
Draft Report Update

Recycled Water Master Plan

Submitted to
Big Bear Area Regional Wastewater Agency

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CH2MHILL

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| E | Phasing of Users |
| F | Recycled Water Regulations, Uses, and Water Quality |
| G | Treatment Analysis Criteria |
| H | Cost Analysis |

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Acronyms and Abbreviations

°F degrees Fahrenheit

μ micrometer

μmhos micromhos

AACE Association for the Advancement of Cost Engineering

afy acre-feet per year

AOP advanced oxidation process

AOX advanced oxidation

AWTF advanced water treatment facility

AWWARF American Water Works Association Research Foundation

BAF biological aerated filter

BBARWA Big Bear Area Regional Wastewater Agency

BCCSD Big Bear City Community Services District

Caltrans California Department of Transportation

CCI construction cost index

CCR California Code of Regulations

CDHS California Department of Health Services

CEQA California Environmental Quality Act

CFU colony-forming unit

DAF dissolved-air floatation

DU dwelling unit

DWP City of Big Bear Lake Department of Water and Power

ED electro dialysis

EDC endocrine-disrupting compound

EDR electro dialysis reversal

EDU equivalent dwelling unit

EHSD Environmental Health Services Department of the County of San Bernardino

ENR *Engineering News Record*

ET evapotranspiration

ET_o reference evapotranspiration

| | |
|----------------------------------|------------------------------------|
| ET _{plant} | plant evapotranspiration |
| FBR | fluidized bed reactor |
| FCT | Paleozoic metaphoric carbonates |
| fps | feet per second |
| ft ² /ft ³ | square feet per cubic foot |
| GAC | granular-activated carbon |
| gpm | gallons per minute |
| gpm/sf | gallons per minute per square foot |
| GRRP | Groundwater Recharge Reuse Project |
| GWR | groundwater replenishment |
| H ₂ O ₂ | hydrogen peroxide |
| HAA | haloacetic acid |
| HDPE | high-density polyethylene |
| hp | horsepower |
| I&I | Inflow and Infiltration |
| K _c | crop coefficient |
| kW-h | kilowatt-hour |
| LF | linear feet |
| LPS | low pressure sewer |
| MBR | membrane bioreactor |
| MCL | maximum contaminant limit |
| MF | microfiltration |
| mg | milligrams |
| MG | million gallons |
| mg/L | milligrams per liter |
| mgd | million gallons per day |
| mj/cm ² | millijoules per square centimeter |
| mL | milliliter |
| mm | millimeter |
| msl | mean sea level |
| MZP | Mesozoic granitic |
| NEPA | National Environmental Policy Act |
| NF | nanofiltration |

| | |
|----------------|---|
| NOAA | National Oceanic and Atmospheric Administration |
| NTU | nephelometric turbidity unit |
| NWRI | National Water Research Institute |
| O&M | operation and maintenance |
| pCi/L | picoCuries per liter |
| PPCPs | pharmaceuticals and personal care products |
| psi | pounds per square inch |
| PVC | polyvinyl chloride |
| Qaa | Pleistocene to recent alluvium and colluvium |
| Qaf | alluvial fan gravel |
| Qal | Pleistocene to recent lake and meadow deposit |
| Qls | landslide deposits |
| Regional Board | California Regional Water Quality Control Board |
| RO | reverse osmosis |
| RWC | recycled water contribution |
| SCE | Southern California Edison |
| SLW | Precambrian quartzite |
| SMART | Simple Multi-Attributable Rating Technique |
| SR | State Route |
| State Board | State Water Resources Control Board |
| TDS | total dissolved solids |
| THM | trihalomethane |
| TIN | total inorganic nitrogen |
| TKN | total Kjeldahl nitrogen |
| TMDL | total maximum daily load |
| TN | total nitrogen |
| TOC | total organic compound |
| TSS | total suspended solids |
| UF | ultrafiltration |
| USEPA | United States Environmental Protection Agency |
| USFS | United States Forest Service |
| USGS | United States Geological Survey |
| UV | ultraviolet |

| | |
|--------|---------------------------------------|
| UWMP | Urban Water Management Plan |
| Valley | Big Bear Valley |
| VSEP | Vibratory Shear Enhanced Processing |
| WAS | waste activated sludge |
| WDR | Waste Discharge Requirements |
| WERF | Water Environment Research Foundation |
| WWTP | Wastewater Treatment Plant |

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1.0 Executive Summary

1.1 Introduction

1.1.1 Purpose

The Big Bear Area Regional Wastewater Agency (BBARWA), which provides wastewater management to the Big Bear Valley (Valley), is seeking to expand the use of the effluent from its wastewater treatment plant to produce recycled water for use within the Valley. The purpose of the BBARWA Valley-wide Recycled Water Master Plan is to achieve this objective. Implementation of this master plan will result in the following benefits:

- Reduction of Valley dependence on limited groundwater supplies
- Extension of available water resources
- Provision of valuable economic and environmental benefits to Valley communities

In addition, the master plan will provide a comprehensive planning document that outlines a phased “road map” for incremental implementation of facilities to achieve the listed benefits. The master plan will be a management tool that BBARWA can use in implementing the Recycled Water Program.

1.1.2 Background

This Recycled Water Master Plan, initiated by the BBARWA, is a result of a cooperative effort by the BBARWA, the Big Bear City Community Services District (BBCCSD), and the City of Big Bear Lake Department of Water and Power (DWP). In addition, the BBCCSD and the DWP supported this effort by providing pertinent data on potential users of recycled water.

The Valley area is a resort community located in the San Bernardino Mountains approximately 100 miles northeast of the City of Los Angeles. It encompasses an area of about 70 square miles and includes two main watersheds – the Big Bear Lake watershed and the Baldwin Lake watershed. The area provides year-round recreational opportunities including biking, boating, fishing, camping, golfing, hiking, snow skiing, snowboarding, and other resort activities.

The Valley area has a growing population composed of permanent residents and seasonal visitors. The population of the area was reported to be approximately 12,000 in 2003, according to the California Department of Finance (Husing, 2003). However, the population in the Valley can expand to about 58,000 residents when measured as the sum of full-time and part-time residents (BBARWA, 2004). In addition to residents, several thousand visitors engage in outdoor activities.

1.2 Project Overview and Drivers

Population is an important driving factor in the Valley due to the limited water supply resources available. In the Valley, the primary water supply is groundwater, although use

of water from Big Bear Lake for making snow is permitted at the two ski resorts in the area, Bear Mountain and Snow Summit. As population and water demand continue to increase, the Valley faces water supply availability and reliability issues. Contributing factors to the water availability and reliability issues are (1) communities outside the Valley own the water rights for Big Bear Lake, (2) importing water from the State Water Project and/or the Colorado River Aqueduct is not feasible due to geographical location, and (3) changing demographics from part-time to full-time residents. As a result, the Valley relies almost entirely on groundwater resources, which are fed by rain and snowmelt, for the water supply. The reliance on local supplies, which are replenished naturally, exacerbates the effects of periodic droughts. As a result, implementing water conservation measures and water recycling is important to augment water supplies and increase the reliability of local water supply resources in the Valley.

1.3 Project Scope

To evaluate the potential for water recycling, the scope of the project included these key activities:

- Market assessment
- Supply evaluation
- Demand evaluation
- Facilities analysis
- Cost analysis

These activities were used to develop a phased approach to implement a recycled water program.

1.4 Report Organization

The report is organized to show the sequential steps taken in developing the activities defined by the scope. The executive summary provides an overview of the master plan, and the details are described in Chapters 2 through 8. The appendixes contain data tables to support the information provided in the body of the document. The main sections of this document are:

- **Introduction** – Contains general information on the setting, BBARWA, and project history
- **Market Assessment** – Contains information on the users and their potential recycled water demands, the potential recycled water supply, and water quality requirements
- **Pipeline Alternatives** – Contains information on the route analysis performed to evaluate route alternatives from the supply source (i.e., the wastewater treatment plant) to the potential users
- **Regulatory Requirements** – Contains information on the current regulations pertaining to recycled water use
- **Treatment Alternatives** – Evaluates treatment options

- **Cost Analysis** – Provides the unit and total costs of the recycled water program
- **Conclusions and Recommendations** – Provides the final findings of the analysis

1.5 Existing BBARWA System

The BBARWA was formed in March 1974 to provide a mechanism to oversee and conduct a study to develop a plan for wastewater management for the Valley. The BBARWA service area includes the entire 79,000 acres of the Valley (see Figure 1-1). The BBARWA receives wastewater from three separate collection systems:

- City of Big Bear Lake
- Big Bear City Community Services District
- County of San Bernardino, County Service Area 53B

Each member agency maintains and operates its own wastewater collection system and delivers wastewater to the BBARWA interceptor system for transport to the Regional Wastewater Treatment Plant (WWTP). The BBARWA operates three main lines:

- Low pressure sewer (LPS) force main, which services the City of Big Bear Lake wastewater system
- North Shore Interceptor, which services the county wastewater system
- BBARWA Trunk Line, which services the BBCCSD wastewater system and conveys flow from the North Shore Interceptor to the treatment plant

The wastewater flows from the main lines are conveyed to the BBARWA Regional WWTP located at Baldwin Lake. Currently, the BBARWA system is composed of a 4.89-million-gallons-per-day (mgd) capacity secondary wastewater treatment plant (with effluent pumping capacity at 9.2 mgd), 14.6 miles of sewer pipeline, and 1.5 miles of existing recycled water pipeline. The average daily flow treated by the BBARWA WWTP is approximately 2.2 mgd based on records over the past 5 years (1999 to 2003).

Currently, the BBARWA discharges secondary wastewater treatment plant effluent to a 480-acre site in the Lucerne Valley where it is used to irrigate alfalfa fields. The alfalfa is used to feed horses, sheep, and other livestock. While this water is being used productively, it is a local water resource that could be further treated and reused in the Valley to augment existing water supplies and improve local water supply reliability. To date over 22 billion gallons of water have been exported from the Big Bear Valley to the discharge site in the Lucerne Valley.

The BBARWA currently operates a small-scale water recycling program under three California Regional Water Quality Control Board (Regional Board) waste discharge requirement (WDR) permits. These permits allow for distribution of recycled water for construction, irrigation, and other permitted activities. Within this program, the BBARWA has about 139 user accounts of various types. Irrigation users comprise the largest number of accounts (188 user accounts), but they use a significantly smaller amount of water than construction users. In 2004/2005, the BBARWA supplied approximately 13 acre-feet of recycled water. Of this, only 12 percent went to supply irrigation users.