Big Bear Area Regional Wastewater Agency

Replenish Big Bear

REPLENISH
Big Bear

WaterSMART: Title XVI Feasibility Study

Prepared for:

BIG BEAR AREA REGIONAL WASTEWATER AGENCY
BBARWA
SINCE 1974

Prepared by:

WSC
WATER SYSTEMS CONSULTING, INC.

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LIST OF TERMS, ACRONYMS AND ABBREVIATIONS

Acronym, Term or Abbreviation	Definition
AF	Acre Foot
AFY	Acre foot per year
Agency Team	BBARWA, BBCCSD, BBLDWP, and BBMWD
APE	Area of Potential Effect
Basin	Big Bear Valley Groundwater Management Zone
Bay-Delta	Sacramento-San Joaquin Delta
BBARWA	Bear Area Regional Wastewater Agency
BBCCSD	Big Bear City Community Services District
BBLDWP	City of Big Bear Lake, Department of Water and Power
BBMWD	Big Bear Municipal Water District
BO	Biological Opinion
BVBGSA	Bear Valley Basin Groundwater Sustainability Agency
CDFW	California Department of Fish and Wildlife
CDM	Camp Dresser & McKee, Inc.
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
CHRIS	California Historical Information System
CNDDB	California Natural Diversity Database
COD	Chemical Oxygen Demand
CVP	Central Valley Project
DAC	Disadvantaged Community
DDW	California Division of Drinking Water
DWR	Department of Water Resources
EA	Environmental Assessment
EDU	Equivalent Dwelling Unit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAT	Full Advanced Treatment
FONSI	Finding of No Significant Impact

Acronym, Term or Abbreviation	Definition
GHG	Greenhouse Gas
Gpd	Gallons Per Day
GSP	Groundwater Sustainability Plan
HRI	Historical Resources Inventory
IDE	IDE Technologies
I/I	Infiltration and Inflow
IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
Lake	Big Bear Lake
LEED	Leadership in Energy and Environmental Design
LV Site	Lucerne Valley Site
MF	Microfiltration
MGD	Million Gallon per Day
MHI	Median Household Income
MMRP	Mitigation Monitoring and Reporting Program
Mutual	Bear Valley Mutual Water Company
NEPA	National Environmental Policy Act
NOP	Notice of Preparation
NPDES	National Pollution Discharge Elimination System
O&M	Operation and Maintenance
PEIR	Program Environmental Impact Report
Reclamation	United States Bureau of Reclamation
RGSP	Regional Groundwater Sustainability Project
RO	Reverse Osmosis
ROWD	Report of Waste Discharge
RWMP	BBARWA Recycled Water Master Plan
RWQCB	California Regional Water Quality Control Board
SDAC	Severely Disadvantaged Community
SEIR	Supplemental Environmental Impact Report
SGMA	Sustainable Groundwater Management Act
SHPO	California State Historic Preservation Office

Acronym, Term or Abbreviation	Definition
SWP	State Water Project
TDS	Total Dissolved Solids
TIN	Total Inorganic Nitrogen
TMDL	Total Maximum Daily Load
TOT	Transient Occupancy Tax
TP	Total Phosphorous
UF	Ultrafiltration
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
UWMP	Urban Water Management Plan
Valley	Big Bear Valley
Valley District	San Bernardino Valley Municipal Water District
WDR	Waste Discharge Requirement
WQO	Water Quality Objective
WSC	Water Systems Consulting, Inc.
WWTP	Wastewater Treatment Plant

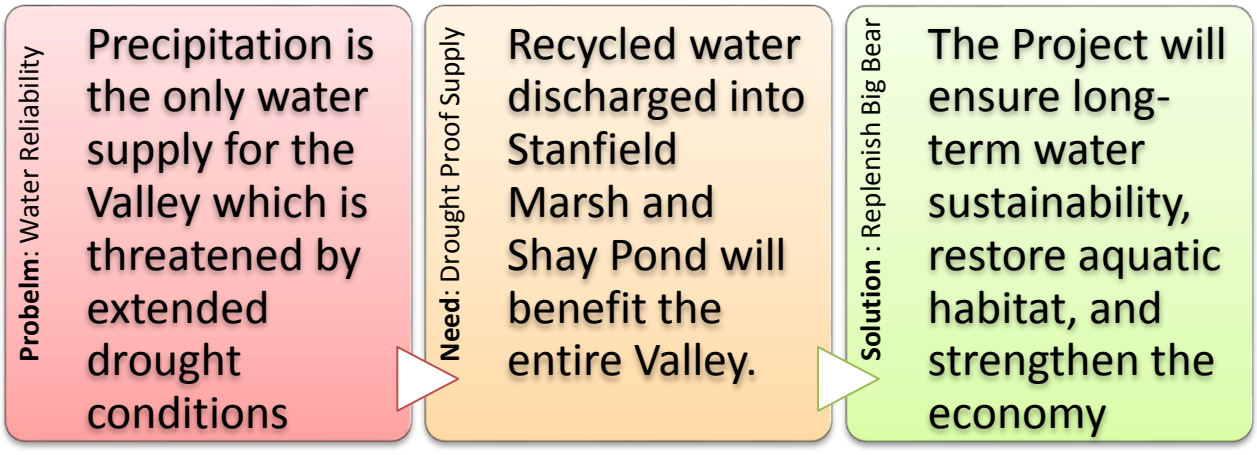
EXECUTIVE SUMMARY

This feasibility study report for the Replenish Big Bear project, prepared by Big Bear Area Regional Wastewater Agency (BBARWA), the non-Federal project sponsor, is submitted for the United States Bureau of Reclamation's (Reclamation) consideration in response to the requirements of the WaterSMART Title XVI Water Reclamation and Reuse Program (Title XVI). BBARWA is submitting this feasibility study on behalf of the Replenish Big Bear Agency Team (Agency Team), which includes BBARWA, Big Bear City Community Services District (BBCCSD), City of Big Bear Lake, Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA).

This feasibility study document layout aligns with WTR 11-01 Section 5 Requirements for a Title XVI Feasibility Study Report to help facilitate Reclamation's review. Note that not all required sections are applicable to the proposed Replenish Big Bear project. These sections remain in this document to confirm that they were considered but not applicable. Each section is summarized in this Executive Summary.

1 Introductory Information

In an effort to protect Big Bear Valley (Valley) and the Santa Ana River Watershed from the impacts of drought and variable precipitation, the Agency Team is advancing Replenish Big Bear; a recycled water project that will utilize a resource currently discharged outside of the watershed to secure a reliable and sustainable local water supply. Replenish Big Bear will diversify the region's drinking water supply portfolio and is a critical component in protecting the unique environment at the top of the watershed and strengthening the tourism industry that drives the recreation-based economy for a disadvantaged community.



Replenish Big Bear is located at the top of the Santa Ana River Watershed in the southwest portion of San Bernardino County, California. The Valley is entirely surrounded by the San Bernardino National Forest and includes an area of approximately 135 square miles within a 12-mile long valley. Surrounded by mountain ridges and rugged slopes, land surface elevations range from 6,000 feet to 9,900 feet. There are many biological resources within the Valley including forests, streams, lakes, meadows, unique

animals, and plants. Some of the protected animals include the Bald Eagle, Southern Rubber Boa, Southwestern Willow Flycatcher, Unarmored Threespine Stickleback fish, and the San Bernardino Flying Squirrel.

Currently, the sole source of potable water in the Valley is groundwater from the unadjudicated Big Bear Valley Groundwater Management Zone (Basin). The Basin lies in the northeastern portion of the Santa Ana River Watershed and is approximately 14 miles long from east to west and 7 miles wide from north to south. Natural precipitation provides the sole source of water supply for the Valley, and is relied on for potable groundwater supplies, replenishing the regions surface waters and lakes, and supporting the rare and diverse habitat and species in the Valley. The primary lake in the Valley is Big Bear Lake (Lake) which receives most of the region's surface water drainage. The Lake has a surface area of approximately 10 square miles with 23 miles of shoreline and is hydrologically connected to the Stanfield Marsh Wildlife and Waterfowl Preserve. The Lake empties on the west into Bear Creek, which is a tributary of the Santa Ana River.

The Valley is home to approximately 23,000 full time residents and is designated as a Disadvantaged and Severely Disadvantaged Community by the State of California Department of Water Resources (DWR). The area is primarily residential but experiences an influx in population from vacationers enjoying the four-season recreational facilities and activities within the Valley. Tourism is the main industry and is the economic lifeblood for the region. Resorts within the Valley offer opportunities for skiing, snowboarding, biking, and golf while Big Bear Lake provides opportunities for fishing, water sports and wildlife viewing. The National Forest provides additional opportunities for outdoor recreation, such as hiking and camping. The Valley is also recognized as an ecological hotspot, known for its year-round habitat for waterfowl and for the high number of plant species known only to this area. The natural resources of the Valley are an ecological asset as well as an essential element of the local economy. The diverse habitat and wildlife in the region are directly linked to the region's tourism industry and are dependent on consistent water supplies.

Replenish Big Bear encompasses the entire Valley, spanning the collective service areas of the Agency Team as shown in Figure 0-1. BBARWA provides wastewater treatment and disposal for the entire 79,000 acres within the Valley. The wastewater treatment plant (WWTP) is served by three separate collection systems that are maintained by the City of Big Bear Lake, BBCCSD, and the County of San Bernardino. BBCCSD's water service area includes Big Bear City and portions of San Bernardino County. BBCCSD's wastewater collection area includes Big Bear City and portions of unincorporated communities. BBLDWP provides water services to the City of Big Bear Lake as well as some unincorporated communities. The City of Big Bear Lake provides wastewater collection services within the city. BBMWD is responsible for the overall management of the Lake. The BVBGSA is a Joint Powers Authority (JPA) comprised BBLDPW, BBCCSD, BBMWD and BBARWA and its service area coincides with the service areas of the member agencies. The BVBGSA is tasked with sustainable management of the Basin's groundwater resources.

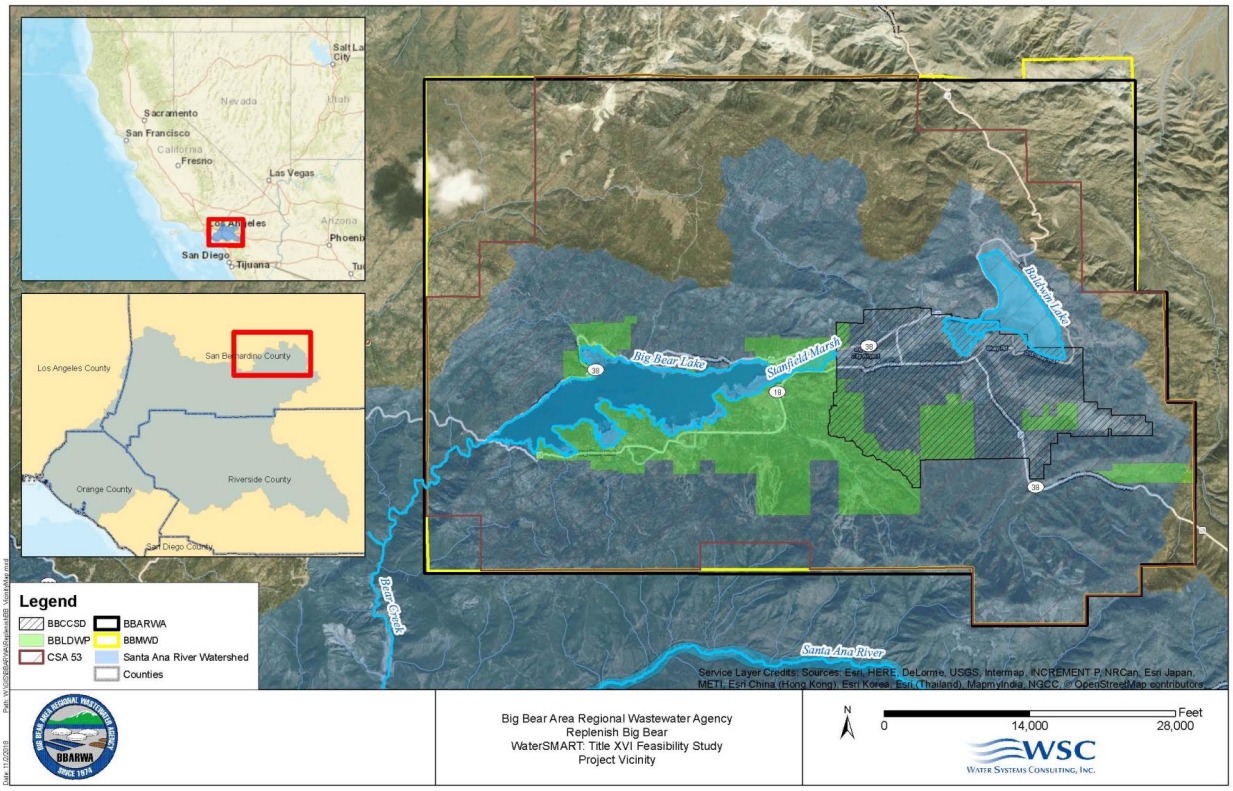


Figure 0-1. Replenish Big Bear Project Area

2 Statement of Problems and Needs

The current water cycle in the Valley is broken. Natural precipitation provides the sole source of water supply for the Valley which flows into the Lake or soaks into the ground to become groundwater. Water is then pumped from the Basin, used by the Big Bear community, then treated and ultimately disposed of outside the watershed. In the absence of Replenish Big Bear, approximately 2,466 AF of water will continue to be pumped out of the watershed annually, which could be treated and put to beneficial use within the Valley.

A long-term decline in precipitation trends and extended drought conditions have resulted in a significant range of impacts in the Valley. The Santa Ana River watershed has been declared primarily in a state of extreme and severe drought, or abnormally dry over the last four years and it is anticipated that future droughts will be longer and drier. Replenish Big Bear has been developed to provide a supplemental water source to expand the existing water supply portfolio and provide a drought proof source of water that results in widespread benefits despite changing weather patterns. Problems that the Valley faces which are driving Replenish Big Bear are detailed below.

Potable Water Supply

Groundwater provides the only potable water supply in the Valley. The estimated storage capacity of the Basin is 42,000 AFY, with a perennial yield of approximately 4,800 AFY. Local water agencies do not have

surface water rights, and imported water is not available due to the lack of infrastructure to the Valley's high elevation and isolated location. Therefore, the local water supply is extremely vulnerable to the timing and amount of precipitation, the ability of the region to recharge groundwater supplies, and the amount of pumping that occurs in the basin. BBLDWP and BBCCSD have implemented multiple water conservation incentive programs to reduce groundwater usage; however, the Agency Team recognizes that additional efforts are needed to provide a reliable and sustainable water supply resilient to future changes.

The projected water demands for BBLDWP and BBCCSD service areas are presented in Table 0-1. In addition, there are numerous wells throughout the Basin serving properties that are not connected to a public water system. Estimates do not include water used from private wells, which was estimated to be approximately 169 AFY. The Basin is not in overdraft and current projections show that groundwater will be able to provide adequate future supplies. However, future unknown climatic conditions, such as extended drought scenarios could affect the reliability of groundwater supplies. Implementation of Replenish Big Bear will keep approximately 2,466 AFY of water from leaving the watershed each year and provide a drought proof high quality water supply to enhance recharge of the Basin. Expanding the region's water supply portfolio will reduce the Valley's vulnerability to future drought conditions.

Table 0-1. Water Demand Projections for Bear Valley Water Agencies (AFY) (1) (2)

Water Agency	2015	2020	2025	2030	2035
BBLDWP	2,095	2,169	2,246	2,326	2,408
BBCCSD	940	1,163	1,220	1,281	1,344
Total	3,035	3,332	3,466	3,607	3,752

Habitat Vulnerability

Variable precipitation and extended droughts result in strenuous habitat conditions that impact the local wildlife. Key wildlife habitat in the Valley that are significantly impacted by fluctuations in precipitation include the Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), Lake, and Shay Pond.

The Stanfield Marsh is a scenic 145-acre nature park that includes a gazebo, walking paths, and two boardwalks that extend out into the marsh, so visitors can observe the wildlife. The Stanfield Marsh is home to rare and diverse species of birds, fish, amphibians, and mammals. Rainfall and snowmelt are the only sources of water for the Stanfield Marsh, so the water level varies from season to season and throughout longer hydrologic cycles. During wet periods, the Stanfield Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, the boardwalks extend over dry soil, and the wildlife become scarce. In the last 15 years, Stanfield Marsh has been less than half full nearly 40 percent of the time. High quality recycled water from the Replenish Big Bear project would provide a new 1,870 AFY drought proof source of inflow to sustain marsh habitat even during dry periods.

The Lake has seen extremely low levels in the last 15 years and currently is 18'1" below full as of December 2018, which is less than 40% full. Preliminary model analysis performed by BBMWD indicates that new inflow into the Lake from Stanfield Marsh could increase water levels by as much as 5 feet in dry years. Increased Lake levels and more wetted shoreline will improve aquatic and riparian habitat. In addition, the increased inflow will provide BBMWD additional flexibility in managing Lake releases to benefit habitats within the Valley as well as downstream.

Shay Pond provides habitat for the federally and state listed endangered Unarmored Threespine Stickleback (Stickleback) fish. This population of Stickleback is unique in that it occurs at a high elevation, about 6,700 ft. above sea level, while all other Stickleback populations inhabit streams below 3,000 ft. Shay Pond is fed by several springs; however, water flows vary substantially from year to year. In 1985 and 1986, a catastrophic mortality of Stickleback in Valley occurred due to insufficient amounts of water. By the summer of 1990, it was thought that the Stickleback remained in only Shay Pond. In accordance with the United States Fish and Wildlife Service (USFWS) requirements, BBCCCSD discharges approximately 80 AFY into Shay Pond to maintain the fish population. Potable water discharged to Shay Pond represents approximately 9% of BBCCSD's customer water demand which could potentially be supplied by recycled water. Replenish Big Bear has been developed to improve habitat conditions for the endangered Stickleback and recover a potable water supply for alternative use.

Recreation-Based Economy

The Valley is Southern California's premier four-season recreational playground drawing more than 7 million visitors annually. Recreation opportunities that drive the economy include but are not limited to: boating, fishing, camping, hiking, mountain biking, wildlife viewing, skiing, biking, and golfing. Recreation opportunities then strengthen the lodging, and service industries in the Valley. Recreational activities are dependent on the amount of precipitation received. Variable precipitation and drought conditions have resulted in impacts to surface water levels in the Lake, wildlife populations, and snow pack which ultimately impact the tourism industry. When surface water levels are low in the summer, there is a reduction in boater activities on the Lake which impacts BBMWD as well as the wide range of industries that service the tourists. In the winter, reduced snowfall from droughts and the impacted ability of the local Resorts to make snow from water stored in the Lake results in less tourists and a significant impact to the local economy.

It is imperative that water supplies are managed to maximize beneficial use in the region and limit any loss of the resource from the watershed. Impacts to the local potable supply, environment and economy could escalate if left unaddressed.

3 Water Reclamation and Reuse Opportunities

Currently, wastewater generated within the Valley undergoes preliminary and secondary treatment at the BBARWA WWTP and is then discharged outside of the watershed to irrigate alfalfa fields in the Lucerne Valley, located approximately 20 miles north of the Valley. The WWTP is located on a 93.5-acre lot in the east side of the Valley, and has a 4.9 million gallon per day (MGD) capacity. In 2016, the WWTP treated approximately 1.9 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake and

CSA 53 in Fawnskin. The average daily flow from 2007 to 2016 (which included a wet and dry cycle) was approximately 2.2 MGD and the maximum month flow was 5.5 MGD. Wastewater generated in the Valley and treated at BBARWA's WWTP is the only source of water that can be reclaimed in the Valley.

There is a long history of exploring water reuse opportunities in the Valley to keep this valuable resource within the watershed. Types of reuse considered include wildlife habitat, landscape irrigation, surface water discharge, groundwater recharge, and recreation. Water reuse opportunities in the Valley were first investigated in 1964 and evaluations have continued intermittently since BBARWA was formed in 1974. In 1980, use of recycled water for crop irrigation began in the Lucerne Valley began.

In 2006 efforts to develop a recycled water program in the Valley culminated with the development of the BBARWA Recycled Water Master Plan (RWMP), and the Program Environmental Impact Report (PEIR). Alternatives evaluated included non-potable reuse for irrigation, industrial, commercial, and construction use; environmental uses; and groundwater recharge through surface recharge basins. The RWMP recommended a phased implementation of a recycled water program that included both non-potable reuse and groundwater recharge at the Greenspot Recharge Site in the Erwin Lake area. However, ultimately the BBARWA Board decided not to approve the implementation of a recycled water project at that time.

In 2016, the Recycled Water Facilities Planning Study (2016 Study) was prepared which updated the market analysis performed in the 2006 RWMP. The 2016 Study evaluated the types of reuse which included: landscape irrigation, fish hatchery supply, surface water discharge, groundwater recharge, and direct potable reuse. The 2016 Study concluded that groundwater recharge at two different recharge sites (Greenspot and Sand Canyon) was the best alternative due to a lower unit cost relative to the other alternatives and higher volume of water retained in the Valley. The availability of high-quality recharge water would benefit the Valley by providing a supplemental drought proof source of supply during future extended drought periods. However, continuous large volumes of recharge water are not needed to sustain local groundwater supplies at this time and the Agency Team determined that a recycled water project that only recharged the groundwater basin did not provide enough benefit to warrant the high cost.

Based on the 2016 Study findings and stakeholder collaboration, additional water reuse alternatives were analyzed that would provide more widespread benefits to the Valley. The goal of the 2018 Bear Valley Lake Alternative Evaluation (2018 Study) was to build on information developed during prior recycled water alternative studies and identify a project that augmented natural recharge for water supply sustainability, protected the rare and diverse habitat and species in the Valley and promoted a thriving community and economy through enhanced recreation. The 2018 Study specifically investigated the proposed Replenish Big Bear project.

A key consideration in the development of any recycled water project is the required quality and treatment level of the recycled water as established by the various permitting agencies and State Regulations. In order to recharge the groundwater basin or discharge recycled water to surface waters, the recycled water must meet the water quality objectives set by the Basin Plan. The Basin Plan provides

a general narrative regarding the water quality objectives for each water body type and specific numeric objectives for TDS, hardness, sodium, chloride, total inorganic nitrogen (TIN), total phosphorous (TP), sulfate, and chemical oxygen demand (COD). The water quality objectives for the Valley are summarized in Table 0-2. As shown, the water quality objectives for Big Bear Lake are the most stringent of the Replenish Big Bear proposed discharge points and will therefore govern the treatment upgrades required for the project.

Table 0-2. Basin Plan Water Quality Objectives

Water Body	TDS	Hardness	Sodium	Chloride	TIN	Sulfate	COD
Inland Surface Streams							
Rathbone Creek	300	-	-	-	-	-	-
Lakes and Reservoirs							
Big Bear Lake	175	125	20	10	0.15	10	-
Wetlands (Inland)							
Stanfield Marsh (Narrative Objectives)	-	-	-	-	-	-	-
Groundwater Management Zones							
Big Bear Valley	300	225	20	10	5	20	-

In addition to the numeric and narrative water quality objectives, Big Bear Lake is subject to a Total Maximum Daily Load (TMDL) numeric target of 35 µg/L-P for total phosphorus during dry hydrologic conditions, per Resolution No. R8-2006-0023. By 2020, the total phosphorus numeric target must be achieved at all times.

The nutrient limits for an NPDES permit to Big Bear Lake are expected to align with the Basin Plan water quality objectives and the TMDL numeric targets to protect the beneficial uses of the lake. The anticipated effluent nutrient limits of 35 µg/L-P for total phosphorus and 0.15 mg/L-N for total inorganic nitrogen would require multiple process steps and consistent treatment through seasonality. However, the Agency Team is currently coordinating with the Regional Board to identify the appropriate permitting process and evaluate the potential to receive alternative discharge limitations.

Based on initial discussions with the SWRCB Division of Drinking Water (DDW), this project would not likely be considered a Surface Water Augmentation project because the Lake is not used directly as a drinking water source and the environmental buffer between the discharge point and downstream uses is extremely large. Additional coordination with DDW will be conducted to verify the permitting strategy and the technical analysis that may be required to support DDW's determination.

Key regulatory requirements for groundwater recharge include recycled water concentration, minimum travel time and pathogen control. The groundwater replenishment regulations in Title 22 require that the initial concentration of filtered and disinfected tertiary recycled water (Recycled Water Concentration or RWC) not exceed 20% of the total recharge water, which requires 80% of the total recharge water to come

from other high-quality water sources for blending. Surface water in the Lake would be used to meet this requirement for Replenish Big Bear.

The Groundwater Recharge Regulations require a minimum "response retention time" or minimum groundwater travel time of two months between the point of surface application or injection, and the point of extraction. Preliminary analysis shows that the recharge water at Sand Canyon will reach the nearest production well (Sheephorn Well) in a little more than approximately 13 months. Based on data assumptions and the analysis conducted, retention times will be more than the minimum 2 months at Sand Canyon.

Pathogen controls include specific provisions for log reduction of microorganisms and treatment process requirements. The treatment process used to treat recharge water for a groundwater replenishment reuse project must provide treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction from raw sewage to usable groundwater. 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 1.0-log reduction. If the treatment process itself does not achieve the required pathogen control credits, additional credit can be gained through underground retention time prior to extraction.

4 Description of Alternatives

The Agency Team is committed to advancing the project and a significant investment in time, money, and effort is already being expended to implement the regional project. In order to fund Replenish Big Bear, the Agency Team intends to leverage local funds along with state and federal funds. The Agency Team has formed a JPA and has committed to sharing costs to advance the projects planning, preliminary engineering, and required documentation to satisfy the California Environmental Quality Act (CEQA)/ National Environmental Policy Act (NEPA) requirements. Each agency budgeted $250,000 for a total of $1,000,000 in FY 2018 to begin this work and intends to budget additional funds in FY 2019 to continue developing the project. Details regarding ultimate cost sharing between members of the Agency Team for additional fixed and variable recycled water project costs have not been determined at this time; however, the Agency Team will continue to collaborate and develop the governance structure as the Replenish Big Bear planning phase advances.

The Agency Team's goal is to implement a project that that recovers water discharged from the BBARWA WWTP outside the watershed and keeps the resource in the Valley for beneficial reuse. This goal will be achieved through development of a multi-benefit water reuse project that:

- Augments natural recharge for water supply sustainability
- Protects the rare and diverse habitat and species in the Valley
- Promotes a thriving community and economy through enhanced recreation

Replenish Big Bear includes planning, design, permitting and construction of Advanced Treatment Facility upgrades, conveyance infrastructure for product water and brine, and monitoring wells to supply advanced purified water to benefit the Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), Big Bear Lake (Lake) water levels, Federally listed Unarmored Threespine Stickleback fish (Stickleback) in Shay Pond, increase groundwater recharge at Sand Canyon, increase stored water supplies as snow, and improve downstream surface water management in the San Bernardino Basin. The project will provide the Valley with a new drought proof water supply by utilizing a resource that is currently discharged outside the watershed. In addition, the project will enhance habitat resiliency to benefit the unique local flora and fauna and strengthen the regions tourism industry.

Project Description

Replenish Big Bear requires upgrades to BBARWA's existing wastewater facility to meet the water quality objectives identified for Big Bear Lake in the Santa Ana Basin Plan. Inorganic nitrogen and phosphorus must be removed through multiple in-series processes because a single process cannot reliably reduce effluent TIN and TP concentrations to the levels required for Big Bear Lake's WQOs. To achieve these strict effluent limits, it is anticipated that BBARWA will need to implement a series of upgrades to existing unit processes and integrate new unit processes, specifically:

- Upgrade the extended aeration process through retrofit of the existing oxidation ditches to optimize biological nitrification-denitrification (NDN) and phosphorus removal.
- Nutrient-laden liquid sidestreams, which are produced during solids handling processes, may require management or treatment due to the potential negative impacts of returning high nutrient loads to other unit processes.
- Retrofit or operational modifications to secondary clarifiers for settling of phosphorus precipitates.
- Addition of an NDN process to reduce inorganic nitrogen concentrations.
- Low pressure filtration, such as microfiltration (MF) or ultrafiltration (UF), to reduce flocculated or colloidal solids upstream of the reverse osmosis (RO) process.
- RO to reduce TDS concentration and nutrient concentrations. The assumed operational recovery for the RO system is 90% of the design flow.
- Addition of ultraviolet (UV) disinfection to deactivating any bacteria, viruses, and other microorganisms.

The design capacity of the treatment upgrades is assumed to be 2.2 mgd, which corresponds with the 10-year average annual flow. Based on a preliminary sizing analysis, increased treatment capacity results in only a marginal increase in yield and does not provide an appreciable increase in economic or environmental benefit. It is assumed that any flows in excess of 2.2 mgd would be treated to a secondary level and discharged to the LV Site, similar to the existing discharge method. A preliminary analysis based on monthly flows for the 10-year period from 2007-2016 indicates that the average secondary effluent available will be approximately 1.93 mgd, or 2,160 AF. Based on a 90% recovery rate, the average recycled water production would be 1.74 mgd, or approximately 1,950 AFY. The design capacity and RW

production estimates will be refined during the preliminary and final design phases based on more detailed flow data and actual MF and RO recovery rates.

Recycled water is planned to be discharged continuously to Shay Pond and Stanfield Marsh; therefore, it will not be necessary to store recycled water at the WWTP. It is anticipated that a new effluent pump station will be required to pump recycled water to both Shay Pond and Stanfield Marsh. The pump station capacity will match the capacity of the recycled water system, which is 2.2 mgd, or approximately 1,530 gpm. Conveyance of recycled water to Shay Pond will occur through an existing 6-inch C-900 PVC pipeline that begins at the intersection of Shay Road and Palomino Drive and terminates near Shay pond. An extension of the pipeline by approximately 710 feet will be required to reach the Shay Pond discharge location. Conveyance of recycled water to Stanfield Marsh requires construction of a new 12-inch pipe from the WWTP to the proposed discharge point which is a length of approximately 19,940 feet.

When water is needed for recharge in Sand Canyon, it is anticipated that the Resort's existing snowmaking infrastructure will be used to transfer water into the existing storage pond located at Bear Mountain Ski Resort. The existing facilities are used primarily in the winter and are expected to be available for the proposed recharge operation, which would only occur in April – October when the resorts are not making snow. A new pump station will be constructed near the pond to convey water through a new pipeline to discharge into Sand Canyon. The pump station and pipeline are sized to convey 380 AF of recharge water over a 6-month period, which equates to approximately 470 gpm. Groundwater recharge at Sand Canyon will require construction of 2 monitoring wells that will be used to collect groundwater samples and monitor water quality in the area.

Existing infrastructure could be used by the Resorts to utilize excess Lake water during wet periods for snow storage and irrigation during the summer. The proposed Replenish Big Bear infrastructure is shown in Figure 0-2.

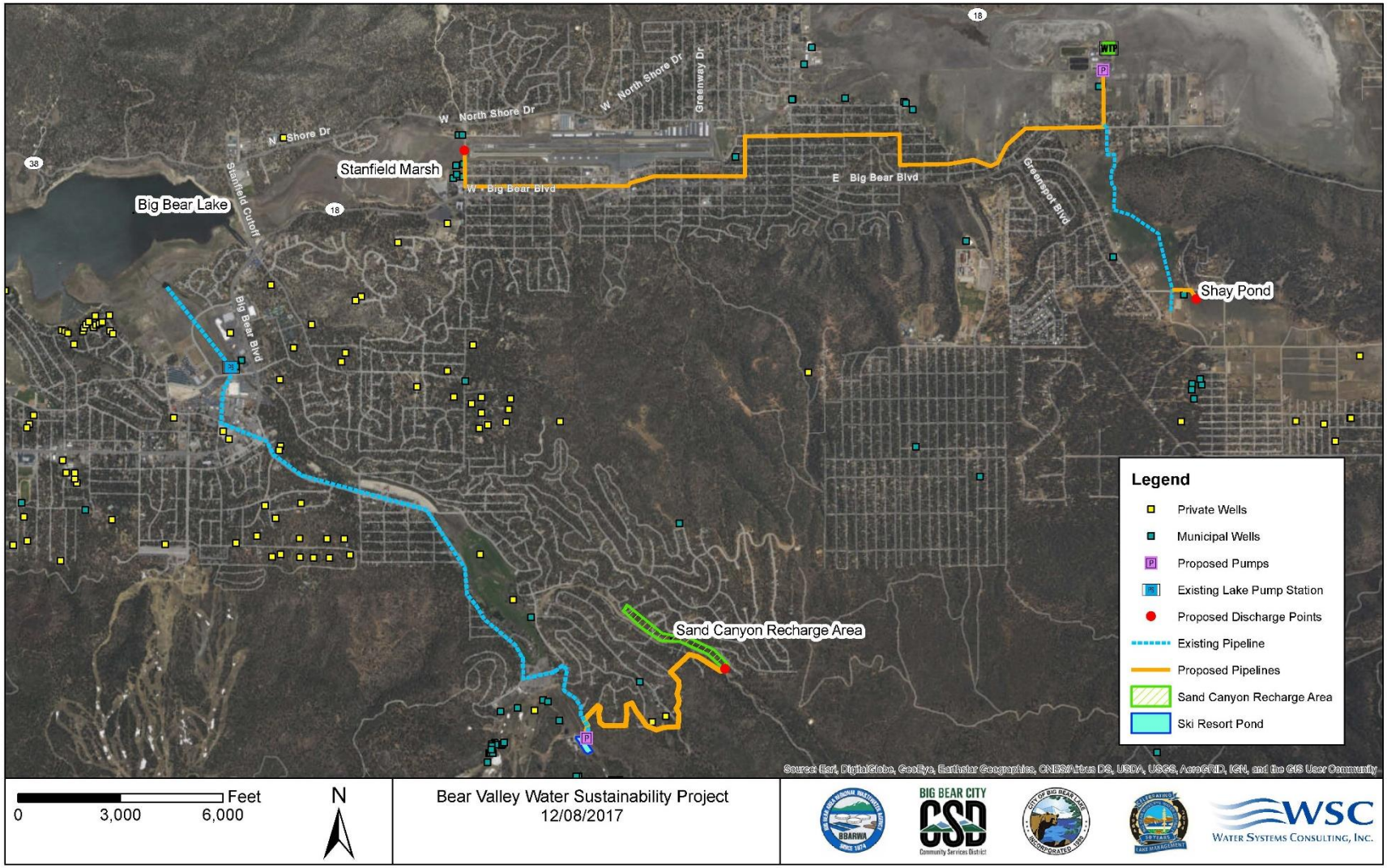


Figure 0-2. Proposed Replenish Big Bear Infrastructure

The preferred brine disposal option for Replenish Big Bear is solar evaporation ponds located at the LV Site. The full recycled water treatment capacity of 2.2 mgd was used for the brine disposal analysis to ensure sufficient disposal capacity if higher recovery rates are achieved or flows increase in the future. The estimated recovery of the RO process is 90%, so 10% of the treated flow, or 220,000 gallons per day (gpd), will be brine concentrate. The total evaporation pond area for 220,000 gpd was calculated to be 77.5 acres. The pipeline will also need to convey peak flows to the LV site and preliminary analysis shows that this will require infrastructure to store a minimum of 3 days of brine production. A brine pump station is required to empty the brine storage tank in 35 hours. This allows the brine storage to be emptied within the effluent storage window. Brine flows will ultimately be conveyed to the evaporation ponds through a new dedicated brine pipeline from the existing balancing reservoir site, which would be approximately 10,000 feet long.

Replenish Big Bear Cost Estimate

Capital and Operation and Maintenance (O&M) costs for the design, construction and operation of Replenish Big Bear are provided in Table 0-3. The 30-Year Net Present Value was calculated based on borrowing 100% of the project cost at a loan term of 30 years and a 5% interest rate. Cost estimate details based on calculated quantities and unit prices are provided later in this feasibility study.

Table 0-3. Replenish Big Bear Unit Costs

	Costs
Total Capital	$43,715,000
Annualized O&M	$2,397,000
Net Present Value (NPV)	$123,309,000
Yield	1,950 AFY
Cost/AF	$2,110

The Agency Team investigated water reclamation opportunities and alternatives for decades before electing to advance Replenish Big Bear. However, consideration will be given throughout the planning and design phase of the project to optimize or include additional project elements as determined necessary. Opportunities for project refinement or additional project elements that may be implemented include: alternative brine disposal location, brine concentration, effluent cooling, emerging recycled water technology, and additional conveyance infrastructure to Sand Canyon.

5 Economic Analysis

The Replenish Big Bear Agency Team has extensively investigated opportunities to improve the reliability of local water supplies and protect local resources. Non-recycled water project, recycled water projects, and a no project scenario have been analyzed and thoroughly considered. Non-recycled water alternatives include the import of SWP from the Lucerne Valley, and recycled water alternatives include landscape irrigation, and groundwater recharge. The project alternatives are briefly discussed below and Table 0-5 summarizes the unit costs and feasibility of each project.

Non-Recycled Water Alternatives

The Valley's location and elevation limits the viability of most water supply alternatives. Desalination alternatives are cost prohibitive because of the high expenses associated with water production, installing infrastructure to the Valley and the amount of pumping that would be required to this isolated location. Surface water alternatives are also not viable because Bear Valley Mutual retains ownership of all surface water inflow into the Lake through the 1977 Judgement. Importing SWP water is the only non-recycled water alternative that could potentially be implemented to improve supply reliability and diversity in the Valley.

In 2004, BBLDWP began evaluating the use of imported water as a supplemental water supply concept. Camp Dresser & McKee, Inc. (CDM) prepared a cost estimate in 2005 for a pipeline from Lucerne Valley to Big Bear Lake by way of the Morongo Pipeline. The most cost-effective path for the pipeline was determined to be along Highway 18. It was assumed in the study that 1,000 AFY of water would be conveyed to the Valley for the purposes of estimating costs for water purchase, treatment plant capital and operation and maintenance costs, and the pipeline and booster pumps capital and operation and maintenance costs. For the purposes of comparison, the capital and O&M costs assumed in the CDM analysis were escalated to the cost basis of the 2018 Study. The estimated unit cost for this imported water concept is $4,280/AF. However, the Big Bear agencies do not currently have supply contracts with any State Water Contractors and it may not be possible to secure them.

Recycled Water Alternatives

As previously noted, the 2016 Study updated the market analysis performed in the 2006 RWMP and is the most recent analysis of recycled water project alternatives to Replenish Big Bear. The 2016 Study evaluated landscape irrigation, fish hatchery supply, surface water discharge, groundwater recharge, and direct potable reuse. During an Alternatives Development Workshop with the Agency Team, recycled water project alternatives that were selected for further evaluation included landscape irrigation and groundwater recharge located at Greenspot, Sand Canyon, and both locations together.

Analysis of recycled water use for landscape irrigation began with an initial list of 55 potential users in the Valley compiled from the 2006 RWMP and additional users identified by stakeholders. This list was reviewed and ultimately refined to eliminate users that are no longer in existence or did not develop as expected; are anticipated to be closed in the near future; have low water demands; or are expected to be unwilling to convert to recycled water. The average of the annual consumption between 2011 and 2014 was used as the estimated recycled water demand. Where consumption records were not available, estimated demands from other studies were used. Depending on which RW distribution system segments are constructed, the beneficial use yield ranges from 54 – 231 AFY and the estimated cost for the most cost-effective recycled water irrigation scenario is $3,950 per AF but only provides 54 AFY of reuse. The unit cost of water associated with irrigation use is much greater than the proposed Replenish Big Bear project; and this project does not satisfy the same demand. As such, production of recycled water for the primary use for landscape irrigation is not considered a viable alternative to Replenish Big Bear.

The 2016 Study analyzed groundwater recharge at the Greenspot site (Alternative 2) and at Sand Canyon (Alternative 3) and as a joint project (Alternative 4). The anticipated recharge capacity at the Greenspot site is 1,000 AFY, and at the Sand Canyon site is 750 AFY. Treatment upgrades, distribution system and recharge facilities, operational requirements, unit cost, and advantages and disadvantages were analyzed for each alternative. The potential projects were subsequently compared and ranked on the basis of qualitative criteria, beneficial use yield and unit cost. The top ranked alternative was Alternative 4, groundwater recharge at both the Greenspot site and at Sand Canyon. The anticipated total recharge capacity is 1,750 AFY which reasonably aligns with the anticipated yield of the Replenish Big Bear project for comparison purposes. Details regarding the 2016 Study Alternative 4 are provided below as this was the highest ranked alternative for a full groundwater recharge project.

Alternative 4 requires tertiary and advanced treatment upgrades to BBARWA's WWTP. The secondary effluent from the existing WWTP would be fed to the advanced treatment process train consisting of:

1. Microfiltration/ultrafiltration (MF/UF)
2. Reverse Osmosis (RO)
3. Ultraviolet Advanced Oxidation (UF/AOP)
4. Brine Disposal

The most stringent blending requirement of the two recharge sites governs the tertiary and advanced RW blending requirements and treatment capacities; this is done to avoid constructing duplicate facilities needed to store, pump and convey two different RW blends to each site. For the combined recharge project at Greenspot and Sand Canyon, the 22% Tertiary/78% Advanced blending requirement for Greenspot is required to meet the initial 20% RWC requirement at each recharge site.

Approximately 50,200 feet of 12-in pipeline is required to convey the RW from the BBARWA WWTP to both recharge sites (approximately 16,200 ft to Greenspot and 34,000 ft to Sand Canyon). A new 1.6 MG storage tank and a pump station would also be constructed on the BBARWA WWTP site for storage and conveyance to the recharge ponds. The pump station would require pumps with capacities of approximately 615 gpm and 475 gpm to convey RW to Greenspot and Sand Canyon, respectively. The Greenspot Recharge Site is assumed to be a 7-acre site to allow more than five acres of area for surface water spreading, plus the necessary additional land for berms and maintenance access. The Sand Canyon Site is assumed to be 2.5-acres based on the results from prior studies (14).

This alternative includes the addition of 6 extraction wells downgradient of the Greenspot recharge site to effectively intercept the water that is artificially recharged. These wells are assumed to have a pumping capacity of 100 gpm each. Water recharged at Sand Canyon is assumed to be produced by existing BBLDWP extraction wells downgradient of the recharge site. It is assumed 2 monitoring wells will be added at each recharge site for groundwater monitoring.

The cost estimate for groundwater recharge at the Greenspot site and Sand Canyon site is summarized in Table 0-4.

Table 0-4. Alternative 4 Cost Summary

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF
Alternative 4: Greenspot & Sand Canyon Recharge	$75,102,000	$2,860,000	1,750	$3,310

A full-scale groundwater recharge project only addresses the potable water supply components of the Valley's water needs and does not provide sufficient benefits to warrant the project costs. The availability of high-quality recharge water would benefit the water agencies by providing a supplemental drought proof supply when needed during future extended drought periods; however, continuous large volumes of recharge water are not needed to sustain local groundwater supplies at this time. The basin also does not have a large available storage volume so agencies would need to shift most of their production to this area, which is not the most energy efficient or operationally flexible approach.

A summary of the unit cost and discussion regarding the feasibility of non-recycled and recycled alternative that would satisfy the same demand as the Replenish Big Bear project is provided in Table 0-5.

No Project Alternative

A "No Project" scenario was considered which would result in the continued reliance on precipitation to supply enough water to meet the potable, environmental, and recreational needs within the Valley. Without Replenish Big Bear, water supplies will continue to be managed in a manner that perpetuates the current broken water cycle by treating wastewater and pumping it out of the watershed. If the Agency Team and Valley stakeholders do not proactively pursue an alternative potable water supply, then the region will be susceptible to significant economic impacts should their only water supply become compromised by reduced availability and reliability.

Table 0-5. Unit Cost Comparison – Regional Water Supply Alternatives

Alternative	Unit Cost ($/AF)	Yield (AFY)	Comments
Recycled Water Supply Alternatives			
Replenish Big Bear			The estimated unit cost of Replenish Big Bear is in line or superior to supply alternatives that satisfy the same demand. This project provides a new sustainable, drought resistant, local water supply that enhances local habitat, protects endangered species, and strengthens the local economy. The project will significantly reduce the export of water from the watershed and repair the currently broken water cycle.
Greenspot & Sand Canyon Groundwater Recharge	$3,310	1,750	Full-scale groundwater recharge is a feasible alternative to provide an alternative drought proof water supply to the Valley. However, the project does not address all of the Agency Team project objectives, which include protection of the rare and diverse habitat and species in the Valley and strengthening the DAC/SDAC recreation-based economy by enhancing the tourism industry.
Non Recycled Water Supply Alternatives			
SWP	$4,280	1,000[1]	SWP is a potentially viable water supply alternative to Replenish Big Bear; however, this supply is vulnerable to availability, reliability, catastrophic conveyance interruptions, and increasing costs. Because this alternative only satisfies one of the Agency Team's project objectives and has a high unit cost it is not being pursued.
[1] SWP annual yields would be subject to obtaining new contracts			

6 Selection of the Proposed Title XVI Project

Replenish Big Bear was developed to achieve all of the Agency Team objectives and address the regional problems faced from the anticipated impacts of future droughts on the Valley's only source of water. Through collaboration and dedication to protect and enhance the Santa Ana River watershed, the Agency Team and regional stakeholders selected a project that will provide a drought proof water supply, bolster habitat for the regions unique flora and fauna and strengthen the regional economy in the face of changing climatic conditions. Replenish Big Bear is the low cost alternative and when consideration is given to both qualitative and quantitative benefits, it is clear that Replenish Big Bear is the best project for the Valley. Project benefits are detailed in Table 0-6.

Table 0-6. Replenish Big Bear Project Benefits

Water Supply	
Increased Resiliency	The Valley relies 100% on local groundwater to satisfy current potable demands. Replenish Big Bear expands the water supply portfolio for the region and reduces vulnerability to drought by producing 1,950 AFY of recycled water. The project will keep approximately 59% of the projected 2020 groundwater demand in the Valley for beneficial use.
Increased Reliability	BBCCSD and BBLDWP will have the ability to increase groundwater pumping to meet changing demands. Approximately 1,950 AFY of recycled water will be put to beneficial use and will remain available through the life of the project.
Groundwater Recharge	380 AFY of recycled water will be available for groundwater recharge in the Basin which meets 12% of the current local water demand and an additional 120 AFY can be used to offset water pumped for golf course irrigation, which would provide in-lieu recharge.
Reduced SWP Water Usage	BBMWD will reduce the need to purchase SWP water to meet Mutual's demands because Lake levels will be higher and Lake releases can be used more often to meet demands instead of SWP water. Reductions will also positively affect Federal State Water Projects such as the Central Valley Project (CVP).
Improved Water Supply Management	Additional inflow from the Marsh into the Lake will enable BBMWD to modify the current Lake management strategy to minimize spills and optimize flood control releases to allow additional water to be captured for recharge of the San Bernardino Basin downstream. Preliminary estimates indicate that an average of 6,000 AF of flood releases over 10-year periods would be available for capture downstream for additional recharge. Flood releases that are currently not captured flow to the Ocean. In addition, the project may support the operational needs of the ACOE's Seven Oaks Dam.
Reduced Potable Water Usage	The project will replace 80 AFY of potable water being used at Shay Pond to sustain approximately 10 acres of Stickleback habitat; 420 million gallons of potable water has been discharged to Shay Pond since 1988.
Environment	
Stanfield Marsh Wildlife & Waterfowl Preserve	1,870 AFY of high-quality water will be discharged to the Marsh providing a consistent water source to sustain 145 acres of wetland habitat.
Big Bear Lake	Water discharged to the Marsh provides new inflow to the Lake to augment Lake levels and improve aquatic and riparian habitat by maintaining wetted habitat for over 300 acres of lake edge. The Lake has seen extremely low levels in the last 15 years and is currently only 40 percent full. It is estimated that Lake Levels could rise up to 5 feet in dry years with implementation of Replenish Big Bear.

Shay Pond	High quality water will be discharged to Shay Pond to sustain 10 acres of habitat for the federally listed Stickleback fish, which is currently sustained using potable groundwater.
Santa Ana River	Increased Lake levels will improve the management of downstream releases for protection of fish and wildlife in Bear Creek and the Santa Ana River. Required water releases vary by month and hydrologic year but the project may allow more water to be released to benefit downstream habitats and species, which includes the threatened Santa Ana sucker.
Bay Delta	Reduced water demand from the SWP to meet Mutual's demands may make this water available to support federally endangered and protected fish species in the Bay-Delta (Delta Smelt, Chinook Salmon), when it is not needed for other regional demands.
Increased Snow Pack	The project would enable the Resorts to increase the amount of snow made during wet winters when excess water is available. Increased snowpack would keep more water in the Valley to augment runoff in the Spring to increase groundwater recharge and improve wildlife habitat in streams and tributaries that feed the Marsh and Lake.
Community / Economy	
DAC Benefits	The community of Big Bear Lake served by BBLDWP and BBCCSD had a population of 22,910 in 2015. Based on DWR criteria, 100% of the Valley's populated area is considered a Disadvantaged or Severely Disadvantaged Community (DAC/SDAC).
Recreation Based Economy	Over 7 million visitors annually visit the Valley which is Southern California's premier four-season recreational playground. The Valley's economy is dependent on water to support the tourist industry. Recreation opportunities that drive the economy that will benefit from Replenish Big Bear include but are not limited to: boating, fishing, camping, hiking, mountain biking, wildlife viewing, skiing/snowboarding, and golfing. Recreation opportunities then strengthen the lodging, food, and service industries in the Valley.
Regional Collaboration	Continued water resource collaboration for water agencies, wastewater agencies, regulatory agencies, and community stakeholders within the Valley and Santa Ana River Watershed.
Public Knowledge / Education	Improved water levels at the Stanfield Marsh will sustain habitat and increase education opportunities for the community and visitors through wildlife observation. In addition, the project establishes community involvement and education of recycled water production through project planning, design, construction, and operation.

Additional benefits realized through implementation of Replenish Big Bear include:

- Eliminate the need to develop additional new or expanded non-recycled water supplies in the Valley.
- Reduce or postpone expanded water supplies downstream of the Lake in the Santa Ana River watershed through improved management of downstream releases.
- Reduce the amount of water extracted from the Basin
- Reduce demands on the Bay-Delta system which could benefit Federal water supply projects and facilities that also operate within that system which include the Central Valley Project, the Delta Project and CALFED.

7 Environmental Consideration and Potential Effects

A preliminary analysis of potential significant impacts was conducted based on the proposed Replenish Big Bear project. The preliminary analysis shows that the majority of impacts would be less than significant or could be reduced to less than significant with implementation of appropriate mitigation measures. Necessary mitigation measures will be further developed during the CEQA review process to minimize or avoid potential impacts associated with the project. The preliminary analysis did not identify any significant and unavoidable impacts. Tom Dodson & Associates has been hired by the Agency Team to conduct the CEQA/NEPA analysis for Replenish Big Bear and prepare the required documentation.

8 Legal and Institutional Requirements

The Agency Team has formed a JPA and is committed to implementing Replenish Big Bear. Details regarding cost sharing between the Agency Team for all fixed and variable recycled water project costs have not been determined at this time; however, the Agency Team will continue to collaborate and develop the governance structure as the Replenish Big Bear planning phase advances.

Additional agreements that may be required include:

- Big Bear Lake Resorts - The Agency Team is continuing conversations with the Resort to establish an agreement for the joint use of their snowmaking facilities for Sand Canyon recharge, additional snow storage, and irrigation of the Bear Mountain golf course.
- Downstream Stakeholders - Communication has also been initiated with Valley District, Western Municipal Water District and other downstream stakeholders to further assess project benefits and opportunities for partnerships.
- Resource Agencies – Partnership with resource agencies such as the Nature Conservancy are being considered to advance the use of recycled water in Shay Pond to enhance Stickleback habitat.

The Agency Team will continue to consider all potential partnerships to improve recycled water production, water management and to maximize realized benefits with project implementation.

Replenish Big Bear implementation will require the Agency Team to obtain permits and/or other forms of approval from Federal, State and local agencies. Anticipated new or modified permits/approvals include but are not limited to the following:

Federal Agencies:

- Reclamation – NEPA lead agency which may require coordination with other federal agencies such as USFWS, State Historic Preservation Office, Army Corps of Engineers, and National Marine Fisheries Service.

State Agencies:

- RWQCB – NPDES for discharge to Stanfield Marsh / Big Bear Lake
- RWQCB – NPDES for discharge to Shay Pond
- RWQCB – General Construction Permit
- RWQCB – Waste Discharge Requirement (WDR) modification for changes in operation and the addition of brine disposal in the Lucerne Valley.
- SWRCB – Recycled Water Use Statewide General Permit
- Caltrans – Encroachment permits for pipelines within the Caltrans Right of Way
- CDFW – Approval for discharge to Shay Pond

Local Agencies:

- The City of Big Bear and/or San Bernardino County – Encroachment permits for improvements within their respected Right of Way
- The City of Big Bear and/or San Bernardino County – Grading and building permits for treatment upgrades and the recharge basin
- South Coast Air Quality Management District – Authority to Construct and Permit to Operate the WWTP upgrades

Permits have not been acquired yet for this project but will be pursued as early as possible during the design process. Replenish Big Bear will not use USBR project water.

No issues have been identified that would prevent the project from implementation; however, the project has remaining project details that need to be evaluated and refined which include the following:

- Confirm that recycled water is an acceptable substitute for the potable water currently being discharged to Shay Pond to support Stickleback.
- Assess the existing effluent pipeline to Lucerne Valley to confirm it can accommodate brine conveyance, and develop operational strategy to maintain dual use of the pipeline.
- Update WWTP flow projections based on current water use trends to inform appropriate sizing of treatment and disposal facilities
- Update estimates of Lake water level impacts based on anticipated project yield, which may consider the effects of evaporation in the Marsh

- Quantify potential Lake water quality improvements resulting from the implementation of the Lake Alternative
- Refine the estimated recharge potential in Sand Canyon through performance of a pilot infiltration test
- Coordinate with San Bernardino County Flood Control District to identify technical studies and management practices needed to enable effective joint use of Sand Canyon for flood control and recharge
- Perform a hydrology study to estimate the volume and timing of additional Lake releases under a range of hydrologic conditions so this information can be used in Valley District's model to assess their ability to capture these flows for recharge.
- For Sand Canyon recharge, verify the pathogen control credit that can be achieved by the selected treatment process and identify whether additional underground retention time is needed to achieve the required total credit.
- Perform a treatment process alternatives analysis and conduct a pilot study using potential equipment to refine design criteria and validate treatment performance estimates, including nutrient removal capability and RO recovery rates
- Evaluate whether effluent temperature reduction will be required in cooler months
- Refine design capacity and RW production estimates based on more detailed flow data, updated future flow projections, and actual MF and RO recovery rates
- Evaluate whether one of the parallel lines from the concrete balancing main to the Lucerne Site could be repurposed for brine conveyance.
- Evaluate whether the existing secondary effluent pump station could be repurposed for the new tertiary effluent discharge
- Initiate a water quality sampling program for nutrients, metals, COD, etc. throughout the existing treatment process to support modeling and design of the potential process upgrades needed at the WWTP.

Project refinements are anticipated for this complex project and unresolved issues are not anticipated to keep Replenish Big Bear from being implemented.

9 Financial Capability of Sponsor

The Agency Team is committed to constructing and operating Replenish Big Bear for the life of the project to keep recycled water in the Valley for beneficial reuse. As such, the Agency Team is prepared to take all necessary actions to pay for the construction and full operation, maintenance, and replacement costs. Outside funding from various sources will be critical to implement this project without putting excessive burden on the local community. A combination of grants, low interest loans and cost-sharing contributions from partner agencies are anticipated. Pursuing project funding will require an upfront investment by the Agency Team, and grant funding is anticipated to be highly competitive. However, funding opportunities for recycled water and environmental enhancement projects are available from several sources. Potential funding and financing programs to be evaluated include but are not limited to the following.

Federal Programs

- Reclamation WaterSMART Title XVI Water Reclamation and Reuse Projects
- United States Department of Agriculture (USDA) Water and Waste Disposal Loan and Grant Program

State Programs

- California Department of Water Resources Integrated Regional Water Management (IRWM) Implementation Grants, implemented through the Santa Ana Watershed Project Authority (SAWPA)
- SWRCB Water Recycling Funding Program (WRFP) Grant and Loan Program
- Infrastructure State Revolving Fund (iBank)
- SWRCB Clean Water State Revolving Fund Loan Program (CWSRF)
- Water Infrastructure Finance and Innovation Act (WIFIA) Loans
- CDFW, Wildlife Conservation Board (WCB), and State Coastal Conservancy (Conservancy) programs for habitat restoration and enhancement
- California Office of Emergency Services (Cal OES) Hazard Mitigation Grant Program

Should Replenish Big Bear not be awarded grant funding, or a low interest loan and bond financing is required, the term will likely be for 25 years at current market rates (approximately 4.5%).

The proposed timeline for implementation of Replenish Big Bear is provided in Table 0-7.

Table 0-7. Anticipated Replenish Big Bear Schedule

Milestone Description	Completion Date
Preliminary Engineering	December 2019
Environmental and Regulatory Compliance	December 2019
Pilot Facility Start-up	January 2020
Final Design	December 2020
Construction	October 2022
Start Up & Closeout	December 2022

10 Research Needs

As detailed in Section 8.e of this feasibility study, there are elements of Replenish Big Bear that require additional analysis and approvals prior to being implemented. Unresolved issues include obtaining approval to discharge recycled water into Shay Pond to support the Stickleback population, and disposal of the project's brine through the existing effluent pipeline. In addition, a number of project elements require evaluation and refinement which are being conducted during preliminary design. Project refinements are anticipated for this complex project and no issues have been identified that would prevent the project from implementation.

1 INTRODUCTORY INFORMATION

WTR 11-01 Requirement 5.B.1

Provide the following introductory information.

(a) Identification of the non-Federal project sponsor(s).
(b) A description of the study area and an area/project map.
(c) A definition of the study area in terms of both the site-specific project area where the reclaimed water supply will be needed and developed, and any reclaimed water distribution systems.

1.A NON-FEDERAL PROJECT SPONSOR(S)

Identification of the non-Federal project sponsor(s).

This feasibility study report for the Replenish Big Bear project, prepared by the Big Bear Area Regional Wastewater Agency (BBARWA), the non-Federal project sponsor, is submitted for Reclamation's consideration in response to the requirements of the WaterSMART Title XVI Water Reclamation and Reuse Program (Title XVI). BBARWA is submitting this feasibility study on behalf of the Replenish Big Bear Agency Team (Agency Team), which includes BBARWA, Big Bear City Community Services District (BBCCSD), City of Big Bear Lake, Department of Water and Power (BBLDWP), Big Bear Municipal Water District (BBMWD), and the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA).

The Agency Team has partnered to jointly fund and pursue a recycled water project that retains water resources in the watershed for beneficial use which will significantly increase the sustainability of local water supplies to benefit the entire Valley. A brief introduction to the Agency Team is provided below.

Big Bear Area Regional Wastewater Agency

BBARWA was formed in March 1974 to develop a plan for wastewater management within the greater Valley region. A subsequent 1975 Wastewater Facilities Plan was prepared which identified the need to provide centralized, environmentally friendly wastewater conveyance, treatment and disposal for the BBARWA service area (Figure 1-1).

The BBARWA service area includes the entire Valley (79,000 acres) and is served by three separate collection systems: City of Big Bear Lake, representing approximately 47% of the connections, and BBCCSD, representing approximately 48% of the connections, and County of San Bernardino Service Area 53B (CSA 53), representing approximately 5% of the connections. Each of these member agencies maintains and operates its own wastewater collection system, and delivers wastewater to BBARWA's interceptor system for transport to the BBARWA Regional Wastewater Treatment Plant (WWTP).

Big Bear City Community Services District

BBCCSD was created in 1966 by a formation and consolidation election and initially provided solid waste collection, fire protection and street lighting services. In 1967, the former Big Bear Mutual Service

Company voted to relinquish ownership and operation of their water system to BBCCSD. Currently BBBCSD's services include water, wastewater collection, fire protection & emergency medical services, solid waste collection, and street lighting services. BBCCSD's water service area includes Big Bear City and portions of San Bernardino County (Figure 1-2). BBCCSD's wastewater collection area includes Big Bear City and portions unincorporated communities such as Sugarloaf, Erwin Lake, Whispering Forest, and Moonridge (Figure 1-1).

City of Big Bear Lake, Department of Water and Power

BBLDWP was formed in 1989 with the purchase of the retail water system from Southern California Water Company and currently provides water service to the City of Big Bear Lake, located along the south side of Big Bear Lake, as well as the unincorporated communities of Fawnskin, which lies to the north of the lake, and Sugarloaf, Erwin Lake and Lake William areas, which lie on the east side of the Valley (Figure 1-2).

The City of Big Bear Lake provides wastewater collection services within the city, while BBCCSD and CSA 53B provide wastewater collection services within BBLDWP's water service area that lies outside the city limits (Figure 1-1). BBLDWP is a department of the City of Big Bear Lake, governed by a Board that is appointed by City Council.

Big Bear Municipal Water District

BBMWD, formed in 1964, is an independent special district that is responsible for the overall management of Big Bear Lake. The primary responsibilities of BBMWD are:

- Stabilization of the level of Big Bear Lake by managing the amount of water released to Bear Valley Mutual
- Watershed/water quality management
- Recreation management
- Wildlife habitat preservation and enhancement
- Bear Valley Dam and Reservoir maintenance

Bear Valley Basin Groundwater Sustainability Agency

BVBGSA is a Joint Powers Authority (JPA) comprised of BBLDWP, BBMWD, BBCCSD and BBARWA. The BVBGSA was formed on April 26, 2017 to serve as the Groundwater Sustainability Agency responsible for managing the Bear Valley Basin in compliance with the Sustainable Groundwater Management Act of 2014. The BBGSA service area coincides with the collective service areas of the member agencies.

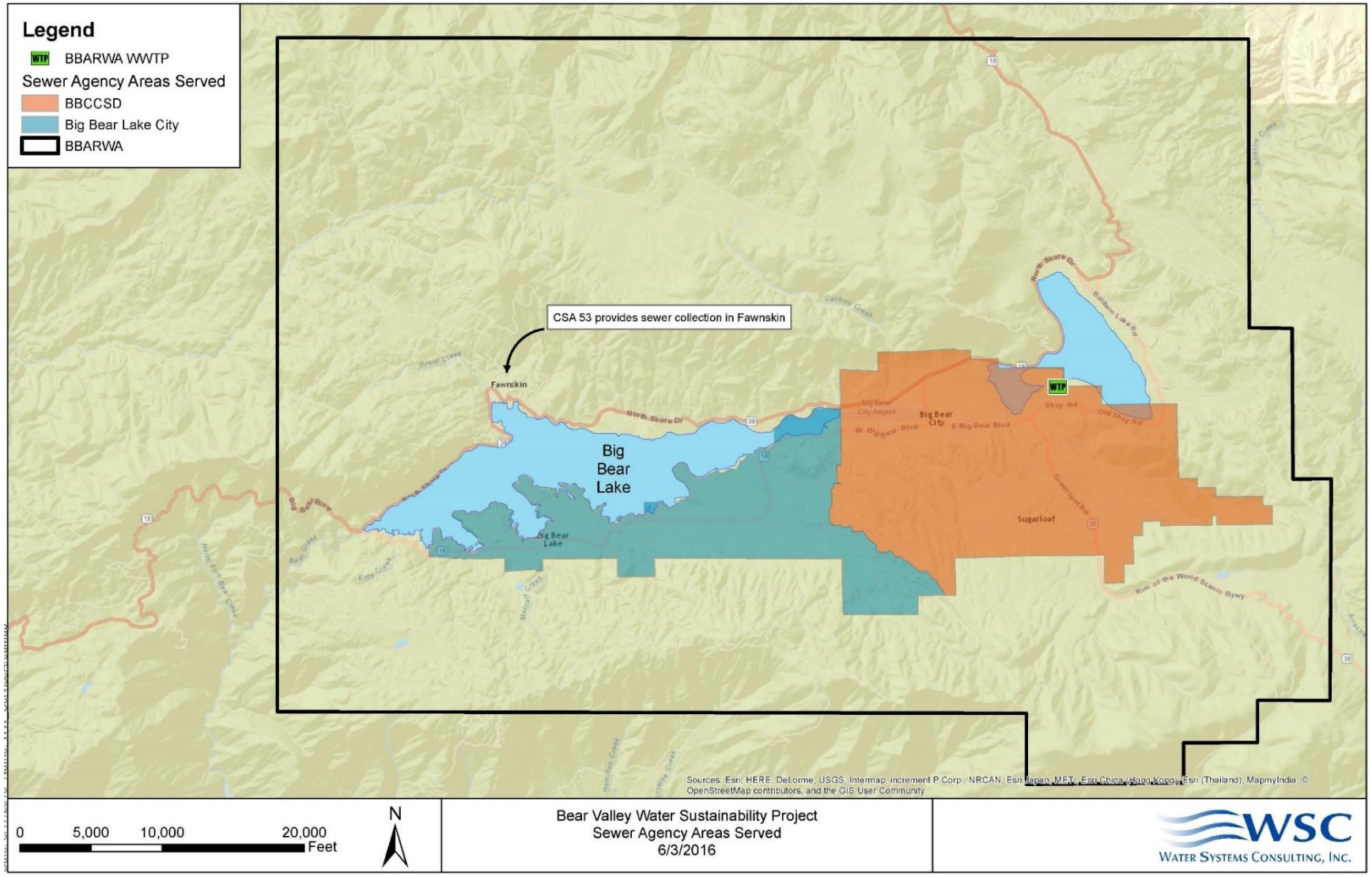


Figure 1-1. Sewer Collection Agency Service Area

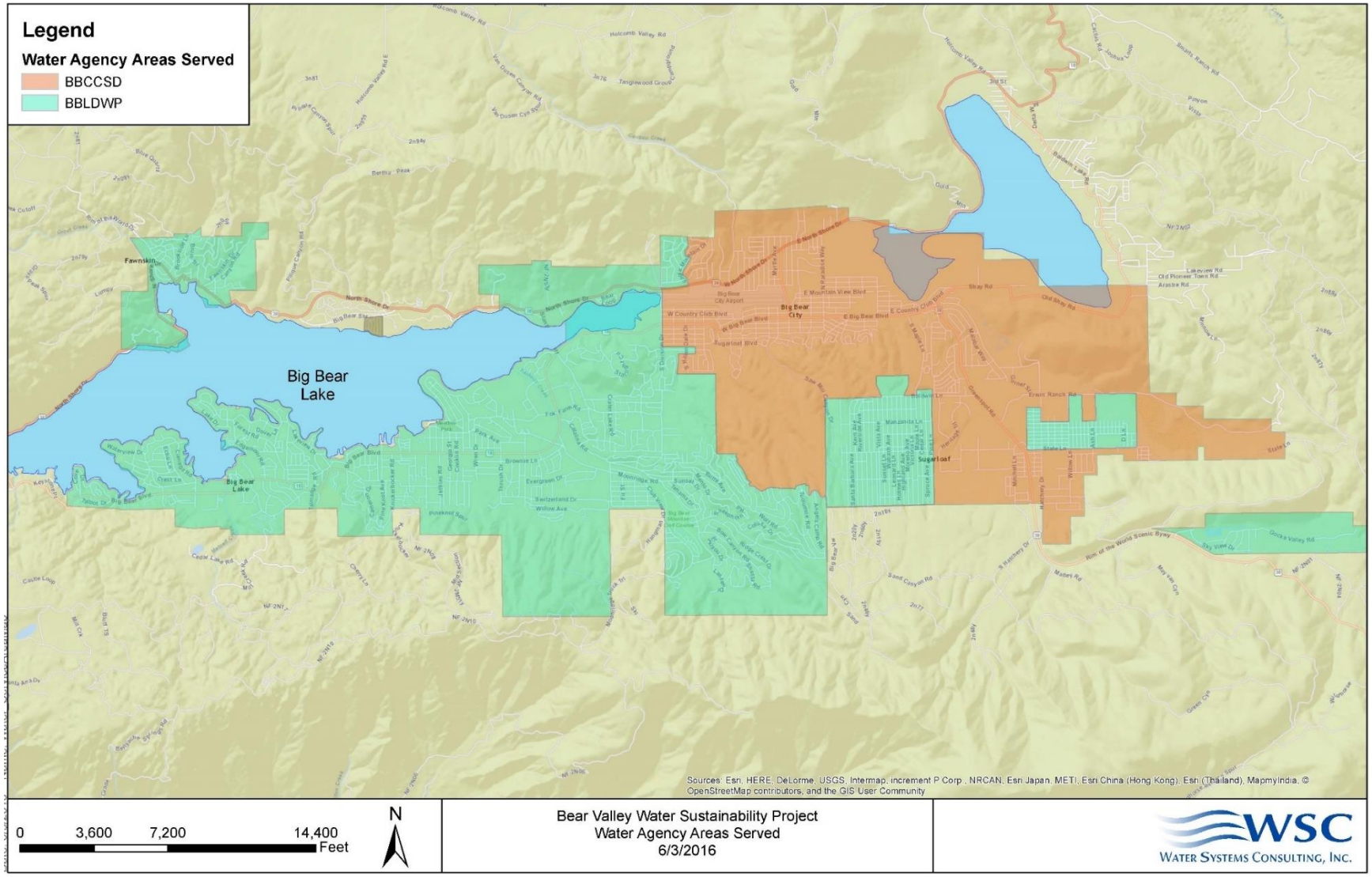


Figure 1-2. Water Agency Service Area

1.B DESCRIPTION OF STUDY AREA

A description of the study area and an area/project map.

Located within San Bernardino County, California, Replenish Big Bear proposes to use advanced treated recycled water for multiple beneficial uses within the Big Bear Valley (Valley). Keeping this resource in the Valley will allow the Agency Team to augment natural recharge for water supply sustainability; protect the rare and diverse habitat and species in the Valley; and strengthen the regional economy through enhanced recreation.

The Valley is located at the top of the Santa Ana River Watershed in the San Bernardino Mountains and includes an area of approximately 135 square miles within a 12-mile long valley surrounded by mountain ridges and rugged slopes. Land surface elevations range from 6,000 feet to 9,900 feet and the area is entirely surrounded by the San Bernardino National Forest. Big Bear Lake (Lake) lies within the Valley and has a surface area of approximately 10 square miles and 23 miles of shoreline. The Lake is hydrologically connected to the Stanfield Marsh Wildlife and Waterfowl Preserve.

The Valley is home to approximately 23,000 full time residents and is a rural community. The area is primarily residential with some commercial uses, and experiences an influx of part-time population and vacationers enjoying the four season recreational facilities within the Valley, with more than 7 million visitors annually. Due to the recreational nature of the Valley economy, occupancy fluctuates seasonally, typically peaking in July and at the lowest level during the winter. However, tourism is the Valley's main industry and, in FY 2017/2018 the total transient revenue in the City of Big Bear Lake was $66,891,750. The Valley's economic lifeblood is the tourism industry which depends on the scenic landscapes and water which provides opportunities for year-round recreation activities. Based on DWR criteria, 100% of the Valley's populated area is considered a Disadvantaged or Severely Disadvantaged Community (DAC/SDAC) due to Median Household Incomes (MHI) less than 80% or 60%, respectively, of the statewide MHI.

Currently, the sole source of potable water supply in the Valley is groundwater from the unadjudicated Big Bear Valley Groundwater Management Zone (Basin). The Basin lies in the northeastern portion of the Santa Ana River Watershed and is approximately 14 miles long from east to west and 7 miles wide from north to south. Natural precipitation provides the sole source of water supply for the Valley, and is relied on for potable groundwater supplies, replenishing the Lake, and supporting the rare and diverse habitat and species in the Valley. Drought conditions and a long-term decline in precipitation trends have led the local water management agencies to investigate opportunities for supplemental water supplies, which are extremely limited due to its isolated location at the top of the watershed. Currently, wastewater generated within the Valley undergoes preliminary and secondary treatment and is discharged outside of the watershed to irrigate alfalfa fields in the Lucerne Valley, located approximately 20 miles north of the Valley. Retaining recycled water in the watershed would significantly increase the sustainability of local water supplies. The Agency Team has partnered to develop a project that will recover this lost water resource, for the benefit of the whole Valley.

The project area for Replenish Big Bear includes the entire Valley, spanning the collective service areas of the Agency Team and northeast portion of the Santa Ana River Watershed as provided in Figure 1-3.

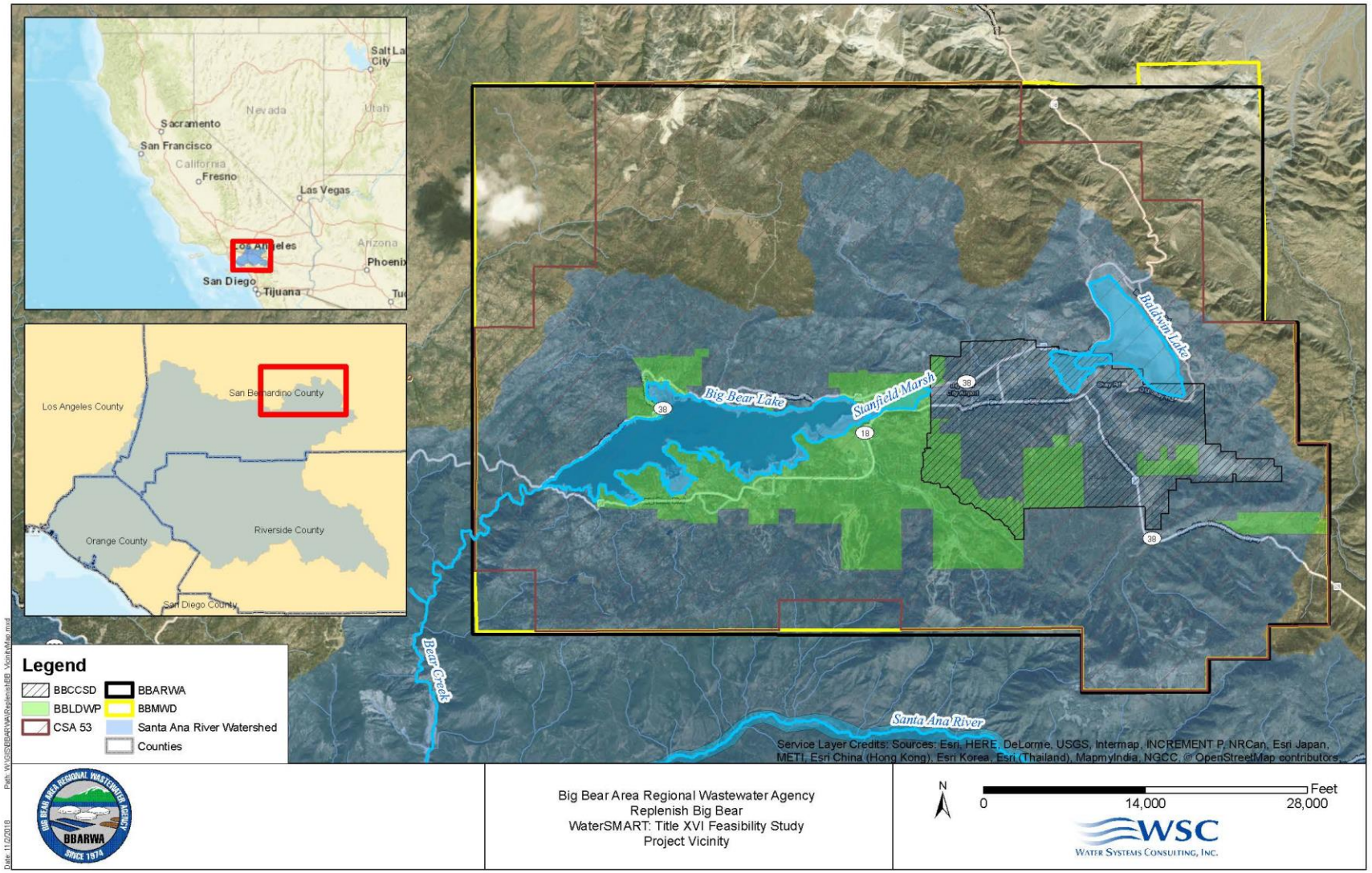


Figure 1-3. Replenish Big Bear Project Area

1.C DEFINITION OF STUDY AREA

A definition of the study area in terms of both the site-specific project area where the reclaimed water supply will be needed and developed, and any reclaimed water distribution systems.

Replenish Big Bear is located in Southern California, in the southwest portion of San Bernardino County. The Study area encompasses the entire Valley and includes the Agency Team service areas as shown in Figure 1-3. California State Route 18 runs through the region, which serves as the major connecting corridor to Los Angeles (west) and Apple Valley (north). The entire area is surrounded by the San Bernardino Mountains and National Forest. There are many biological resources within the Valley including forests, streams, lakes, meadows, unique animals, and plants. Some of the protected animals include the Bald Eagle, Southern Rubber Boa, Southwestern Willow Flycatcher, Unarmored Threespine Stickleback, and the San Bernardino Flying Squirrel.

Study Area Hydrology and Geology

The Valley climate is a semi-arid, Mediterranean environment with cold winters, warm summers, and moderate rainfall. The average monthly temperature ranges from about 32 to 62 degrees Fahrenheit (°F), with an average annual temperature of 47°F. Most of the precipitation typically occurs from November through April. Records show that the average monthly precipitation ranges from about 0.1 inches to 7.10 inches. The historical precipitation and temperatures are presented in Figure 1-4 and Figure 1-5. As shown, declining precipitation and increasing temperature trends have the potential to impact the sustainability of local water supplies in the Valley.

The sole source of water supply in the Valley is groundwater from the Basin, which is not adjudicated. The Basin has a surface area of 19,600 acres and is naturally recharged from percolation of precipitation, runoff and underflow from fractured rock formations; with groundwater levels that generally correlate with annual fluctuations of precipitation. Storage capacity of the Basin is estimated by DWR at 42,000 AFY with the maximum perennial yield estimated at 4,800 AFY (3). The Basin is primarily composed of unconsolidated alluvium and is divided into upper, middle and lower aquifers; where the upper and middle aquifers are the primary producers. Based on the drainage system, the Basin is divided into 16 hydrologic subunits with the main tributaries including Grout Creek, Van Dusen Canyon, Sawmill Canyon, Sand Canyon, Knickerbocker Creek, Metcalf Creek, and North Creek. The Basin and subunits are presented in Figure 1-6.

There are two lakes in the middle of the Basin: perennial Big Bear Lake and the ephemeral Baldwin Lake. Surface drainage within the Basin flows to one of the two lakes, mostly to Big Bear Lake. Big Bear Lake empties on the west into Bear Creek, which is a tributary of the Santa Ana River. Baldwin Lake sits in a local closed depression and does not empty to any other body of water. As previously noted, the Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh) is connected to Big Bear Lake and is naturally recharged in the same manner as the lakes.

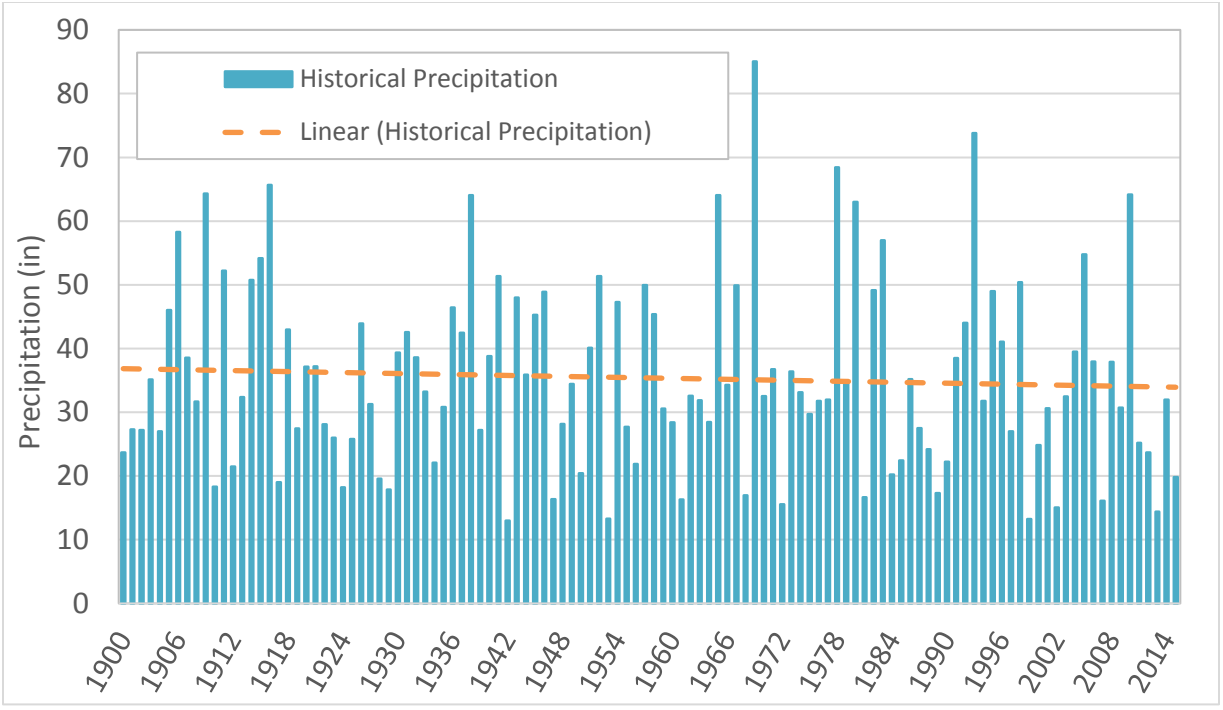


Figure 1-4. Historical Precipitation in the Big Bear Valley (4)

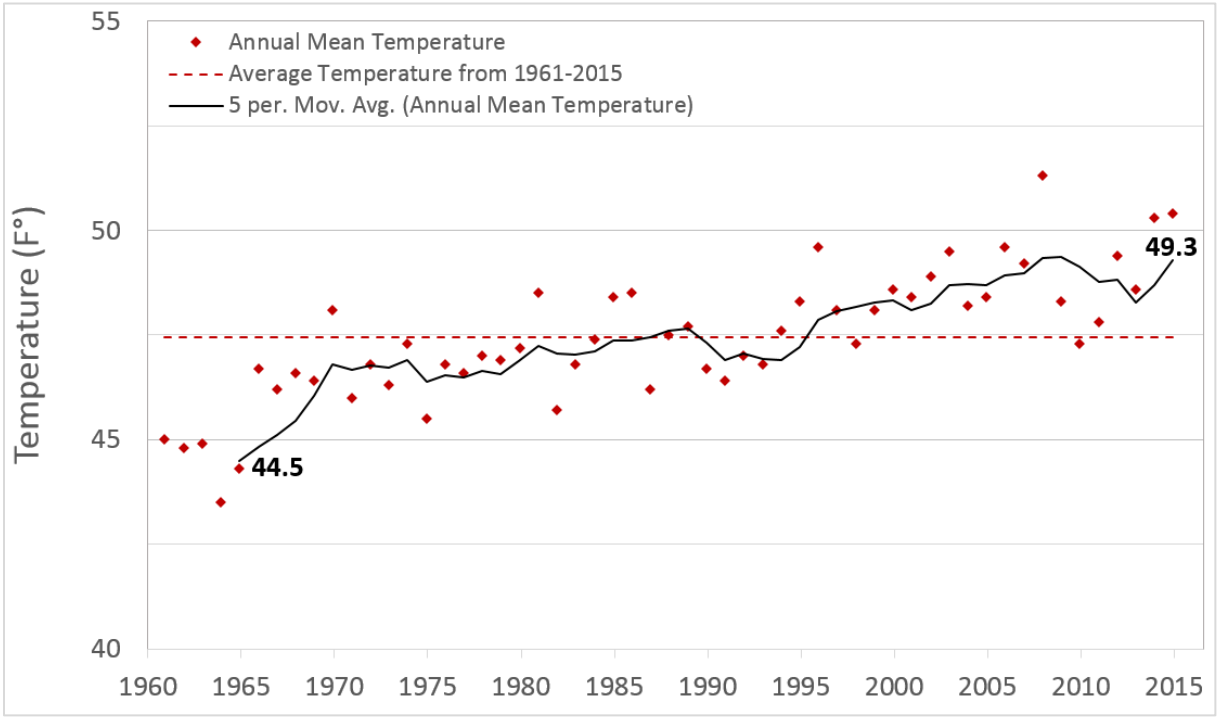


Figure 1-5. Historical Average Annual Temperatures in the Big Bear Valley (5)

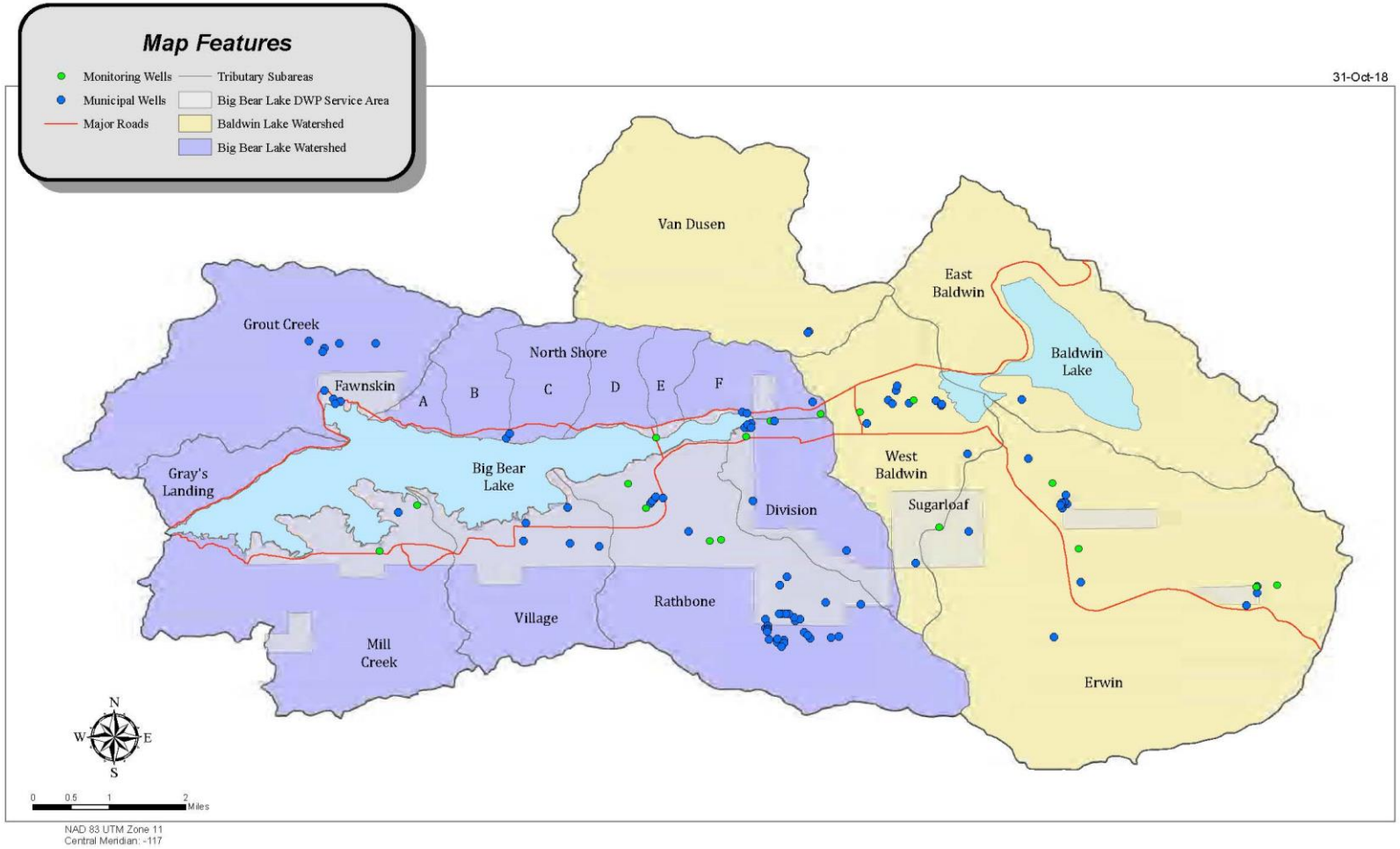


Figure 1-6. Big Bear Valley Groundwater Basin and Subunits (6)

In addition, the Valley includes many additional streams, creeks, and ponds that are fed by naturally occurring springs and seasonal precipitation. Of particular importance to the Valley is Shay Pond, which is the primary habitat for a population of Federally and State endangered Unarmored Threespine Stickleback. Shay Pond receives water from Shay Creek which is generally a perennial stream fed by several springs. The Shay Creek vicinity includes Shay Pond, Sugarloaf Pond, Juniper Springs, Motorcycle Pond, Shay Creek, Wiebe Pond, and Baldwin Lake. Although Shay Creek is fed by several springs, water flows vary substantially from year to year. Natural precipitation is a critical source of water the surrounding flora and fauna as well as to full time residents and visitors.

Reclaimed Water Source

BBARWA owns and operates a 4.9 million gallon per day (MGD) capacity wastewater treatment plant (WWTP) located just south of Baldwin Lake on the east side of the Valley. BBARWA's service area includes three separate collection systems: City of Big Bear Lake, BBCCSD, and County of San Bernardino Service Area 53B (CSA 53). Each of these member agencies maintains and operates its own wastewater collection system, and delivers wastewater to BBARWA's interceptor system for transport to the BBARWA WWTP. In 2016, the WWTP treated approximately 1.9 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake and CSA 53 in Fawnskin. Additional details regarding the BBARWA WWTP and the source of reclaimed water is provided in Section 3.f of this feasibility study.

Existing Reclaimed Water Distribution Systems

The BBARWA WWTP discharge is regulated by the Santa Ana Regional Water Quality Control Board (SARWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR) issued on June 24, 2005 (Appendix G). There are three permitted discharge locations, summarized in Table 1-1. Discharge Point 001 for irrigation in Lucerne Valley, is located within the Colorado River Basin Region and is regulated by Colorado River Basin RWQCB WDR Order No. R7-2016-0026 (Colorado WDR), issued on June 30, 2016 (Appendix H).

Treated secondary effluent is discharged to a 480-acre site in Lucerne Valley (LV Site) for irrigation of fodder and fiber crops that are used as feed for livestock. The LV Site is owned by BBARWA and leased to a farmer for crop production. Use of recycled water for crop irrigation began at the LV Site in 1980, and 100% of the WWTP effluent is currently discharged to this location. Figure 1-7 depicts the location of BBARWA's existing recycled water distribution facilities and the LV Site, approximately 20 miles north of the Valley. Discharge Points 002 and 003 are not currently used. Details regarding the effluent requirements for recycled water discharge are discussed later in Section 3.a.

Table 1-1. WDR Order No. R8-2016-0044 Discharge Points

Discharge Point	Effluent Description	Receiving Water/Disposal Site	Recycling Reuse
001[1]	Secondary effluent w/o disinfection	Storage Ponds in Lucerne Valley	Irrigation in Lucerne Valley
002	Secondary effluent with disinfection	State surface water (Storage pond in Baldwin Lake) and Big Bear Valley Groundwater Management Zone	Construction and wildlife habitat
003	Tertiary effluent with disinfection	Big Bear Valley Groundwater Management Zone	Irrigation

Notes:
1. The Colorado River Basin Regional Water Quality Control Board (Region 7) regulates the use of the recycled water in the Lucerne Valley (WDR Order No. R7-2016-0026).

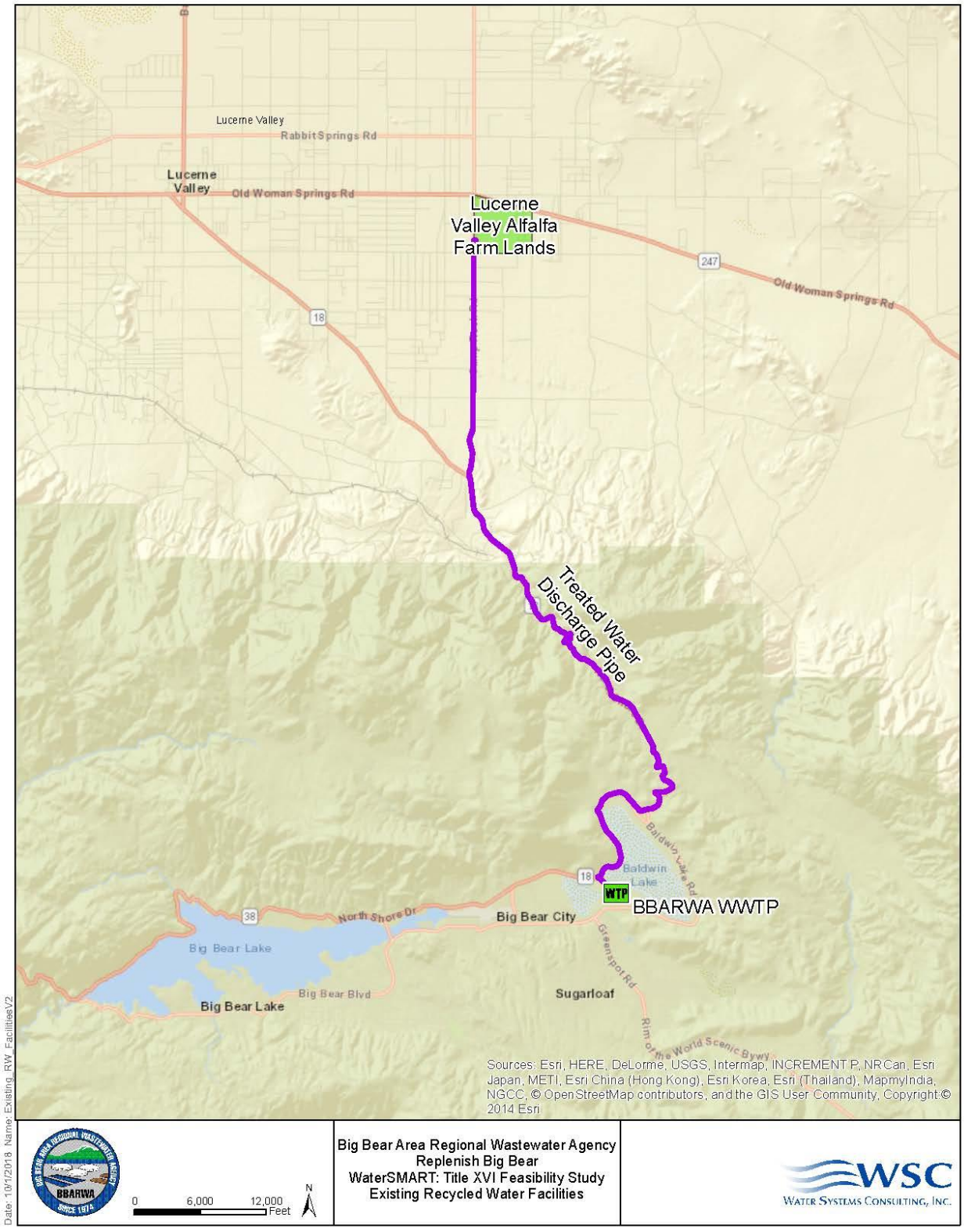


Figure 1-7. Existing Recycled Water Facilities

2 STATEMENT OF PROBLEMS AND NEEDS

WTR 11-01 Requirement 5.B.2

Describe key water resource management problems and needs for which a water reclamation and reuse project may provide a solution, including the following information. All projections shall be reasonable and applicable for a minimum of 20 years.

(a) Description of the problem and need for a water reclamation and reuse project.
(b) Description of current and projected water supplies, including water rights, and potential sources of additional water other than the proposed Title XVI project, and plans for new facilities other than the proposed Title XVI project, if any.
(c) Description of current and projected water demands, including a description of the current and projected water supply and demand imbalances.
(d) Description of any water quality concerns for the current and projected water supply.

2.A DESCRIPTION OF PROBLEM AND NEED FOR PROJECT

Description of the problem and need for a water reclamation and reuse project.

Natural precipitation provides the sole source of water supply for the Valley, and is relied on for potable groundwater supplies, supporting rare and diverse habitat and species, and sustaining the region's recreation-based economy. Drought conditions and the long-term decline in precipitation trends as shown in Figure 1-4 and Figure 1-5 have highlighted a significant range of impacts to the Valley due to the variability of the resource. In addition, California has been in a state of severe drought which resulted in significant water restrictions and impacts to wildlife habitat. Figure 2-1 shows the severity and frequency of drought in the Valley over the last four years (7). The Santa Ana River watershed within San Bernardino County has been declared primarily in a state of extreme and severe drought, or abnormally dry over the last four years as shown in Figure 2-2. Mean temperatures are predicted to increase, both globally and regionally and it is anticipated that future droughts are going to be longer and drier (8) thus having the potential for a greater impact on local and regional water supply availability. Potential impacts on the sustainability of local water supplies in the Valley resulting from future droughts include:

- Reduction of snowpack, which is a significant source of water in the Valley
- Increase in intensity and frequency in extreme weather events which includes drought
- Effects on groundwater recharge during droughts
- General decline in ecosystem health and function
- Changes to potable water demand level and patterns due to increasing temperatures.

Replenish Big Bear has been developed to provide a supplemental water source to expand the existing supply portfolio that results in widespread benefits despite anticipated changes in weather patterns. Details regarding specific problems the Valley is faced with which are driving implementation of the Agency Team's recycled water project are provided below.

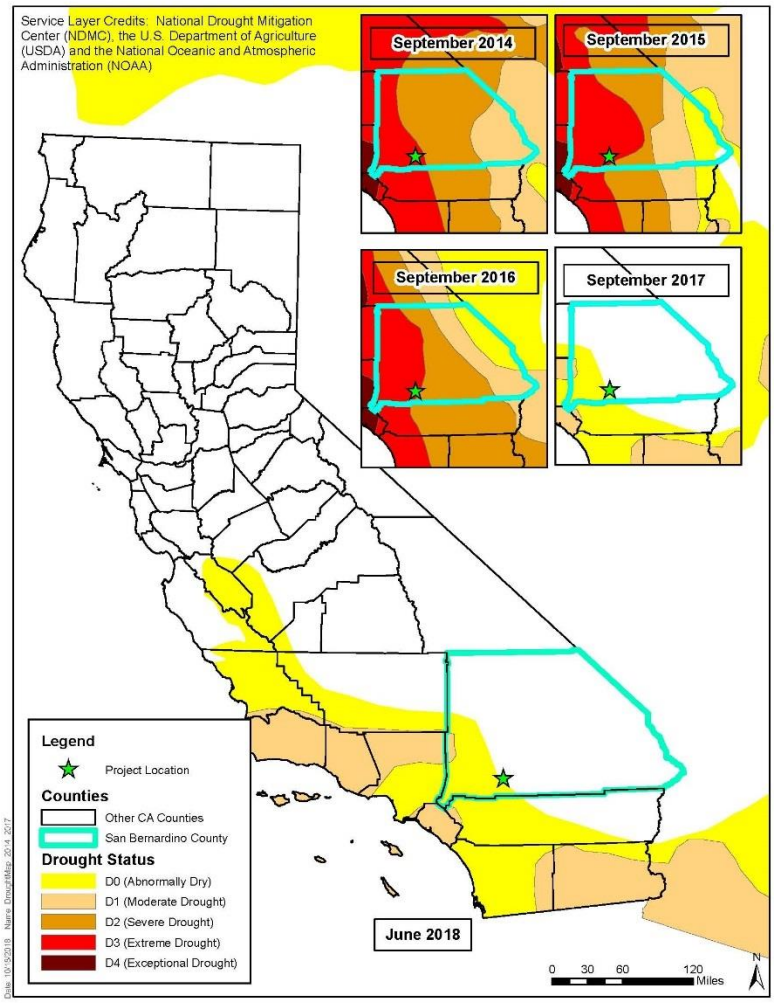


Figure 2-1. Drought Status Map 2014-2018

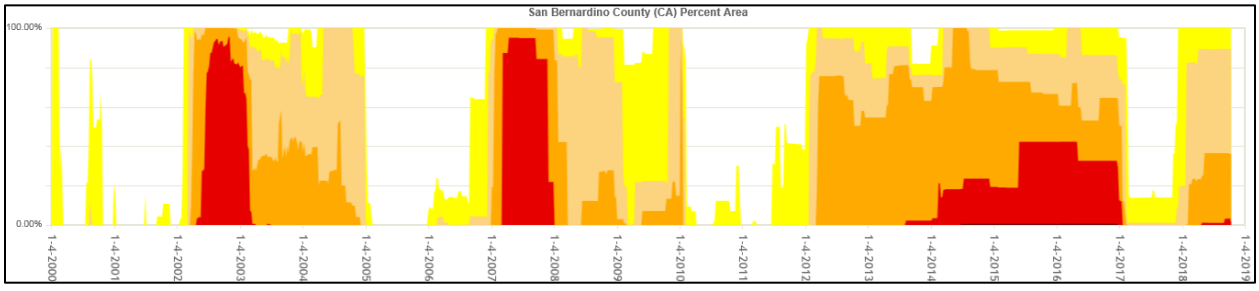


Figure 2-2. San Bernardino County Drought Status 2000 – 2018

Potable Water Supply Reliability

Groundwater provides the only potable water supply in the Valley. Local water agencies do not have surface water rights, and imported water is not available due to the lack of infrastructure to the Valley's high elevation and isolated location. Therefore, the local water supply is extremely vulnerable to the timing and amount of precipitation, the ability of the region to recharge groundwater supplies, and the amount of pumping that occurs in the basin. Of these key elements, only the amount of water withdrawn from the Basin is currently managed by the Agency Team. BBLDWP and BBCCSD have pursued and implemented multiple water use efficiency measures and actions, including water use restrictions and multiple water conservation incentive programs to reduce groundwater usage and meet statewide drought mandates. Demand Management Measures implemented by each agency are summarized in Table 2-1.

Efforts by the water agencies have been successful in reducing demand; and total potable consumption has been maintained below the safe yield of the groundwater basin. However, the safe yield has the potential to change in the future and the Agency Team recognizes that efforts to keep water resources in the Basin and increase local groundwater recharge are required to improve future water supply reliability and meet projected increasing demands. Implementation of Replenish Big Bear will keep approximately 2,466 AFY of water from leaving the watershed and provide a drought proof high quality water supply that can be used to enhance recharge of the Basin.

The Big Bear Mountain Resort (Resort) operates two local ski and snowboard parks, as well as the Bear Mountain Golf Course. Groundwater from the Resort's private wells is currently used to irrigate the golf course, which accounts for approximately 120 AF extracted from the Basin annually. Drought conditions impact the amount of water used to maintain the golf course. Implementation of Replenish Big Bear would make it possible for the Resort to reduce irrigation from groundwater wells by using a blend of recycled water and lake water from the lake, delivered through their existing snowmaking infrastructure. This operation would leave groundwater in the basin that would otherwise have been pumped out and would function as in-lieu recharge for the BBLDWP and BBCCSD who could use that water to meet the community's potable water needs instead.

Expanding the region's water supply portfolio will reduce the Valleys vulnerability to future drought conditions.

Table 2-1. Demand Management Measures Implemented by BBLDWP & BBCCSD

Retail Agency Demand Management Measure	BBLDWP Measures (9)	BBCCSD Measures (10)
Water Waste Prevention Ordinances	Water Conservation Program Policy No. 2014-02 includes several indoor and outdoor water waste prevention policies.	Ordinance No. 2016-05 imposes water waste prohibitions for increasingly stringent water-supply shortage stages
Metering	Initiated Advanced Metering Infrastructure project to better track water system demands in real time and measure the effects of conservation measures.	Currently, all water services are metered and Ordinance Nos. 29 and 4S were enacted to declare foals pertaining to water meters
Conservation Pricing	Applies tiered rate structure to encourage minimization of water use.	Applies tiered rate structure to encourage minimization of water use.
Public Education and Outreach	Conducts water supply and conservation public education through local newspapers, social media and radio advertisements and manages a Xeriscape Demonstration Garden to provide ideas for residential drought tolerant landscape.	Conducts water conservation education and outreach through public water conservation awareness program and sponsors the local Xeriscape Demonstration Garden.
Distribution System Real Loss Management Program	The DWP conducts regular mass balance audits of metered water production versus metered water sales to detect unusual changes in the water operation, and performs hydraulic modeling to identify existing system deficiencies.	Staff performs regular inspections or contracts leak detection companies to check for system leaks. Completed AWWA Water Audit for 2015.
Water Conservation Program Coordination	Employs one full-time staff person as Water Conservation and Public Information Specialist and one part-time Water Conservation Technician to manage the responsibilities of the water conservation program.	BBCCSD's conservation program is managed by the Water Department Superintendent with support from Water Department Staff. The shared responsibilities are equivalent to a full-time conservation coordinator's responsibilities
Other	Offers indoor conservation consults/audits, landscape surveys, turf buyback programs and provides rebates to customers for performing high efficiency appliance retrofits	Reviews effectiveness of demand management measures by continually observing water production and usage. Educational outreach directed at younger customers to encourage continued future water conservation.

Habitat Vulnerability

Surrounded by the San Bernardino Mountains and situated at the top of the Santa Ana River Watershed, the Valley provides an environment where the area's unique flora and fauna can flourish. However, variable precipitation which is increasingly impacted by drought results in strenuous habitat conditions impacting the local wildlife. Key wildlife habitat in the Valley that are significantly impacted by fluctuations in precipitation include the Stanfield Marsh, Big Bear Lake and Shay Pond.

Stanfield Marsh Wildlife and Water Fowl Preserve

The Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh) is a scenic 145-acre nature park that includes a gazebo, walking paths, and two boardwalks that extend out into the marsh so visitors can observe the wildlife. The Stanfield Marsh is home to rare and diverse species of birds, fish, amphibians, and mammals. In the center of the Marsh, there is an island that was constructed to provide a safe haven for waterfowl, including a moat-like barrier to make it difficult for predators to reach it, even when water levels are low. Rainfall and snowmelt are the only sources of water for the Stanfield Marsh, so the water level varies from season to season and throughout longer hydrologic cycles. During wet periods, the Stanfield Marsh is a thriving wildlife preserve. During extended drought conditions, the water level recedes dramatically, the boardwalks extend over dry soil, and the wildlife become scarce. This condition is shown in Figure 2-3, which was taken in September 2016 following the multi-year drought. In the last 15 years, Stanfield Marsh has been less than half full nearly 40 percent of the time. High quality recycled water from the Replenish Big Bear project would provide a new, drought proof source of inflow to sustain marsh habitat even during dry periods.

Figure 2-3. Aerial View of the Dry Marsh, September 2016

Big Bear Lake

Water supplied to the Stanfield Marsh will also provide new inflow to the Lake that will augment water levels. The Lake has seen extremely low levels in the last 15 years. As of December 10, 2018, the Lake was 18'1" below full, less than 40% full by volume. Figure 2-4 shows the fluctuation in Lake levels between 2000 and 2018. Note that the Lake was only full once during this timeframe which occurred in May of 2011 following a wet winter. Preliminary model analysis performed by BBMWD indicates that new inflow into the Lake from Stanfield Marsh could increase water levels by as much as 5 feet in dry years. Increased Lake levels and more wetted shoreline will improve aquatic and riparian habitat. In addition, the increased inflow will provide BBMWD additional flexibility in managing Lake releases to benefit habitats within the Valley as well as downstream.

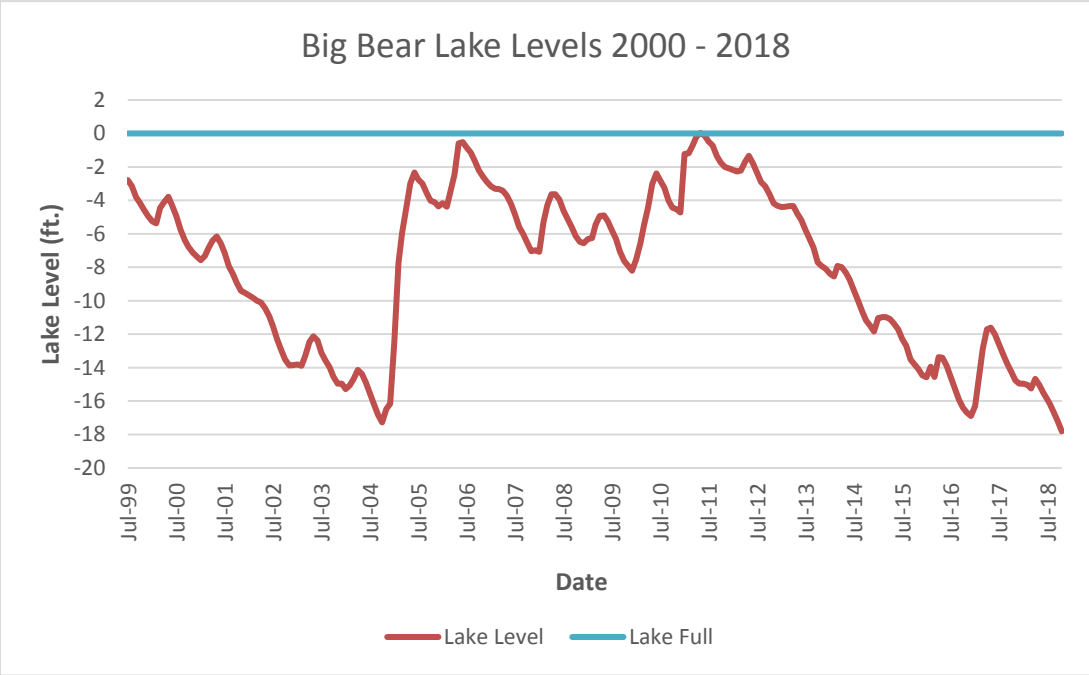


Figure 2-4. Big Bear Lake Levels 2000 - 2018

Shay Pond

The Unarmored Threespine Stickleback (Stickleback) fish, is listed as both a Federal and State of California Endangered Species under the respective Endangered Species Acts (11). On the California list, the Stickleback is also given the title of Fully Protected Species (12). Stickleback have been on the Federal list since 1970 and on the State list since 1971 (12) (13). A population of Stickleback has existed in the Shay Creek area on the east side of the Valley, as shown in Figure 2-5, which includes Shay Pond. The Shay Creek vicinity population is unique in that it occurs at a high elevation, about 6,700 ft. above sea level, while all other Stickleback populations inhabit streams below 3,000 ft.

Although Shay Creek is fed by several springs, water flows vary substantially from year to year. Shay Creek Stickleback populations undergo major fluctuations as their pond and creek habitat expands and

contracts. According to the U.S. Forest Service, catastrophic mortality of Stickleback in Shay Creek and Baldwin Lake occurred in 1985 and 1986 due to insufficient amounts of water. However, some of the Stickleback survived this period in the deeper pools of Shay and Wiebe Ponds. By the summer of 1990, it was thought that the Stickleback remained in only Shay Pond, which is maintained by supplemental water from the BBCCSD (13). The United States Fish and Wildlife Service (USFWS) 2002 Biological Opinion (BO) requires BBCCSD to provide water to Shay Pond and maintain a minimum 20-gallon-per-minute outflow from the pond. To meet this outflow requirement, BBCCSD discharges 50 gpm of potable water into the pond which equates to 80 AFY. Augmented flows from BBCCSD have a substantial impact on the survival of this endangered species as has been observed during previous droughts.

The benefits of augmenting flows in Shay Pond are evident; however, maintaining a minimum pond water level that supports suitable habitat conditions for fish does not come without an impact to BBCCSD's water supplies. BBCCSD potable water discharged to Shay Pond represents approximately 9% of their customer water demand. The 2002 BO states that, should a suitable alternative supply of water be found to be appropriate for the Stickleback in the future, BBCCSD may use an 'in-lieu' water supply to fulfill requirements to maintain Shay Pond. Advanced treated recycled water could help satisfy the pond flow requirements and make the 80 AFY of potable water available for consumption or to satisfy other needs. Replenish Big Bear has been designed to improve habitat conditions for the endangered Stickleback and recover a potable water supply for alternative use.

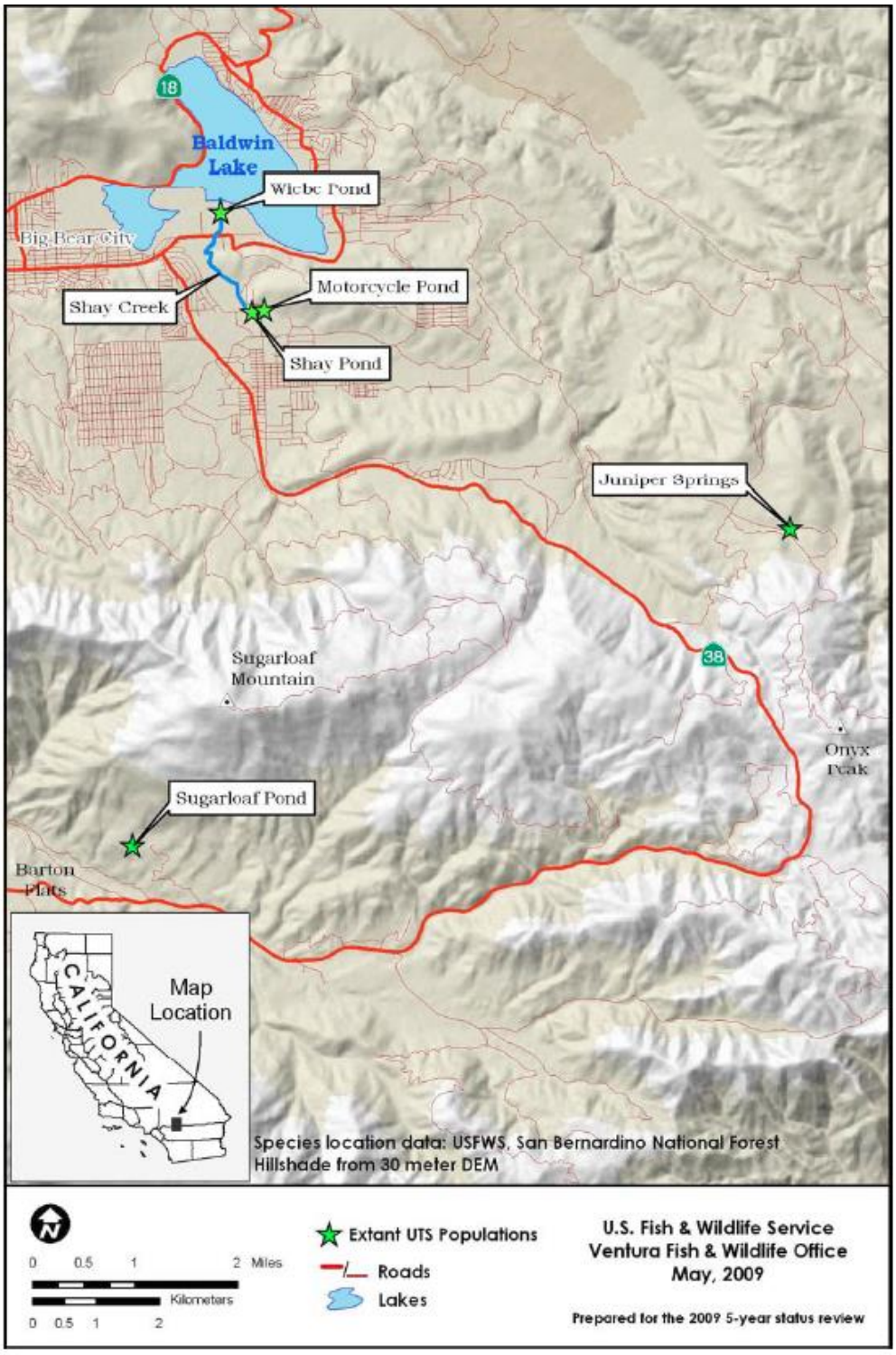


Figure 2-5. Stickleback Populations in the Shay Creek Area (13)

Recreation-Based Economy

The local economy is driven by tourism and recreation. Resorts within the Valley offer opportunities for skiing, snowboarding, mountain biking and golf while Big Bear Lake provides opportunities for fishing and water sports. The National Forest provides additional opportunities for outdoor recreation, such as hiking and camping. The Valley is recognized as an ecological hotspot, known for its year-round habitat for waterfowl and for the high number of plant species known only to this area. The area is a popular destination for wildlife viewing with Big Bear Lake being home to the largest population of wintering bald eagles in southern California. The natural resources of the Valley are an ecological asset as well as an essential element of the local economy (14). Dependence on the Valley's unique environment and activities makes the economy susceptible to drought and reaffirms the need to secure a reliable drought proof water supply that benefits the region's sensitive habitat and recreational resources. Recreation activities that are critical to the local economy are dependent on the amount of precipitation received and how the resource is managed. Management of water in the region impacts the amount of water in Big Bear Lake and has a direct impact on activities.

When Lake levels are low, BBMWD is often forced to close one of their two boat ramps. BBMWD requires a permit to operate a boat on the Lake and the total number of boat permits sold is directly impacted by Lake levels and the ability to access boat ramps. Total boat permit revenue peaked in 2013 with a total revenue of $721,316 and has steadily declined with lake levels and the total revenue in 2018 was $486,563. Decreased revenue ultimately affects Lake operations.

The City of Big Bear Lake assesses a Transient Occupancy Tax (TOT) on visitor's renting hotel, motel, lodging, private home or other facilities for stays less than 30 days. The City's main industry is tourism, and as a four-season resort community, TOT is the second largest revenue source for the City, making up approximately 26% of the general-purpose revenues (15). During Fiscal Year 2017/2018, the total TOT revenue was $4,013,505, and the total lodging revenue in the City was $66,891,750. Revenue from tourists fluctuate depending on the timing and amount of snowfall the region receives which impacts winter activities as well as summer activities dependent on the snow melt. Failure to sustain the local water supply, and enhance both Lake levels and snowpack could result in a devastating impact to the region's economy and way of life.

In the winter, water from the Lake is used by Big Bear Mountain Resort (Resort) for snow making purposes. Currently the Resort is authorized to withdraw a maximum of 11,000 acre-feet (AF) of water from the Lake over a 10-year rolling period, not exceeding 1,300 AF in any single year. It is calculated that half of the water withdrawn from the lake for snow production is returned as runoff (16). Low lake levels have the potential to significantly complicate snow making operations and the Resort would benefit from increased Lake levels. Over the past 5 seasons (FY 2014 – FY 2018) the Resort has had approximately 3,000,000 skier/snowboarder visits. Visitors in the winter are directly tied to weather conditions and the Resorts' ability to facilitate snow activities. Lake levels are nearing a point where the Resorts would need to modify their pumping infrastructure to enable them to continue to pump water for snow making, which would increase their costs. If Lake levels drop much lower, it is anticipated that water would no longer be

pulled out for snowmaking which would significantly impact the Resort's business and the entire Valley's economy.

During wet periods, excess water could be stored as snow using the Resort's existing snowmaking infrastructure. Increasing the amount of snowpack would reduce spills from the Lake, keep more water in the Valley and enhance winter recreation by allowing the Resorts to use water for snowmaking beyond their current allotment. When the snow melts in the spring, runoff would be augmented, which is expected to increase natural groundwater recharge and has the potential to improve fish spawning habitat in streams tributary to the Lake. This element of the project is considered a secondary benefit and has not been fully evaluated but does represent a unique and innovative water management strategy that would be made possible only through the implementation of Replenish Big Bear.

It is imperative that water supplies are managed to maximize beneficial use in the region and limit any loss of the resource from the watershed. Impacts to the local potable supply, environment and economy could escalate if left unaddressed.

2.B DESCRIPTION OF CURRENT AND PROJECTED WATER SUPPLIES

Description of current and projected water supplies, including water rights, and potential sources of additional water other than the proposed Title XVI project, and plans for new facilities other than the proposed Title XVI project, if any.

The sole source of water for the Valley is groundwater from the unadjudicated Basin. DWR estimates the storage capacity of the Basin at 42,000 AFY and the perennial yield of the Basin has been updated over the years in pieces. Based on the most recent information available, the low end of the estimated perennial yield is 4,800 AFY (17) (18). Table 2-2 provides the perennial yield of the Baldwin Lake Watershed and the Big Bear Lake Watershed subunits.

Table 2-2. Perennial Yield of the Big Bear Valley Groundwater Management Zone (Basin)

Baldwin Lake Watershed (AFY)	
Erwin Subunit	890[1]
East Baldwin Subunit	100[2]
West Baldwin Subunit	500-1,000[2]
Van Dusen Subunit	800-900[2]
Big Bear Lake Watershed (AFY)	
Grout Creek Subunit	280[1]
North Shore Subunit	240[1]
Mill Creek Subunit	100-175[1]
Division Subunit (with Subarea F)	500-600[3]
Village Subunit	250[1]
Rathbone Subunit	1,100[1]
TOTAL	**4,760-5,535**

[1] Geoscience, 2006
[2] Geoscience, 1999
[3] Thomas Harder & Co., 2010

Although BBMWD manages Big Bear Lake, no members of the Agency Team have surface water rights. Potential future sources of supply are limited to recycled water due to the Valley's remote location and high elevation. The use of imported water and desalination alternatives are infeasible because of the high costs associated with installing infrastructure to the Valley and the amount of pumping that would be required to this isolated location. Additional details regarding the City's current, projected, and potential future water supplies are provided below and in Section 5 of this feasibility study.

Drinking water is provided to customers in the Valley by BBCCSD and BBLDWP. BBCCSD's water service area includes Big Bear City and portions of San Bernardino County. Groundwater is delivered to BBCCSD's customers through 6,040 service connections. The distribution system and major facilities include four reservoirs with a total capacity of 6.25 million gallons, 81.7 miles of pipeline, 10 active vertical wells, 2 slant wells, 2 springs, 6 booster stations, a fluoride blending system, an iron and manganese treatment facility, 418 fire hydrants, chlorination at seven locations, and more than 1,600 gate valves. BBLDWP's water service area includes the City of Big Bear Lake, located along the south side of Big Bear Lake, as well as the unincorporated communities of Fawnskin, which lies to the north of the lake, and Sugarloaf, Erwin Lake and Lake William areas, which lie on the east side of the Valley. Groundwater is delivered to BBLDWP's customers through 15,520 service connections. The distribution system and major facilities include 179 miles of pipeline, 55 wells (33 groundwater and 22 slant), 15 reservoirs and 11 booster stations (19). In addition to groundwater being supplied by municipal water purveyors, there are numerous private wells throughout the Basin serving properties that are not connected to a public water system.

The Basin is monitored and managed by both BBCCSD and BBLDWP. BBCCSD manages the Basin by conducting monthly monitoring in 11 non-pumping monitoring wells and 13 production wells, monthly monitoring of surface flow in Van Dusen Creek, Shay Creek and Green Canyon Creek, and has established action criteria for average groundwater levels across BBCCSD that are tied to conservation stages and measures. BBLDWP manages the Basin based on the Groundwater Monitoring and Management Plan developed in 2003. BBLDWP manages the Basin by conducting monthly monitoring of 18 non-pumping monitoring wells and approximately 40 production wells, bi-annual Technical Review Team meetings, and has established conservation levels based on groundwater levels and trends in key wells.

As previously noted, Valley water supply alternatives are limited due to the remote location and high elevation. Imported water and desalination are infeasible, and the only viable supply alternative is recycled water. BBARWA owns and operates a 4.9 MGD capacity WWTP which treats all wastewater generated in the Valley, and no additional sources of wastewater are available for reuse. All wastewater treated by BBARWA's WWTP is available for reuse and in 2017, approximately 2,660 AFY, or 2.4 MGD, was treated and discharged outside the watershed to irrigate fields in the Lucerne Valley. No new facilities are currently planned to treat wastewater or provide an alternative water supply. Additional details regarding the BBARWA WWTP and the source of reclaimed water available for future use is provided in Section 3.f of this feasibility study.

Section 2.b – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
BBCCSD System Supplies	Appendix A	Section 5	5-1 to 5-2
BBLDWP System Supplies	Appendix B	Section 6	6-1 to 6-2

2.C DESCRIPTION OF CURRENT AND PROJECTED WATER DEMANDS

Description of current and projected water demands, including a description of the current and projected water supply and demand imbalances.

The BBCCSD service area is primarily residential and the BBLDWP service area is primarily residential with commercial accounts making up 5% and industrial making up less than 1% of the total accounts. Both service areas experience an influx of part-time population and vacationers enjoying the summer and winter recreational facilities within and adjacent to the service area. Due to the recreational nature of the Big Bear City economy, occupancy within the service area fluctuates seasonally, typically peaking in July and at the lowest level during the winter. Big Bear City has the potential to experience large demand changes. However, population and recreation fluctuations are anticipated to remain constant relative to previous years. The current and projected full-time resident population for BBCCSD and BBLDWP are provided in Table 2-3, which are anticipated to increase to 26,571 by 2035 (1) (2). Additional details regarding current and projected population figures are provided in the BBCCSD 2015 Urban Water Management Plan (UWMP) (Appendix A), and BBLDWP 2015 UWMP (Appendix B). A document crosswalk is provided at the end of this section.

Table 2-3. BBCCSD & BBLDWP Resident Population Historical, Current & Projected (1) (2)

	2015	2020	2025	2030	2035
BBCCSD	11,528	11,667	12,244	12,849	13,485
BBLDWP	11,382	11,786	12,204	12,637	13,086
Total	22,910	23,453	24,448	25,486	26,571

The projected water demands for BBLDWP and BBCCSD area are presented in Table 2-4. The historical and projected water demands for each water agency along with the total demands for the agencies are presented in Figure 2-6. In addition to the municipal water purveyors, there are numerous private wells throughout the Basin serving properties that are not connected to a public water system. These estimates do not include water used from private wells, which was estimated to be approximately 169 AFY in the BBLDWP 2006 Water Master Plan.

Table 2-4. Water Demand Projections for Bear Valley Water Agencies (AFY) (1) (2)

Water Agency	2015	2020	2025	2030	2035
BBLDWP	2,095	2,169	2,246	2,326	2,408
BBCCSD	940	1,163	1,220	1,281	1,344
Total	3,035	3,332	3,466	3,607	3,752

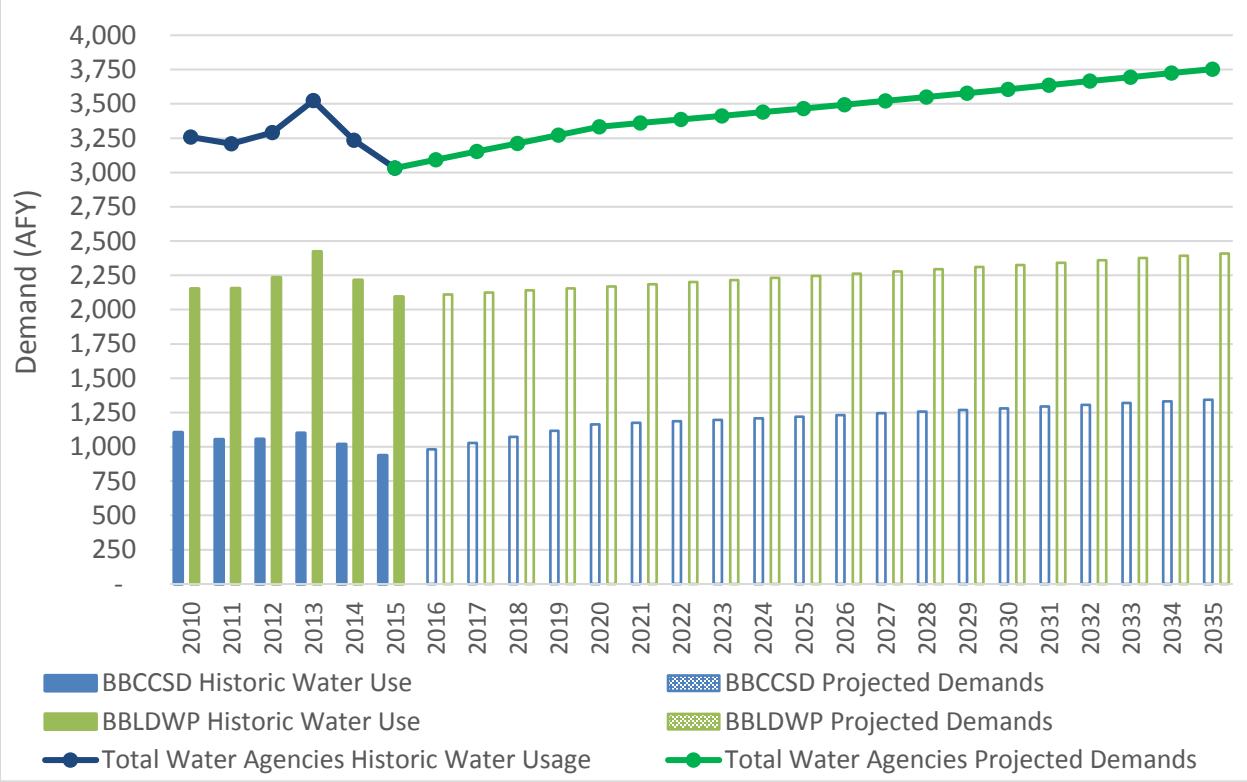


Figure 2-6. Historic and Projected Water Demands for Bear Valley Water Agencies

Figure 2-6 shows the decrease in consumption that occurred in 2013 which was a direct response to state mandated water use reduction targets and conservation efforts made by BBCCSD and BBLDWP. BBCCSD and BBLDWP plan to continue maximizing groundwater supplies through implementation of the operational strategies and demand management measures which will help keep the safe yield of the groundwater basin in balance. The BBCCSD and BBLDWP 2015 UWMPs provide that the Basin is not in overdraft and that it will be able to provide adequate supplies during extended periods of drought. Current and projected demands are below the Basin's maximum perennial yield of 4,800 AFY. However, future unknown climatic conditions, such as new worst-case drought scenarios could affect the reliability of groundwater supplies. As such, the Agency Team has extensively analyzed potential alternative water supplies for future use which is detailed in Section 5 of this feasibility study. Additional details regarding the Valley water supply and demand is provided in the BBCCSD 2015 UWMP (Appendix A), and BBLDWP 2015 UWMP (Appendix B). A document crosswalk is provided at the end of this section.

Section 2.c – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
BBCCSD Population	Appendix A	Section 3.3	3-4 to 3-6
BBLDWP Population	Appendix B	Section 2.5	2-5 to 2-6
BBCCSD System Water Use	Appendix A	Section 3	3-1 to 3-5
BBLDWP System Water Use	Appendix B	Section 4	4-1 to 4-4

2.D DESCRIPTION OF WATER QUALITY CONCERNS

Description of any water quality concerns for the current and projected water supply.

The Basin generally contains high quality water. The BBLDWP 2015 UWMP states that the eastern portion of the Basin does contain elevated fluoride levels and there are other problem constituents including manganese, uranium, and arsenic. Water quality issues have resulted in occasional blending projects, water treatment plants and wells being shut down; however, water quality issues are not anticipated to disrupt groundwater supply (2).

Total dissolved solids (TDS) concentrations in the Big Bear Valley groundwater supplies range from 140 to 450 mg/l with an average of 250 mg/l. For recycled water projects, the concentration of TDS (or salts) in the water are of importance because recycled water with higher TDS than the source water can impact beneficial uses as well as treatment costs. For groundwater recharge applications, elevated TDS levels may be prohibited to protect the groundwater quality. In this case, excess salts would need to be removed, resulting in higher costs for Full Advanced Treatment (FAT) process construction and operation, as well as the brine management system. In recycled water irrigation applications, elevated TDS levels in the RW can be harmful to landscape plants or turf due to salt buildup in the root zone. Salt buildup in landscape applications can often be managed and is not likely to require additional treatment (16). Additional information regarding Basin and Replenish Big Bear water quality objectives is provided in Section 3.a of this feasibility study.

3 WATER RECLAMATION AND REUSE OPPORTUNITIES

WTR 11-01 Requirement 5.B.3

Address the opportunities for water reclamation and reuse in the study area, and identify the sources of water that could be reclaimed, including the following information.

(a) Description of all uses for reclaimed water, or categories of potential uses, including, but not limited to, environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation. Identify any associated water quality, and associated treatment requirements.
(b) Description of the water market available to utilize reclaimed water, including:
    i. Identification of existing and potential users, expected use, peak use, on-site conversion costs, desire to use reclaimed water, including letters of intent if available.
    ii. Description of any consultation with potential reclaimed water customers. Letters of intent must be included, if applicable.
    iii. Description of the market assessment procedures used.
(c) Discussion of considerations (for example: physical, converting systems for reused water, or public acceptance) which may prevent implementing a water reuse project. Identify methods or community incentives to stimulate reclaimed water demand, and methods to eliminate obstacles which may inhibit the use of reclaimed water, including pricing.
(d) Identification of all the water and wastewater agencies that have jurisdiction in the potential service area or over the sources of reclaimed water.
(e) Description of potential sources of water to be reclaimed, including impaired surface and ground waters.
(f) Description and location of the source water facilities, including capacities, existing flows, treatment processes, design criteria, plans for future facilities, and quantities of impaired water available to meet new reclaimed and reused water demands.
(g) Description of any current water reuse taking place in the study area, including a list of reclaimed water uses, type and amount of reuse, and a map of existing pipelines and use sites.
(h) Description of current and projected wastewaters and disposal options other than the proposed Title XVI project, and plans for new wastewater facilities, including projected costs, if any.
(i) Summary of any water reclamation and reuse technology currently in use in the study area, and opportunities for development of improved technologies.

3.A DESCRIPTION OF ALL USES FOR RECLAIMED WATER

Description of all uses for reclaimed water, or categories of potential uses, including, but not limited to, environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation. Identify any associated water quality, and associated treatment requirements.

There is a long history of exploring water reuse opportunities in the Valley to keep this valuable resource within the watershed. Types of reuse considered include wildlife habitat, landscape irrigation, surface water discharge, groundwater recharge, and recreation. Water reuse opportunities in the Valley were first investigated in 1964 and evaluations have continued intermittently since BBARWA was formed in 1974. A key consideration in the development of any recycled water project is the required quality and treatment level of the recycled water as established by the various permitting agencies and State Regulations. The key drivers for treatment upgrades for Replenish Big Bear are described below, with a detailed review of recycled water regulations provided in Appendix C. A document crosswalk is provided at the end of this section.

Basin Plan Water Quality Objectives

In order to recharge the groundwater basin or discharge recycled water to surface waters, the recycled water must meet the water quality objectives set by the Basin Plan. The Basin Plan establishes beneficial uses and water quality standards for the ground and surface waters of the region and includes an implementation plan describing the actions by the RWQCB and others that are necessary to achieve and protect the water quality standards. The Basin Plan provides a general narrative regarding the water quality objectives for each water body type and specific numeric objectives for TDS, hardness, sodium, chloride, total inorganic nitrogen (TIN), total phosphorous (TP), sulfate, and chemical oxygen demand (COD). The water quality objectives for the Valley are summarized in Table 3-1. As shown, the water quality objectives for Big Bear Lake are the most stringent of the Replenish Big Bear proposed discharge points and will therefore govern the treatment upgrades required for the project.

Table 3-1. Basin Plan Water Quality Objectives

Water Body	TDS	Hardness	Sodium	Chloride	TIN	Sulfate	COD
Inland Surface Streams							
Rathbone Creek	300	-	-	-	-	-	-
Lakes and Reservoirs							
Big Bear Lake	175	125	20	10	0.15	10	-
Wetlands (Inland)							
Stanfield Marsh (Narrative Objectives)	-	-	-	-	-	-	-
Groundwater Management Zones							
Big Bear Valley	300	225	20	10	5	20	-

Big Bear Lake Nutrient Limits

In addition to the numeric and narrative water quality objectives, Big Bear Lake is subject to a Total Maximum Daily Load (TMDL) numeric target of 35 µg/L-P for total phosphorus during dry hydrologic conditions, per Resolution No. R8-2006-0023. By 2020, the total phosphorus numeric target must be achieved at all times. A causal target was established for phosphorus because it was determined to be the limiting nutrient in the lake; however, nitrogen may be the limiting nutrient under certain conditions

and as a result, a nitrogen TMDL may be established in the future. Data collected in accordance with the Big Bear Lake Watershed-wide Nutrient Monitoring Plan is currently used to assess compliance with the lake's water quality objectives, and can also assist in determining nutrient TMDL waste-load allocations (WLAs) and numeric targets for nitrogen in the future. Response targets for macrophyte coverage, percentage of nuisance aquatic-vascular plant species and chlorophyll "a" concentration have also been implemented under the nutrient TMDL to further assess water quality improvements in the Lake.

The nutrient limits for an NPDES permit to Big Bear Lake may align with the Basin Plan water quality objectives and the TMDL numeric targets to protect the beneficial uses of the lake. The anticipated effluent nutrient limits of 35 µg/L-P for total phosphorus and 0.15 mg/L-N for total inorganic nitrogen would require multiple process steps and consistent treatment through seasonality. For a cold climate like Big Bear's, compliance with stringent nutrient limits through the winter season would be the greatest challenge due to decreased biological nutrient removal when wastewater temperatures drop below 10-degrees Celsius. Some California wastewater facilities that operate in cold climates have separate summer and winter nutrient limits in consideration of this seasonal affect – the winter limits being less stringent – although it is unknown at this point if BBARWA's future discharge permit would be considered for seasonal limits. The treatment required to meet the expected phosphorus and nitrogen limits includes enhanced nutrient removal processes and technologies, as further described in Section 4.c of this feasibility study.

Note that the RWQCB may consider permitting increased nutrient limits for the discharge if an approved nutrient offset program is implemented as well. A nutrient offset program would reduce nutrient loads elsewhere in the watershed by an amount at least equal to the amount discharged in excess of the water quality objectives. Coordination with the RWQCB is in progress and potential regulatory strategies are being explored.

Based on initial discussions with the SWRCB Division of Drinking Water (DDW), this project would not likely be considered a Surface Water Augmentation project because the Lake is not used directly as a drinking water source and the environmental buffer between the discharge point and downstream uses is extremely large. Additional coordination with DDW is in progress to verify the permitting strategy.

Groundwater Recharge Requirements

Key regulatory requirements for groundwater recharge using recycled water include recycled water concentration, minimum travel time and pathogen control.

Recycled Water Concentration

The groundwater replenishment regulations in Title 22 require that the initial concentration of filtered and disinfected tertiary recycled water (Recycled Water Concentration or RWC) not exceed 20% of the total recharge water, which requires 80% of the total recharge water to come from other high-quality water sources for blending. Blend water can be a combination of imported water, captured surface water, or natural underflow. If sufficient dilution water is not available from these sources, advanced purified recycled water using reverse osmosis (RO) and advanced oxidation can serve as a dilution source. As

discussed previously, imported water is not available in the Valley. The Groundwater Recharge Regulations assess a project's compliance with the RWC requirement using a 120-month running monthly average.

Replenish Big Bear proposes to discharge treated water to the Stanfield Marsh, which will flow through to the Lake and blend with surface water captured in the Lake, which is expected to be a qualified dilution water source. Based on annual Lake inflows from 1977 to 2016 (20), the lowest 10-year rolling average of Lake inflows over this period was 10,389 AF, which occurred in 2016. Based on effluent flows from 2007-2016, the anticipated 10-year average recycled water flow into the Lake would be approximately 1,870 AF, which would equate to approximately 16% RWC in the Lake on a 10-year rolling average.

In addition, natural underflow beneath the Sand Canyon recharge area is expected to qualify as a dilution source. A preliminary estimate of underflow volume was developed by Thomas Harder & Co. in the Sand Canyon Recharge Evaluation Technical Memorandum, dated November 29, 2017 and attached as Appendix E. Depending on the interpretation of the data by the SWRCB Department of Drinking Water (DDW), the underflow dilution credit is estimated to range from 58 AFY to 247 AFY, which would further reduce the RWC of 16% from the blended Lake water. Based on preliminary assessments of available diluent water, groundwater recharge at Sand Canyon with blended water from the Lake is expected to meet the initial RWC requirement of 20%.

At the planning level, there is some uncertainty in the treatment requirements because the qualifying dilution water has not been fully quantified. If needed, the Agency Team will have an opportunity to perform additional analysis to demonstrate to the RWQCB and DDW that tertiary treatment and dilution water will meet the Title 22 and Basin Plan requirements. The RWQCB and DDW will make the final decisions on the required treatment levels after review and evaluation of technical information presented by the Agency Team during the permitting process.

Minimum Travel Time

The Groundwater Recharge Regulations require a minimum "response retention time" or minimum groundwater travel time of two months between the point of surface application or injection, and the point of extraction. Harder's preliminary analysis shows that the recharge water at Sand Canyon will reach the nearest production well (Sheephorn Well) in a little more than approximately 13 months. For preliminary recharge siting purposes, the Groundwater Recharge Regulations allow a "credit" of 0.25 for travel time calculations using an analytical model, as was done for this analysis. Thus, the credited retention time is interpreted to be 3.25 months (13 x 0.25). This credited retention time is less than the minimum retention time of 2 months, indicating that the simulated recharge operation is feasible based on the data assumptions in the analysis.

Pathogen Control

Pathogen controls include specific provisions for log reduction of microorganisms and treatment process requirements. The treatment process used to treat recharge water for a groundwater replenishment reuse project must provide treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia

cyst reduction, and 10-log Cryptosporidium oocyst reduction from raw sewage to usable groundwater. 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 1.0-log reduction. If the treatment process itself does not achieve the required pathogen control credits, additional credit can be gained through underground retention time prior to extraction. The pathogen control credit requirement and underground retention time will be considered as part of the treatment process selection during preliminary design.

Section 3.a – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Recycled Water Policy	Appendix C	3.3 Appendix B	3-9 to 3-12 B-1 to B-12

3.B DESCRIPTION OF THE WATER MARKET

Description of the water market available to utilize reclaimed water, including:

3.b.i Existing and Potential Users

Identification of existing and potential users, expected use, peak use, on-site conversion costs, desire to use reclaimed water, including letters of intent if available.

There is a long history of exploring water reuse opportunities in the Valley to keep this valuable resource within the watershed for a variety of beneficial uses that includes wildlife habitat, landscape irrigation, surface water discharge, and groundwater recharge. Water reuse opportunities in the Valley were first investigated in 1964 and evaluations have continued intermittently since BBARWA was formed in 1974. Appendix C includes a timeline summarizing the evolution of wastewater management in the Valley From 1935 to 2003 as well as a partial list of documents related to water reuse in the Valley, as of April 2005. A document crosswalk is provided at the end of this section.

In 1980, use of recycled water for crop irrigation began. As discussed in Section 1.b, currently all wastewater generated in the Valley undergoes preliminary and secondary treatment and is discharged to the 480-acre site in Lucerne Valley. Treated water is used for irrigation of fodder and fiber crops that are used as feed for livestock.

In 2006 efforts to develop a recycled water program in the Valley culminated with the development of the BBARWA Recycled Water Master Plan (RWMP), and the Program Environmental Impact Report (PEIR). The PEIR examined the alternatives put forth in the RWMP. Alternatives evaluated included non-potable reuse for irrigation, industrial, commercial, and construction use; environmental uses; and groundwater recharge through surface recharge basins. The RWMP recommended a phased implementation of a recycled water program that included both non-potable reuse and groundwater recharge at the Greenspot Recharge Site in the Erwin Lake area. Phase 1 included only groundwater recharge at the Greenspot Recharge Site. A recycled water distribution system to non-potable users was recommended for subsequent phases once assurances were obtained from potential recycled water users who would be

connected. Ultimately, the BBARWA Board certified the PEIR in 2006 and received and filed the RWMP, but decided not to approve the implementation of a recycled water project at that time.

In 2016, the Recycled Water Facilities Planning Study (2016 Study) was prepared which updated the market analysis performed in the 2006 RWMP. The 2016 Study evaluated the types of reuse listed below, and is available in Appendix C. A document crosswalk of the market analysis is provided at the end of this section.

- Landscape Irrigation
- Fish Hatchery Supply
- Surface Water Discharge
- Groundwater Recharge – Inland injection and/or surface spreading
- Direct Potable Reuse, pending future regulations

The 2016 Study concluded that groundwater recharge at two different recharge sites (Greenspot and Sand Canyon) was the best alternative due to a lower unit cost relative to the other alternatives and higher volume of water retained in the Valley. The availability of high-quality recharge water would benefit the Valley by providing a supplemental drought proof source of supply during future extended drought periods. However, continuous large volumes of recharge water are not needed to sustain local groundwater supplies at this time. Stringent water quality requirements and the challenge of disposing of the brine waste generated from the treatment process upgrades makes full-scale groundwater recharge in the Valley a costly option when the project only addresses the potable water supply component of the Valley's water needs. The Agency Team determined that a recycled water project that only recharges the groundwater basin does not provide enough benefit to warrant the high cost. Therefore, full scale groundwater recharge in the Valley was not pursued.

Based on the 2016 Study findings and stakeholder collaboration, additional water reuse alternatives were analyzed that would provide more widespread benefits to the Valley. The goal of the 2018 Bear Valley Lake Alternative Evaluation (2018 Study) was to build on information developed during prior recycled water alternative studies to achieve the following goals.

1. Augment natural recharge for water supply sustainability
2. Protect the rare and diverse habitat and species in the Valley
3. Promote a thriving community and economy through enhanced recreation

The 2018 Study specifically investigated the proposed Replenish Big Bear project (formerly referred to as the Bear Valley Sustainable Water Project). The market analysis analyzed upgrading the WWTP to produce high quality water for the following uses and benefits:

- Continuous discharge of high-quality water to the Stanfield Marsh Wildlife and Waterfowl Preserve, providing a consistent water source to sustain habitat and increase education opportunities for the community and visitors.
- Continuous inflow of water from Stanfield Marsh to the Lake to augment Lake levels, enhance recreational opportunities and aquatic habitat and support water quality improvements

- Continuous discharge of high-quality water to Shay Pond to sustain habitat for the federally listed Stickleback fish, which is currently sustained using potable groundwater
- Periodic groundwater recharge in Sand Canyon during dry periods to strengthen the sustainability of the Basin during extended droughts
- Periodic storage of water locally as snow during wet periods using existing snow making infrastructure. Increased snowpack provides flexibility to further enhance winter recreation, reduce spills from the Lake, augment spring runoff and increase groundwater recharge.
- Irrigate the Bear Mountain Golf Course in the summer to reduce existing groundwater withdrawals from the Basin
- Provide additional water supply for downstream users and habitat when water exceeds needs in the Valley.

The preliminary design capacity of the treatment upgrades is 2.2 MGD, which corresponds with the 10-year average annual flow to the WWTP. It is assumed that any flows in excess of 2.2 MGD would be treated to a secondary level and discharged to Lucerne Valley, similar to the existing discharge method. Accounting for seasonal and annual flow variations and the volume disposed of as brine, the preliminary estimate of yield from Replenish Big Bear is 1,950 AFY. Of this total, 1,870 AFY would be discharged to Stanfield Marsh, and 80 AFY discharged to Shay Pond. Groundwater recharge at Sand Canyon involves the extraction of water from the Lake during dry periods as necessary to supplement groundwater supply. The recharge potential at Sand Canyon is approximately 380 AFY over a 6-month period, based on a recharge area of approximately 4.2 acres and a recharge rate of 2.1 ft/day (21).

In addition, increased extractions of Lake water could occur in the winter to increase snow pack and occur in the summer to offset potable water used to irrigate the Bear Mountain Golf Course. The amount of water that may be available for additional snow making has not been determined at this time. Recycled water use at the golf course has the potential to offset 120 AFY of water that is extracted from the Basin based on the estimated golf course demand.

The 2018 Study is provided in Appendix D and a document crosswalk of the market analysis is provided at the end of this section.

Section 3.b.i – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Evolution of Valley Wastewater Management	Appendix C	Appendix C	C-1 to C-8
2016 Recycled Water Market Analysis	Appendix C	Section 4	4-1 to 4-11
2018 Recycled Water Market Analysis	Appendix D	Section 5	5-1 to 5-12

3.b.ii Consultation with Potential Water Customers

Description of any consultation with potential reclaimed water customers. Letters of intent must be included, if applicable.

As previously discussed, the discharge locations for the advanced treated recycled water are the Stanfield Marsh and Shay Pond. As such, discharge of recycled water at these locations requires agreement and consultation with the agencies that manage and regulate these resources. This section of the feasibility study focuses on the agencies that manage the resources, and information regarding required coordination with permitting agencies is provided in Section 8.

BBMWD is responsible for the management of the Lake and surrounding wildlife habitat preservation and enhancement. As a member of the Replenish Big Bear Agency Team, BBMWD is committed to project implementation. Shay Creek stakeholders include the United States Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), the San Bernardino National Forest (SBNF), BBCCSD, BBLDWP, and BBARWA. These agencies formed a Shay Creek Working Group during the process of preparing the USFWS 2002 Biological Opinion (BO) for the area (22). Replenish Big Bear aligns with the BO requirements which allow BBCCSD to use an 'in-lieu' water supply to maintain minimum outflow requirements. The Agency Team has discussed Replenish Big Bear with other members of the Shay Creek Working Group and received positive feedback about developing a new source of water supply for Shay Pond. Project implementation will require close coordination between the Shay Creek Working Group to confirm the suitability of recycled water to support the long-term survival of Stickleback.

Replenish Big Bear also includes extracting Lake water and discharging it into Sand Canyon to recharge groundwater supplies. Implementation of groundwater recharge in Sand Canyon requires coordination with BBMWD, San Bernardino County Flood Control District, the Resort and BBLDWP. Recharge would only occur during dry periods and will require coordination with BBWMD and consideration of Lake levels. Also, Sand Canyon serves as a flood control channel and recharge would need to be conducted intermittently to avoid interference with flood flows. Coordination with the San Bernardino County Flood Control District is required prior to implementing groundwater recharge at this location. In addition, coordination with the Resort is required because it is anticipated that the existing lake pump station and pipeline owned by the Resort will be used to transfer water to the existing storage pond located at the Bear Mountain Ski Resort. From there, a new pump station and pipeline operated by BBLDWP would convey water to the Sand Canyon Recharge site. The Agency Team has conducted preliminary discussions with the Resort regarding the potential joint use of their facilities and they have expressed an interest in developing an agreement.

Resort coordination is also required to increase winter snowpack (if pursued) and for delivery of irrigation water to the Bear Mountain Golf Course in the summer. As Replenish Big Bear preliminary planning and design efforts advance, the Agency Team will conduct frequent outreach to engage with project stakeholders and obtain necessary agreements to implement the project.

3.b.iii Market Assessment Procedures

Description of the market assessment procedures used.

Section 3.b.i supporting document crosswalk references documents in the Appendix of this feasibility study that provide details on the market assessment that has occurred for recycled water use in the Valley. Replenish Big Bear has been selected as the preferred project because it achieves widespread benefits.

Replenish Big Bear is a multi-component project that achieves the Agency Team's goal of recovering a lost water supply to increase the sustainability of local water supplies and benefit the entire Valley. The Agency Team will continue to collaborate with stakeholders to refine benefits, identify additional benefits and identify the best path forward for sustainable water in the Valley.

3.C CONSIDERATIONS WHICH MAY PREVENT PROJECT IMPLEMENTATION

Discussion of considerations (for example: physical, converting systems for reused water, or public acceptance) which may prevent implementing a water reuse project. Identify methods or community incentives to stimulate reclaimed water demand, and methods to eliminate obstacles which may inhibit the use of reclaimed water, including pricing.

No issues have been identified that would prevent the project from implementation. While many milestones have been completed, including completion of the Recycled Water Facilities Planning Study, Lake Alternative Evaluation, preliminary consultation with regulators, project selection, obtaining local and regional project support, and preliminary groundwater modeling; risks and challenges still exist as project refinement and implementation occurs. Most project risks are small with only minor impacts to either budget, schedule, or both. However, some of the bigger challenges that the Replenish Big Bear project faces include use of recycled water in Shay Pond to support Stickleback survival and brine disposal using the existing effluent pipeline, which are described below.

Shay Pond Stickleback Analysis

Replenish Big Bear includes discharge of approximately 80 AFY of recycled water to Shay Pond to maintain a minimum 20-gallon-per-minute outflow from the pond. In accordance with the USFWS BO, treated water may be used to offset the current potable water being discharged to the pond by BBCCSD. However, the treated water must first be studied to confirm suitability to support Stickleback survival.

The concept of providing recycled water to Shay Pond was previously evaluated by BBARWA, and requirements for implementation were included as a mitigation measure in the Mitigation Monitoring and Reporting Program (MMRP) of the *Final Program Environmental Impact Report for the Big Bear Area Regional Wastewater Agency's Recycled Water Master Plan* (PEIR). The Mitigation Measure provides that BBARWA shall initiate a long-term study of Stickleback survival in recycled water which includes the following steps: (1) obtain submittals outlining a proposed study program to answer the question of whether the Stickleback can survive and breed over several generations without any measurable damage to individuals or the population; (2) consult with the USFWS and CDFW to obtain concurrence and approval to implement the study program; (3) fund the study implementation and compile a report of results and recommendations; and (4) submit the report and recommendation to the USFWS and CDFW with the objective of obtaining an incidental take permit to use recycled water to supplement the habitat in Shay Creek and replace potable water currently being used for this purpose. It is anticipated that these steps will be required for implementation of Replenish Big Bear. Specific issues that are anticipated to be addressed through these studies include contaminants of emerging concern (CECs), endocrine disrupting compounds (EDCs), and temperature.

Obtaining an incidental take permit from USFWS and CDFW is incorporated into the project schedule, but this effort has the potential to delay project implementation. If the study finds that recycled water impacts the long-term survival of the Stickleback, then implementation of this project element would not advance. Replenish Big Bear can still move forward without discharging water to this location, and all recycled water would then be released at Stanfield Marsh.

Brine Disposal

A key challenge with implementation of Reverse Osmosis (RO) treatment, particularly in inland communities, is effective management of the brine concentrate. The Bear Valley Lake Alternative Evaluation (Appendix D) considered a variety of brine disposal alternatives. Based on this analysis, solar evaporation ponds in the Lucerne Valley were identified as the most cost-effective method. The Agency Team anticipates using the existing effluent pipeline for brine conveyance as it is not financially feasible to construct a second pipeline to Lucerne Valley. Further evaluation is needed to assess the suitability of the existing cement lined ductile iron pipe to convey brine. If the pipeline needs to be lined or replaced to make it suitable for long term brine conveyance, it would significantly increase the capital cost. In that case, the brine disposal strategy would be revisited to re-evaluate the most cost effective alternative. The capital and/or operating cost of brine disposal may increase, but it is not anticipated that it would make the project infeasible.

Permitting

Although the permitting strategy for Replenish Big Bear has the potential to be complex, the Agency Team has conducted several preliminary discussions with regulators and does not anticipate that permit requirements will make the project infeasible. Anticipated permitting procedures are discussed in Section 8.d of the feasibility study.

3.D AGENCIES WITH JURISDICTION

Identification of all the water and wastewater agencies that have jurisdiction in the potential service area or over the sources of reclaimed water.

As discussed throughout this feasibility study, Replenish Big Bear is a regional recycled water project, and the Agency Team is comprised of BBARWA, BBCCSD, BBLDWP and BBMWD, which encompass all of the water and wastewater agencies that have jurisdiction in the project area. The Agency Team has a long history of cooperative management of their shared water resources and continue to actively work together to manage groundwater supplies, surface waters, and wastewater. Section 1.a provides an introduction to the Agency Team and additional information regarding the water management practices in the Valley are provided below.

Big Bear Valley Groundwater Management Zone

BBLDWP and BBCCSD manage and monitor the Basin. Through the Groundwater Monitoring and Management Plan, BBLDWP contributes to Basin management by conducting monthly monitoring of 18 non-pumping monitoring wells and approximately 40 production wells, bi-annual Technical Review Team

meetings, and has established conservation levels based on groundwater levels and trends in key wells. BBCCSD also manages the groundwater level and water quality by conducting monthly monitoring in 11 non-pumping monitoring wells and 13 production wells, monthly monitoring of surface flow in Van Dusen Creek, Shay Creek and Green Canyon Creek, and has established action criteria for average groundwater levels across the BBCCSD service area that are tied to conservation stages and measures.

In 2014, California passed the Sustainable Groundwater Management Act (SGMA), which established a framework for sustainable, local groundwater management. DWR is responsible for implementing the law and supporting local agencies to achieve sustainable groundwater management. DWR identified the Basin as a Medium Priority Basin and SGMA requires Medium Priority Basins that are not in critical overdraft to be managed under a Groundwater Sustainability Plan (GSP) by January 21, 2022. The GSP will be developed and implemented through the Bear Valley Basin Groundwater Sustainability Agency (BVBGSA), which is a Joint Powers Authority (JPA) comprised of the four Replenish Big Bear agencies. The GSP is anticipated to be completed by 2020.

Big Bear Lake Water Management

Key management practices and documents that govern the management of the water in Big Bear Lake are provided below. This information is also presented graphically in Figure 3-2.

The 1977 Judgement

The Big Bear Dam was originally constructed to provide water storage for Bear Valley Mutual Water Company (Mutual), which was formed in 1903 by the citrus growers of the Redlands/Highland area to ensure water supply for irrigation needs. The historic operation of the Big Bear Lake as an irrigation reservoir resulted in drastic fluctuations in Lake levels, which conflicted with the goals of BBMWD and the community of Big Bear Valley. A legal conflict over the water rights and management of the Lake was ultimately settled out of court through the 1977 Judgement. Under the terms of this judgement, BBMWD purchased the Lake bottom, Bear Valley Dam, and the right to utilize and manage the surface of the Lake from Bear Valley Mutual. Bear Valley Mutual retained a storage right and ownership of all water inflow into the Lake (23) . Mutual has the right to request Lake releases as may be reasonably necessary to meet the requirements of Mutual's stockholders, not exceeding 65,000 AF in any ten-year period.

In-Lieu Water and Lake Release Policy

The 1977 Judgment allows BBMWD to maintain a higher water level in the lake by delivering water to Mutual from an alternate source of water. This alternate source of water, referred to as In-Lieu Water, comes mainly from the State Water Project (SWP) through a contract executed in 1996 with San Bernardino Valley Municipal Water District (Valley District), a State Water Contractor. This In-Lieu Agreement provides that:

- BBMWD shall make Lake releases to meet the demands of Mutual when such releases are consistent with BBMWD's Lake Release Policy (described below)

- Whenever Lake releases under the Lake Release Policy are not sufficient to meet Mutual's demands, Valley District shall provide In-Lieu Water to Mutual to meet the remainder of their demands
- BBMWD shall pay Valley District a fixed annual fee, which is escalated annually based on BBMWD's assessed value. In 2018, BBMWD's In-Lieu payment to Valley District was $1,476,043.

BBMWD's current Lake Release Policy was adopted in 2006 and provides guidance on how Mutual demands will be met depending on the level of the Lake.

- When Big Bear Lake is in the top 4 feet, Mutual's demands will be met with lake releases
- When Big Bear Lake is between 4 and 6 feet below full, lake releases will be made in the months of November through April and In-Lieu Water will be obtained from May to October
- When Big Bear Lake is more than 6 feet below full, In-Lieu Water will be obtained

New Wastewater Exports

The 1977 Judgement required that, beginning in 1986, any net export of water to an area of the Upper Bear Creek Watershed that is not tributary to the Santa Ana Watershed would be transferred from BBMWD's Lake Account to Mutual's Lake Account, as discussed below. A net wastewater export occurs annually and is calculated as the difference between the wastewater that leaves the Big Bear Lake watershed and the water that is imported into the Big Bear Lake Watershed from the Baldwin Lake Watershed. Groundwater that is produced within the Big Bear Lake Watershed and sent to the sewer after use is treated at the BBARWA WWTP (located in the Baldwin Lake Watershed), then discharged to Lucerne Valley; this water is exported from the Big Bear Lake Watershed. Groundwater that is produced in the Baldwin Lake Watershed by BBLDWP and BBCCSD and served to customers within the Big Bear Lake Watershed is imported into the Big Bear Lake Watershed. In 2016, the net wastewater exported from the Big Bear Lake Watershed was 848 AF.

Watermaster Accounting

The 1977 Judgment requires the establishment of a Watermaster to maintain three basic accounts:

1. BBMWD's Lake Account - A detailed account to reflect actual operation of the Lake by BBMWD.
2. Mutual's Lake Account - A corollary account that simulates the effect of Mutual's operation if Mutual had owned the Lake, the In-Lieu Program was not in place, and there was no net wastewater export from the Big Bear Lake Watershed.
3. Basin Make-up Account - An account of BBMWD's annual and cumulative obligation for Basin Make-up Water in the San Bernardino Groundwater Basin to offset any deficiencies in recharge as a result of BBMWD's Lake operation. In 2016, the Basin Make-up Account had an ending balance of 27,120 AF. This positive amount means that there has been an increase in groundwater recharge in the San Bernardino Basin as a result of the BBMWD operation of the Lake.

Figure 3-1 depicts the actual Lake levels under BBMWD's operation compared to the simulated Lake operation by Mutual as shown by the balance of Mutual's Lake Account. In 2016, BBMWD's operation of the Lake resulted in a Lake level 14.43 feet higher than it would have been under Mutual's operation.

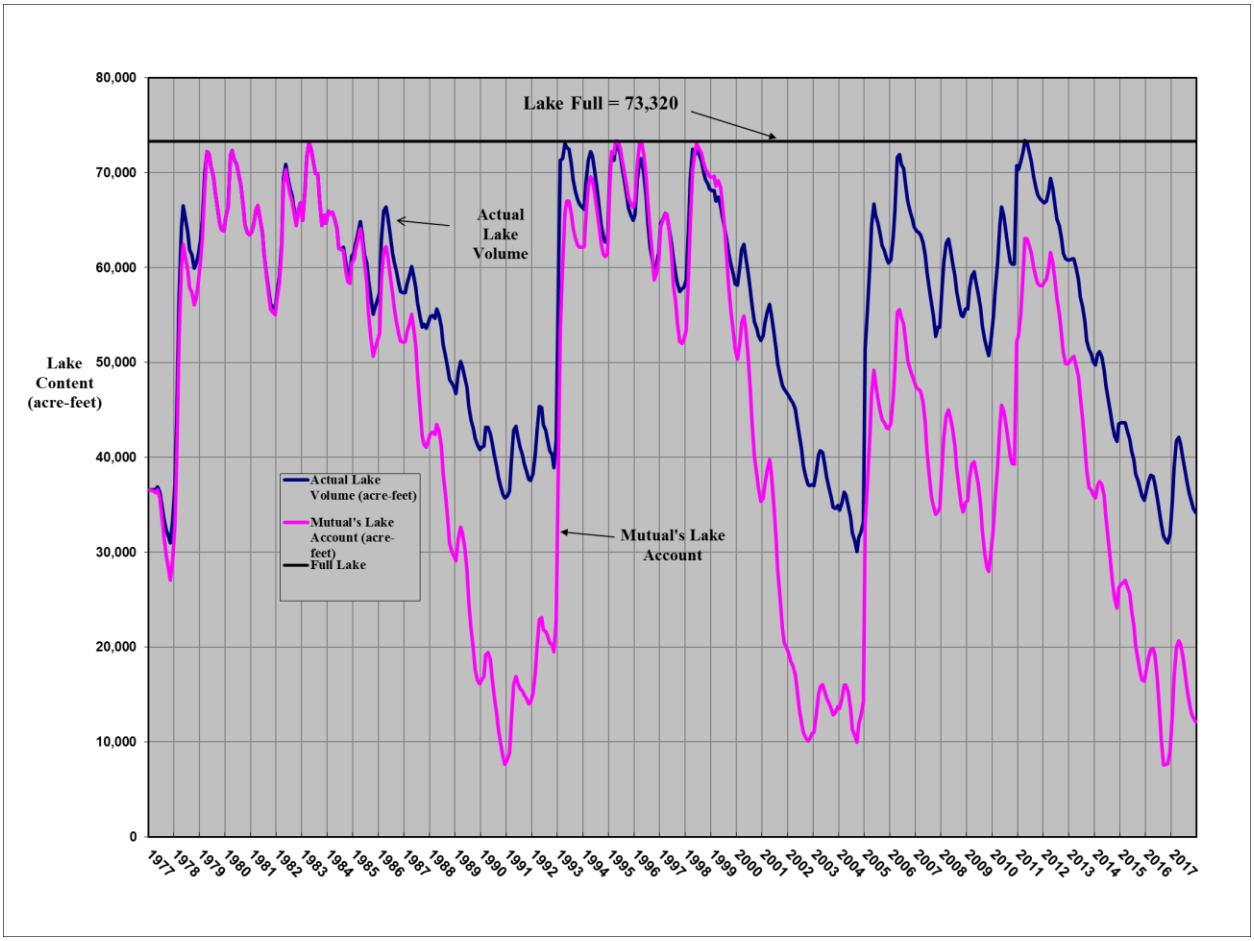


Figure 3-1. Actual Lake Levels and Mutual's Lake Account Comparison, 1977 - 2016

Snow Making Withdrawals

BBMWD currently has a contract with the Big Bear Mountain Resorts, allowing the withdrawal of an allocated amount of water from the Lake to use for snow making purposes. Currently, the Resort is authorized to withdraw a maximum of 11,000 acre-feet (AF) of water from the Lake over a 10-year rolling period, not exceeding 1,300 AF in any single year. It is calculated that half of the water withdrawn from the lake for snow production is returned as runoff (24).

Fish Protection Releases

In 1995, the SWRCB issued Order No. 95-4, which requires BBMWD and Mutual to release water from the Lake for fishery protection in Bear Creek. Sufficient water must be released from the Lake to maintain a seven-day average flow of 1.2 cubic feet per second (cfs) and minimum average daily flow of 1.0 cfs in Bear Creek no more than 500 feet downstream of its confluence with West Cub Creek, referred to as

Station A. SWRCB Order No. 95-4 also requires sufficient releases to maintain a minimum flow of 0.3 cfs approximately 300 feet downstream of the toe of the dam, referred to as Station B. The dam releases required to maintain these minimum flows vary by month and by hydrologic year type (normal, above normal or below normal precipitation).

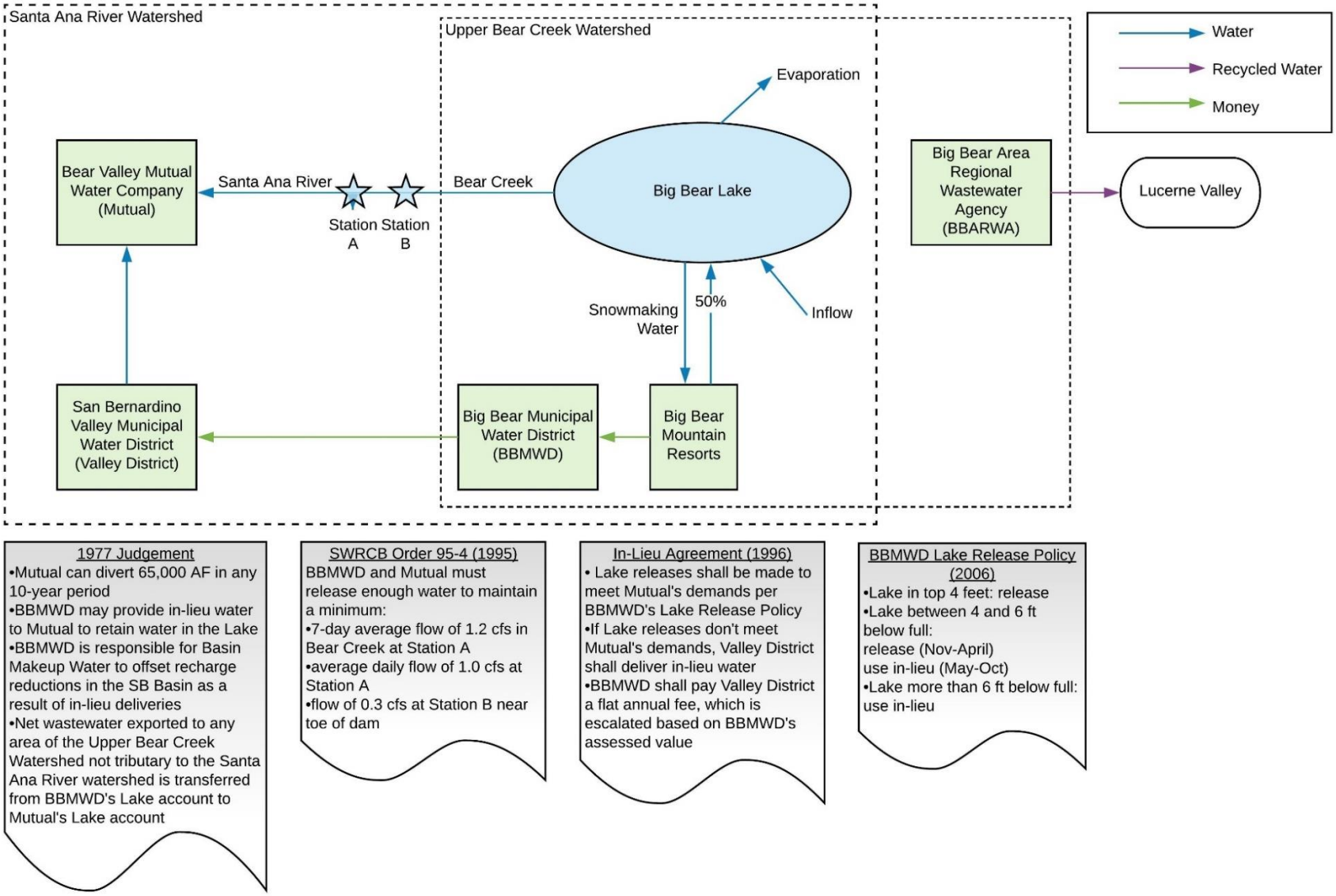


Figure 3-2. Big Bear Lake Management Framework

Regulatory agencies governing the development of recycled water projects with jurisdiction in the project area include the SWRCB, DDW, and the RWQCB's (Colorado River Basin, and Santa Ana) which are discussed further in Section 8.d.

3.E POTENTIAL SOURCES OF WATER TO BE RECLAIMED

Description of potential sources of water to be reclaimed, including impaired surface and ground waters.

The only source of water that will be reclaimed is treated effluent from the BBARWA WWTP as described in Sections 1.c and 3.f. No other sources of water are available to be reclaimed.

3.F DESCRIPTION AND LOCATION OF SOURCE WATER FACILITY

Description and location of the source water facilities, including capacities, existing flows, treatment processes, design criteria, plans for future facilities, and quantities of impaired water available to meet new reclaimed and reused water demands.

BBARWA owns and operates a 4.9 million gallon per day (MGD) capacity WWTP located just south of Baldwin Lake on the east side of the Valley. In 2016, the WWTP treated approximately 1.9 MGD of municipal wastewater collected from BBCCSD, the City of Big Bear Lake and CSA 53 in Fawnskin.

Existing and Projected Wastewater Flows

The influent flows to BBARWA's WWTP are comprised of three components:

- Flow from full-time residential homes
- Flows due to tourism, commercial activities and part-time residential homes
- Flows from Infiltration and Inflow (I/I) due to precipitation

These components create a seasonal variation in the wastewater flows treated at the plant. Based on full-time residency rates from BBCCSD and BBLDWP and the number of full-time dwelling units reported by Bear Valley Electric, BBARWA's 2010 Sewer Master Plan (2010 SMP) estimated that the full-time residential rate is 38% (25).

The tourism season is largely concentrated in the months of December through April due the local ski resorts; this period also corresponds with higher precipitation and increased flows due to I/I. The months of June and July also see a slight rise in tourism due to Lake recreation activities. Average daily flows and the seasonal variation during the 10-year period from 2007 to 2016 (which included a wet and dry cycle) are shown in Figure 3-3. The average daily flow for this 10-year period is approximately 2.2 MGD and the maximum month flow is 5.5 MGD.

The 2010 SMP estimated the future sewer flows based on future population and equivalent dwelling unit (EDU) projections utilizing the constant sewer load index of 172 gallons per day (gpd) for full time residential EDUs. The 2010 SMP assumes the full-time EDUs will increase at an annual rate of 0.8% over a 20-year period based on a long-term average. Assuming the full-time residence rate remains at 38% and that I/I will be consistent with the previous average, the 2010 SMP projects that the average annual sewer flows will increase to 2.7 MGD by 2030. However, the 2010 SMP flow projections did not account for reduced sewer loads due to recent water conservation so future flows will likely be significantly lower

than projected. As such, future flow projections need to be updated as part of the preliminary design phase to inform the design capacity for treatment upgrades based on realistic flows determined by current water use trends. Replenish Big Bear intends to maximize recycled water production to the greatest extent feasible for discharge to Stanfield Marsh and Shay Pond. Together these discharge locations can accommodate the volume of recycled water produced and the project is not being designed to meet existing or future recycled water demands from potential specific customers. The BBARWA 2010 Sewer Master Plan is provided in Appendix F, and a document crosswalk is provided at the end of this section.

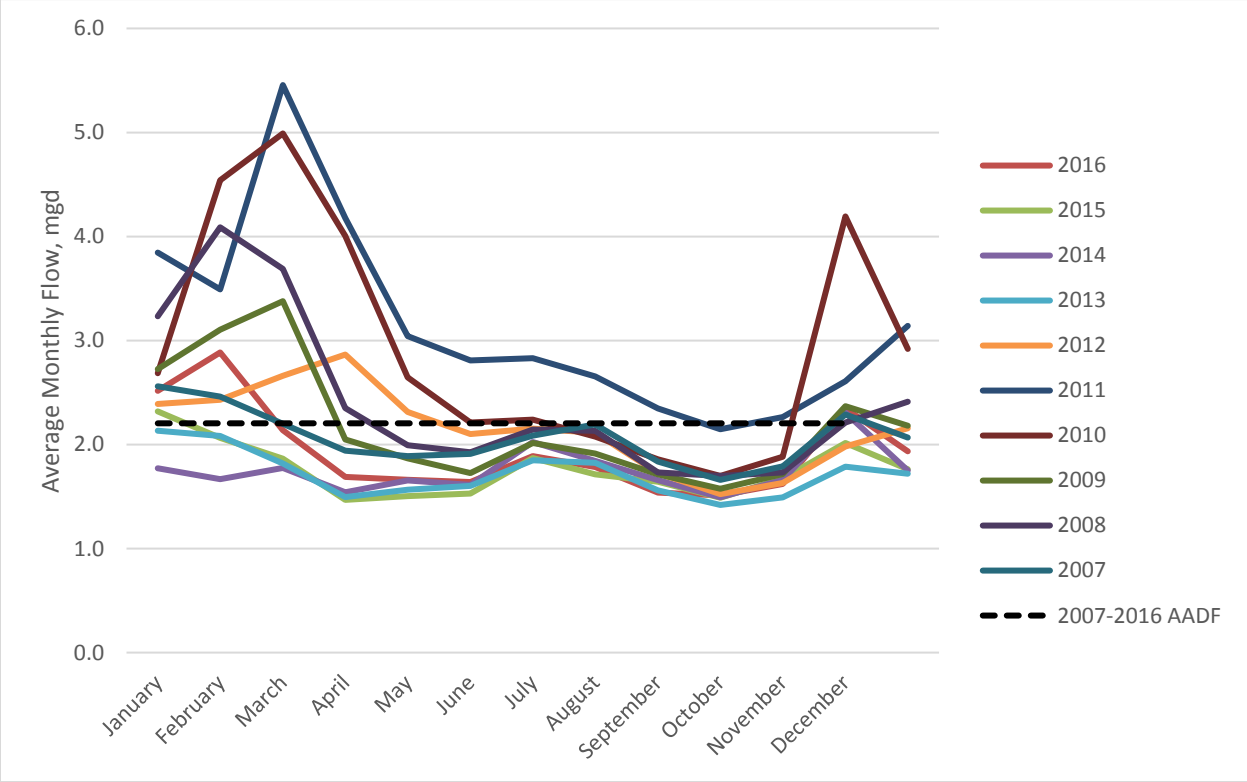


Figure 3-3. 10-Year Average Daily Flows by Month (2007-2016)

Existing Facilities

BBARWA's WWTP is located on a 93.5-acre lot. The WWTP process components occupy 11.2 acres and the remaining 82.3 acres include storage ponds and evaporation ponds. Influent flows are conveyed through three BBARWA operated sewer mains and lift stations to the plant. The WWTP currently provides preliminary and secondary treatment. Table 3-2 summarizes the WWTP's treatment processes and the process flow diagram is depicted in Figure 3-4.

BBARWA recently completed several upgrades to the sludge dewatering process. Heat exchangers were installed on the existing generator to capture waste heat; hot water from the heat exchangers is used to heat the floor of the lined drying bed. A 315 foot by 60-foot metal building was also constructed to cover the lined drying bed so that the dewatering process could operate year-round.

BBARWA's WWTP generates its own electricity using three natural gas generators that can be run in parallel: two 250 KW Cummins generators and one Waukesha generator with a rating of 600 kilowatts for a total generating capacity of 1100 kilowatts. BBARWA only generates the energy needed to operate the WWTP and Administration Building and typical generation is in the range of 225,000 - 350,000 kilowatt-hours (kW-hr) per month. In 2015, total energy generation was 3,100,216 kW-hr. Natural gas consumption was 43,544 million British Thermal Units (MMBTU) or 435,440 therms. BBARWA also has a connection to the Bear Valley Electric utility system that is used to run its pumping stations and can serve as an emergency backup power supply for the WWTP.

Table 3-2. BBARWA's WWTP Treatment Process

Treatment Process[1]	Description
Preliminary Treatment	Consists of bar screens, grit removal and disposal of solids
Secondary Biological Treatment	Consists of oxidation ditches which use mechanical aeration to achieve organic material stabilization, nutrient removal and pathogen reduction. Solids production is minimized by the Cannibal® Solids Reduction System, through use of a side-stream interchange bioreactor with aeration controlled by the ORP level.
Secondary Sedimentation Treatment	Consists of clarifiers to settle solids. Waste activated sludge (WAS) is pumped to a dissolved air floatation (DAF) system
WAS Thickening	Consists of a DAF system that skims sludge for sludge dewatering. Filtrate is returned to oxidation ditches.
Sludge Dewatering[2]	Sludge is dewatered using a belt press and dried in a building with heated floors that utilize waste heat from a generator. The building allows sludge to be dried year-round. The dry solids are hauled to a composting facility in Redlands.

Notes:
1. Descriptions obtained from the 2005 BBARWA Recycled Water Master Plan unless otherwise noted.
2. Obtained from BBARWA's website - http://bbarwa.org

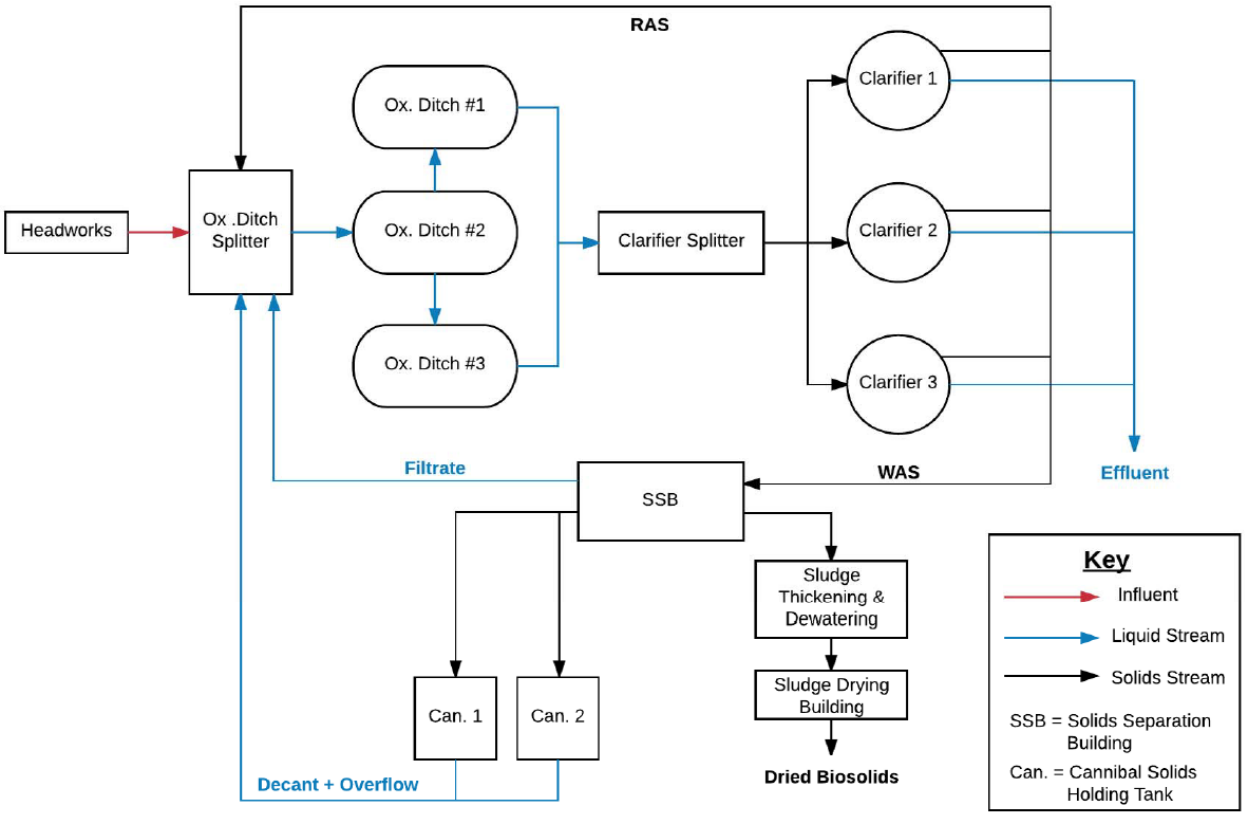


Figure 3-4. BBARWA WWTP Process Flow Diagram

Existing Discharge Requirements

The wastewater stream that is treated by the WWTP consists of sewage generated from urban land uses. There are no significant sources of major industrial waste or processing water treated by the facility (25). The WWTP discharge is currently regulated by the Santa Ana Regional Water Quality Control Board (SARWQCB) under Waste Discharge and Producer/User Water Recycling Requirement (WDR) Order No. R8-2005-0044 (Santa Ana WDR) issued on June 24, 2005 (Appendix G). There are three permitted discharge locations, summarized previously in Table 1-1 . Discharge Point 001 for irrigation in Lucerne Valley, is located within the Colorado River Basin Region and is regulated by Colorado River Basin RWQCB WDR Order No. R7-2016-0026 (Colorado WDR), issued on June 30, 2016 (Appendix H).

Treated secondary effluent is discharged to a 480-acre site in Lucerne Valley (LV Site) for irrigation of crops used as feed for livestock. Use of recycled water for crop irrigation at the LV Site began in 1980 and 100% of the WWTP effluent is currently discharged to the LV Site. As previously discussed, Figure 1-7 depicts the location of BBARWA's existing recycled water distribution facilities and the LV Site, approximately 20 miles north of the Valley. Discharge Points 002 and 003 are not currently used.

The effluent requirements for conventional pollutants for recycled water discharged to the LV Site contained within the Colorado WDR are presented in Table 3-3 and a summary of the actual effluent quality in 2015 is presented in Table 3-4.

The previous Colorado WDR that regulated this discharge (Board Order 01-156 - Appendix I) included a Total Dissolved Solids (TDS) limit of a maximum of 400 mg/L above the domestic source water. The WWTP discharge was always well within compliance with this requirement. The recently updated WDR required BBARWA to provide a technical report in the form of a study that analyzes the impacts to groundwater in the vicinity of the LV Site by the discharge and an evaluation of water quality trends. The results of the study will be used to establish an appropriate effluent limitation for TDS. BBARWA submitted this report to the Colorado River Basin RWQCB in December 2017 with a recommendation that the prior TDS limit remain unchanged. The Colorado River Region RWQCB has not yet provided feedback on the report or an indication of whether the TDS effluent limitation will be changed. At this time, a substantive change in the TDS limit is not anticipated and treatment upgrades are not anticipated to be required to remain in compliance with this WDR. As such, there are no plans for future facilities.

Table 3-3. Discharge Limits for LV Site

Parameter	Units	30 Day Mean	7 Day Mean	Maximum Daily
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	-
Total Suspended Solids (TSS)	mg/L	30	45	-
Chloride	mg/L	60	-	80
Sulfate	mg/L	60	-	80
Boron	mg/L	-	-	0.75
Total Nitrogen	mg/L	10	-	-
pH	pH units	Between 6.0 - 9.0 at all times		

Table 3-4. 2015 BBARWA WWTP Effluent Quality – Annual Average

Parameter	Value	Units
TDS	453	mg/L
BOD_5	6	mg/L
TSS	13	mg/L
Chloride	56	mg/L
Sulfate	43	mg/L
Phosphorus	2.3	mg/L
Total Inorganic Nitrogen (TIN)	4.6	mg/L
pH	7.12 – 8.09	pH units

Section 3.f – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Existing and Projected Wastewater Flows	Appendix C	3	3-1 to 3-2
Existing and Projected Sewer Flow	Appendix F	3	3-1 to 3-15
BBARWA Service Area	Appendix F	2	2-1 to 2-5
Existing Facility Capacities	Appendix F	4	4-1 to 4-33
BBARWA Capital Improvement Plan	Appendix C	3.24	3-9

3.G CURRENT WATER REUSE IN THE STUDY AREA

Description of any current water reuse taking place in the study area, including a list of reclaimed water uses, type and amount of reuse, and a map of existing pipelines and use sites.

Currently all wastewater generated within the Valley undergoes preliminary and secondary treatment at the BBARWA WWTP and is discharged to the LV Site approximately 20 miles north of the Valley. No water reuse is currently taking place in the Valley. Additional information regarding current water reuse in the Valley is provided in Sections 1.c and 3.f of this feasibility study.

3.H OTHER WASTEWATER AND DISPOSAL OPTIONS

Description of current and projected wastewaters and disposal options other than the proposed Title XVI project, and plans for new wastewater facilities, including projected costs, if any.

Section 3.f describes the current and projected wastewater flows for the Valley, and the permitted discharge locations for disposal. Although there are currently three permitted discharge locations provided in the WDR, only the LV Site is used to dispose all the treated effluent. BBARWA and the Agency Team are not considering disposal options other than the advanced treatment of recycled water for beneficial use in the Valley. This feasibility study presents information that identifies Replenish Big Bear (Proposed Title XVI Project) as the superior project alternative. If Replenish Big Bear is not implemented, the currently permitting disposal practice would continue; there are no plans for new wastewater facilities within the Valley.

3.I RECLAMATION AND REUSE TECHNOLOGY IN USE IN STUDY AREA

Summary of any water reclamation and reuse technology currently in use in the study area, and opportunities for development of improved technologies.

Section 3.f describes the current preliminary and secondary treatment process and technology utilized at the BBARWA WWTP. Opportunities to improve reuse technology at the WWTP are described in Sections 4 and 5 of this feasibility study.

4 DESCRIPTION OF ALTERNATIVES

WTR 11-01 Requirement 5.B.4

The following information is required.

(a) Description of the non-Federal funding condition. The reasonably foreseeable future actions that the non-Federal project sponsor would take if Federal funding were not provided for the proposed water reclamation and reuse project, including estimated costs.
(b) Statement of the specific objectives all alternatives, including the Title XVI Project, are designed to address.
(c) Description of the proposed Title XVI project including detailed project cost estimate; annual operation, maintenance, and replacement cost estimate; and life cycle costs shall be provided with sufficient detail to permit a more in-depth evaluation of the project, including non-construction costs. In this regard, the cost estimates shall clearly identify expenditures for major structures and facilities, as well as other types of construction and non-construction expenses, and shall be based on calculated quantities and unit prices.
(d) The estimated costs shall also be presented in terms of dollars per million gallons (MG), and/or dollars per acre-foot of capacity, to facilitate comparison of alternatives described in Paragraph 4.B(5) below. References, design data, and assumptions must be identified. The level of detail shall be as required for feasibility studies in RM D&S, Cost Estimating (FAC 09-01).
(e) Description of waste-stream discharge treatment and disposal water quality requirements, if applicable, for the proposed Title XVI project.
(f) Description of at least two alternative measures, or technologies available for water reclamation, distribution, and reuse for the project under consideration. These alternatives must be approvable by the state(s) or tribal authorities in which the project will be located.

4.A NON-FEDERAL FUNDING CONDITION

Description of the non-Federal funding condition. The reasonably foreseeable future actions that the non-Federal project sponsor would take if Federal funding were not provided for the proposed water reclamation and reuse project, including estimated costs.

Implementation of Replenish Big Bear will diversify the water supply portfolio in the Valley and secure a drought proof local source of water to augment groundwater recharge, enhance habitat for rare and diverse species and strengthen the local recreation-based economy. Due to the broad benefits for the community, the Agency Team is committed to advancing this recycled water project. In order to fund Replenish Big Bear, the Agency Team intends to leverage local funds along with state and federal funds. Information regarding actions the Agency Team will take in the absence of Federal funding is detailed below.

Local Funding

In response to state mandated SGMA requirements for groundwater management, the four agencies advancing Replenish Big Bear established a JPA (BVBGSA) to prepare a GSP. Formation of the JPA provides the framework and necessary agreements for the Agency Team to continue protecting the Basin and implement Replenish Big Bear. Currently each of the agencies have committed to equally sharing costs to advance the projects planning, preliminary engineering, and required documentation to satisfy the California Environmental Quality Act (CEQA)/ National Environmental Policy Act (NEPA) requirements. Each agency budgeted $250,000 for a total of $1,000,000 in FY 2018 to begin this work and intends to budget additional funds in FY 2019 to continue developing the project.

Details regarding ultimate cost sharing between members of the Agency Team for additional fixed and variable recycled water project costs have not been determined at this time. The Agency Team will continue to collaborate and develop the governance structure as the Replenish Big Bear planning phase advances. The Agency Team is committed to advancing the project and a significant investment in time, money, and effort is already being expended to implement the regional project.

Additional Funding

The Replenish Big Bear Agency Team plans to leverage state and federal funding to the greatest extent possible to assist with project costs and reduce potential burdens to local rate payers. In the absence of federal funding, the Agency Team plans to supplement cost-sharing contributions with a combination of grants and low interest loans. A funding and financing strategy plan is currently being developed to pursue funding from programs that align with the Replenish Big Bear objectives and timeline. Potential non-federal funding programs that have been identified include:

- DWR Integrated Regional Water Management Implementation (IRWM) Grants, implemented through the Santa Ana Watershed Project Authority
- SWRCB Water Recycling Funding Program Grant and Loan Program
- SWRCB Clean Water State Revolving Fund Loan Program
- iBank Loan Program
- Cal OES Hazard Mitigation Grant Program
- Proposition 1 & Proposition 68 funding through the California Department of Fish and Wildlife (CDFW), Wildlife Conservation Board (WCB), and California Natural Resources Agency (CNRA).

Additional information regarding eligible funding programs being considered by the Agency Team is provided in Appendix C, and a document crosswalk is provided at the end of this section.

As previously noted, 100% of the Valley's populated area is considered a DAC or SDAC. As such, it is anticipated that Replenish Big Bear will be competitive when pursuing funding because many funding and financing programs have requirements to fund projects that benefit DAC and SDAC communities.

The Agency Team will continue to explore grant and financing opportunities as the project advances.

Section 4.a – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Eligible Funding Program	Appendix C	8	8-1 to 8-3

4.B ALTERNATIVE OBJECTIVES

Statement of the specific objectives all alternatives, including the Title XVI Project, are designed to address.

The goal of the Agency Team is to implement a project that recovers water discharged from the BBARWA WWTP outside the watershed and keeps the resource in the Valley for beneficial reuse. This goal will be achieved through development of a multi-benefit water reuse project that:

- Augments natural recharge for water supply sustainability
- Protects the rare and diverse habitat and species in the Valley
- Promotes a thriving community and economy through enhanced recreation

4.C DESCRIPTION OF PROJECT WITH COST ESTIMATE

Description of the proposed Title XVI project including detailed project cost estimate; annual operation, maintenance, and replacement cost estimate; and life cycle costs shall be provided with sufficient detail to permit a more in-depth evaluation of the project, including non-construction costs. In this regard, the cost estimates shall clearly identify expenditures for major structures and facilities, as well as other types of construction and non-construction expenses, and shall be based on calculated quantities and unit prices.

Replenish Big Bear includes planning, design, permitting and construction of Advanced Treatment Facility upgrades, conveyance infrastructure for product water and brine, recharge and brine evaporation ponds, and monitoring wells. These facilities will supply advanced purified water to benefit the Stanfield Marsh Wildlife and Waterfowl Preserve (Stanfield Marsh), Big Bear Lake (Lake) water levels, Federally listed Unarmored Threespine Stickleback fish (Stickleback) in Shay Pond, increase groundwater recharge at Sand Canyon, increase stored water supplies as snow, and improve downstream surface water management in the San Bernardino Basin. The project will provide the Valley with a new drought proof water supply by utilizing a resource that is currently discharged outside the watershed. In addition, the project will enhance habitat resiliency to benefit the unique local flora and fauna and strengthen the regions tourism industry. Details regarding Replenish Big Bear project elements and estimated costs are provided below.

Project Description

Treatment Upgrades

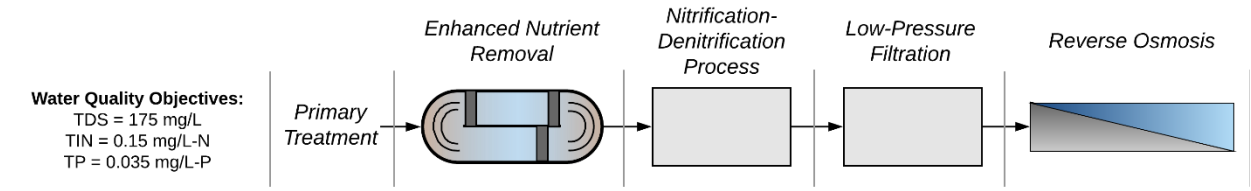
Replenish Big Bear requires upgrades to BBARWA's existing wastewater facility to meet the water quality objectives identified for Big Bear Lake in the Santa Ana Basin Plan (Table 3-1). Inorganic nitrogen and phosphorus must be removed through multiple in-series processes because a single process cannot reliably reduce effluent TIN and TP concentrations to the levels required for Big Bear Lake's WQOs. To achieve these strict effluent limits, it is anticipated that BBARWA will need to implement a series of upgrades to existing unit processes and integrate new unit processes, specifically:

- Upgrade the extended aeration process through retrofit of the existing oxidation ditches to optimize biological nitrification-denitrification (NDN) and phosphorus removal. Phosphorus removal occurs in anaerobic conditions and denitrification occurs in anoxic conditions, both of which could be incorporated into the existing infrastructure with modifications to aeration patterns or with dedicated tanks. If needed, chemical precipitation of soluble phosphorus can be performed through addition of a metal salt within the activated sludge tankage, upstream of clarification.
- Nutrient-laden liquid sidestreams, which are produced during solids handling processes, may require management or treatment due to the potential negative impacts of returning high nutrient loads to other unit processes. The need for sidestream treatment will be determined during subsequent phases of the project when a plant-wide mass balance and/or process model can be developed to identify sidestream characteristics.
- Retrofit or operational modifications to secondary clarifiers for settling of phosphorus precipitates. It is important to note that chemical precipitation of phosphorus within the existing clarifiers requires an evaluation of effects on sludge production and handling. Removal of phosphorus through chemical precipitation is expected to increase solids production and impact operation of the current solids handling process.
- Addition of an NDN process to reduce inorganic nitrogen concentrations. This process may consist of a biologically active filter with sand or synthetic media, or biological reactors designed specifically for nitrogen and phosphorus removal. The denitrification process will likely require an external carbon source to facilitate the reduction of nitrate.
- Low pressure filtration, such as microfiltration (MF) or ultrafiltration (UF), to reduce flocculated or colloidal solids upstream of the reverse osmosis (RO) process.
- RO to reduce TDS concentration and nutrient concentrations. The assumed operational recovery for the RO system is 90% of the design flow. While it may be challenging for conventional RO systems to achieve this recovery rate, emerging RO technologies that are configured for brine recirculation, multiple pass, or in-series operation to achieve high recoveries (such as closed-circuit reverse osmosis), have been demonstrated to achieve high recovery rates with reduced energy consumption at comparable capital costs to conventional RO (26). Such technologies would need to be piloted with BBARWA's specific water quality characteristics to verify expected performance for this application.
- Addition of ultraviolet (UV) disinfection to deactivating any bacteria, viruses, and other microorganisms.

The low-pressure filtration and RO unit processes are expected to provide the physical filtration for reduction of the 1 to 2 mg/L of TIN and TP coming from upstream processes. RO is the only unit process capable of removing TDS, making it a critical unit process for compliance with WQOs. At this stage of planning, it is assumed that 100% of the design flow will need to receive RO treatment to meet the WQOs. RO offers the advantage of removing organics, inorganics and nutrients to a sufficient level for meeting nutrient WQOs; however, the RO process also presents the challenge of managing brine stream disposal in an inland location, as further discussed in this feasibility study. The Agency Team is in the process of

coordinating with regulators to identify whether permitting strategies that do not require 100% RO may be feasible.

A representative process flow diagram (PFD) for this alternative is shown in Figure 4-1. Potential water quality performance for TIN, TP and TDS constituents are estimated for each unit process; however, it is important to note that the performance of each of these unit processes is highly site specific based on the water quality composition being treated. A pilot test of each unit process will be required to refine performance estimates and establish design criteria.



Potential Water Quality Performance	TIN (mg/L-N)	--	5	1	1	0.1
	TP (mg/L-P)	8	2	2	0.1	0.02
	TDS (mg/L)	430	430	430	430	50*

Figure 4-1. Representative Treatment Process Flow Diagram

Design Capacity and Annual Yield

The design capacity of the treatment upgrades is assumed to be 2.2 mgd, which corresponds with the 10-year average annual flow from 2007 to 2016. Based on a preliminary sizing analysis, increased treatment capacity results in only a marginal increase in yield and does not provide an appreciable increase in economic or environmental benefit. It is assumed that any flows in excess of 2.2 mgd would be treated to a secondary level and discharged to the LV Site, similar to the existing discharge method.

However, due to daily and seasonal variations in flow, the actual yield will be less than 2.2 mgd. It is assumed that the existing secondary effluent storage volume at the WWTP will offset some daily variations in flow, but the capacity is not sufficient to offset seasonal variations, particularly in dry years when summer flows have been as low as 1.6 mgd. A preliminary analysis based on monthly flows for the 10-year period from 2007-2016 indicates that the average secondary effluent captured for advanced treatment will be approximately 1.93 mgd, or 2,160 AF. Based on a 90% recovery rate from RO, the average recycled water production would be 1.74 mgd, or approximately 1,950 AFY. The design capacity and RW production estimates will be refined during the preliminary and final design phases based on more detailed flow data and actual MF and RO recovery rates.

Recycled Water Distribution

Recycled water is planned to be discharged continuously to Shay Pond and Stanfield Marsh; therefore, it will not be necessary to store recycled water at the WWTP. It is anticipated that a new effluent pump station will be required to pump recycled water to both Shay Pond and Stanfield Marsh. The pump station capacity will match the capacity of the recycled water system, which is 2.2 mgd, or approximately 1,530

gpm. Note that it may be possible to repurpose the existing WWTP secondary effluent pump station and avoid the need for a new effluent pump station. An evaluation of the existing pump stations and the WWTP operations will be conducted during preliminary design to determine if this option is viable; however, to be conservative the feasibility study includes a new pump station.

Conveyance of recycled water to Shay pond will occur through an existing 6-inch C-900 PVC pipeline that begins at the intersection of Shay Road and Palomino Drive and terminates near Shay pond. This pipeline was constructed in 1986 for future use but has never been put into service. An extension of the pipeline by approximately 710 feet will be required to reach the Shay Pond discharge location. Conveyance of recycled water to Stanfield Marsh requires construction of a new 12-inch pipe from the WWTP to the proposed discharge point which is a length of approximately 19,940 feet.

When water is needed for recharge in Sand Canyon, it is anticipated that the Resort's existing snowmaking infrastructure will be used to transfer water into the existing storage pond located at Bear Mountain Ski Resort. The existing facilities are used primarily in the winter and are expected to be available for the proposed recharge operation, which would only occur in April – October when the resorts are not making snow. A new pump station will be constructed near the pond to convey water through a new pipeline to discharge into Sand Canyon. The pump station and pipeline are sized to convey 380 AF of recharge water over a 6-month period, which equates to approximately 470 gpm. Groundwater recharge at Sand Canyon will require construction of 2 monitoring wells that will be used to collect groundwater samples and monitor water quality in the area.

Existing infrastructure could be used by the Resorts to utilize excess Lake water during wet periods for snow storage and irrigation during the summer.

The proposed Replenish Big Bear infrastructure is shown in Figure 4-2.

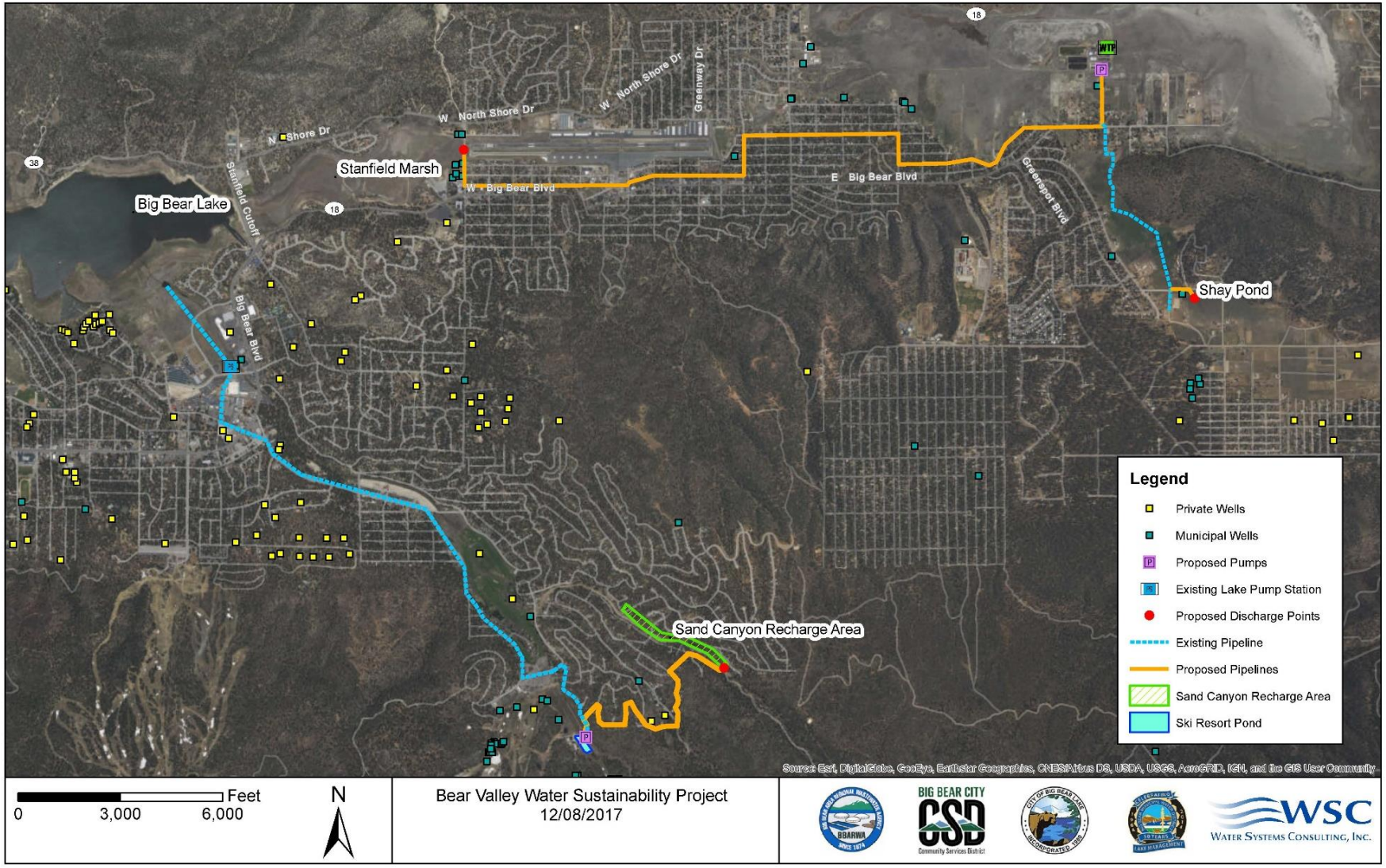


Figure 4-2. Proposed Replenish Big Bear Infrastructure

Brine Disposal

The preliminary brine disposal strategy for Replenish Big Bear is solar evaporation ponds located at the LV Site. The full recycled water treatment capacity of 2.2 mgd was used for the brine disposal analysis to ensure sufficient disposal capacity if higher recovery rates are achieved or flows increase in the future. The estimated recovery of the RO process is 90%, so 10% of the treated flow, or 220,000 gallons per day (gpd), will be brine concentrate. The total evaporation pond area for 220,000 gpd was calculated to be 77.5 acres. BBARWA desires to use the existing effluent pipeline to the LV site as a dual purpose line for brine conveyance due to the high cost of constructing a second pipeline to Lucerne Valley. Because this pipeline will also need to be used to convey peak flows to the Lucerne Valley site, the operational strategy to maintain dual use of this pipeline will be an important consideration to ensure that BBARWA is able to remain in compliance with discharge permit requirements at all times. To convey peak flows to the LV site, a preliminary analysis shows that this will require infrastructure to store a minimum of 3 days of brine production. A brine pump station is required to empty the brine storage tank in 35 hours. This allows the brine storage to be emptied within the window of time that the existing effluent storage ponds at the plant would fill up before the pipeline would need to be switched back to effluent conveyance. Brine flows will ultimately be conveyed to the evaporation ponds through a new dedicated brine pipeline from an existing balancing reservoir site, which would be approximately 10,000 feet long. Additional details regarding brine disposal is provided in Section 4.e of this feasibility study.

Replenish Big Bear Cost Estimate

Capital and Operation and Maintenance (O&M) costs for the design, construction and operation of Replenish Big Bear are provided in Table 4-1. The 30-Year Net Present Value was calculated based on borrowing 100% of the project cost at a loan term of 30 years and a 5% interest rate. Table 4-2 provides additional details regarding cost estimates for the preferred project based on calculated quantities and unit prices. A document crosswalk is included at the end of this section to provide detailed unit cost calculations.

Table 4-1. Replenish Big Bear Unit Costs

	Costs
Total Capital	$43,715,000
Annualized O&M	$2,397,000
30 Year Net Present Value (NPV)	$123,309,000
Yield	1,950 AFY
Cost/AF	$2,110

Table 4-2. Replenish Big Bear Detailed Cost Estimate

Capital Cost						
	Capacity/Size		Length			
Pipeline to Lake	12	in	19940	LF	$	2,886,000
Pipeline to Stickleback Pond	4	in	710	LF	$	67,000
Pipeline from Snow Making Pond to Sand Canyon	8	in	7210	LF	$	855,000
Recycled Water Storage	0.00	MG			$	-
Effluent Pump Station @ WWTP	1528	gpm			$	787,000
Pump Station @ Snow Making Pond	471	gpm			$	490,000
Enhanced Biological Nutrient Removal	2.20	MGD			$	1,918,000
Nitrification-Denitrification Process	2.20	MGD			$	2,758,000
MF/UF and RO	2.20	MGD			$	9,364,000
UV Disinfection	1.93	MGD			$	1,480,000
Brine Concentrator	0	gpd			$	-
Evaporation Ponds	77.5	acres			$	4,843,000
Brine Storage	0.66	MG			$	924,000
Brine Pump Station	470	gpm			$	431,000
Brine Pipeline	8	in	10000	LF	$	1,185,000
Monitoring Well for GWR	2	EA			$	215,000
Construction Subtotal					**$**	**28,203,000**
Construction Contingency	20%				$	5,641,000
Implementation Costs	35%				$	9,871,000
Total Capital Cost					**$**	**43,715,000**
O&M Cost Estimates						
	Capacity/Size		Length			
Pipeline			37860	LF	$	77,000
Storage	0.66	MG			$	14,000
Pump Station	2469	gpm				
Maintenance					$	132,000
Power					$	51,000
Enhanced Biological Nutrient Removal	2.20	MGD			$	150,000
Nitrification-Denitrification Process	2.20	MGD			$	211,000
UF/RO/UV	2.20	MGD			$	1,598,000
Evaporation Ponds	77.46	acres			$	38,000
Compliance Activities for Discharge Permits					$	126,000
Total Annual O&M Cost					**$**	**2,397,000**

Financial Assumptions

Cost Estimates

The cost opinions (estimates) included in this Study are prepared in conformance with industry practice and, as planning level cost opinions, will be ranked as a Class 4 Conceptual Opinion of Probable Construction Cost as developed by the Association for the Advancement of Cost Engineering (AACE) Cost Estimate Classification System (27). The AACE classification system is intended to classify the expected accuracy of planning level cost opinions, and is not a reflection on the effort or accuracy of the actual cost opinions prepared for the study. According to AACE, a Class 4 Estimate is intended to provide a planning level conceptual effort with an accuracy that will range from -30% to +50% and includes an appropriate contingency for planning and feasibility studies. The conceptual nature of the design concepts and associated costs presented in this feasibility study are based upon limited design information available at this stage of the project. These cost estimates have been developed using a combination of data from RS Means CostWorks®, recent bids, vendor supplied data, experience with similar projects, current and foreseeable regulatory requirements and an understanding of the necessary project components. As specific projects progress, the design and associated costs could vary significantly from the project components identified in this feasibility study. Cost opinions are planning level and may not fully account for site-specific conditions that will affect the actual costs, such as soils conditions and utility conflicts.

For projects components where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 3 of 2017, adjusted for San Bernardino, California, is used. Material prices were adjusted in some cases to provide estimates that align closer with actual local bid results. For projects where RS Means CostWorks® data is not available, cost opinions are generally derived from bid prices from similar projects, vendor quotes, material prices, and labor estimates, with adjustments for inflation, size, complexity and location.

Cost opinions are in 2017 dollars (ENR 20 City Average Construction Cost Index of: 10,817 for October 2017).

Markups and Contingencies

For the development of the planning level cost estimates, several markups and contingencies are applied to the estimated construction costs to obtain the total estimated project costs. The markups are intended to account for costs of engineering, design, administration, and legal efforts associated with implementing the project (collectively, Implementation Markup). Contingency accounts for additional construction costs that could not be anticipated at the time of this analysis. A summary of the markups and contingencies applied are presented in Table 4-3.

Table 4-3. Cost Estimate Markup and Contingency Assumptions

	Markups and Contingencies
	Construction Subtotal
+	20% of Construction Subtotal for Contingency
+	40% of Construction Subtotal for Implementation
=	**Total Capital Cost**

Net Present Value

To comply with federal funding program requirements, the net present values (NPV) are calculated for each alternative and treatment option. The NPVs account for capital costs (one-time costs associated with each alternative) and operation and maintenance (O&M) costs (i.e. electrical and maintenance) over a 30-year period. O&M costs are subdivided into Conveyance Pumping Energy costs and Non-Energy costs to enable these costs to be escalated at different rates in the future, recognizing that energy costs are anticipated to rise faster than non-energy costs. The assumptions used to calculate the costs for each alternative are summarized in the table below.

Table 4-4. Cost Estimate Assumptions

Assumption	Current Value	Annual Escalation Rate	Description
Loan Terms	100% loan for 30-year loan term with a 5% capital financing rate		Loan term based on CWSRF loan term.
Discount Rate			A Discount Rate of 3% is used for the NPV
O&M – Conveyance Pumping Energy	$ 0.14/ KW-hr	3.0 %	Energy escalation based on US Energy Information Administration (USEIA) previous 5-year average electricity rate data for California Commercial rates.
O&M – Non Energy	Varies by facility type, based on capacity or capital cost	2.4%	Non-energy escalation based on California CCI previous 5-year average

4.D FEASIBILITY STUDY LEVEL PROJECT COST ESTIMATE

The estimated costs shall also be presented in terms of dollars per million gallons (MG), and/or dollars per acre-foot of capacity, to facilitate comparison of alternatives described in Paragraph 5.B(5) below. References, design data, and assumptions must be identified. The level of detail shall be as required for feasibility studies in RM D&S, Cost Estimating (FAC 09-01).

As detailed in Section 4.c and Table 4-2, the unit cost ($/AF) was developed for the recycled water yield, based on borrowing 100% of the project cost at a loan term of 30 years and a 5% interest rate. A unit cost summary table is provided below (Table 4-5).

Table 4-5. Replenish Big Bear Unit Cost

Total Capital Cost	Annual O&M	Annual Yield (AF)[1]	30 year Net Present Value (NPV)	Unit Cost ($/AF)[2]
$43,715,000	$2,397,000	1,950	$123,309,000	$2,110

Notes:
1. Based on 10-year average flows.
2. Unit costs for various alternatives are calculated by dividing the 30-year NPV by the total yield in the 30-year period. See Section 4.c for more detail.

Note that the unit cost is anticipated to be reduced through the procurement of both State and Federal funding and financing assistance.

4.E WASTE-STREAM DISPOSAL AND WATER QUALITY

Description of waste-stream discharge treatment and disposal water quality requirements, if applicable, for the proposed Title XVI project.

As previously discussed, a key challenge with implementation of RO treatment is effective management of the brine concentrate. This section details the preliminary brine disposal strategy for Replenish Big Bear, and additional information regarding alternatives considered are provided in Section 4.f.

Solar evaporation ponds located at the LV Site are the preliminary brine disposal strategy for Replenish Big Bear. Evaporation ponds rely on solar energy to evaporate water from the brine concentrate stream, leaving behind precipitated salts, which ultimately are disposed of in a landfill. Evaporation ponds for brine concentrate disposal are most appropriate for smaller volume flows and for regions having a relatively warm, dry climate with high evaporation rates, level terrain, and low land costs. Evaporation ponds are relatively easy to construct, are low maintenance and have no mechanical equipment except for pumps to convey brine to the ponds. However, pond size requirements can be quite high depending on the brine flow and evaporation rates. In addition, regulatory requirement for impervious liners of clay or synthetic membranes can substantially increases the cost of construction. Monitoring wells will be required to verify that seepage from the ponds is not contaminating underlying groundwater.

The full recycled water treatment capacity of 2.2 mgd was used for the brine disposal analysis to ensure sufficient disposal capacity if higher recovery rates are achieved or flows increase in the future. As previously discussed, the estimated recovery of the RO process is 90%, so 10% of the treated flow, or 220,000 gallons per day (gpd), will be brine concentrate.

Locating the evaporation ponds at the LV Site allows for smaller sized ponds due to the higher evaporation rate and lower precipitation in the Lucerne Valley compared with Big Bear Valley. The estimated evaporation rate in Lucerne Valley is 63 inches per year (28) and average annual precipitation is 8.4 inches per year (29). Evaporation efficiency of brine is significantly lower than fresh water; while complex site-specific variables impact the actual evaporation rate, an evaporation ratio of 0.70 is considered a reasonable allowance in absence of site-specific data (30). Subtracting the annual precipitation from the annual evaporation and adjusting for brine evaporation efficiency yields a net evaporation rate of 38.2

inches per year in Lucerne Valley. The required evaporative area of an evaporation pond is based on the flow rate of brine and the evaporation rate, but the actual pond area constructed should be at least 20% larger to allow for operational contingency and space for dikes and service roads (30). The total evaporation pond area for 220,000 gpd in the Lucerne Valley was calculated using an evaporation pond regression model (30) and is equal to 77.5 acres.

Conveyance of brine to the LV Site will require use of the existing effluent pipeline as it is not financially feasible to construct a second pipeline to the Lucerne Valley. Because this pipeline will also need to convey peak flows to the LV Site, the operational strategy to maintain dual use of this pipeline is important. The key constraint for dual use is anticipated to occur during winter periods with sustained higher flows. During these periods, the availability of the pipeline to convey brine to Lucerne Valley will be limited and brine discharges will need to occur in a series of relatively short windows during which the effluent storage provides a buffer to discharge brine. The maximum month effluent flow from the WWTP in the 10-year period from 2007-2016 occurred in March 2011 and was 169 million gallons (MG), or an average monthly flow of 5.6 mgd. The maximum daily flow in March 2011 was 7.6 mgd, but the maximum day flow in the 10-year period was 9.6 mgd on December 22, 2010, which is equal to the maximum capacity of the effluent pump station. The WWTP has 10 MG of emergency storage that provides sufficient capacity to manage peak hour flows (31) so 9.6 mgd is the maximum expected effluent flow, limited by the capacity of the auxiliary effluent pump station.

The design capacity of the Replenish Big Bear tertiary treatment upgrades is 2.2 mgd, so the secondary effluent discharged to Lucerne Valley will be reduced by that amount during high flow periods. The WWTP has two secondary effluent storage ponds with a combined storage of 5 MG. Table 4-6 shows the duration of time that the effluent pumps can be turned off during peak flow periods and the duration of time they will need to run to empty the storage ponds once they are filled. At a minimum, 13 hours of brine storage volume must be provided at the WWTP to allow for the secondary effluent pumps to empty the ponds. During a peak day event, the secondary effluent storage will refill in only 15 hours. Additional brine storage is recommended to provide operational flexibility so that operators do not have to transition from effluent to brine discharge during a peak day while also managing peak hour flows using the emergency storage pond. Preliminary analysis provides for 3 days of brine storage, but this could be increased if additional operational flexibility is needed. The brine pump station is sized to empty the brine storage tank in 35 hours so that it can be emptied within the effluent storage window of the 1-Year max month flow condition in Table 4-6. The resulting brine storage and pumping capacity is shown in Table 4-7.

Table 4-6. Secondary Effluent Storage and Pumping Durations in Peak Flow Periods

Wet Weather Flow Condition	Total Flow, mgd	Secondary Effluent Flow, mgd[1]	Hours of Secondary Effluent Storage[2]	Minimum Time to Empty Secondary Effluent Storage[3]
10-Year Maximum Month Flow (2007-2016)[4]	3.3	1.1	109 hours	13 hours
1-Year Maximum Month Flow (2011)	5.6	3.4	35 hours	13 hours
Peak Daily Wet Weather Flow	9.6	7.6	15 hours	13 hours

Notes:
1. Total Flow minus 2.2 mgd which is diverted to the tertiary treatment system
2. Time to fill 5MG secondary effluent storage when effluent pumps are off, assuming that it is emptied by a prior pumping cycle. This is the available window for brine discharge.
3. Assumes auxiliary pumps are operated at maximum capacity of 9.6 mgd until the ponds are emptied
4. Average of maximum month flows for the 10 year period 2007-2016

Table 4-7. Brine Storage and Pumping Capacity for Lucerne Valley Evaporation Pond

Brine Flow Rate	Brine Storage Volume, gallons	Brine Pumping Capacity, gpm
RO Concentrate (220,000 gpd)	660,000	470

Under this operational scenario, the discharge pipeline to Lucerne Valley would be used for brine discharge for up to 35 hours, then would be available for secondary effluent discharge for up to 3 days while to brine storage tank is refilled. Each time the pipeline use switches from brine to secondary effluent, the brine remaining in the pipeline would need to be flushed into the evaporation pond before the effluent could be applied to the fields. A flushing and monitoring protocol will need to be established to ensure that the discharge to the fields remains in compliance with BBARWA's WDR permit which regulates this discharge. The existing WDR permit will need to be modified to include the proposed evaporation pond, subject to approval by the Colorado River RWQCB. This mode of operation would limit the amount of time the pipeline is filled with brine and may help reduce corrosion potential; however, further evaluation is needed during the preliminary design phase to assess the suitability of the existing cement lined ductile iron pipe to convey brine.

The existing discharge pipeline fills a concrete lined balancing reservoir located approximately 1.25 miles south of BBARWA's LV Site then flows by gravity to the LV site to irrigate the fields. Because the concrete balancing reservoir was not likely constructed with an impervious liner and it would be difficult to flush frequently, it is anticipated that brine flows will not enter the balancing reservoir. Brine flows will need to be conveyed to the LV site through a new dedicated brine pipeline from the balancing reservoir site, which

would be approximately 10,000 feet long. Automatic control valves at the balancing reservoir site will enable BBARWA to conduct the pipeline flushing remotely before switching to effluent discharge. Note that BBARWA's 2010 Sewer Master Plan indicates that there are 2 parallel pipelines from the balancing reservoir to the LV Site, so the configuration and operation of these pipelines will be investigated to evaluate whether one could be repurposed to convey brine to the LV site and eliminate the need to construct a new pipeline.

4.F ALTERNATIVE MEASURES OR TECHNOLOGIES FOR RECLAMATION, DISTRIBUTION, AND REUSE

Description of at least two alternative measures, or technologies available for water reclamation, distribution, and reuse for the project under consideration. These alternatives must be approvable by the state(s) or tribal authorities in which the project will be located.

The Agency Team investigated water reclamation opportunities and alternatives for decades before electing to advance Replenish Big Bear. Recycled water studies that investigated water reclamation opportunities and potential recycled water uses are summarized in Section 3.b and a description of the alternatives and their costs are summarized on Section 5.b. The preferred project has been identified; however, consideration will be given to optimize or include the following project elements as determined necessary through project refinement.

- Brine disposal and minimization
- Effluent cooling
- Advanced treatment technology
- Groundwater recharge at Sand Canyon

These alternatives are all viable and feasible project elements that may be included as the project advances through the preliminary planning and design phase.

Brine Disposal

As discussed in Sections 4.c and 4.e, the preliminary brine disposal strategy for Replenish Big Bear is conveying brine to solar evaporation ponds located at the Lucerne Valley via the existing effluent disposal pipeline. Sufficient space is available in the Lucerne Valley to construct the 78-acre evaporation pond site; however, if recovery of additional water is desired or if it is necessary to reduce the size of the evaporation pond, an additional treatment process can be added to further concentrate the brine volume. Potential brine concentration processes include electrodialysis reversal (EDR), Vibratory Shear Enhanced Process (VSEP) and Enhanced Membrane Systems (EMS), which were previously evaluated for BBARWA (32). Although these processes recover additional water for beneficial use, they are relatively high in capital and O&M cost and increase operational complexity.

A brine concentrator is assumed to have a 90% recovery rate, so 10% of the original brine concentrate, or 22,000 gpd, will be discharged to an evaporation pond. Brine concentrator recovery rates greater than 90% may be achievable and would further reduce the brine volume discharged to the evaporation pond. The water recovered from a brine concentrator is expected to be relatively low in TDS (less than 500 mg/l),

so it expected that the product water could be blended with the RO permeate and still meet the TDS WQO for the proposed uses.

In addition to considering opportunities to recover additional water and further concentrate the brine, the Agency Team has also considered using evaporation ponds located in Big Bear Valley at the WWTP site. The estimated evaporation rate in Big Bear Valley is 45 inches/year (28) and the average annual precipitation at the BBCCSD station is 14.4 inches per year (20). Table 4-8 provides the total evaporation pond areas for the WWTP located in the Big Bear Valley and the LV Site. The areas were calculated using an evaporation pond regression model (30). As shown, the evaporation pond areas are greatly reduced when the brine is concentrated. The BBARWA WWTP site is 80 acres and the adjacent land is primarily in the flood plain and/or National Forest System Land so only the 13.8-acre evaporation pond alternative near the WWTP site is feasible.

Table 4-8. Brine Evaporation Pond Areas

	Evaporation Pond Total Area, acres	
Brine Flow Rate	**Big Bear Valley**	**Lucerne Valley**
RO Concentrate (220,000 gpd)	138	77.5
Reduced Brine (22,000 gpd)	13.8	7.7

If the evaporation ponds are located at the BBARWA WWTP site, the brine is assumed to be conveyed directly from the treatment process to the evaporation ponds, so brine storage and brine pumps would not be required. A new pipeline from the RO process to the evaporation ponds approximately 2,000 feet would be needed if the evaporation ponds are located within the current WWTP site.

Comparative capital and O&M costs for each scenario are presented in Table 4-9. Alternative 1 is considered infeasible due to the size of the required pond, and the remaining alternatives are relatively comparable in capital cost. The O&M cost of Alternative 3 is substantially lower because it does not include a brine concentrator. Although Alternative 3 is the preferred alternative, Alternative's 2 and 4 are viable alternatives that may be considered as the project advances.

Table 4-9. Brine Concentration and Evaporation Comparative Costs

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Cost Component[1]	Big Bear Valley RO Concentrate 138 Acre Pond[2]	Big Bear Valley Reduced Brine 13.8 Acre Pond	Lucerne Valley RO Concentrate 77.5 Acre Pond	Lucerne Valley Reduced Brine 7.7 Acre Pond
Capital Costs				
Evaporation Pond	$13,394,000	$1,339,000	$7,507,000	$750,000
Brine Concentrator	-	$8,522,000	-	$8,522,000
Brine Storage	-	-	$1,432,000	$143,000
Brine Pump Station	-	-	$584,000	$93,000
Brine Pipeline	$290,000	$219,000	$1,837,000	$1,452,000
Total Capital Cost	**$ 13,684,000**	**$ 10,080,000**	**$ 11,360,000**	**$ 10,960,000**
O&M Cost				
Evaporation Pond	$67,000	$7,000	$38,000	$4,000
Brine Concentrator	-	$539,000	-	$539,000
Brine Storage	-	-	$14,000	$1,000
Brine Pump Station	-	-	$52,000	$5,000
Brine Pipeline	$3,000	$2,000	$18,000	$15,000
Total O&M Cost	**$ 70,000**	**$ 548,000**	**$ 122,000**	**$ 564,000**

Notes:
1. Capital costs include 25% markup for construction contingency and 30% markup for implementation.

Effluent Cooling

Lake water temperatures and WWTP effluent temperatures vary seasonally. While they are relatively similar in the summer months, the WWTP effluent temperature is considerably higher than the Lake temperature in the winter, as shown in Figure 4-3. It is expected that the discharge permit for this alternative would include limits for effluent temperature, and/or the allowable temperature change in the Lake caused by the discharge to avoid adverse thermal impacts to aquatic habitat. As a result, the treatment upgrades may need to include a provision for effluent cooling during winter.

Temperature reduction of the effluent may be achieved through various methods or a combination of methods (33). Potential methods that may be applicable to BBARWA's WWTP include:

- Selecting a disinfection process with lower relative heat addition than other alternatives (i.e. chlorine contactor or UV) and by covering the disinfection facility to reduce solar energy addition
- Use of a multiple port diffuser system at the discharge location to facilitate more rapid mixing with the receiving water
- Discharge into a constructed wetland with long detention times through shaded, deep narrow channels

- Discharge into shallow reservoir to act as a cooling pond to achieve evaporative and radiative heat loss prior to surface water discharge. Depending on the configuration of the treatment process, the existing secondary effluent storage ponds may be able to provide some cooling benefit
- Spray cooling, which uses evaporative cooling to remove heat from treated wastewater by spraying it into the air from a lined pond when the ambient temperature is significantly lower than the effluent temperature. Spray cooling could potentially be implemented in the secondary effluent storage ponds and would require the installation of a pump, manifold and nozzles.
- Cooling towers or chillers could be considered, although they are expensive to install and operate so this equipment is not desirable

The need for effluent cooling will be assessed during the preliminary engineering phase once discharge temperature criteria are more well defined. The costs for Replenish Big Bear included in Section 4.c does not include the cost of effluent cooling but this may be a component that is ultimately included in the final project.

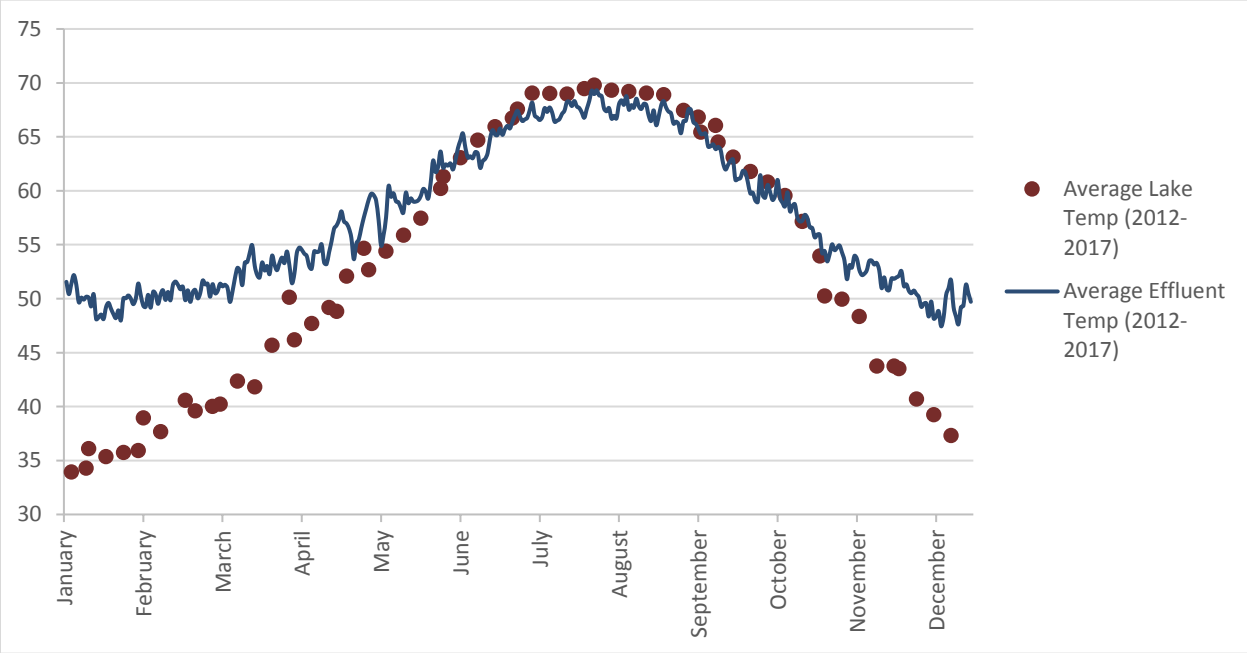


Figure 4-3. Comparison of Average Lake and BBARWA Effluent Temperatures (2012-2017)

Advanced Treatment Technology

Advanced treatment upgrades described in Section 4.c are representative processes selected because they represent a proven water purification process that is anticipated to be able to meet the water quality requirements for the project. However, alternative technologies are being evaluated during the preliminary engineering phase to identify the most appropriate treatment process to meet the expected permit conditions and optimize construction and O&M costs. The existing activated sludge process at the BBARWA WWTP will be evaluated as an alternative for enhanced nutrient removal considering the potential retrofits that can improve treatment within the existing process. Additionally, proprietary

activated sludge systems that provide high nitrogen and phosphorus removal rates will serve as viable alternatives for enhanced nutrient removal. More advanced treatment process evaluations for treatment downstream of nutrient removal will include low- and high-pressure filtration systems, as well as media filtration systems. Advanced disinfection and oxidation processes will also be considered for removal of trace contaminants and pathogens, with the level of treatment being highly dependent on the regulatory conditions of the project.

Groundwater Recharge at Sand Canyon

As discussed in Sections 3.b.ii and 4.c, groundwater recharge at Sand Canyon involves extracting water from the Lake (a blend of surface water and recycled water) and discharging it into the canyon. It is anticipated that the existing lake pump station and pipeline owned by the Resort will be used to transfer water to the existing storage pond located at the Bear Mountain Ski Resort. The Resort is interested in reaching an agreement for the joint use of their facilities; however, should an agreement not be negotiated then constructing new pumping and conveyance facilities to reach Sand Canyon would be required. This would increase the project cost by approximately $2 million, but is a feasible recycled water distribution alternative for the project.

In addition, Sand Canyon serves as a flood control channel. Recharge operations would only occur during dry periods and would be operated intermittently as needed to avoid interference with flood flows. Prior studies evaluating potential recharge operations in Sand Canyon considered constructing a series of small berms along the streambed to create a percolation area or modifying the stream channel to create a meandering stream with small natural ponds to slow the water down and enhance percolation. Another concept considered was the use of inflatable rubber dams in the channel which could be inflated to create percolation ponds during the recharge operation and deflated at all other times so as not to impact the natural function of the channel. Alternative measures to maximize groundwater recharge will be further analyzed as the project design phase progresses.

5 ECONOMIC ANALYSIS

WTR 11-01 Requirement 5.B.5

A Title XVI feasibility study report must include an economic analysis of the proposed Title XVI project relative to other water supply alternatives that could be implemented by the non-Federal project sponsor in lieu of a Title XVI project. This assessment needs to identify the degree to which the Title XVI project alternative is cost-effective, and the economic benefits that are to be realized after implementation. The study lead must submit the following information for the economic analysis in a Title XVI feasibility study report.

(a) The economic analysis included in the feasibility study report shall describe the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward alleviation of economic problems and the meeting of future water demand.
(b) A cost comparison of alternatives that would satisfy the same demand as the proposed Title XVI project. Alternatives used for comparison must be likely and realistic, and developed with the same standards with respect to interest rates and period of analysis.
(c) Description of other water supply alternatives considered to accomplish the objectives to be addressed by the proposed Title XVI project, including benefits to be gained by each alternative, total project cost, life cycle cost, and corresponding cost of the project water produced expressed in dollars per MG, and/or dollars per acre-foot. An appraisal level cost estimates, or better, is acceptable for these alternatives.
(d) When a Title XVI project provides water supplies for municipal and industrial use, the benefits of the Title XVI project can be measured in terms of the cost of the alternative most likely to be implemented in the absence of the project. This is assuming that the two alternatives would provide comparable levels of service. This comparison must be provided, if applicable.
(e) Some Title XVI project benefits may be difficult to quantify; for example, a drought tolerant water supply, reduced water importation, and other social or environmental benefits. These benefits shall be documented and described qualitatively as completely as possible. These qualitative benefits can be considered as part of the justification for a Title XVI project in conjunction with the comparison of project costs described above.

5.A EXISTING AND PROJECTED FUTURE CONDITIONS WITH & WITHOUT PROJECT

The economic analysis included in the feasibility study report shall describe the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward alleviation of economic problems and the meeting of future water demand.

No Project Scenario

A "No Project" scenario results in continued reliance on precipitation to supply enough water to meet the potable, environmental, and recreational needs within the Valley. Without Replenish Big Bear, water

supplies will continue to be managed in a manner that perpetuates the current broken water cycle. The current water cycle in the Valley consists of the following: Water enters the Valley as precipitation and flows into the Lake to become surface water or soaks into the ground to become groundwater; groundwater is pumped and used by the Big Bear community; after community use, water is pumped out of the Valley as treated wastewater to irrigate crops in the Lucerne Valley. In the absence of Replenish Big Bear, approximately 2,466 AF of water will continue to be pumped out of the watershed annually, which could be treated and put to beneficial use within the Valley. Details regarding the Valley's projected future without Replenish Big Bear are provided below.

Potable Water Supply

As detailed in Section 2.a, groundwater provides the only potable water supply for the Valley which is vulnerable to drought conditions. Although it is projected that the Basin will be able to provide adequate supplies for the next 20 years, future unknown climatic conditions could affect the reliability of groundwater supplies. In addition, BBCCSD will continue to discharge approximately 80 AFY to Shay Pond to maintain minimum flow requirements and support the endangered Stickleback population. The annual discharge of 80 AF of potable water to the pond is significant for BBCCSD because it represents approximately 9% of their customer demand. If the Agency Team and Valley stakeholders do not proactively pursue an alternative potable water supply, then the region will be susceptible to significant economic impacts should their only water supply become compromised by reduced availability and reliability.

Without project implementation and the increased flow of water to the Lake, it is anticipated that In-Lieu SWP water provided by Valley District will continue to be utilized to meet nearly all of Mutual's needs. As detailed in Section 3.d, BBMWD is required to provide Mutual with up to 65,000 AF of water in a 10-year rolling period; currently, this water is predominantly from the SWP to minimize lake releases and help maintain higher Lake levels. The Lake has seen extremely low levels over the last 15 years as shown in Figure 5-1, and it is anticipated that Lake water will be insufficient to meet demands. The BBMWD Lake Release Policy requires that Mutual's demands be met with In-Lieu SWP water whenever the lake is more than 6 feet below full, and during some months when the Lake is between 4 and 6 feet below full. As such, BBMWD will continue to pay Valley District an annual fee based on assessed property values in San Bernardino County to pay for Mutual's SWP water whenever the Lake level falls within this range. These fees have increased since first being established in 1996 and are anticipated to continue increasing based on rising property values and Lake levels may remain low due to reduced precipitation and drought conditions. BBMWD's historic In-Lieu water expenses are provided in Table 5-1, and represent an ongoing financial burden for BBMWD.

Continued low Lake levels will perpetuate the demand on SWP water supplies that are already overstressed. In the Sacramento-San Joaquin Delta (Bay-Delta), 300 percent more water than the supply normally can accommodate is allocated to various uses (32). SWP water reliability is affected by drought, management and environmental protection issues, and risk of seismic damage to the delivery system. Although there is no panacea for correcting the SWP allocation issues, every effort to reduce demand

from this system will have a beneficial impact and reduce pressure on these supplies and increase supply reliability for other SWP users.

Table 5-1. BBMWD In-Lieu Fees 1996 – 2018

Year	In-Lieu Payment	Year	In-Lieu Payment
1996	$834,000	**2008**	$1,102,055
1997	$834,000	**2009**	$1,212,499
1998	$834,000	**2010**	$1,281,739
1999	$834,000	**2011**	$1,212,499
2000	$834,000	**2012**	$1,204,220
2001	$834,000	**2013**	$1,187,657
2002	$834,000	**2014**	$1,178,144
2003	$834,000	**2015**	$1,220,012
2004	$834,000	**2016**	$1,278,393
2005	$834,000	**2017**	$1,414,140
2006	$834,000	**2018**	$1,476,043
2007	$953,930		

Recreation-Based Economy

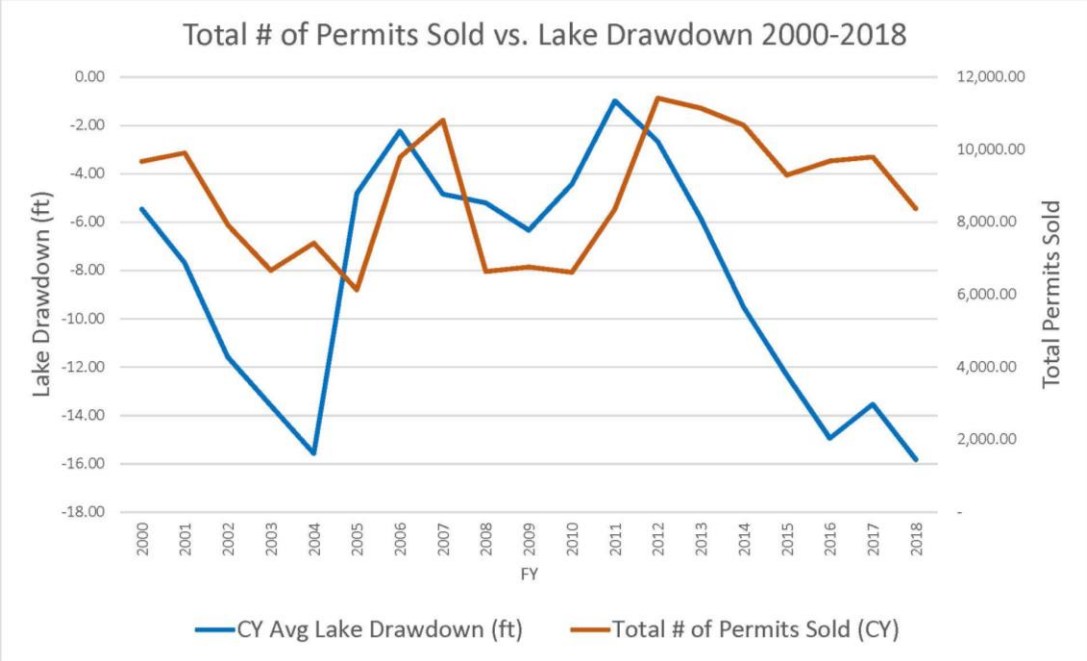
Another primary factor that is driving project implementation is the need to maintain and strengthen water supplies that support the region's tourism industry and recreation-based economy. As detailed in Section 2.a, variable precipitation and drought conditions have resulted in strenuous habitat conditions impacting surface water levels and wildlife habitat. Many of the environmental impacts that will affect wildlife and their habitat in the region are difficult to economically quantify and are therefore described in greater detail in Section 5.e of this feasibility study. However, impacts to Lake levels and the tourism industry that are anticipated if Replenish Big Bear is not implemented can be quantified, and are detailed below.

BBMWD requires a permit to operate a boat on the Lake and, as shown in Figure 5-1, the total number of boat permits sold is directly impacted by Lake levels. The total number of permits and associated revenue decrease when Lake levels decrease, which ultimately affect lake operations. Total boat permit revenue peaked in 2013 with a total revenue of $721,316 and has steadily declined with lake levels and the total revenue in 2018 was $486,563. Without the supply of additional water to the Lake, BBMWD is unable to adjust the management strategy for the Lake and maintain higher water levels. Decreased boat permits have a direct impact on BBMWD revenue, and the decrease in tourists coming to use the lake also has an impact on other tourism driven businesses such as boat rentals, hotels, camping, and dining.

The City of Big Bear Lake assesses a Transient Occupancy Tax (TOT) on visitor's renting hotel, motel, lodging, private home or other facilities for stays less than 30 days. The City's main industry is tourism, and as a four-season resort community, TOT is the second largest revenue source for the City, making up approximately 26% of the general-purpose revenues (15). The TOT rate is currently 8% which was raised from 6% in 2008 by voter approved Measure Y. The additional 2% is set aside in a separate fund to be

specifically used for infrastructure improvements and amenities aimed at enhancing the visitor experience. During Fiscal Year 2017/2018, the total TOT revenue was $4,013,505, and the total lodging revenue in the City was $66,891,750. Furthermore, funds from Measure Y's inception to June 2017 total $7,500,000. Revenue from tourists fluctuate depending on the timing and amount of snowfall the region receives which impacts winter activities as well as summer activities dependent on the snow melt. Failure to sustain the local water supply, and enhance both Lake levels and snowpack could result in a devastating impact to the region's economy and way of life.

Figure 5-1. Big Bear Lake Permits Sold Compared with Water Levels



The primary tourist draw in the winter is the Resorts, that provide opportunities for skiing/snowboarding, tubing, shopping, and dining. Over the past 5 seasons (FY 2014 – FY 2018) the Resort has had approximately 3,000,000 skier/snowboarder visits. Visitors in the winter are directly tied to weather conditions and the Resorts' ability to facilitate snow activities. The Resorts ability to make snow during dry winters allows the resorts to stay open and maintain the tourist draw to the Valley. Lake levels are nearing a point where the Resorts would need to modify their pumping infrastructure to enable them to continue to pump water for snow making, which would increase their costs. If Lake levels drop much lower, it is anticipated that water would no longer be pulled out for snowmaking which would significantly impact the Resort's business and the entire Valley's economy.

Replenish Big Bear Project Scenario

Replenish Big Bear embraces the One Water concept, which is an integrated planning and implementation approach to managing finite water resources for long-term resilience and reliability, meeting both community and ecosystem needs (34). The Agency Team recognizes the value of all water and the need

to balance the Valley's community and ecosystem needs for a sustainable future. Replenish Big Bear will secure a drought proof water supply and strengthen the local recreation-based economy.

Implementation of Replenish Big Bear will result in an estimated annual yield of 1,950 AFY of recycled water from the BBARWA WWTP. This yield represents approximately 59% of the Valley's projected groundwater demand in 2020. Recycled water produced will directly offset potable water used to maintain Shay Pond (approximately 80 AFY) and irrigate the Resort's golf course (approximately 120 AFY). Estimated costs associated with construction, operation and maintenance of Replenish Big Bear are detailed in Section 4.c, and will require a significant investment by the Agency Team. However, through extensive analysis Replenish Big Bear has been identified as the most feasible alternative for securing a reliable and sustainable local water supply, protecting the region's unique habitat and wildlife, and strengthening the local economy. Costs associated with the inability to meet future demands and inability to maintain the local economy are anticipated to be drastically more expensive than proceeding with the recycled water project. In addition, concerted efforts are being made to obtain grant and low interest loans to further reduce costs associated with implementing Replenish Big Bear, as detailed in Section 9.b and 9.c.

5.B ALTERNATIVES COST COMPARISON

A cost comparison of alternatives that would satisfy the same demand as the proposed Title XVI project. Alternatives used for comparison must be likely and realistic, and developed with the same standards with respect to interest rates and period of analysis.

The Replenish Big Bear Agency Team has extensively investigated opportunities to improve the reliability of local water supplies and protect local resources as discussed in Section 3.b.i. Both non-recycled and recycled water projects have been analyzed, and alternative projects to Replenish Big Bear along with an explanation regarding the feasibility of each alternative are provided below and summarized in Table 5-3.

Non-Recycled Water Project Alternatives

As previously discussed, the Valley's location and elevation limits the viability of most water supply alternatives. Desalination alternatives are cost prohibitive because of the high expenses associated with water production, installing infrastructure to the Valley and the amount of pumping that would be required to this isolated location. Surface water alternatives are also not viable because Bear Valley Mutual retains ownership of all surface water inflow into the Lake through the 1977 Judgement, as detailed in Section 3.d. Importing SWP water is the only viable non-recycled water alternative that could potentially be implemented to improve supply reliability and diversity in the Valley.

In 2004, BBLDWP began evaluating the use of imported water as a supplemental water supply concept. Camp Dresser & McKee, Inc. (CDM) prepared a cost estimate in 2005 for a pipeline from Lucerne Valley to Big Bear Lake by way of the Morongo Pipeline. The pipeline alignment for the 2005 study was determined in a separate report CDM prepared in 2004 that determined the most cost-effective path for the pipeline was along Highway 18. The two CDM reports were compiled and are provided in Appendix J. It was assumed in the study that 1,000 AFY of water would be conveyed to the Valley for the purposes of estimating costs for water purchase, treatment plant capital and operation and maintenance costs, and

the pipeline and booster pumps capital and operation and maintenance costs. For the purposes of comparison, the capital and O&M costs assumed in the CDM analysis were escalated to the cost basis of the 2018 Study. The estimated unit cost for this imported water concept is $4,280/AF. However, the Big Bear agencies do not currently have supply contracts with any State Water Contractors and it may not be possible to secure them.

In addition to the high cost of SWP water, this non-local supply source is affected by multiple factors that impact reliability. Water supply imported from other areas of the state may be threatened by state-wide drought, effects of climate change in the SWP source area, management and environmental protection issues in the Sacramento-San Joaquin Delta that affect the amount and reliability of SWP deliveries, risk of seismic damage to the SWP delivery system, and increases in SWP water cost. SWP water does not have the same reliability as the Replenish Big Bear project. Furthermore, this alternative would not provide benefits to the Valley's environment or recreation industry. Despite the shortcomings associated with increasing or obtaining new SWP allocations; if a recycled water project is not advanced then SWP water is the only other project alternative that could be pursued to obtain additional water supply.

Recycled Water Project Alternatives

As previously discussed, the 2016 Study updated the market analysis performed in the 2006 RWMP and is the most recent analysis of alternative recycled water projects other than Replenish Big Bear. The 2016 Study evaluated the types of reuse listed below, and is available in Appendix C.

- Landscape Irrigation
- Fish Hatchery Supply
- Surface Water Discharge
- Groundwater Recharge – Inland injection and/or surface spreading
- Direct Potable Reuse, pending future regulations

During an Alternatives Development Workshop with the Agency Team, the following recycled water project alternatives were selected for further evaluation.

1. Disinfection Tertiary Landscape Irrigation
2. Groundwater Recharge at Greenspot
3. Groundwater Recharge at Sand Canyon
4. Groundwater Recharge at Greenspot & Sand Canyon

Details regarding the alternative recycled water projects are provided below and a document crosswalk of the analysis is provided at the end of this section.

Landscape Irrigation

An initial list of 55 potential recycled water users in the Valley was compiled from the users listed in the 2006 RWMP, as well as additional users identified by the Project Team. At the Alternatives Development Workshop for the 2016 Study, the Agency Team reviewed this list and eliminated some potential users that: are no longer in existence or did not develop as expected; are anticipated to be closed in the near

future; have low water demands; or are expected to be unwilling to convert to recycled water. A final list of potential recycled water users was compiled and for each user, consumption records from 2011-2014 were obtained. The average of the annual irrigation consumption between 2011 and 2014 was used as the estimated recycled water demand. Where consumption records were not available, estimated demands from other studies were used. Depending on which RW distribution system segments are constructed, the beneficial use yield ranges from 54 – 231 AFY. The estimated cost for the most cost-effective recycled water irrigation scenario is $3,950 per AF, but only provides 54 AFY of reuse. The unit cost of water associated with irrigation use is much greater than the proposed Replenish Big Bear project; and this project does not satisfy the same demand or provide environmental or recreational benefits. As such, production of recycled water for the primary use for landscape irrigation is not considered a viable alternative to Replenish Big Bear. Details regarding this analysis and potential irrigation users are provided in Appendix C, and a document crosswalk is provided at the end of this section.

Groundwater Recharge Via Surface Spreading

The 2016 study analyzed groundwater recharge separately at the Greenspot site (Alternative 2) and at Sand Canyon (Alternative 3) and as a joint project (Alternative 4). The anticipated recharge capacity at the Greenspot site is 1,000 AFY, and at the Sand Canyon site is 750 AFY. Treatment upgrades, distribution system and recharge facilities, operational requirements, unit cost, and advantages and disadvantages were analyzed for each alternative. The potential projects were subsequently compared and ranked on the basis of qualitative criteria, beneficial use yield and unit cost. The top ranked alternative was Alternative 4, groundwater recharge at both the Greenspot site and at Sand Canyon. The anticipated total recharge capacity is 1,750 AFY which reasonably aligns with the anticipated yield of the Replenish Big Bear project for comparison purposes. Details regarding Alternative 4 are provided below as this was the highest ranked alternative for a full groundwater recharge project.

Alternative 4 requires tertiary and advanced treatment upgrades to BBARWA's WWTP. The secondary effluent from the existing WWTP would be fed to the advanced treatment process train consisting of:

5. Microfiltration/ultrafiltration (MF/UF)
6. Reverse Osmosis (RO)
7. Ultraviolet Advanced Oxidation (UF/AOP)
8. Brine Disposal

The most stringent blending requirement of the two recharge sites governs the tertiary and advanced RW blending requirements and treatment capacities; this is done to avoid constructing duplicate facilities needed to store, pump and convey two different RW blends to each site. For the combined recharge project at Greenspot and Sand Canyon, the 22% Tertiary/78% Advanced blending requirement for Greenspot is required to meet the initial 20% RWC requirement at each recharge site.

Approximately 50,200 feet of 12-in pipeline is required to convey the RW from the BBARWA WWTP to both recharge sites (approximately 16,200 ft to Greenspot and 34,000 ft to Sand Canyon). A new 1.6 MG storage tank and a pump station would also be constructed on the BBARWA WWTP site for storage and conveyance to the recharge ponds. The pump station would require pumps with capacities of

approximately 615 gpm and 475 gpm to convey RW to Greenspot and Sand Canyon, respectively. The alignment and configuration of the distribution system can be optimized based on the final flow and head requirements of the distribution and recharge facilities. The Greenspot Recharge Site is assumed to be a 7-acre site to allow more than five acres of area for surface water spreading, plus the necessary additional land for berms and maintenance access. The Sand Canyon Site is assumed to be 2.5-acres based on the results from prior studies (14).

This alternative includes the addition of 6 extraction wells downgradient of the Greenspot recharge site to effectively intercept the water that is artificially recharged. These wells are assumed to have a pumping capacity of 100 gpm each. Water recharged at Sand Canyon is assumed to be produced by existing BBLDWP extraction wells downgradient of the recharge site. It is assumed 2 monitoring wells will be added at each recharge site for groundwater monitoring.

The cost estimate for groundwater recharge at the Greenspot site and Sand Canyon site is summarized in Table 5-2.

Table 5-2. Alternative 4 Cost Summary

Alternative	Capital Cost	O & M Cost	Recycled Water Yield, AF	Unit Cost, $/AF
Alternative 4: Greenspot & Sand Canyon Recharge	$75,102,000	$2,860,000	1,750	$3,310

As previously discussed, a full-scale groundwater recharge project addresses only the potable water supply components of the Valley's water needs and does not provide sufficient benefits to warrant the project costs. The availability of high-quality recharge water would benefit the water agencies by providing a supplemental drought proof supply when needed during future extended drought periods; however, continuous large volumes of recharge water are not needed to sustain local groundwater supplies at this time and the basin does not have a large available storage volume so agencies would need to shift most of their production to this area, which is not the most energy efficient or operationally flexible approach.

A summary of the unit cost and discussion regarding the feasibility of non-recycled and recycled alternative that would satisfy the same demand as the Replenish Big Bear project is provided in Table 5-3.

Table 5-3. Unit Cost Comparison – Regional Water Supply Alternatives

Alternative	Unit Cost ($/AF)	Yield (AFY)	Comments
Recycled Water Supply Alternatives			
Replenish Big Bear			The estimated unit cost of Replenish Big Bear is in line or superior to supply alternatives that satisfy the same demand. This project provides a new sustainable, drought resistant, local water supply that enhances local habitat, protects endangered species, and strengthens the local economy. The project will significantly reduce the export of water from the watershed and repair the currently broken water cycle.
Greenspot & Sand Canyon Groundwater Recharge	$3,310	1,750	Full-scale groundwater recharge is a feasible alternative to provide an alternative drought proof water supply to the Valley. However, the project does not address all of the Agency Team project objectives, which include protection of the rare and diverse habitat and species in the Valley and strengthening the DAC/SDAC recreation-based economy by enhancing the tourism industry.
Non Recycled Water Supply Alternatives			
SWP	$4,280	1,000[1]	SWP is a potentially viable water supply alternative to Replenish Big Bear; however, this supply is vulnerable to availability, reliability, catastrophic conveyance interruptions, and increasing costs. Because this alternative only satisfies one of the Agency Team's project objectives and has a high unit cost it is not being pursued.

[1] SWP annual yields would be subject to obtaining new contracts

Section 5.b – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Irrigation Recycled Water Analysis	Appendix C	4.2 5 Appendix F Appendix G	4-2 to 4-4 5-1 to 5-7 F-1 to F-3 G-2
Groundwater Recharge	Appendix C	4.2 5 5.5 6 Appendix F Appendix G	4-6 to 4-10 5-7 to 5-27 5-31 to 5-33 6-1 to 6-4 F-3 to F-10 G-3 to G-7
Groundwater Recharge Subsurface	Appendix C	4.2	4-11
Direct Potable Reuse	Appendix C	4.2	4-11

5.C DESCRIPTION OF WATER SUPPLY ALTERNATIVES

Description of other water supply alternatives considered to accomplish the objectives to be addressed by the proposed Title XVI project, including benefits to be gained by each alternative, total project cost, life cycle cost, and corresponding cost of the project water produced expressed in dollars per MG, and/or dollars per acre-foot. An appraisal level cost estimates, or better, is acceptable for these alternatives.

Sections 5.a and 5.b describe alternatives considered to accomplish project objectives that will be met by Replenish Big Bear. Therefore, no further discussion is provided in this section.

5.D ALTERNATIVES COST COMPARISON IN ABSENCE OF PROJECT

When a Title XVI project provides water supplies for municipal and industrial use, the benefits of the Title XVI project can be measured in terms of the cost of the alternative most likely to be implemented in the absence of the project. This is assuming that the two alternatives would provide comparable levels of service. This comparison must be provided, if applicable.

In the absence of Replenish Big Bear, implementation of groundwater recharge at the Greenspot site and Sand Canyon is the most feasible alternative (Alternative 4). The costs associated with implementing Alternative 4 are provided in Section 5.b. As previously noted, the projected yield and unit cost of this alternative are inferior to Replenish Big Bear. In addition, Alternative 4 does not provide protection for the rare and diverse habitat and species in the Valley nor strengthen the recreation-based economy for this DAC/SDAC community by enhancing the tourism industry.

5.E PROJECT BENEFITS

Some Title XVI project benefits may be difficult to quantify; for example, a drought tolerant water supply, reduced water importation, and other social or environmental benefits. These benefits shall be documented and described qualitatively as completely as possible. These qualitative benefits can be considered as part of the justification for a Title XVI project in conjunction with the comparison of project costs described above.

As detailed in Section 5.b, the unit cost of Replenish Big Bear is far lower compared to alternative water supply projects. In addition, when consideration is given to the qualitative benefits, it is clear that Replenish Big Bear is the superior project for the Valley. Replenish Big Bear is the only project that achieves all of the objectives identified in Section 4.b, and benefits detailed in Table 5-4:

Table 5-4. Qualitative Project Benefits

Water Supply	
Increased Resiliency	The Valley relies 100% on local groundwater to satisfy current potable demands. Replenish Big Bear expands the water supply portfolio for the region and reduces vulnerability to drought by producing 1,950 AFY of recycled water. The project will keep approximately 59% of the projected 2020 groundwater demand in the Valley for beneficial use.
Increased Reliability	BBCCSD and BBLDWP will have the ability to increase groundwater pumping to meet changing demands. Approximately 1,950 AFY of recycled water will be put to beneficial use and will remain available through the life of the project.
Groundwater Recharge	380 AFY of recycled water will be available for groundwater recharge in the Basin which meets 12% of the current local water demand and an additional 120 AFY can be used to offset water pumped for golf course irrigation, which would provide in-lieu recharge.
Reduced SWP Water Usage	BBMWD will reduce the need to purchase SWP water to meet Mutual's demands because Lake levels will be higher and Lake releases can be used more often to meet demands instead of SWP water. Reductions will also positively affect Federal State Water Projects such as the Central Valley Project (CVP).
Improved Water Supply Management	Additional inflow from the Marsh into the Lake will enable BBMWD to modify the current Lake management strategy to minimize spills and optimize flood control releases to allow additional water to be captured for recharge of the San Bernardino Basin downstream. Preliminary estimates indicate that an average of 6,000 AF of flood releases over 10-year periods would be available for capture downstream for additional recharge. Flood releases that are currently not captured flow to the Ocean. In addition, the project may support the operational needs of the ACOE's Seven Oaks Dam.
Reduced Potable Water Usage	The project will replace 80 AFY of potable water being used at Shay Pond to sustain approximately 10 acres of Stickleback habitat; 420 million gallons of potable water has been discharged to Shay Pond since 1988.
Environment	
Stanfield Marsh Wildlife & Waterfowl Preserve	1,870 AFY of high-quality water will be discharged to the Marsh providing a consistent water source to sustain 145 acres of wetland habitat.
Big Bear Lake	Water discharged to the Marsh provides new inflow to the Lake to augment Lake levels and improve aquatic and riparian habitat by maintaining wetted habitat for over 300 acres of lake edge. The Lake has seen extremely low levels in the last 15 years and is currently only 40 percent full. It is estimated that Lake Levels could rise up to 5 feet in dry years with implementation of Replenish Big Bear.

Shay Pond	High quality water will be discharged to Shay Pond to sustain 10 acres of habitat for the federally listed Stickleback fish, which is currently sustained using potable groundwater.
Santa Ana River	Increased Lake levels will improve the management of downstream releases for protection of fish and wildlife in Bear Creek and the Santa Ana River. Required water releases vary by month and hydrologic year but the project may allow more water to be released to benefit downstream habitats and species, which includes the threatened Santa Ana sucker.
Bay Delta	Reduced water demand from the SWP to meet Mutual's demands may make this water available to support federally endangered and protected fish species in the Bay-Delta (Delta Smelt, Chinook Salmon), when it is not needed for other regional demands.
Increased Snow Pack	The project would enable the Resorts to increase the amount of snow made during wet winters when excess water is available. Increased snowpack would keep more water in the Valley to augment runoff in the Spring to increase groundwater recharge and improve wildlife habitat in streams and tributaries that feed the Marsh and Lake.
Community / Economy	
DAC Benefits	The community of Big Bear Lake served by BBLDWP and BBCCSD had a population of 22,910 in 2015. Based on DWR criteria, 100% of the Valley's populated area is considered a Disadvantaged or Severely Disadvantaged Community (DAC/SDAC) as shown in Figure 5-2. It is important to note that a large majority of the eastern portion of the service area is uninhabited national forest.
Recreation Based Economy	Over 7 million visitors annually visit the Valley which is Southern California's premier four-season recreational playground. The Valley's economy is dependent on water to support the tourist industry. Recreation opportunities that drive the economy that will benefit from Replenish Big Bear include but are not limited to: boating, fishing, camping, hiking, mountain biking, wildlife viewing, skiing/snowboarding, and golfing. Recreation opportunities then strengthen the lodging, food, and service industries in the Valley.
Regional Collaboration	Continued water resource collaboration for water agencies, wastewater agencies, regulatory agencies, and community stakeholders within the Valley and Santa Ana River Watershed.
Public Knowledge / Education	Improved water levels at the Stanfield Marsh will sustain habitat and increase education opportunities for the community and visitors through wildlife observation. In addition, the project establishes community involvement and education of recycled water production through project planning, design, construction, and operation.

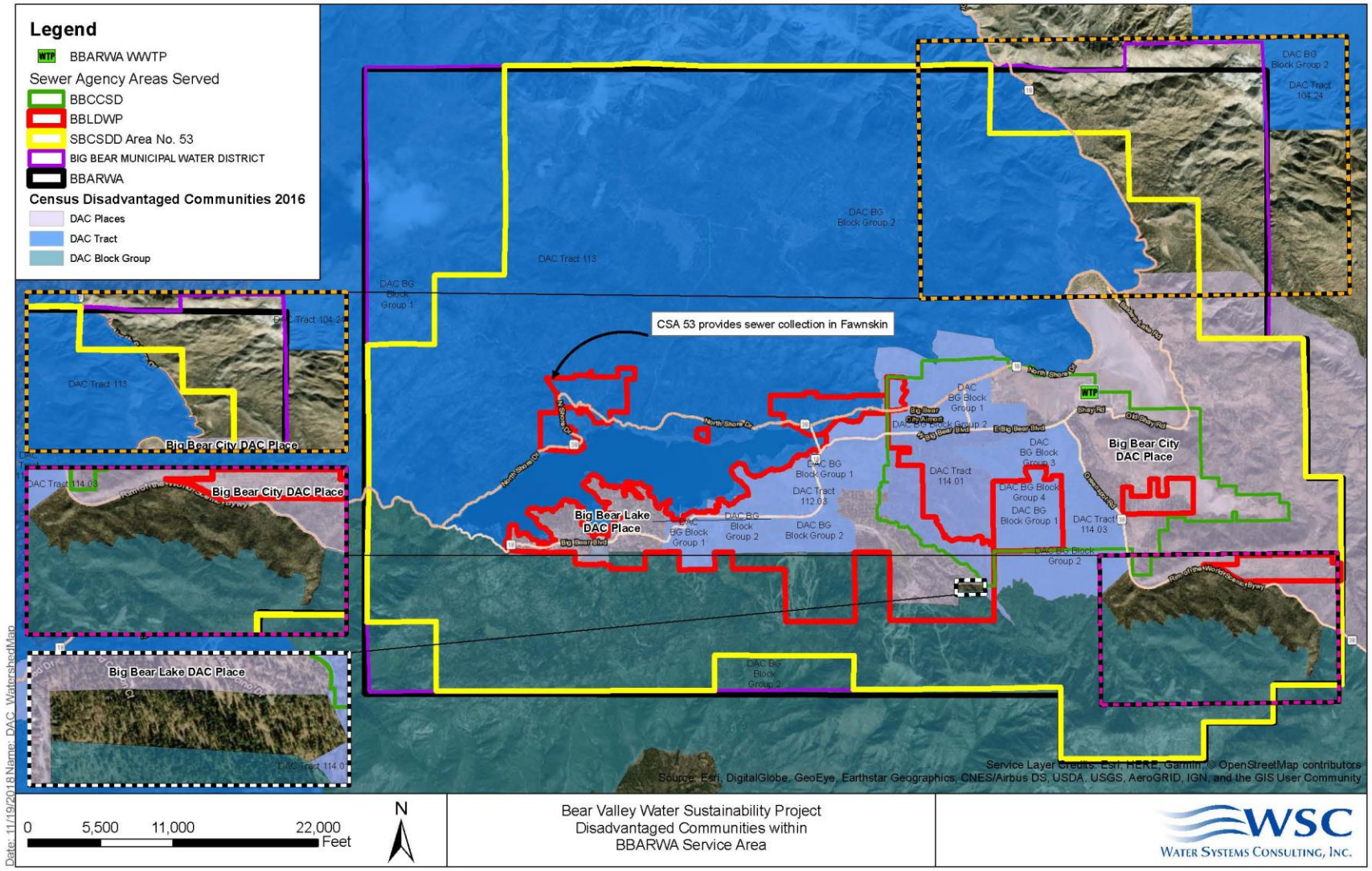


Figure 5-2. Big Bear Valley Disadvantaged Communities

6 SELECTION OF THE PROPOSED TITLE XVI PROJECT

WTR 11-01 Requirement 5.B.6

(a) Provide a justification of why the proposed Title XVI project is the selected alternative in terms of meeting objectives, demands, needs, cost effectiveness, and other criteria important to the decision.
(b) Provide an analysis and, if applicable, an affirmative statement of whether the proposed Title XVI project would address the following:
   i. reduction, postponement, or elimination of development of new or expanded water supplies;
   ii. reduction or elimination of the use of existing diversions from natural watercourses, or withdrawals from aquifers;
   iii. reduction of demand on existing Federal water supply facilities; and
   iv. reduction, postponement, or elimination of new or expanded wastewater facilities.

6.A SELECTED ALTERNATIVE

Provide a justification of why the proposed Title XVI project is the selected alternative in terms of meeting objectives, demands, needs, cost effectiveness, and other criteria important to the decision.

Replenish Big Bear is designed to achieve all of the objectives identified in Section 4.b and Section 5.e, and address the regional problems identified Section 2.a. In addition, Replenish Big Bear is consistent with State-wide objectives to increase water supply reliability, advance recycled water opportunities, manage groundwater, and reduce the use of imported water. The decision to implement Replenish Big Bear was made after years of analysis of alternative supply projects, and opportunities to advance recycled water on both local and regional scale. Through collaboration and dedication to protect and enhance the Santa Ana River watershed, the Agency Team and regional stakeholders selected a project that will provide a drought proof water supply, bolster habitat for the regions unique flora and fauna and strengthen the regional economy in the face of changing climatic conditions.

6.B PROJECT IMPACTS TO EXISTING AND FUTURE SUPPLIES

Provide an analysis and, if applicable, an affirmative statement of whether the proposed Title XVI project would address the following:

6.b.i New or Expanded Water Supplies

Reduction, postponement, or elimination of development of new or expanded water supplies.

Replenish Big Bear provides an alternative water supply to the region via recharge of recycled water to the groundwater basin that will not be impacted by future droughts. The project allows BBCCSD and BBLDWP to withdraw groundwater to meet projected demands for the foreseeable future while maintaining the safe yield of the Basin. It is anticipated that the project will eliminate the need to develop additional new or expanded non-recycled water supplies in the Valley. Implementation of Replenish Big

Bear will eliminate the need for the Agency Team to pursue imported SWP water from the Mojave Water Agency because sufficient water will be available in the Basin to meet demand.

Replenish Big Bear also has the potential to reduce or postpone expanded water supplies downstream of the Lake in the Santa Ana River watershed. BBMWD's coordinated water releases from the Lake with downstream water agencies may allow additional water to be captured for recharge in the San Bernardino Basin opposed to this resource being wasted during the wet season by flowing to the ocean. The additional capture of water for recharge could reduce downstream needs to develop new water supplies.

6.b.ii Reduction or Elimination of the use of Existing Diversions or Withdrawals

Reduction or elimination of the use of existing diversions from natural watercourses, or withdrawals from aquifers.

Replenish Big Bear has been designed to reduce the amount of water currently extracted from the Basin to provide sufficient flows in Shay Creek (80 AFY), and supply irrigation water for the Resort golf course (120 AFY). In addition, improved management of the Lake by BBMWD in response to higher lake levels will result in the reduction of SWP water withdrawn from the Bay-Delta to meet Mutual's demands with In-Lieu SWP water.

6.b.iii Existing Federal Water Supply Facilities

Reduction of demand on existing Federal water supply facilities.

Valley District is a State Water Contractor that provides water from the Bay-Delta. As previously stated, Replenish Big Bear will provide higher lake levels and allow BBMWD to provide lake water to meet Mutual's demand and reduce reliance on the SWP. Reduced SWP will reduce demands on the Bay-Delta system and could benefit Federal water supply projects and facilities that also operate within that system which include the Central Valley Project, the Delta Project and CALFED.

6.b.iv New or Expanded Wastewater Facilities.

Reduction, postponement, or elimination of new or expanded wastewater facilities.

This section of the required Title XVI Feasibility Study Report Contents is not applicable to Replenish Big Bear. The BBARWA WWTP has sufficient capacity to accommodate current and anticipated flows and no new facilities are planned for treating wastewater.

7 ENVIRONMENTAL CONSIDERATION AND POTENTIAL EFFECTS

WTR 11-01 Requirement 5.B.7

The review of a Title XVI feasibility study report does not require National Environmental Policy Act (NEPA) compliance. The Department of the Interior categorical exclusion 1.11 "Activities which are educational, informational, advisory, or consultative to other agencies, public and private entities, visitors, individuals or the general public" applies to Reclamation's consultative review, and preparation of the Title XVI feasibility study reports. As stated in Paragraph 1. Scope, Reclamation is not making a recommendation to go forward with the proposed Title XVI project, nor is Reclamation using the Title XVI feasibility study report to propose an action to the Congress.

(a) The Title XVI feasibility study report must include sufficient information on the proposed Title XVI project to allow Reclamation to assess the potential measures and costs that may be necessary to comply with NEPA, and any other applicable Federal law. Accordingly, the following information is required.
   i. Discussion whether, and to what extent, the proposed Title XVI project will have potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources.
   ii. Discussion whether, and to what extent, the project will have potentially significant environmental effects, or will involve unique or undefined environmental risks.
   iii. Description of the status of required Federal, state, tribal, and/or local environmental compliance measures for the proposed Title XVI project, including copies of any documents that have been prepared, or results of any relevant studies.
   iv. Any other information available to the study lead that would assist with assessing the measures that may be necessary to comply with NEPA, and other applicable Federal, state or local environmental laws such as the Endangered Species Act or the Clean Water Act.
   v. Discussion of how the proposed Title XVI project will affect water supply and water quality from the perspective of a regional, watershed, aquifer, or river basin condition.
   vi. Discussion of the extent to which the public was involved in the feasibility study, and a summary of comments received, if any.
   vii. Description of the potential effects the project may have on historic properties. Discussion must include potential mitigation measures, the potential for adaptive reuse of facilities, an analysis of historic preservation costs, and the potential for heritage education, if necessary.

(b) If, at a later date, Reclamation provides funds for construction, appropriate NEPA, and other environmental compliance, must be completed.

7.A ENVIRONMENTAL CONSIDERATIONS FOR ASSESSING NEPA COMPLIANCE

The Title XVI feasibility study report must include sufficient information on the proposed Title XVI project to allow Reclamation to assess the potential measures and costs that may be necessary to comply with NEPA, and any other applicable Federal law. Accordingly, the following information is required.

Tom Dodson & Associates has been hired by the Agency Team to conduct the CEQA/NEPA analysis for Replenish Big Bear and prepare the required documentation. Efforts to analyze potential project impacts are just getting started; however, a preliminary analysis was conducted to address requirements of this feasibility study. Preliminary analysis shows that the majority of impacts would be less than significant or could be reduced to less than significant with implementation of appropriate mitigation measures. Necessary mitigation measures will be further developed during the CEQA/NEPA review process to minimize or avoid potential impacts associated with the proposed project. The preliminary analysis did not identify any significant and unavoidable impacts associated with implementation of the proposed project.

7.a.i Potential Significant Impacts

Discussion whether, and to what extent, the proposed Title XVI project will have potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources.

Endangered or Threatened Species, and Natural Resources

According to the California Natural Diversity Database (CNDDB), 79 sensitive species have been documented to occur in the Fawnskin, Big Bear City, Big Bear Lake and Moonridge - USGS 7.5-minute series quadrangles. Of the 79 species identified in these four quads, 16 (12 plant species and 4 animals species) are State or federally listed species. This analysis takes into account species range as well as documentation within the vicinity of the Project Area. Replenish Big Bear has the potential to impact sensitive and listed species; however, based on a preliminary analysis and experience with similar projects in the Valley, adequate mitigation is available to avoid or compensate for potential impacts and reduce impacts to a less than significant.

Prior to implementation of the proposed project, a Biological Resources Assessment for Replenish Big Bear will be conducted to evaluate the project's potential direct, indirect, and temporary impacts to biological resources and jurisdictional waters that may occur during construction and operation. Project components generally will be located in developed areas, including public rights-of-way, in the City of Big Bear Lake, and in unincorporated portions of San Bernardino County. However, some of the sensitive species in the project area, and therefore the most likely to be affected by implementation of Replenish Big Bear, are described below.

Endangered, Threatened or Proposed Wildlife Species

- The Mountain yellow-legged Frog (Rana muscosa) is federally listed as threatened, listed as a state species of special concern, and is considered sensitive by the San Bernardino National Forest. In Southern California, mountain yellow-legged frogs live within and adjacent to streams that traverse ponderosa pine, montane hardwood conifer, and montane riparian habitats. The species ranges in elevation from 1,200 to 7,500 feet. This species is never found far from water with adults preying on a variety of invertebrates and terrestrial insects. Tadpoles feed on algae and diatoms found on rocky stream, lake and pond bottoms. They have been found in the east fork of Barton Creek approximately 0.3 miles west of Jenks Lake and 0.5 miles south of Highway 38. These frogs

breed and lay eggs from March to May in Southern California, depending on local conditions. Tadpoles typically overwinter before transforming to adult frogs. Adults hibernate in iced-over streams. Predators include garter snakes and introduced trout (CDFG 1988). Historic occurrences: Keen Camp, Schain's Ranch, Fuller Mill Creek, Tahquitz Creek, South Fork San Jacinto River, Strawberry Valley, Cabazon, Snow Creek, Andreas Canyon (S1); Cucamonga, Day, and Etiwanda Canyons, Lytle Creek (CA); Jenks Lake (SG).

- The Southwestern Willow Flycatcher (Empidonax traillii extimus) is federally and state-listed as endangered. The willow flycatcher is a riparian bird known to nest in riparian woodlands and dense willow thickets within meadows and streams. It feeds primarily on insects and occasionally on seeds and berries. An important habitat component is the dense growth of the lower branches within willow thickets or a dense shrub understory. Occurrence: nesting at Thurman Flats (SG); migrant to Bluff Lake, Big Bear Basin, desert riparian (Terrace Springs), Viscera Springs (BB), Mojave River (AH), Bautista Canyon, Strawberry and Herkey Creeks, Gamer Wash, lower Palm and Andreas Canyons (SJ). This species has also been observed nesting at Cushenbury Springs near the San Bernardino National Forest.
- Bald Eagles (Haliaeetus leucocephalus) occur in a variety of habitats. Key habitat components are large bodies of water or rivers with abundant fish, and large trees or snags with heavy limbs or broken tops. Dense stands of conifers are used for Communal roosts. Winter roosts may be 10-12 miles from feeding areas. Platform stick nests are usually built 50-200 feet from the ground in the largest tree in an old growth stand, especially ponderosa pine. Nests are typically located within 1 mile of permanent water. Nest stands may have canopy cover of less than 40%, so long as the nest itself is shaded. Bald eagles feed on fish, carrion, and occasional small mammals. Bald eagles breed from February to July, with peak activity from March to June. This species is monogamous, and reaches breeding age at 4-5 years. Pairs produce a clutch of usually 2 eggs (range 1-3). The incubation period is 34-36 days, and the young are semi altricial and hatch asynchronously.
- Southern rubber boa (Charina bottae umbratica) is a Federal species of concern and a State Threatened species. This species is a rare and secretive snake found only in the San Bernardino and San Jacinto mountains of southern California. The species is typically associated with habitats that contain rock outcrop, downed or dead trees, and a fair amount of litter on the ground. Rubber boas are restricted to montane forest habitat, and are not expected to disperse through other habitats (e.g., chaparral). They are slow-moving and are vulnerable to cars, children and pets. It occurs in moist woodlands and coniferous forests. During warm months it is active at night and on overcast days. It hibernates during winter, usually in crevices in rocky outcrops.

Sensitive Wildlife Species

- California Spotted Owl (Strix occidentalis). Spotted owls on the San Bernardino National Forest typically nest in dense, old-aged, multilayered forests with large (>24" ave. DBH) trees, hardwood understories, and greater than 60% canopy closure. They prefer stands with large diameter snags, trees with broken tops, diseased trees with cavities, and large diameter fallen trees. Spotted owls usually nest in platform nests, tree or snag cavities. They feed on small mammals. Spotted owls

breed from early March through June, with a peak period from April to May. Most fledge only a single owlet. Spotted owls become sexually mature by age 3 (CDFG 1990a). The California spotted owl is a species of special concern and is listed as sensitive by the San Bernardino National Forest.

- San Bernardino Flying Squirrel (Glaucomys sabrinus californicus). The San Bernardino Mountains support a disjunct, isolated subspecies of northern flying squirrels. This Subspecies is separated from the closest populations of other subspecies in the Sierras by at least 150 miles. Little is known about the San Bernardino subspecies – distribution has been established through owl pellet analysis but status of the population is still in question. Northern flying squirrels typically rely on seeds, nuts, and fruits of conifers, oaks, other trees and shrubs, lichens, fungi, eggs, and birds. They forage in trees and on the forest floor. Flying squirrels are generally associated with old growth or mature, dense conifer forests. Important habitat elements include cavities in mature trees, large snags, and logs. Often they are found near riparian areas and probably require free water. Most nests and shelters are located in cavities in trees or snags. Occasionally stick nests are built. They usually breed in March, and the gestation period is 37-40 days. The average litter size is four, and only the female provides parental care. Young are weaned at approximately 80 days. Two litters per year may be common in southern California Flying squirrels may breed in their first year. Flying squirrels are active year-round and are nocturnal. Loss of snags to firewood and timber programs have probably contributed to declines in populations. In residential areas, cat predation may contribute to losses. Flying squirrels are part of the diet of California spotted owls. Predators include owls, domestic cats, bobcats and long-tailed weasels.
- San Bernardino mountain kingsnake (Lampropeltis zonata parvirubra) is a Federal species of concern and a State species of special concern. It occurs in pine and incense-cedar forests in southern California's higher mountain ranges. It tends to have limited seasonal activity and spotty distribution, which may explain the limited knowledge of their biology and population status (Stebbins 1954, Glaser 1970). It is considered a "Special Animal" by the California Department of Fish and Wildlife, but has no status under federal or state Endangered Species Acts. It is known from varying habitats, including chaparral and forest, and is expected to occur throughout the Big Bear area on north and south-facing slopes of the mountain range. It is better able to disperse than the rubber boa, but is an attractive snake and is especially vulnerable to collectors.
- The yellow-breasted chat (Icteria virens) is a small songbird that forages in riparian thickets of willow, brushy tangles near watercourses. Nests are built in riparian woodland habitats. The habitat range of this species includes much of western North America. Yellow-breasted chat winters in Central America. The yellow-breasted chat is listed as Species of Special Concern by the CDFW. It is not listed by the USFWS.

Endangered, Threatened or Proposed Plant Species

- California Taraxacum (Taraxacum califotnicum) is a federally endangered species endemic to the northeastern San Bernardino Mountains. Occurrences range from Big Bear and Holcomb valleys to South Fork Meadows in the Santa Ana River watershed. The CNDDB lists twenty-six extant occurrences. This species is found between 5,300 and 9,000 feet elevation and typically flowers between May and July. T. californicum is the only native dandelion in the state and is of

considerable interest to plant taxonomists. According to the CNDDB, occurrences of California taraxacum are known near Horse Meadow, south of Barton Flats and about 2 miles southwest of the confluence of the South Fork with the main stem of the Santa Ana River; and at Seven Oaks Camp.

- San Bernardino bluegrass (Poa atropurpurea) is a federally endangered species found in the San Bernardino Mountains and in the Palomar and Laguna mountains of San Diego County. This perennial grass occupies the edges of wet meadows where there is less competition from more mesic species. However, the non-native Poa pratensis can grow at the same locations and there is potential for genetic absorption to occur. San Bernardino blue grass is the first Poa spp. to flower and this should be considered during surveys. This plant grows between 4,400 and 8,060 feet elevation (1500 and 2200 meters) and typically flowers between May and June. Plants are dioecious and detection may be difficult. The CNDDB documents several occurrences for this species. At the northern end of its range, Poa atropurpurea appears to be declining. Two areas with confirmed occurrences (Wildhorse Meadow and Holcomb Valley) are located partly on the San Bernardino National Forest. Additional occurrences were discovered on in Holcomb Valley during surveys conducted in 1999. One occurrence at North Baldwin is managed by the California Department of Fish and Wildlife.
- Ash-gray Indian paintbrush (Castilleja cinerea) inhabits pebble plain openings within montane coniferous forests, pinyon-juniper (Pinus-Juniperus spp.) woodlands, dry montane meadows, and Mojavean desert scrub. Ash-grey Indian paintbrush prefers, but is not limited to, pebble plain habitats. Montane coniferous forest species associated with ash-grey Indian paintbrush include incense-cedar (Calocedrus decurrens), Jeffrey pine, ponderosa pine (P. ponderosa), Sierra juniper, white fir (Abies concolor), California black oak (Quercus kelloggii), and canyon live oak (Q. chrysolepis). Common shrub species within the montane coniferous forest are mountain big sagebrush (A. tridentata ssp. vaseyana), manzanita (Arctostaphylos spp.), ceanothus (Ceanothus spp.), and curlleaf mountain mahogany (Cercocarpus ledifolius). Ash-grey Indian paintbrush also inhabits dry montane meadows of southern California. Species of bentgrass (Agrostis spp), hairgrass (Deschampsia spp), muhly grass (Muhlenbergia spp.), bluegrass (Poa spp.), along with sedges (Carex spp., Scirpus spp.), and rushes (Juncus spp.) are commonly found in these meadows. Ash-grey Indian paintbrush is a perennial herb 2 to 6 inches (5-15 cm) in height. The spike-like inflorescence ranges in color from greenish yellow to a crimson red. Ash-grey Indian paintbrush is a hemiparasitic plant that obtains some nutrients and water from a host plant. Host plant species parasitized by ash-grey Indian paintbrush include southern mountain buckwheat, Kennedy's buckwheat (Eriogonum kennedyi var. kennedyi) Wright's buckwheat (Eriogonum wrightii var. subscaposum), basin big sagebrush, black sagebrush (A. nova), and other Artemisia species.
- Big Bear Valley milk-vetch (Astragalus lentiginosus var. sierrae) is a perennial herb, flowering from April to August. It prefers sandy and gravelly soils, including pebble plains. It occurs in Mojave desert scrub, pinyon and juniper woodland and upper montane coniferous forest. This species also occurs in stony meadows and along seeps, at elevations extending from 5,900 to 8,600 feet. This species is a California endemic and is found only in the San Bernardino Mountains. Big Bear

Valley milkvetch is a List 1B.2 plant in the California Native Plant Society Inventory (CNPS 2010). It is not listed by the USFWS or the CDFW.

- Pygmy pussy paws (Calyptridium pygmaeum) is an annual herb that is found on sandy or gravelly soils in habitats ranging from upper montane coniferous forest to subalpine coniferous forest. The known elevation range is from 6,500 to 10,200 feet. It blooms from June through August from the Sierra Nevada ranges south to the San Bernardino Mountains. It is currently only known from fewer than 10 occurrence, and is possibly threatened by development and recreational activities. Pygmy pussy paws is a List 1B.2 plant in the CNPS Inventory (CNPS 2010). It is not listed by the USFWS or CDFW.
- Southern mountain buckwheat (Eriogonum kennedyi ssp. montanum) is a woody perennial subspecies that forms dense leafy mats on the grounds. It blooms from July through September on dry stony slopes in lower montane coniferous forest (CNPS 2010). Elevations where this species is found ranges from 5,800 to 9,500 feet (CNPS 2010). Southern mountain buckwheat is found in the San Bernardino Mountains and in the Los Padres Mountains of Ventura County. This species occurs on only seven sites on the San Bernardino Mountains, mostly around the Bear Valley area all on pebble plains habitats. Ownership includes private, state and U.S. Forest Service (USFS) lands. All seven population area threatened (USFWS 1998). The southern mountain buckwheat is listed as threatened by the USFWS and is on List 1B.2 of the CNPS Inventory (CNPS 2010).
- Silver-haired ivesia (Ivesia argyrocoma) is a perennial herb that occurs in the upper montane coniferous forest. The known range is confined to the San Bernardino Mountains, and to sites in Baja California. This species occurs in meadows, seeps, usually on alkaline soils, as well as pebble plains at elevations ranging from 4,700 to 9,700 feet. Silver-haired ivesia is a List 1B.2 plant in the CNPS Inventory (CNPS 2010). It is not listed by the USFWS or the CDFW.
- Hall's monardella (Monardella macrantha spp. hallii) is a rhizomatous herb that grows from slender woody rootstocks. It occurs in valley grasslands to lower montane coniferous forest, usually on dry slopes and ridges. It flowers June to October at elevations ranging from 2,400 to 7,200 feet. The known habitat range is from the San Gabriel and San Bernardino mountains to the Cuyamaca and Santa Ana mountains. Hall's monardella is a List 1B.3 plant in the CNPS Inventory (CNPS 2010) and is considered sensitive by the CDFW. It is not listed by the USFWS.
- The San Bernardino ragwort (Packera bernardina) is a perennial herb that is found in upper montane coniferous forest. It blooms from May through July at elevations ranging from 5,900 to 7,600 feet elevation. This species prefers mesic, sometimes alkaline meadows, seeps, pebble plain habitats and dry rocky slopes. There are fewer than 20 populations in the San Gabriel and San Bernardino mountains. San Bernardino ragwort is a List 1B.2 plant in the CNPS Inventory (CNPS 2010). It is not listed by the USFWS or the CDFW.
- Big Bear Valley phlox (Phlox dolichantha) is a perennial herb that is found in upper montane coniferous forest. It blooms from May through July at elevations ranging from 6,500 to 9,750 feet. It prefers pebble plains habitat, but also occurs on sloping hillsides in shade and openings in the forest cover. This species is a California endemic and is found only in the San Bernardino

Mountains. Big Bear Valley phlox is a List 1B.2 plant in the CNPS Inventory (CNPS 201). It is not listed by the USFWS or the CDFW.

- The San Bernardino Mountains bladderpod (Physaria kingii ssp. bernardinus) is a perennial herb that blooms from May to June. It prefers dry sandy to rocky carbonate soils in pinyon-juniper woodlands, lower montane coniferous forest and subalpine coniferous forest. The known elevation range is from 6,000 to 8,900 feet. This species is endemic to the San Bernardino Mountains. The San Bernardino Mountains bladderpod is listed as endangered by the USFWS and is a List 1B.1 plant in the CNPS Inventory (CNPS 201). It is not listed by the CDFW.
- Southern Jewelflower (Streptanthus campestris) is a perennial herb found in chapparal, pinyon-juniper woodlands and lower montane coniferous forest. It prefers rocky open areas at elevations from 2,900 to 7,600 feet. It blooms from May to July from the San Gabriel Mountains south through to the Cuyamaca Mountains of San Diego County. There is one disjunct population from Santa Barbara County. Southern jewelflower is List 1B.3 plant in the CNPS Inventory (CNPS 201). It is not listed by the USFWS or the CDFW.

Appropriate pre-construction surveys and consultation with jurisdictional state and federal agencies would be required prior to implementation of the proposed project. Impacts to species and habitats may be potentially significant; however, it is expected that mitigation measures could be developed to avoid or minimize potential impacts to endangered or threatened species.

CDFW is a trustee agency for biological resources throughout the state under CEQA and has direct jurisdiction under the California Fish and Game Code (CFGC). Under the California Endangered Species Act (CESA) and the federal Endangered Species Act (FESA), the CDFW and the USFWS, respectively, have direct regulatory authority over species formally listed as threatened or endangered (and listed as rare for CDFW). Native and/or migratory bird species are protected under the federal Migratory Bird Treaty Act (MBTA) and CFGC 3503, 3503.5, and 3511.

Special-status species are those plants and animals: 1) listed, proposed for listing, or candidates for listing as Threatened or Endangered by the USFWS and the National Marine Fisheries Service (NMFS) under the FESA; 2) listed or proposed for listing as Rare, Threatened, or Endangered by the CDFW under the CESA; 3) recognized as California Species of Special Concern (CSSC) by the CDFW; 4) afforded protection under MBTA or CFGC; and 5) occurring on Lists 1 and 2 of the CDFW California Rare Plant Rank (CRPR) system.

Regulated Waters of the United States

Prior to implementation of Replenish Big Bear, preliminary jurisdictional delineations of waters crossed by the proposed project or otherwise potentially affected by project activities would be performed. Statutes within the Clean Waters Act (CWA), CFGC, and California Code of Regulations (CCR) protect wetlands and riparian habitat. The U.S. Army Corps of Engineers (USACE) has regulatory authority over wetlands and waters of the United States under Section 404 of the federal Clean Water Act (CWA). The Regional Water Quality Control Boards (RWQCBs) ensure water quality protection in California pursuant to Section 401 of the CWA and Section 13263 of the Porter-Cologne Water Quality Act. The CDFW

regulates waters of the State as it relates to sensitive biological resources under the CFGC Section 1600 (et seq.).

Public Health and Safety

Construction and operation of Replenish Big Bear could adversely impact public health and safety. The potential for public health and safety impacts would be confirmed during the CEQA review process. Based on the preliminary evaluation it is anticipated that significant impacts to public health and safety could be avoided or reduced to a less than significant level through the development and implementation of appropriate mitigation measures.

Air Quality

Construction of Replenish Big Bear could generate dust and diesel particulate matter that may degrade local air quality. Sensitive receptors, including residents adjacent to project construction activities, may be subject to an elevated risk of exposure to toxic air contaminants such as diesel particulate matter and dust from soils with naturally occurring asbestos. Due to the temporary and geographically dispersed nature of construction activities along a pipeline alignment, it is not anticipated that construction emissions, including the potential emission of toxic air contaminants, would result in the exposure of sensitive receptors to substantial pollutant concentrations. Operation and maintenance activities could also result in particulate matter emissions if diesel-powered vehicles are used or if unpaved surfaces are disturbed. These emissions have not yet been quantified. Further analysis conducted as part of the ongoing CEQA review process will quantify these emissions using the CalEEMod emissions model; however, due to the size and scope of the project, the short-term nature of construction activities, and the minimal emissions expected from operation, it is not anticipated that project-related emissions would exceed significance thresholds.

Hazards and Hazardous Materials

Construction of Replenish Big Bear would involve the transportation, storage, and use of hazardous materials. These hazardous materials may include gasoline, diesel fuel, engine oil, coolants, and lubricants used in construction vehicles. Construction activities may also mobilize naturally-occurring asbestos, pesticides, herbicides, or fertilizers present in the project area soils. Operation of Replenish Big Bear would include the transportation, storage, and use of hazardous materials associated with the advanced treatment. The storage, handling, and use of hazardous materials would be subject to CalOSHA, City and County requirements associated with accumulation time limits, proper storage locations and containers, proper labeling, and proper handling. Impacts related to project-related transport, use, or disposal of hazardous materials and the potential to create a hazard to the public or the environment through accidental release or reasonably foreseeable upset would be potentially significant. The project would implement mitigation measures to minimize the risk of exposure to hazardous materials for workers and the public.

Emergency Response

During Replenish Big Bear construction and operation, compliance with all applicable County and City codes and regulations pertaining to emergency response and evacuation plans maintained by the police and fire departments would be required. Construction activities associated with the proposed project could include temporary lane or street closures during pipeline construction that could potentially impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Because of the potential for temporary lane or street closures, impacts would be potentially significant. Mitigation measures, such as a traffic management plan, would be implemented as necessary to minimize or prevent adverse impacts to emergency response or emergency evacuation plans.

Cultural Resources

The Bear Valley area has long been a part of the homeland of the Serrano Indians, whose traditional territory is centered in the San Bernardino Mountains, but also includes the southern rim of the Mojave Desert, extending from today's Victorville eastward to Twentynine Palms. At least two Serrano clans lived near the Bear Valley: the Pervetum clan, whose territory reached from the headwaters of the Santa Ana River to the vicinity of Big Bear Lake, and the Yuhavetum clan, whose territory stretched from present-day Highlands northeast to the Bear Valley. Although contact with Europeans may have occurred as early as 1771 or 1772, Spanish influence on Serrano lifeways was negligible until the 1810s, when a mission asistencia was established on the southern edge of Serrano territory. Between then and the end of the mission era in 1834, most of the Serranos in the San Bernardino Mountains were removed to the nearby missions. At present, most Serrano descendants are found on the San Manuel and the Morongo Indian Reservations, where they participate in ceremonial and political affairs with other Native American groups on an inter-reservation basis.

Excavation activities associated with project construction could disturb buried cultural resources. A cultural resources evaluation consistent with the requirements of CEQA and Section 106 of the National Historic Preservation Act will be conducted for the Replenish Big Bear project, including archaeological and historical setting and potential impacts from the project. A paleontological assessment will be conducted to identify potential impacts to paleontological resources. Prior to implementation of Replenish Big Bear, appropriate mitigation measures will be implemented to avoid archaeological, historical, and paleontological resources where feasible and to properly treat and record cultural resources where avoidance is not possible. It is anticipated that implementation of appropriate mitigation measures would reduce potential impacts to cultural resources to a less than significant level.

Construction activities required for Replenish Big Bear would involve substantial ground disturbing activities, including grading and excavation. Although no tribal or native cultural resources are known to be present, excavation could potentially impact currently unknown tribal cultural resources. Impacts would be potentially significant. Native American consultations under Assembly Bill 52 of 2014 will be conducted. The outcome of these consultation efforts will be documented in the EIR. It is anticipated that appropriate avoidance or mitigation measures could be developed during the Native American consultation and CEQA review process to reduce potential impacts to tribal cultural resources to a less than significant level.

7.a.ii Potential Significant Environmental Effects

Discussion whether, and to what extent, the project will have potentially significant environmental effects, or will involve unique or undefined environmental risks.

In addition to the potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources discussed above, implementation of Replenish Big Bear may result in additional potentially significant environmental effects. Additional potential impacts include greenhouse gas emissions, noise, vibration, and transportation/traffic. The significance of these potential impacts will be confirmed during the CEQA review process. Based on the preliminary analysis, it is anticipated that these potentially significant environmental effects could be reduced to a less than significant level through implementation of appropriate mitigation measures.

7.a.iii Status of Required Environmental Compliance Measures

Description of the status of required Federal, state, tribal, and/or local environmental compliance measures for the proposed Title XVI project, including copies of any documents that have been prepared, or results of any relevant studies.

It is anticipated that Replenish Big Bear will require permits or reviews from the following federal, state and local agencies: USACE, USFWS, CDFW, RWQCB, and the State Office of Historic Preservation (SHPO). Appropriate right-of-way easements and permits would also be required for any access roads or staging areas on land owned by other jurisdictions. No NEPA or CEQA documentation has been prepared or processed to date. Consultants have been retained and the process to fulfill both environmental review procedures has been initiated.

7.a.iv Additional Information

Any other information available to the study lead that would assist with assessing the measures that may be necessary to comply with NEPA, and other applicable Federal, state or local environmental laws such as the Endangered Species Act or the Clean Water Act.

No additional information is available at this time to assist with assessing the measures that may be necessary to comply with all applicable laws.

7.a.v Regional Effects on Water Supply and Water Quality

Discussion of how the proposed Title XVI project will affect water supply and water quality from the perspective of a regional, watershed, aquifer, or river basin condition.

Replenish Big Bear is intended to maximize the beneficial reuse of advanced treated water, and it is anticipated that implementation of the project will result in a net increase in surface and groundwater supplies compared to existing conditions. In order to recharge the groundwater basin or discharge recycled water to surface waters, the recycled water must meet the water quality objectives set by the Basin Plan and will be subject to NPDES discharge permit limits issued by the Regional Board, which will be protective of existing water quality and beneficial uses. Replenish Big Bear will treat wastewater in accordance with required discharge limitations and as such it is not anticipated that the project will negatively impact water quality in either surface or groundwater supplies. Additional evaluations regarding the project's effect on water supplies will be conducted as part of the CEQA review process and during preliminary design. It is anticipated that mitigation measures or changes to the project design or operation will be implemented to minimize or avoid potential negative impacts.

In addition, the project has the potential to change drainage patterns or increase erosion or siltation as a result of ground disturbances, grading, and increased impervious surface area. However, all elements of the proposed project will comply with all City, County or other jurisdictional agency stormwater management requirements.

7.a.vi Feasibility Study Public Involvement

Discussion of the extent to which the public was involved in the feasibility study, and a summary of comments received, if any.

The public has been involved throughout various stages of the development of this recycled water project. Replenish Big Bear (previously Bear Valley Water Sustainability Project – BVWSP), as well as the other alternatives evaluated, has been presented and discussed during numerous Council and Board meetings regularly held by the Agency Team members which are open to the public, as well as numerous public meetings held by community groups, including the local Sierra Club Group. Also, as discussed in Section 3.b.i, analysis of recycled water and alternative water supply options have been discussed in numerous planning documents available for public review. The Agency Team is fully committed to public engagement throughout the planning phase to ensure transparency and keep community members informed.

Public outreach will remain an important component of Replenish Big Bear as the project advances through planning, design, construction, and operation. The public will continue to have opportunities to engage with Agency Team through regularly scheduled meetings and through the CEQA/NEPA process. In addition, the Agency Team recently launched a Replenish Big Bear website (replenishbigbear.com) to provide project information, updates, and an opportunity for the public to ask questions and subscribe to the project mailing list to stay informed.

7.a.vii Potential Effects on Historic Properties.

Description of the potential effects the project may have on historic properties. Discussion must include potential mitigation measures, the potential for adaptive reuse of facilities, an analysis of historic preservation costs, and the potential for heritage education, if necessary.

The statewide Historical Resources Inventory (HRI) is not available for public review according to the California Historical Information System (CHRIS) Information Center Rules of Operation Manual (Section III.A). The HRI would be consulted after the determination of an Area of Potential Effect (APE) under project-level analysis. To compile a listing of recognized cultural resources within the project vicinity, information will be obtained from the California State Office of Historic Preservation (SHPO). In addition, a review of the National Register of Historic Places interactive map will be conducted.

As discussed in Section 7.a.i, a cultural resources study in accordance with CEQA and Section 106 of the NHPA will be conducted, which will include a search of the CHRIS to identify recorded cultural resources within the project APE, local consultation, a survey of the APE, and the identification of the appropriate measures to address historic properties, if applicable. These measures may include but not be limited to archaeological excavation, archaeological and/or Native American monitoring of project construction, and/or Historic American Building Survey/Historic American Engineering Record documentation as appropriate. Because the majority of project components would be located underground in public rights-of-way and therefore would not alter existing buildings or structures, it is anticipated that appropriate mitigation could be developed to reduce potential impacts to historic properties to a less than significant level.

7.B NEPA COMPLIANCE

If, at a later date, Reclamation provides funds for construction, appropriate NEPA, and other environmental compliance, must be completed.

BBARWA acknowledges that under no circumstances may any ground-disturbing activities (including grading, clearing, and other preliminary activities) begin on Replenish Big Bear before environmental compliance is complete and Reclamation explicitly authorizes work to proceed for the purposes of Title XVI funding. It is understood that this pertains to all components of the proposed project, including those that are part of the non-Federal cost-share.

8 LEGAL AND INSTITUTIONAL REQUIREMENTS

WTR 11-01 Requirement 5.B.8

The Title XVI feasibility study shall identify any legal or institutional requirements, or barriers to implementing the proposed Title XVI project.

(a) Analysis of any water rights issues potentially resulting from implementation of the proposed water reclamation and reuse project. All proposed Title XVI projects must comply with state water law.
(b) Discussion of legal and institutional requirements (e.g., contractual water supply obligations, Indian trust responsibilities, water rights settlements, regional water quality control board requirements), state, and/or local requirements with the potential to affect implementation of the project. Title XVI projects using Reclamation project water must address contractual requirements as described in RM Policy, Reuse of Bureau of Reclamation Project Water (PEC 05-13).
(c) Discussion of the need for multi-jurisdictional or interagency agreements, any coordination undertaken, and any planned coordination activities.
(d) Discussion of permitting procedures required for the implementation of water reclamation projects in the study area, and any measures that the non-Federal project sponsor can implement that could speed the permitting process.
(e) Discussion of any unresolved issues associated with implementing the proposed water reclamation and reuse project, how and when such issues will be resolved, and how the project would be affected if such issues are not resolved.
(f) Identification of current and projected wastewater discharge requirements resulting from the proposed Title XVI project (e.g., brine disposal).
(g) Description of rights to wastewater discharges resulting from implementation of the proposed Title XVI project.

8.A POTENTIAL WATER RIGHT ISSUES

Analysis of any water rights issues potentially resulting from implementation of the proposed water reclamation and reuse project. All proposed Title XVI projects must comply with state water law.

The Basin is not adjudicated and BBCCSD and BBLDWP will be able to continue pumping water from the Basin to meet potable demand. Replenish Big Bear does not impact current groundwater rights of the Agency Team.

Implementing groundwater recharge operations at Sand Canyon has the potential to impact surface water rights under the 1977 Judgement. Prior studies evaluating potential recharge operations in Sand Canyon considered constructing a series of small berms along the streambed to create a percolation area or modifying stream channel to create a meandering stream with small natural ponds to slow the water down and enhance percolation. An additional concept that that may be considered is the use of inflatable rubber dams in the channel which could be inflated to create percolation ponds during the recharge operation only and deflated at all other times so as not to impact the natural function of the channel.

However, all of these concepts would need to be coordinated with the flood control agency to ensure that the capacity of the flood control channel remains sufficient to meet the primary purpose of providing flood protection. If these improvements resulted in a decrease in surface flow entering the Lake, then the impact to surface water rights under the 1977 Judgment would need to be evaluated.

The Big Bear Watermaster accounting process, which is based on the 1977 Judgement, will need to be modified to address the addition of a new water source into the Lake and provide BBWMD with the authority to allow extractions for groundwater recharge and golf course irrigation.

Treated secondary effluent is currently discharged to a 480-acre site in Lucerne Valley for irrigation of fodder and fiber crops that are used as feed for livestock. The LV Site is owned by BBARWA and leased to a farmer for crop production and BBARWA has the right to modify or terminate this lease and retain the water in the Big Bear Valley. The water is entirely contained on the LV Site and is not permitted to pond or run off the site so it does not support any environmental uses at the LV Site.

8.B POTENTIAL LEGAL AND INSTITUTIONAL REQUIREMENTS WITH POTENTIAL TO IMPACT IMPLEMENTATION

Discussion of legal and institutional requirements (e.g., contractual water supply obligations, Indian trust responsibilities, water rights settlements, regional water quality control board requirements), state, and/or local requirements with the potential to affect implementation of the project. Title XVI projects using Reclamation project water must address contractual requirements as described in RM Policy, Reuse of Bureau of Reclamation Project Water (PEC 05-13).

Replenish Big Bear will require the Agency Team to obtain permits and/or other forms of approval from Federal, State and local agencies as detailed in Sections 7 and 8.d of this feasibility study. Permits have not been acquired yet for this project but will be pursued as early as possible during the design process. Replenish Big Bear will not use USBR project water.

8.C MULTI-JURISDICTIONAL OR INTERAGENCY AGREEMENTS

Discussion of the need for multi-jurisdictional or interagency agreements, any coordination undertaken, and any planned coordination activities.

Replenish Big Bear has been identified as the preferred recycled water project through extensive analysis and regional collaboration. Implementation of this multifaceted project will require various agreements and continued coordination with regional stakeholders. The Agency Team formed a JPA in response to the state mandated SGMA requirements, and this agreement established the framework for advancing Replenish Big Bear. Each of the four agencies in the JPA have committed to equally sharing Replenish Big Bear costs for planning, preliminary engineering, and documentation needed to satisfy CEQA/NEPA requirements. Details regarding cost sharing between the Agency Team for additional fixed and variable project costs have not been determined at this time. However, the Agency Team will continue to collaborate and develop a governance structure as the planning phase advances.

In addition to establishing the Agency Team's governance structure, agreements may be established with the Big Bear Lake Resorts, potential downstream stakeholders and resource agencies.

- Big Bear Lake Resorts - The Agency Team is continuing conversations with the Resort to establish an agreement for the joint use of their snowmaking facilities for Sand Canyon recharge, additional snow storage, and irrigation of the Bear Mountain golf course. It is anticipated that an agreement will be successfully negotiated and communication between the Agency Team and Resort representatives will continue in 2019.
- Downstream Stakeholders - Communication has also been initiated with Valley District, Western Municipal Water District and other downstream stakeholders to further assess project benefits and opportunities for partnerships. Creation of a new beneficial water source at the top of the watershed provides many opportunities to coordinate with agencies downstream of the Lake to optimize water supply management and environmental benefits throughout the Santa Ana Watershed.
- Resource Agencies – Partnership with resource agencies such as the Nature Conservancy are being considered to advance the use of recycled water in Shay Pond to enhance Stickleback habitat.

The Agency Team will continue to consider all potential partnerships to improve recycled water production, water management and to maximize realized benefits with project implementation.

8.D IMPLEMENTATION PERMITTING PROCEDURES

Discussion of permitting procedures required for the implementation of water reclamation projects in the study area, and any measures that the non-Federal project sponsor can implement that could speed the permitting process.

Replenish Big Bear implementation will require the Agency Team to obtain permits and/or other forms of approval from Federal, State and local agencies. Permits have not been acquired yet but will be pursued as early as possible during the design process. Coordination will also be required with the permitting agencies to determine the projects permitting strategy and required technical studies. Anticipated new or modified permits/approvals include but are not limited to the following:

Federal Agencies:

- Reclamation – NEPA lead agency which may require coordination with other federal agencies such as USFWS, State Historic Preservation Office, Army Corps of Engineers, and National Marine Fisheries Service.

State Agencies:

- RWQCB – NPDES for discharge to Stanfield Marsh / Big Bear Lake
- RWQCB – NPDES for discharge to Shay Pond
- RWQCB – General Construction Permit

- RWQCB – Waste Discharge Requirement (WDR) modification for changes in operation and the addition of brine disposal in the Lucerne Valley.
- SWRCB – Recycled Water Use Statewide General Permit
- Caltrans – Encroachment permits for pipelines within the Caltrans Right of Way
- CDFW – Approval for discharge to Shay Pond

Local Agencies:

- The City of Big Bear and/or San Bernardino County – Encroachment permits for improvements within their respected Right of Way
- The City of Big Bear and/or San Bernardino County – Grading and building permits for treatment upgrades and the recharge basin
- South Coast Air Quality Management District – Authority to Construct and Permit to Operate the WWTP upgrades

To obtain a NPDES permit, BBARWA will need to submit a Report of Waste Discharge (ROWD) to the Santa Ana RWQCB, along with an Engineering Report describing the treatment upgrades, effluent characteristics, and proposed uses. The Engineering Report must also be submitted to DDW for review in parallel and DDW will issue findings and conditions for the Sand Canyon recharge component of the project to be incorporated into the discharge permit issued by the RWQCB. The ROWD will be submitted as soon as the Engineering Report is available but no later than six months before the project comes online, as it typically takes six months for the Regional Board and EPA to review and issue a new permit.

In accordance with CEQA, the Agency Team will prepare an Environmental Impact Report (EIR). Since federal funding is being pursued through Reclamation's Title XVI Program, a CEQA-Plus document will be prepared to help facilitate NEPA compliance. Potential actions that will be required by Reclamation include:

- Review EIR/EA (or separate EA based on approach selected)
- Review the Cultural Resources Technical Study Report and provide report and cover letter to SHPO (unless SHPO consultation was previously conducted under CEQA Plus).
- Review Biological Resources Assessment and initiate Section 7 consultation with USFWS and NMFS (if potential take of federally listed species is identified), unless the Section 7 consultation has already been initiated under CEQA Plus or USACE as part of 404/401, if required.
- Consult with NMFS regarding Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act, if impacts are identified. Unless already conducted under CEQA Plus or USACE as part of 404/401, if required.
- Maintain an administrative record to support Reclamation's NEPA findings
- Website posting of FONSI

The Agency Team intends to proactively monitor and manage permitting needs and timelines to implement construction and operation of Replenish Big Bear in an efficient and timely manner.

8.E UNRESOLVED ISSUES FOR IMPLEMENTATION

Discussion of any unresolved issues associated with implementing the proposed water reclamation and reuse project, how and when such issues will be resolved, and how the project would be affected if such issues are not resolved.

As noted in Section 3.c, no issues have been identified that would prevent the project from implementation. However, unresolved issues associated with implementing Replenish Big Bear include obtaining approval to discharge recycled water into Shay Pond to support the Stickleback population, and disposal of the project's brine through the existing effluent pipeline. A brief summary of these issues and efforts to resolve them are provided below.

Shay Pond Discharge

Prior to discharging water into Shay Pond to support Stickleback populations, the Agency Team must first confirm that recycled water is an acceptable substitute for the potable water currently being discharged. A long-term study of Stickleback survival in recycled water is required and it is anticipated that it will require the following:

1. Obtain submittals outlining a proposed study program to answer the question of whether the Stickleback can survive and breed over several generations without any measurable damage to individuals or the population
2. Consult with the (USFWS) and (CDFW) to obtain concurrence and approval to implement the study program
3. Fund the study implementation and compile a report of results and recommendations
4. Submit the report and recommendation to the [USFWS] and [CDFW] with the objective of obtaining an incidental take permit to use recycled water to supplement the habitat in Shay Creek and replace potable water currently being used for this purpose.

If the study finds that recycled water impacts the long-term survival of the Stickleback, then implementation of this project element may not advance. Replenish Big Bear can still move forward without discharging water to this location.

Brine Disposal

Replenish Big Bear intends to pursue solar evaporation ponds in the Lucerne Valley to dispose of the project's brine. The Agency Team anticipates using the existing effluent pipeline for brine conveyance as it is not financially feasible to construct a second pipeline to Lucerne Valley. A condition assessment and corrosion testing of the existing discharge pipeline to Lucerne Valley needs to be performed to determine whether the existing pipeline could accommodate brine conveyance without resulting in significant corrosion. In addition, because the effluent pipeline will also need to be used to convey peak flows to the Lucerne Valley site, the operational strategy to maintain dual use of this pipeline will be an important consideration to ensure that BBARWA is able to remain in compliance with discharge permit requirements at all times. Additional analysis of the pipeline and operational strategies are required prior to finalizing the project design. However, as discussed in Section 4.f, alternative brine disposal locations and

technologies for further concentrating the brine volume are available and may be implemented if required to ensure that the project advances.

In addition to the issues noted above, it should also be noted that additional project details are being evaluated during the preliminary engineering phase which include:

- Update WWTP flow projections based on current water use trends to inform appropriate sizing of treatment and disposal facilities
- Update estimates of Lake water level impacts based on anticipated project yield, which may consider the effects of evaporation in the Marsh
- Quantify potential Lake water quality improvements resulting from the implementation of the Lake Alternative
- Refine the estimated recharge potential in Sand Canyon through performance of a pilot infiltration test
- Coordinate with flood control agency to identify technical studies and management practices needed to enable effective joint use of Sand Canyon for flood control and recharge
- Perform a hydrology study to estimate the volume and timing of additional Lake releases under a range of hydrologic conditions so this information can be used in Valley District's model to assess their ability to capture these flows for recharge.
- For Sand Canyon recharge, verify the pathogen control credit that can be achieved by the selected treatment process and identify whether additional underground retention time is needed to achieve the required total credit.
- Perform a treatment process alternatives analysis and conduct a pilot study using potential equipment to refine design criteria and validate treatment performance estimates, including nutrient removal capability and RO recovery rates
- Evaluate whether effluent temperature reduction will be required in cooler months
- Refine design capacity and RW production estimates based on more detailed flow data, updated future flow projections, and actual MF and RO recovery rates
- Evaluate whether one of the parallel lines from the concrete balancing main to the Lucerne Site could be repurposed for brine conveyance
- Evaluate whether the existing secondary effluent pump station could be repurposed for the new tertiary effluent discharge
- Initiate a water quality sampling program for nutrients, metals, COD, etc. throughout the existing treatment process to support modeling and design of the potential process upgrades needed at the WWTP.

Project refinements are anticipated for this complex project and unresolved issues are not anticipated to keep Replenish Big Bear from being implemented.

8.F WASTE DISCHARGE REQUIREMENTS

Identification of current and projected wastewater discharge requirements resulting from the proposed Title XVI project (e.g., brine disposal).

Sections 1.c, 3.a, and 3.f detail the existing BBARWA wastewater discharge requirements and the Santa Ana WDR and Colorado WDR are available in Appendix G and Appendix H respectively. In addition, Section 4.e details the preferred brine disposal option for Replenish Big Bear at the LV Site.

The Agency Team has initiated conversations with the RWQCB and has a meeting scheduled in January 2019 to discuss permitting requirements and the approach to modifying or obtaining new permits to implement Replenish Big Bear.

8.G WASTEWATER DISCHARGE RIGHTS

Description of rights to wastewater discharges resulting from implementation of the proposed Title XVI project.

This section of the required Title XVI Feasibility Study Report Contents is not applicable to Replenish Big Bear. As noted in Section 8.f, BBARWA will be responsible for properly disposing of the brine.

9 FINANCIAL CAPABILITY OF SPONSOR

WTR 11-01 Requirement 5.B.9

At the Title XVI feasibility study stage, Reclamation must request enough information to determine that the non-Federal project sponsor is likely to demonstrate financial capability if the project moves to construction. Reclamation will request more detailed information to make a determination that the non-Federal project sponsor is financially capable of funding the non-Federal share of the project's costs before a funding agreement covering construction can be executed. Accordingly, the following information is required to be included in the Title XVI feasibility study report.

(a) Proposed schedule for project implementation.
(b) Discussion of the willingness of the non-Federal project sponsor to pay for its share of capital costs and the full operation, maintenance, and replacement costs.
(c) A plan for funding the proposed water reclamation and reuse project's construction, operation, maintenance, and replacement costs, including an analysis of how the non-Federal project sponsor will pay construction and annual operation, maintenance, and replacement costs.
(d) Description of all Federal and non-Federal sources of funding and any restrictions on such sources, for example, minimum or maximum cost-share limitations. Generally, for Title XVI authorized projects, the Federal cost share is limited to 25 percent, or $20,000,000, whichever is less.

9.A IMPLEMENTATION SCHEDULE

Proposed schedule for project implementation.

Table 9-1 provides the anticipated Replenish Big Bear schedule milestone dates and timeline.

Table 9-1. Anticipated Replenish Big Bear Schedule

Milestone Description	Completion Date
Preliminary Engineering	December 2019
Environmental and Regulatory Compliance	December 2019
Pilot Facility Start-up	January 2020
Final Design	December 2020
Construction	October 2022
Start Up & Closeout	December 2022

9.B PROJECT SPONSOR WILLINGNESS TO PAY

Discussion of the willingness of the non-Federal project sponsor to pay for its share of capital costs and the full operation, maintenance, and replacement costs.

The Agency Team is committed to constructing and operating Replenish Big Bear for the life of the project to keep water from being discharged outside of the Valley and putting it to beneficial reuse. As such, the Agency Team is prepared to take all necessary actions to pay for the construction and full operation, maintenance, and replacement costs. Section 9.c provides details regarding the plan to cover all costs.

9.C FUNDING PLAN

A plan for funding the proposed water reclamation and reuse project's construction, operation, maintenance, and replacement costs, including an analysis of how the non-Federal project sponsor will pay construction and annual operation, maintenance, and replacement costs.

Outside funding from various sources will be critical to implement this project without putting excessive burden on the local community. A combination of grants, low interest loans and cost-sharing contributions from partner agencies are anticipated. Pursuing project funding will require an upfront investment by the Agency Team, and grant funding is anticipated to be highly competitive. However, Replenish Big Bear is expected to be attractive to funding agencies because it meets several objectives commonly prioritized by funding programs, including:

- Relies upon and strengthens local and regional partnerships
- Develops a new, local, sustainable water supply that benefits regional communities
- Improves water supply reliability
- Improves groundwater basin quality
- Serves a disadvantaged or severely disadvantaged community
- Improves conditions for fish and wildlife and protects the watershed
- Enhances park, water, and natural resource values through improved recreation, tourism, and natural resource investments

Funding opportunities for recycled water and environmental enhancement projects are available from several state and federal sources. The Agency Team is screening applicable sources based on eligibility criteria, funding availability, program and beneficial use goals and objectives, and/or program constraints to identify and prioritize funding and financing pursuits. In addition, a monthly cash flow model with tabular and graphical summaries of encumbrances and funds by project phase will be developed. Potential funding and financing programs to be evaluated include but are not limited to the following.

Federal Programs

- Reclamation WaterSMART Title XVI Water Reclamation and Reuse Projects
- United States Department of Agriculture (USDA) Water and Waste Disposal Loan and Grant Program

State Programs

- California Department of Water Resources Integrated Regional Water Management (IRWM) Implementation Grants, implemented through the Santa Ana Watershed Project Authority (SAWPA)
- SWRCB Water Recycling Funding Program (WRFP) Grant and Loan Program
- Infrastructure State Revolving Fund (iBank)
- SWRCB Clean Water State Revolving Fund Loan Program (CWSRF)
- Water Infrastructure Finance and Innovation Act (WIFIA) Loans
- CDFW, Wildlife Conservation Board (WCB), and State Coastal Conservancy (Conservancy) programs for habitat restoration and enhancement
- California Office of Emergency Services (Cal OES) Hazard Mitigation Grant Program

California voters recently passed the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68) which will provide funding for projects with many of the Replenish Big Bear project benefits. The Agency Team will continue to investigate and pursue funding and financing opportunities to assist with project costs and reduce the burden to rate payers. A summary of some of the eligible funding programs being considered is provided in Appendix C, and a document crosswalk is provided below.

Should Replenish Big Bear not be awarded grant funding, or a low interest loan and bond financing is required, the term will likely be for 25 years at current market rates (approximately 4.5%). As previously noted, details regarding cost sharing between the Agency Team have not been finalized at this time. However, the Agency Team will continue to collaborate and develop a governance structure as the planning phase advances and is committed to implementing the project.

Section 9.c – Supporting Document Crosswalk			
Topic	**Location**	**Section**	**Page Number(s)**
Eligible Funding Programs	Appendix C	8.2	8-1 to 8-3

9.D FUNDING SOURCES

Description of all Federal and non-Federal sources of funding and any restrictions on such sources, for example, minimum or maximum cost-share limitations. Generally, for Title XVI authorized projects, the Federal cost share is limited to 25 percent, or $20,000,000, whichever is less.

Funding through outside state and federal programs has not been secured yet for Replenish Big Bear. The Agency Team is actively pursuing both grant and low interest loan opportunities to reduce project costs and potential impacts to local rate payers. Section 9.c details some of the potential sources of funding available that will be pursued.

The Agency Team anticipate pursuing federal funding through Reclamation's Title XVI Water Reclamation and Reuse Program for 25 percent of the project cost. The Agency Team may elect to designate the BVBGSA as the applicant for the grant. In accordance with Title XVI funding limitations, the total federal funding share for Replenish Big Bear will not exceed 25% of the total Project cost.

10 RESEARCH NEEDS

WTR 11-01 Requirement 5.B.10

At a minimum, the report must include a statement on whether the proposed water reclamation and reuse project includes basic research needs, and the extent that the proposed Title XVI project will use proven technologies and conventional system components. The following information is required only if further research is necessary to implement the proposed Title XVI.

(a) Description of research needs associated with the proposed water reclamation and reuse project, including the objectives to be accomplished through research.
(b) Description of the basis for Reclamation participation in the identified research.
(c) Identification of the parties who will administer and conduct necessary research.
(d) Identification of the timeframe necessary for completion of necessary research.

10.A RESEARCH NEEDS

Description of research needs associated with the proposed water reclamation and reuse project, including the objectives to be accomplished through research.

As discussed in Section 8.e, there are elements of Replenish Big Bear that require additional analysis and approvals prior to being implemented. Unresolved issues include obtaining approval to discharge recycled water into Shay Pond to support the Stickleback population, and disposal of the project's brine through the existing effluent pipeline. In addition, a number of project elements require evaluation and refinement which are being conducted during preliminary design. Project refinements are anticipated for this complex project and no issues have been identified that would prevent the project from implementation.

10.B BASIS FOR RECLAMATION PARTICIPATION IN RESEARCH

Description of the basis for Reclamation participation in the identified research.

Reclamation participation is not necessary for any additional analysis or research needed to implement Replenish Big Bear.

10.C PARTIES ADMINISTERING AND CONDUCTING RESEARCH

Identification of the parties who will administer and conduct necessary research.

The Agency Team and their consultants will continue to advance the project through the planning and design phase of the project. Specific parties have not been identified to conduct the required research; however, those details are anticipated to be determined in early 2019.

10.D RESEARCH TIMEFRAME

Identification of the timeframe necessary for completion of necessary research.

As noted in Section 9a, preliminary engineering and final design will be completed between 2019 and 2020. All research needed to complete the project design is anticipated to be completed by early 2020.

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APPENDIX A. BBCCSD 2015 UWMP

[Appendix Provided Electronically]

APPENDIX B. BBLDWP 2015 UWMP

[Appendix Provided Electronically]

APPENDIX C. RECYCLED WATER FACILITIES PLANNING STUDY

[Appendix Provided Electronically]

APPENDIX D. BEAR VALLEY LAKE ALTERNATIVE EVALUATION

[Appendix Provided Electronically]

APPENDIX E. 2017 SAND CANYON RECHARGE EVALUATION

[Appendix Provided Electronically]

APPENDIX F. BBARWA 2010 SEWER MASTER PLAN

[Appendix Provided Electronically]

APPENDIX G. SANTA ANA REGION ORDER NO. R8-2005-0044

[Appendix Provided Electronically]

APPENDIX H. COLORADO RIVER BASIN ORDER R7-2016-0026

[Appendix Provided Electronically]

APPENDIX I. COLORADO RIVER BASIN ORDER NO. 01-156

[Appendix Provided Electronically]

APPENDIX J. STATE WATER PROJECT COST ESTIMATE

[Appendix Provided Electronically]