Executive Summary

This Water Facilities Master Plan has been prepared for the San Bernardino Municipal Water Department (SBMWD). The primary objective of this report is to develop a Capital Improvement Plan (CIP) which will serve as the basis for a long term financial plan.

The last water master plan was completed in 2007. A number of changes within the Service Area necessitate this new Water Facilities Master Plan. In general, demands have been trending downwards the last several years. However, San Bernardino is expected to experience growth between now and ultimate demand conditions. In order to prepare the water infrastructure to accommodate this growth, this Water Facilities Master Plan was undertaken so that a systematic approach could be used to determine what improvements will be required to serve expected future demands.

Service Area Description

SBMWD has a service area of approximately 45 square miles and provides water service to customers within the City of San Bernardino, with a small percentage of out-of-city accounts. Given the high percentage of service to City parcels, the land use as defined by the City of San Bernardino's General Plan is used as the primary basis for development in the Department's service area. In addition to the City's General Plan, the Department's water system billing database (HTE) and information from the County's General Plan are used to classify land uses for undeveloped and unincorporated areas that fall within the Department's service boundaries. The City of San Bernardino currently has a population of approximately 215,000 people.

Historical and Current Water Demands

Since 2001, water use within the Department's service area has ranged from a low of 41,844, AF to as high as 55,135 AF. Typically the annual fluctuations are found to be primarily in response to factors such as weather conditions, economy or unemployment. Following the downturn in the California economy, water demands declined to approximately 41,844 AF in 2013, showing a downward trend since 2008.

Water Demand Projections

An important element in utility master planning is a planning level assessment of future water demands and supply requirements. Land use and population are two integral elements which define future planning efforts. The Department has historically used a change in land use approach for previous and ongoing forecasting activities. The data sources used for future planning efforts for this plan include population projections, SBMWD water billing data, previous planning studies and service area developments.

This information was used to update the water duty factors (WDF) for the Department. Water duty factors are defined as the daily water use per some specified unit, such as acre, person or dwelling unit. The methodology used to update WDFs involves correlating historical parcel-level

water consumption data with its designated land use type, so that the actual water use per acre or per unit can be calculated.

Regression analyses were performed on the SBMWD billing data from the year 2001 through 2013 to evaluate the correlation between water use among various customer types and weather and economic factors. This analysis evaluated the correlation between water use among various customer types and weather (evapotranspiration (ET), precipitation) and economic (unemployment rate) factors for the SBMWD customers over this same time period. Although it was found that there wasn't a high correlation with ET, the results of the demand analyses indicate that water demands correlated well with the changing economic conditions within the Department's service area. When the economy is "good" with a low unemployment rate, water usage increases. From this analysis, water usage is predicted to increase as much as 10 to 33 percent, depending upon the customer type, under good economic conditions. Due to the level of statistical significance between local unemployment rates and water usage, a return to a good economy factor was integrated in the water demand projections

Current Water Supply

SBMWD relies solely on water extracted from the underlying aquifer, the Bunker Hill Groundwater Basin to meet its demands. This water is distributed via SBMWD's water distribution system consisting of pipelines, storage reservoirs, pumping stations, hydroelectric generating stations, manual and automatic control valves, fire hydrants, and water meters located throughout 19 individual pressure zones.

A small amount of imported State Water Project water can be made available to SBMWD via purchase from Valley District.

Currently, SBMWD does not use recycled water within its service area. However, the SBMWD Water Reclamation Division is pursuing the Clean Water Factory project to treat effluent from the San Bernardino Water Reclamation Plant to a quality approved for recharge and convey the recycled water to the Waterman Basins, the East Twin Creek Spreading Grounds, and the Devil Canyon and Sweetwater Basins for surface spreading in the northern portion of the SBMWD service area. The Clean Water Factory will also be designed to treat a side stream of San Bernardino Water Reclamation Plant effluent to a quality approved for direct non-potable use and convey the tertiary treated recycled water to customers that can benefit from a non-potable water supply.

For the future, it is projected that SBMWD will continue to receive the majority of its water supply from groundwater. Recycled water and imported water are expected to augment the groundwater to complete the future water supply portfolio.

Existing Water System

SBMWD's water distribution system consists of pipelines, storage reservoirs, pumping stations, hydroelectric generating stations, manual and automatic control valves, fire hydrants, and water meters located throughout the various individual pressure zones. SBMWD has 700 miles of pipeline varying in size from 2 inches to 78 inches in diameter, approximately 42,000 metered water services, 13,800 valves, and 4,000 fire hydrants. SBMWD has 44 water storage

reservoirs containing a total of 112 million gallons of domestic water storage capacity. These reservoirs vary in size from 40,000 gallons to 12 million gallons and are located throughout many of the pressure zones. SBMWD's pumping stations capacities range from 1,500 gpm to 14,000 gpm. In addition, most pressure zones have automated inter-zonal water transfer capabilities to improve water system reliability. SBMWD also has 54 groundwater production wells.

There are 19 primary pressures zones within the Department's water distribution system. The zone reservoir elevations range from 1,249 feet to 2,100 feet mean seal level and are located at appropriate elevations necessary to provide adequate water pressure throughout the pressure zone service area.

Hydraulic Model Development

To evaluate the SBMWD distribution system, a new computerized hydraulic model was developed in InfoWater for the distribution system. GIS data provided by the Department was used to construct the hydraulic model. The model includes all water facilities in the distribution system including water pipelines 2-inch in diameter and greater, groundwater wells, storage tanks, booster stations, inter-tie connections, pressure regulating valves, and other infrastructure within the system. Peaking factors for demands were derived from daily production data provided by the Department. Average day and maximum day demands were calculated from the data. Elevations were assigned to all model facilities using a Light Detection and Ranging (LiDAR) data survey conducted by San Bernardino County.

Demands were spatially allocated using actual water usage information from customer billing records from the 2012 calendar year. Each customer billing record was then assigned to the appropriate junction in the hydraulic model.

The allocation of future demands is split into five categories: specific plans, area plans, infill, vacant housing and undeveloped parcels. The allocation of specific plans and area plans was performed manually on a development by development basis. Infill and undeveloped demands were input into the model using a similar process as the existing demands, with a point in a GIS shapefile for each parcel with a calculated future demand. Vacant housing parcel demands were added to the demands in the model by manually identifying developed lots that did not show water usage for the 2012 calendar year.

A diurnal demand pattern was created from system-wide data gathered over a one month period in 2012. The same diurnal pattern was assigned to all demands within the system.

The model was calibrated for the majority of the pressure zones within the Department's distribution system. Data from the Department's fire hydrant test database was used, along with data collected during hydrant tests performed specifically for this project.

Hydraulic Analysis and Capital Improvement Program

Planning level unit costs were developed from industry manufacturers, previous master planning experience, master planning costs presented by similar agencies and bid histories from comparable projects.

The calibrated model was used to assess the distribution system's capacity to deliver maximum day plus fire flow and peak hour demands to the system users as the City grows toward ultimate demand conditions. Pressure and pipeline velocity criteria were used to determine whether the system has adequate capacity to meet the existing and ultimate demands. In addition, the Department's storage and pumping facilities were evaluated against maximum day demand conditions. The storage was evaluated to determine if the amount was adequate to provide sufficient operational, emergency and fire storage. The pumping facilities for each zone were evaluated to determine if there is sufficient capacity to support maximum day demands.

The analysis revealed deficiencies in piping, storage and pumping in various locations throughout the system. Recommended projects to resolve these deficiencies were proposed. A summary of the findings and recommended improvements for each area is shown in Table ES-1.

Table ES-1 Summary of Capacity-Based Capital Improvements

CIP Description	Cost to Meet Deficiencies Under Existing Demand Conditions	Cost to Meet Deficiencies Under Ultimate Demand Conditions
Pipe CIP	$8,062,000	$0
Storage CIP	$239,000	$3,081,000
Pumping CIP	0	$1,460,000
Zone Realignment Studies	$150,000	
Total CIP	**$8,451,000**	**$4,541,000**