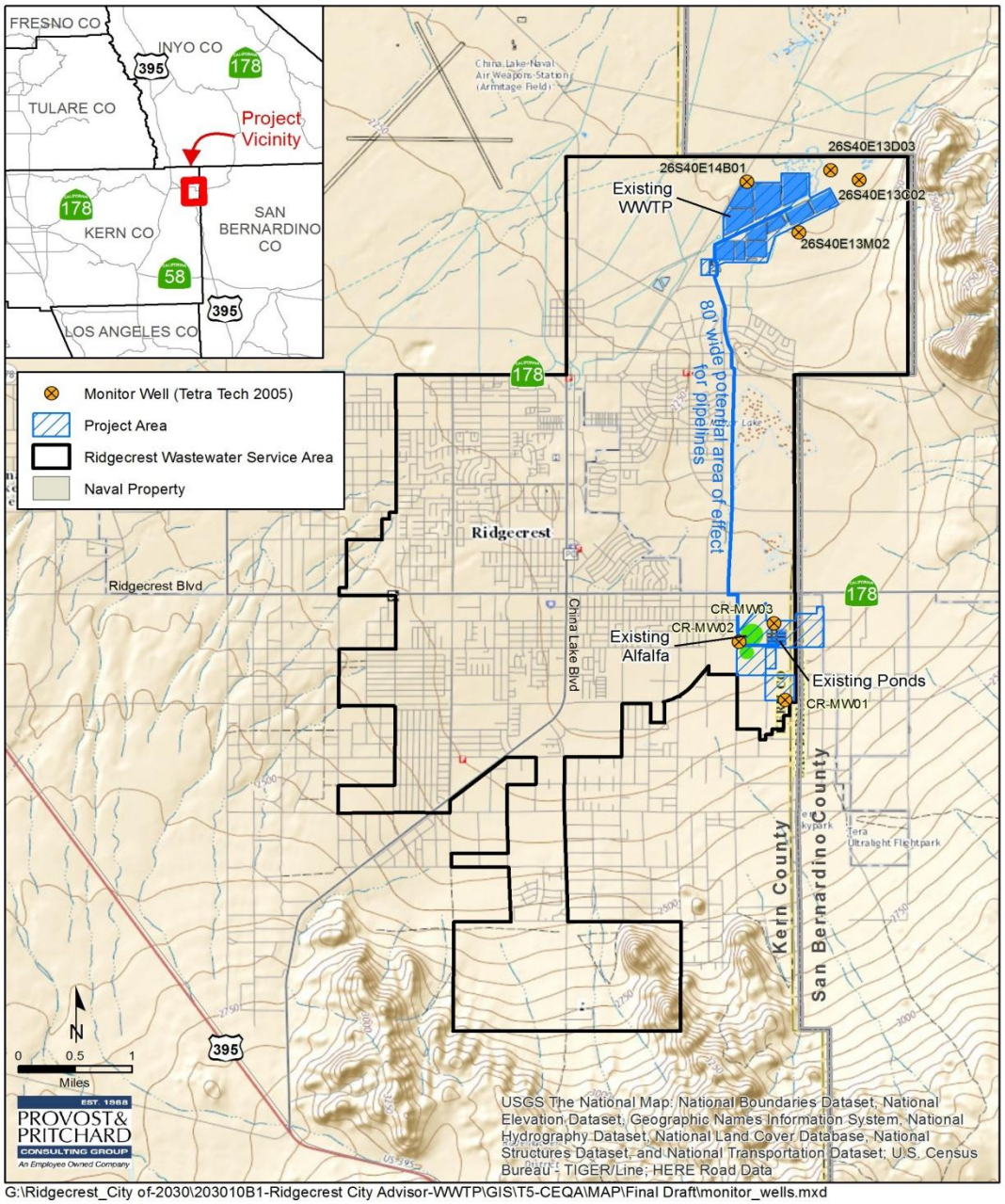
Table 1-1. Monitor Well Groundwater Quality Summary

	NAWS WWTP Wells				City Site Wells		
	26S40E14B01	26S40E13D03	26S40E13C02	26S40E13M02	CR-MW01	CR-MW02	CR-MW03
Groundwater Elevation	2179.57	2178.71	2182.59	2180.55	2159.05	2161.09	2159.36
Ammonia (NH4) mg/L	0.35	0.13	0.15	0.18	0.16	0.17	0.13
Chloride mg/L	290	390	270	170	320	220	210
Nitrate as N mg/L	<1.1	<2.2	<1.1	<0.6	2.5	1.2	1.5
TKN mg/L	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
TDS mg/L	1400	1500	1200	1100	740	760	780
Surfactants (MBAS) mg/L	0.21	0.24	0.096	0.09	<0.05	<0.05	<0.05
Arsenic, µg/L	520	550	260	380	43	9.9	10

Of note is that while the groundwater surface elevations are relatively consistent between the NAWS and City sites, the ground surface elevation at the NAWS site is over 100 feet lower. Therefore the typical depth to groundwater at the NAWS site ranges from 7 to 20 feet, while at the City site the depth to groundwater ranges from approximately 107 to 171 feet. (Facility Plan, Section 1.4.5.)

The groundwater at the NAWS site was evaluated with respect to the AGR basin objectives, and the groundwater at the City site was evaluated with respect to the MUN and AGR basin objectives.

Figure 2, Groundwater Well Map



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6 PROJECTED EFFLUENT QUALITY

The effluent quality from the proposed new WWTF facility is based on the proposed project design criteria as shown in **Table 9.** Inorganic chemicals and metals in the effluent are assumed to be the same as they are now because the treatment process will not affect these constituents. The presumed water quality for inorganic chemicals and metals are based on sampling from the existing Pond 3 (Table 6).

Table 9. WWTP Influent and Projected Performance

Design Criteria	Phase 1/2
Average Annual Daily Flow (AAD)	3.6 mgd
Average Day, Maximum Month Flow (ADMM)	4.0 mgd
Maximum Day Flow (MDF)	4.7 mgd
Average Influent BOD_5	270 mg/l
Average Influent TSS	270 mg/L
Average Influent TKN	40.5 mg/L
Effluent BOD_5	30 mg/L
Effluent TSS	30 mg/L
Effluent Total Nitrogen	<10 mg/L

6.1 Treatment Technology

The Project proposes to treat wastewater using biological and physical processes to achieve secondary-quality recycled water with nitrogen removal. The process will be an oxidation ditch design with nitrification/de-nitrification and secondary clarification. The denitrification process was selected because it is considered best practicable control; technology (BPCT) for nitrogen removal. No disinfection is proposed at the WWTP. The Navy currently chlorinates effluent it receives from the City for disinfection before irrigating the golf course. This practice is planned to continue after construction of the new WWTP. A future process is planned to produce tertiary disinfected recycled water with an initial capacity of 1.8 mgd. When that process is implemented filtration and disinfection will be added to the WWTF. The effluent BOD and TSS will improve to an anticipated 10 mg/L, with other constituents mostly unchanged.

The WWTP will include additional features designed for compliance with the waste discharge requirements expected to be issued by the Water Board, to protect groundwater beneficial uses and intended to provide consistent, reliable delivery of recycled water at the expected quality. WWTP features to provide this assurance will include the following:

- Emergency power generation facilities sufficient to operate necessary process units.

- Redundant machinery and components as needed to allow uninterrupted operation during loss of any single device.
- Automated control, monitoring and alarm systems.
- Process ability to remove nitrogen to 10 mg/L or less, (measured as Nitrogen), consistent with the primary MCL.
- Compliance with requirements for monitoring of effluent BOD and other constituents as specified in the anticipated Waste Discharge requirements.

Error! Reference source not found.10 presents a summary of the predicted concentrations of known substances and constituents of concern in the proposed wastewater effluent. With the exception of Total N, these were derived from sampling from Pond 3 (**Table 6**).

Table 10. Projected Effluent Water Quality from Proposed WWTP

Constituent	Projected Effluent Concentration	Units	Controlling Factor
Chloride	150	mg/L	Source Water Supply
TDS	670	mg/L	Source Water Supply, community contribution
Total Nitrogen	<10	mg/L	Treatment Plant Performance
Arsenic	6.1	µg/l	Source Water Supply
Boron	1.1	mg/L	Source Water Supply

The nitrate (as N) levels in the planned effluent are projected to be , 10 mg/L due to a nitrogen removal process that will be incorporated in the design of the facility. This plant will produce undisinfected secondary treated water that will be used for percolation and irrigation purposes, shown below in **Error! Reference source not found.11** as the lowest-quality recycled water acceptable for any sort of reclamation, with the most limited possibilities for reuse.

The disinfection provided by the Navy prior to golf course irrigation raises the quality of that portion of the effluent to Disinfected Secondary -23. In either case, the water can be permissibly used for turf irrigation. Although the new WWTP will not initially disinfect the water, the future expansion phase will allow for the addition of a filtration and disinfection process for future Title 22 unrestricted use.

Table 11. Title 22-Permitted Recycled Water Uses

Recycled Water type	Treatment Process	Approved Uses	Median Coliform (MPN/100 ml)
Disinfected Tertiary	Filtered and Disinfected	Spray Irrigation of Food Crops, Unrestricted Landscape Irrigation Recreational Impoundment	2.2
Disinfected Secondary - 2.2	Oxidized and Disinfected	Surface Irrigation of Food Crops Restricted Recreational Impoundment Surface Irrigation of Orchards and Vineyards	2.2
Disinfected Secondary - 23	Oxidized and Disinfected	Pasture for Milking Animals, Landscape Irrigation, Landscape Impoundment	23
Undisinfected Secondary	Oxidized	Fodder, Fiber and Seed Crops	-

7 CONSTITUENTS OF CONCERN

Based on available surface and groundwater data, source water data and estimated recycled water concentrations, a limited number of constituents have been identified as constituents of concern for further analysis. In addition, other select constituents that may be of particular interest to the Water Board have been included for further analysis. The constituents of concern that are addressed within this report are listed below in **Table 12** and **Table 13** for the NAWS site and the City site, respectively.

Table 12. Potential Constituents of Concern for the Proposed WWTP Recycled Water, NAWS Disposal Sites Subject to AGR Basin Objectives

Chemical	Units	Estimated Effluent Water Quality	AGR BQO	Existing GW Conc., NAWS Site	High Quality Ground-water?	Level of Significance	Groundwater Degradation	Constituent of Concern
Chloride	mg/L	150	(1)	180 -390	N	Less than Significant	N	Y
TDS	mg/L	675		1,100 - 1,500	N	Less than Significant	N	Y
Boron	mg/L	1.05		unknown	unknown		unknown	Y

Projected effluent concentrations are based on estimated plant performance and existing source water quality.

1 Basin Plan provides narrative objective only. Actual objective is dependent on crop to be irrigated.

As can be seen in **Table 12**, chloride, TDS and boron are listed as constituents of concern. The Basin Plan provides only a narrative water quality objective for chemical constituents. These three constituents fall into the category indicating that there would be slight to moderate restriction in the use of this water. Consequently, some crops may be suitable for irrigation with the groundwater while others may not. Some yield reduction may occur. Alfalfa and turf grass can be irrigated with the proposed effluent. A more detailed assessment of the effect these constituents have on the groundwater supply is in the following sections.

Groundwater is designated as “high quality” for a constituent if the concentration is below the Basin Quality Objective (BQO). The local groundwater is considered to be “High Quality” for nitrogen and boron.

Table 13. Potential Constituents of Concern for the Proposed WWTP Recycled Water, City Disposal Site Subject to MUN Basin Objectives

Chemical	Units	Estimated Effluent Water Quality(1)	MCL (MUN BQO)	Existing GW Conc., City Site	High Quality Ground-water?	Level of Significance	Groundwater Degradation	Constituent of Concern
Chloride	mg/L	150	250-500	>750	N	Less than Significant	N	N
Total N	mg/L	<10	10	1.2 - 2.5	Y	Significant	Y	Y
TDS	mg/L	675	500-1000	740 - 780	N	Less than Significant	N	Y
Boron	mg/L	1.05	(2)	unknown	Y	Less than Significant	N	Y
Arsenic	µg/L	6	10	21	N	Less than Significant	N	N
Coliform	MPN	undisinfected	1.1	-	Y[3]	Less than Significant	N	N

1 Projected effluent concentrations are based on estimated plant performance and existing source water quality.
2 Neither the State of California nor USEPA have MCLs for boron. State action level is 1 mg/L.
3 Effective concentration by the time the effluent percolates through over 100 feet of soil to reach the shallow groundwater. Actual effluent concentration leaving the WWTP is >22 MPN.

As can be seen in **Table 13**, the effluent exceeds the recommended MCL for TDS but is below the upper limit of 1,000 mg/L. For chloride the limit is below the recommended level. Although total nitrogen in the effluent will cause degradation of the high quality groundwater with respect to nitrogen, the degradation is minor. Groundwater monitor results over the past 14 years do not show significant degradation of the groundwater. A more detailed assessment of the effect these constituents have on the groundwater supply is in the following sections.

Groundwater is designated as “high quality” for a constituent if the concentration is below the MCL. The local groundwater is considered to be “High Quality” for nitrogen and is unknown for boron.

For both sites, if the groundwater was determined to be high quality water for a specific constituent, it was evaluated to determine if the proposed discharge would cause significant degradation of the high quality water. The thresholds of significance are detailed in Section 4.2 above. The effluent concentrations of the constituents assessed were estimated based on current and planned future WWTP performance.

Existing background groundwater concentrations of chloride and arsenic exceed the MCL, the basin quality objectives and the projected effluent concentrations, so the effluent will not degrade the groundwater for these constituents at either site.

TDS in the both groundwater and the projected effluent discharge exceed the MCL recommend standard for drinking water and the basin quality objectives at both sites, however, the groundwater concentration is higher than the projected effluent concentration and there will be no further groundwater degradation as a result of the proposed discharge.

Where the quality of the receiving water for a particular constituent of concern is unknown, due to there being insufficient information to make a determination, it is assumed to be of high quality and is addressed accordingly. Each constituent of concern is addressed in more detail in Section 7.2 below.

7.1 Method of Reclamation

Effluent from the new WWTP will be pumped to one of several disposal/re-use sites, which include:

- Percolation/evaporation ponds at the NAWS WWTP site
- Irrigation of the China Lake Golf Course at NAWS
- Irrigation of the alfalfa fields owned by the City, at the City site
- New and existing percolation ponds at the City site.
- Future recycled water landscape and park irrigation.

The two irrigation sites will receive water during months when irrigation is agronomically necessary, and will receive only enough water to meet the agronomic needs of the grass and crops without over-watering. This water will be stored in ponds at the NAWS site and the City site. The balance of the effluent will percolate and evaporate from the pond complex on the NAWS and City sites. The application of effluent and fertilizers will be based on an Irrigated lands farm and nutrient management plan.

The shallow groundwater at the two sites is of slightly different character, and is governed by different basin quality designations, so each site is evaluated separately below.

7.2 Analysis of Impact of Proposed Reclamation on Identified Constituents of Concern for Groundwater

The groundwater analysis in **Tables 12 and 13** are used as the baseline for analysis of applications at all three sites (NAWS ponds, NAWS golf course and City site – ponds and alfalfa). The effects of individual constituents of concern are discussed below.

7.2.1 Total Nitrogen

Groundwater in the area of both the NAWS site and the City site appears to be of high quality for nitrate and nitrite. Nitrite is produced as an intermediate product in the biological nitrification process, and would only be present in the recycled water (above the detection limit) when partial nitrification of ammonia occurs. The aeration reactor design and corresponding mean cell residence time for the proposed WWTP will be designed to be sufficiently long to ensure that complete nitrification occurs prior to recycled water use.

The nitrate form of nitrogen will remain after nitrification but will then be removed by the treatment process through an anoxic step known as denitrification. Consequently, the resulting recycled water will contain low but measurable levels of ammonia and nitrate. Total Nitrogen (consisting mainly of Nitrates plus organic nitrogen) in the effluent will be <10 mg/L, below the applicable MCL and MUN BQO of 10 mg/l, but above the background, which ranges from 0.6 to 2.2 mg/L at the NAWS site and from 1.2 to 2.5 mg/L at the City site. The following sections break down the impacts to the two sites and separate the analysis by application method.

7.2.1.1 NAWS Percolation/evaporation Ponds

The receiving groundwater is overall a poor quality water. The nitrogen concentration of the effluent is expected to be <10 mg/L .The MUN beneficial use does not apply at the NAWS site. For the AGR beneficial use, there is no BQO numeric limit for nitrogen. Consequently, the impacts at this site are **Less Than Significant**. The “no project” alternative and Alternative 1 and 2 all have identical impacts.

7.2.1.2 City Percolation Ponds

The receiving water at the City site is high quality for nitrogen, with concentrations measured in the range from <1.2 mg/L to 2.5 mg/L, though it is overall a poor quality water. The MUN beneficial use applies at the City site. Under the current condition and the No Project alternative, no nitrogen is removed from the effluent by the WWTP process, and the concentration of nitrogen is and would remain above both the background. The average value of 9 mg/L is near the MCL, but test results range as high as 13.5 mg/L, making this a **Significant and Unavoidable** impact.

Due to the biological nitrogen removal process envisioned for the new WWTP, the nitrogen concentration of the effluent under both Alternative 1 and Alternative 2 is expected to be <10 mg/L, below the MCL of 10 mg/L, although it would remain measurably above the nitrogen concentration of the high-quality background, continuing to cause degradation. Although the degradation occurring would no longer tend to cause the groundwater to exceed the MCL for nitrogen, it will continue to increase concentration of nitrogen above background, which is a **Significant and Unavoidable** Impact.

It should be noted that the background remains of high quality even though the existing WWTP does not have biological nitrogen removal capability and effluent is currently

being disposed in the manner proposed for the Project. Alternative 1 and Alternative 2 will increase the number of percolation ponds over the "no project" alternative, but will not affect effluent flow rate, and will discharge effluent with reduced nitrogen, mitigating the impact to the greatest degree practical.

7.2.1.3 Nutrient Balance – NAWS Golf Course

In the current condition and under the No Project alternative, the nitrogen concentration in the effluent averages approximately 10 mg/L, which results in an annual application of 133 lbs/ac of nitrogen to the grass at the China Lake Golf Course, below the agronomic need of 225 lbs/ac for Bermuda grass, as listed in the Western Fertilizer Handbook, Table 4-1. The AGR beneficial use does not include a nitrogen limit, so this impact is considered **Less Than Significant**.

Under Alternative 1 and Alternative 2, the contribution of nitrogen from the recycled water is approximately 105 lbs/ac, a reduction but not a substantial change. The AGR beneficial use does not include a nitrogen limit, so this impact is considered **Less Than Significant**.

It should be noted that the irrigation of the golf course is already on-going in the current condition, and there will be no change in irrigation rate or practice under Alternative 1 or Alternative 2. Irrigation with recycled wastewater effluent is encouraged by state policy and is presumed to have a beneficial impact so long as other environmental regulations are met. The nitrogen removal proposed by the Project will mitigate the impact to the greatest degree practical. With proper nutrient management of the golf course, the turf grass will assimilate most nitrogen applied, thus minimizing its potential effect on groundwater.

7.2.1.4 Nutrient Balance – City Alfalfa Fields

In the current condition and under the No Project alternative, the nitrogen concentration in the effluent averages approximately 9 mg/L, which results in an annual application of 128 lbs/ac of nitrogen to the alfalfa at the City site, less than the agronomic need of 380 lbs/ac for alfalfa, as listed in the Western Fertilizer Handbook, Table 4-1. Under the No Project Alternative, Alternative 1 and Alternative 2, the contribution of nitrogen from the recycled water is much less than the 380 lbs/ac agronomic needs of the alfalfa. Effectively all nitrogen will be taken up and used by the growing crop and will not degrade the groundwater, so this impact is considered **Less Than Significant**.

It should be noted that the continued irrigation of the alfalfa field is part of the current condition and will continue without change to irrigation rate or practice in both Alternative 1 and 2. Irrigation with recycled wastewater effluent is encouraged by state policy and is presumed to have a beneficial impact so long as other environmental regulations are met. The nitrogen removal proposed by the Project will mitigate the impact to the greatest degree practical.

7.2.2 Boron

There are no numeric groundwater quality objectives for boron concentration for AGR-designated groundwater in the Lahontan basin. Water designated as AGR "…shall not contain concentrations of chemical constituents in amounts that adversely affect the water for beneficial uses." Crop sensitivity to boron varies from a low of 0.5 mg/L for the most sensitive crops to up to 15 mg/L for very tolerant crops. For example, alfalfa, a crop commonly grown in the Indian Wells Valley, is a tolerant crop that can be irrigated with water with a boron concentration of 4.0 to 6.0 mg/L. The most sensitive crops, including citrus, blackberries, stone fruits and grapes are not commonly grown in the area. The anticipated effluent quality of about 1.0 mg/L will allow for irrigation of all but very sensitive and sensitive crops.

There is no State or Federal MCL for boron; however the SWRCB DDW has a Notification Level (action level) of 1.0 mg/L. Notification levels are non-regulatory health based advisory levels established by DDW for chemicals in which MCLs have not been established. Though, assuming the groundwater quality is below 1.0 mg/L, this discharge may slightly degrade the presumed high-quality background, this impact will not impair the MUN beneficial use at the City site. At the NAWS, site there is no MUN beneficial use and therefore there is no drinking water impact. Because the effluent will have a boron concentration of about 1.0 mg/L, the use the effluent or the receiving groundwater for AGR will be limited, in the worst case, to irrigation of moderately sensitive and less sensitive crops that will tolerate 1.0 mg/L of boron and above. These impacts are considered to be **Less Than Significant**.

It is noted that for the NAWS site, there is no change in the quantity or quality of boron in the effluent and thus the impact of the proposed Alternatives 1 or 2 will be the same as the no project alternative. As boron enters the groundwater table, there will be limited mixing and transport of boron with the groundwater. The mixing will further dilute the boron concentration. Any potential degradation, however unlikely, would remain within both the AGR and MUN basin quality objectives. No additional mitigation measures are available.

7.2.3 Total Dissolved Solids (TDS)

7.2.3.1 NAWS Golf Course Reclamation Area

For analysis of potential impacts from recycled water use, it was estimated that recycled water from the WWTP will have a TDS of about 675 mg/L. For purposes of this analysis, the AGR water quality objective for TDS of 450 mg/L was used, though depending upon the crop the actual tolerance to TDS in the water can be higher or lower than that. The local groundwater at the NAWS site has a TDS concentration of 1,100 to 1,500 mg/L, much higher than many crops will tolerate.

With respect to effects on groundwater from the application of recycled water to the irrigation areas, other factors including evaporation, precipitation and dilution will affect the impact the recycled water has on groundwater TDS concentrations. The required infiltration rate needed to percolate the planned quantity of effluent over the acreage of

ponds available in less than 0.10 inch/day. Based upon percolation tests at the NAWS site, long-term percolation rates are expected to greatly exceed that value, at more than 1.0 inch/day. Average precipitation is 4.27 inches/year.

TDS in the percolate below the root zone will be multiplied as a result of the irrigation efficiency at the golf course site. Assuming 75 percent irrigation efficiency for sprinklers, the TDS in the deeper percolate will be multiplied by a factor of 4.0. An analysis of that effect is shown in **Table 14**.

7.2.3.2 City Alfalfa Reclamation Area

Recycled water from the WWTP will have a TDS of 640 mg/L. The MUN BQO is the MCL of 1000 mg/L, which is the upper limit for municipal water supply.

With respect to effects on groundwater from the application of recycled water to the irrigation areas, other factors including evaporation and precipitation will affect the impact the recycled water has on groundwater TDS concentrations. The required infiltration rate needed to percolate the planned quantity of effluent over the acreage of ponds available in less than 0.10 inch/day. Based upon percolation tests at the City site, long-term percolation rates are expected to greatly exceed that value, at more than 1.0 inch/day.

TDS in the percolate below the root zone will be multiplied by 4.0 as a result of the irrigation efficiency. An analysis of that effect is shown in **Table 14**.

Table 14. TDS in Percolate Below the Root Zone

	Golf Course	Alfalfa
Recycled Water Applied (acre-feet)	385.02	73.25
Effective Precipitation (acre-feet)	28.53	11.87
Total Water Applied (acre-feet)	413.55	85.12
Percentage Recycled	93%	86%
Percentage Precipitation	7%	14%
Recycled Water TDS (mg/L)	675	675
Precipitation TDS (mg/L)	0	0
Irrigation Efficiency	75%	75%
Local Shallow Groundwater TDS	1069	1069
Deep Percolation Groundwater TDS (mg/L)	2514	2323

The proposed reclamation will degrade the quality of the groundwater with respect to TDS, at both the NAWS golf course and at the City alfalfa fields. The concentrations of TDS in the groundwater leaving the root zone will exceed the AGR and MUN basin quality objectives for TDS. The addition of the TDS from the recycled water will increase the TDS of the groundwater above the basin quality objectives at both the NAWS and City sites, which are **Significant and Unavoidable** Impacts.

This impact occurs wherever groundwater or surface water is used for irrigation and is unavoidable wherever evapo-transpiration exceeds available precipitation. The impact is the same for the current condition as it is for Alternative 1 and 2. Irrigation with recycled wastewater effluent is encouraged by state policy and is presumed to have a beneficial impact so long as all other environmental regulations are met. No practical mitigation for this impact is available.

7.2.3.3 NAWS Percolation/Evaporation Ponds

Effluent from the WWTP will have a TDS of 675 mg/L. The AGR beneficial use objective of 450 mg/L was used as the applicable water quality standard. The concentrations of TDS in the groundwater exceed the agricultural quality objective for TDS. However, the shallow groundwater does not meet beneficial use objectives, and in fact is not used at all. The concentration of TDS in the effluent, while exceeding the agricultural objective, is still less than the TDS concentration in the groundwater beneath the NAWS site (1,360 mg/L) and will not cause degradation. Therefore this is a **Less Than Significant** Impact.

7.2.3.4 City Percolation Ponds

Effluent from the WWTP will have a TDS of 675 mg/L. The MUN beneficial use objective of 1000 mg/L was used as the applicable water quality standard. The concentration of TDS in the groundwater is less than the Basin Quality Objective for TDS at the City site. The shallow groundwater meets the beneficial use objectives, at 760 mg/L TDS. The concentration of TDS in the effluent is less than the secondary MCL upper limit and less than the TDS concentration in the groundwater beneath the City site and will not cause degradation. Therefore this is a **Less Than Significant** Impact.

7.2.4 Total Coliform

There is no data available to determine if groundwater in the area is of high quality for total Coliform organisms. As noted above, the recycled water will not be disinfected as part of the wastewater treatment process. However, percolation to groundwater has a natural disinfection effect. Percolation through more than approximately 100 feet of soil in route to the shallowest groundwater, as at the City site, provides necessary time for pathogens to be destroyed in the anoxic subterranean environment. Accordingly the effective Coliform concentration when the effluent reaches the shallow groundwater at the City site is expected to be at or below background and no degradation is anticipated, making this a **Less than Significant** impact at the City site.

At the NAWS site, with an AGR beneficial use, there is no coliform objective and the discharge will not cause degradation. Therefore this is a **Less Than Significant** impact.

It is noted that this discharge occurs in the current condition. Chemical disinfection performed locally by the Navy prior to irrigating the golf course will effectively remove Coliform from both the golf course percolate, mitigating potential degradation.

7.3 Summary of Analysis

The proposed operation represents a continuation of the City's WWTP effluent disposal that has been going on for more than fifty years. Additional disposal sites are being considered, to add capacity, and proposed treatment performance will result in higher-quality effluent particularly with respect to nitrogen removal.

Most of the constituents in the local groundwater meet the MCL requirements, but the groundwater is considered of poor quality for chloride, TDS and arsenic. With the following exceptions, the effluent produced by the treatment plant is of higher quality than the groundwater and will not degrade the quality of the existing groundwater. The impacts for all these constituents are considered to be **Less Than Significant**.

In the current condition and under the No Project Alternative, nitrogen is not and will not be removed from the WWTP effluent, yet the average effluent concentration is at or just above the MCL. While that doesn't matter at the NAWS site where the AGR beneficial use is in place, at the City site subject to the limits of the MUN beneficial use this results in degradation of a high-quality background, which is a **Significant and Unavoidable** impact. Under Alternative 1 and Alternative 2 design of the new WWTP will include nitrogen removal, to concentration levels below the MCL but above the concentration found in the groundwater. This application of the best available technology for nitrogen removal will improve the current situation, reducing the nitrogen concentration of the effluent below the MCL, though there will still be degradation of the groundwater with respect to nitrogen. Because of degradation of a high-quality groundwater at the City site, this impact is determined to be **Significant but Unavoidable**.

The anticipated boron concentration of the effluent is 1.1 mg/L. The concentration of boron in the source municipal water ranges from 0.18 to 2.1 mg/L, according to reporting from the IWVWD, the City's water purveyor. Shallow groundwater concentrations have not been tested, so are presumed to be of high quality with respect to Boron at both the NAWS and City sites. The most representative effluent concentration for boron comes from testing done in the existing Pond #3, which is tested semi-annually. Boron concentrations vary but have averaged just over 1.0 mg/L. There is no numeric objective for boron concentration for AGR-designated groundwaters in the Lahontan basin. The maximum concentration from moderately-sensitive agriculture is 2 mg/L. There is no State or Federal MCL for boron; however there is a State Notification Level of 1 mg/L. The average effluent concentration is just below these levels. Though this discharge may slightly degrade the presumed high-quality background, this impact is considered to be **Less Than Significant**.

Total dissolved solids (TDS) will not meet the most stringent agricultural water quality objectives after treatment, but will meet the MUN BQO upper limit of 1000 mg/L. The effluent TDS concentration will be substantially less than the groundwater TDS concentration at both the NAWS site and the City site. Therefore, no further degradation of the groundwater will take place as a result of effluent percolation at the City WWTP and NAWS ponds, and the impact is considered **Less Than Significant**.

When the effluent TDS concentration is increased in the root zone by evapo-transpiration during irrigation, of the golf course at the NAWS site or the alfalfa fields at the City site, the concentration in the percolate will be higher than the background at both the NAWS and City sites. These impacts are determined to be **Significant but Unavoidable**.

It is noted that these effects are unavoidable impacts of irrigation. However, there is no change from the no project alternative with either Alternative 1 or 2. As noted, State policy encourages irrigation with wastewater effluent and it is presumed to be beneficial so long as other environmental regulations are met.

The proposed WWTP will not disinfect effluent. Natural disinfection resulting from subsurface transport down through the soil will effectively remove Coliform from both the incidental percolate and the alfalfa percolate at the City WWTP site, resulting in **Less Than Significant** impacts for Coliform at this location.

At the NAWS site, chemical disinfection performed locally by the Navy prior to irrigating the golf course will effectively remove Coliform from both the golf course percolate, resulting in **Less Than Significant** impacts for Coliform at that location.

The very shallow groundwater at the NAWS site may not provide sufficient underground transport for full natural disinfection of the incidental percolation at the NAWS ponds. However, the AGR beneficial use has no WQO for Coliform bacteria. There is no change from the current condition. This impact is considered **Less than Significant**.

8 CONCLUSION

The SWRCB Recycled Water Policy says that “The Regional Water Boards shall, absent unusual circumstances…, permit recycled water projects that meet the criteria set forth in this Policy…” This project does not impact the existing or potential future beneficial uses of the receiving water, and is therefore in compliance with Resolution No. 68-16.

Based on the water quality assessment, the project will degrade some high quality waters in certain respects, which is a mandatory finding of significance. However, it will not affect present and anticipated beneficial uses of the water, and will not result in water quality less than the prescribed water quality objectives, except where such water is already present.

The impact of the proposed effluent disposal upon water quality is considered to be **Significant and Unavoidable** with respect to nitrogen and TDS but not significant with respect to other water quality parameters. These impacts result from irrigation and concentration of salts within the root zone. The impacts are small and incremental and will not affect the MUN or AGR beneficial uses. It should be noted that irrigation with wastewater effluent is encouraged by State policy and that concentration of salts in and below the root zone is an unavoidable consequence of irrigation when evapo-transpiration exceeds precipitation.