Final Draft

# 2019 Recycled Water Master Plan

for the

City of Victorville

Prepared Under the Responsible Charge of:

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California R.C.E. No. 072424, Expires 6/30/2022

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WSC

Water Systems Consulting, Inc.

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# Glossary of Terms

| | |
|---|---|
| °F | Fahrenheit |
| ~ | approximately |
| [#] | reference material – see Chapter 7 |
| 2015 UWMP | 2015 Urban Water Management Plan |
| 2016 SMP | 2016 Sewer Master Plan |
| ADD | average day demand |
| AF | acre feet |
| AFY | Arce feet per year |
| BPS | booster pump stations |
| CDFW | California Department of Fish and Wildlife |
| CIP | Capital Improvement Plan |
| City | City of Victorville |
| District | Victorville Water District |
| DWR | California State Department of Water Resources |
| ETo | evapotranspiration |
| fps | feet per second |
| ft/kft | feet per 1000 feet |
| GAFB | George Air Force Base |
| GIS | Geographical Information Systems |
| gpm | gallons per minute |
| HDPP | High Desert Power Project |
| HGL | Hydraulic Grade Line |
| HWL | high water level |
| IWTP | Industrial Wastewater Treatment Plant |
| MDD | maximum day demands |
| MG | million gallons |
| MGD | million gallons per day |
| MOU | Memorandum of Understanding |
| PHD | Peak Hour Demand |
| psi | pounds per square inch |
| RW | recycled water or reclaimed water |

| | |
|---|---|
| RWMP | Recycled Water Master Plan |
| SCLA | Southern California Logistics Airport |
| SCLA SP | Southern California Logistics Airport Specific Plan |
| sqft | square feet |
| VVWRA | Victor Valley Water Reclamation Authority |
| WSC | Water Systems Consulting, Inc. |
| WWTP(s) | wastewater treatment plant(s) |

CHAPTER 1

# Introduction

Victorville Water District (District) engaged Water Systems Consulting, Inc. (WSC) to prepare a Recycled Water Master Plan (RWMP) to guide the District's planned capital project expenditures in an efficient and cost-effective manner for recycled water (RW), also referred to as reclaimed water, use in the Southern California Logistics Airport (SCLA) area. The following section describes the purpose of this RWMP, planning documents referenced in the preparation of this plan, and background information about the District's existing RW system.

## 1.1 Purpose

The primary purposes of this RWMP are to:

- Prepare for growth expected within the SCLA area with an adaptive framework to respond to changing conditions
- Identify existing and future system deficiencies
- Develop a prioritized list of improvement projects, including anticipated costs, to address the deficiencies and maintain the condition and capacity of the RW distribution system



## 1.2 Relationship to Other Documents

The following is a summary of other recent planning documents that were referenced during the preparation of the RWMP.

- **Sewer Master Plan –** The Sewer Master Plan (2016 SMP) was completed in December 2016. The 2016 SMP contained a demand forecast methodology to determine projected sewer flows which assisted in the RW supply projection.

- **SCLA Specific Plan** – The SCLA Specific Plan (SCLA SP) is currently being developed. However, it was far enough along during the development of this RWMP to provide information on future development in the SCLA area. This information was used in demand projections and demand allocation in the hydraulic model.
- **2015 Urban Water Management Plan** – The 2015 Urban Water Management Plan (2015 UWMP) assesses the District's current and long term demands and sources of supply and complies with California State Department of Water Resources (DWR) criteria for water supply planning. The 2015 UWMP provided population growth and was used in supply projections.
- **2019 Water Master Plan** – The 2019 Water Master Plan (2019 WMP) assess the District's current and future water system. Water demands and the demand projection methodology assisted in the RW supply projection for this RWMP.

## 1.3 Background

### 1.3.1 Location

The District is located in the southwest region of San Bernardino County, California. The District lies north of the San Bernardino Mountains in the Mojave Desert approximately 90 miles northeast of Los Angeles. The District's service area, shown in Figure 1-1, encompasses the entire City of Victorville (City) as well as areas within the City's sphere of influence. The District is bounded by the City of Adelanto to the west and the City of Hesperia to the south. The Town of Apple Valley, Spring Valley Lake, and the Mojave Narrows Regional Park lie to the east.

#### *1.3.1.1 Study Area*

This RWMP focuses on RW use in the SCLA area, where the existing Industrial Wastewater Treatment Plant (IWTP), existing RW facilities and existing users are located. SCLA, formerly known as the George Air Force Base (GAFB), is located in the northern portion of the District's service boundary. GAFB closed in 1992 and all of GAFB's existing water and wastewater systems along with a portion of the groundwater production capacity were acquired by the City. In 1995, GAFB began operation as SCLA, which is intended to be a logistical hub for commercial and industrial activities in the western United States. Figure 1-1 shows the location of the SCLA Study Area.

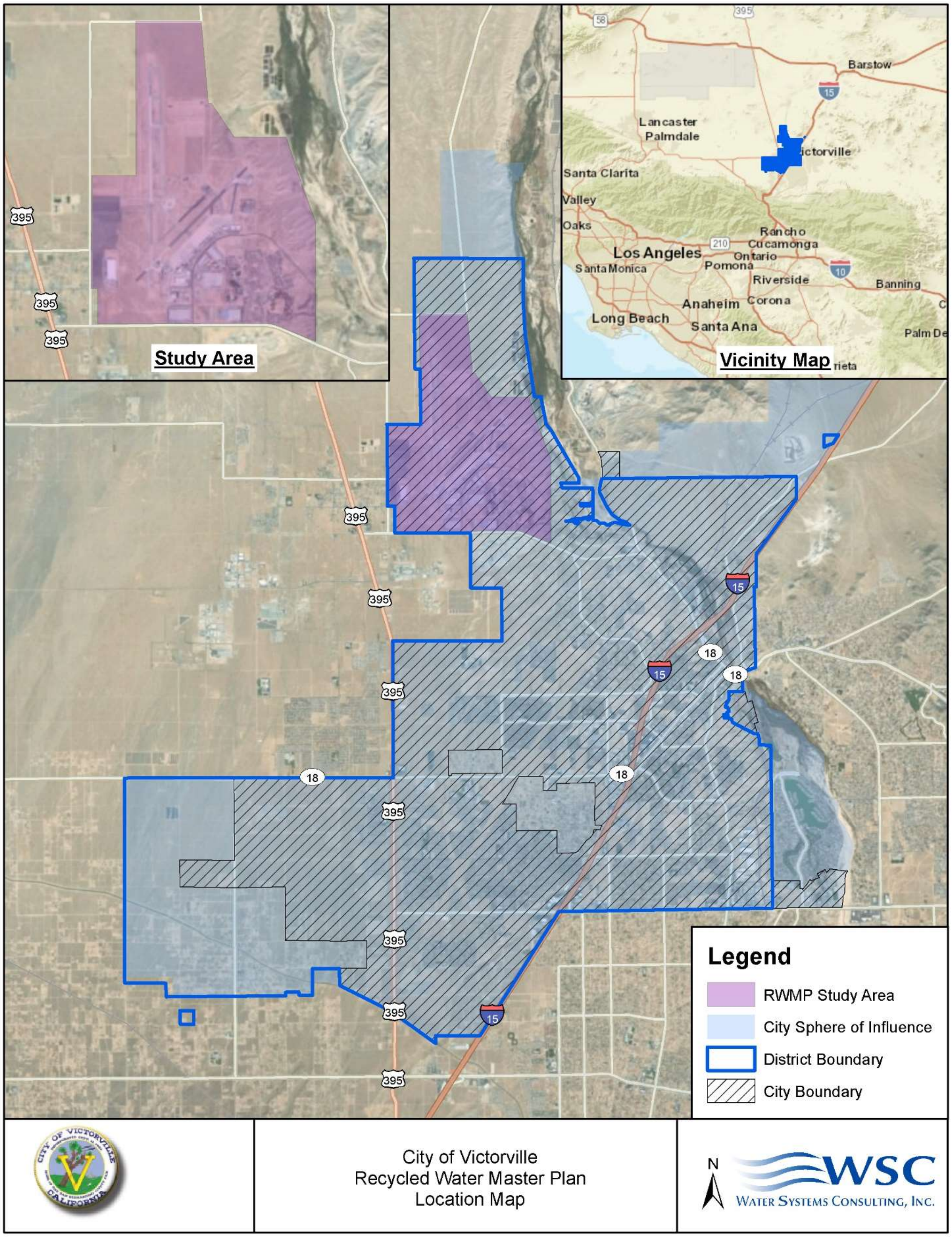



Figure 1-1. Location Map

#### 1.3.1.2 Climate

The District's climate is characterized by warm summers and cool winters. Table 1-1 presents average climate data for the service area, including temperature, rainfall and reference evapotranspiration (ETo). As shown in Table 1-1 the warmest month of the year is July with an average temperature of 80 degrees Fahrenheit (°F), while the coldest months of the year are December and January with an average temperature of 44°F.

The annual average precipitation at the District is about 6 inches. As shown in Table 1-1, the majority of the rainfall occurs in the months of November through March. January and February are the wettest months with an average rainfall of approximately 1 inch.

**Table 1-1. Historical Climate Data**

| Month | Average Temperature, °F(1) | Average Precipitation, in(1) | Average Standard ETo, in(2) |
|---|---|---|---|
| **January** | 44.4 | 0.95 | 2.02 |
| **February** | 47.8 | 1.05 | 3.51 |
| **March** | 52.0 | 0.80 | 5.16 |
| **April** | 58.0 | 0.36 | 6.55 |
| **May** | 65.2 | 0.13 | 7.65 |
| **June** | 73.2 | 0.04 | 8.75 |
| **July** | 80.0 | 0.14 | 8.68 |
| **August** | 78.8 | 0.21 | 9.27 |
| **September** | 72.9 | 0.23 | 6.73 |
| **October** | 62.4 | 0.32 | 4.26 |
| **November** | 51.0 | 0.50 | 2.90 |
| **December** | 44.4 | 0.79 | 2.16 |

*1. NOAA weather station 049325 in Victorville; data from 1917 through 2016; http://wrcc.dri.edu*

*2. CIMIS weather station 117 in Victorville; http://wwwcimis.water.ca.gov/*

### 1.3.2 Potable Water Purveyor

The District is the potable water purveyor for the SCLA area. The District provides water to a service area of approximately 85-square miles. The District's potable water supply includes groundwater pumped from the District's 35 wells and groundwater purchased from Mojave Water Agency. Based on the 2019 Water Master Plan, the maximum current capacity of the District's existing wells is approximately 57.3 million gallons per day (MGD) or 39,770 gallons per minute (gpm). This is sufficient to meet the current demand (28.5 MGD) and 2028 demands (40 MGD) at average at maximum day demand (MDD).

### 1.3.3 District's Service Area Population

The population in the District's service area was estimated to be 128,005 in 2015 [1]. Per the 2015 UWMP, the average annual population growth for the District's service area through 2040 is estimated to be 1.9%. The estimated population for 2040 is 204,986. Population projections were prepared by Beacon Economics under contract with Mojave Water Agency for the 2015 UWMP. Historical data used in the forecast of the incorporated cities were obtained from the California Department of Finance, which makes estimates available from 1970 forward on an annual basis. Based on this data, Beacon Economics created an econometric time series model to capture the historical correlations with countywide population growth. Future population growth was then estimated using these historic correlations and a forecast of countywide population growth.

The historical and projected annual population growth rates are shown in Table 1-2. The historical, current, and projected service area populations are shown in

Table 1-3 and Figure 1-2. Additional details on the population projection methodology can be found in the 2015 UWMP.

**Table 1-2. Historical and Projected Annual Growth Rate**

| | 2005-2010 | 2010-2015 | 2015-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 |
|---|---|---|---|---|---|---|---|
| **Growth Rates** | 5.9% | 1.0% | 1.7% | 2.3% | 2.0% | 1.9% | 1.6% |

**Table 1-3. Historical, Current and Projected Population**

| | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|---|---|---|
| **Population Served** | 69,095 | 91,832 | 122,051 | 128,005 | 139,151 | 155,657 | 172,143 | 188,896 | 204,986 |

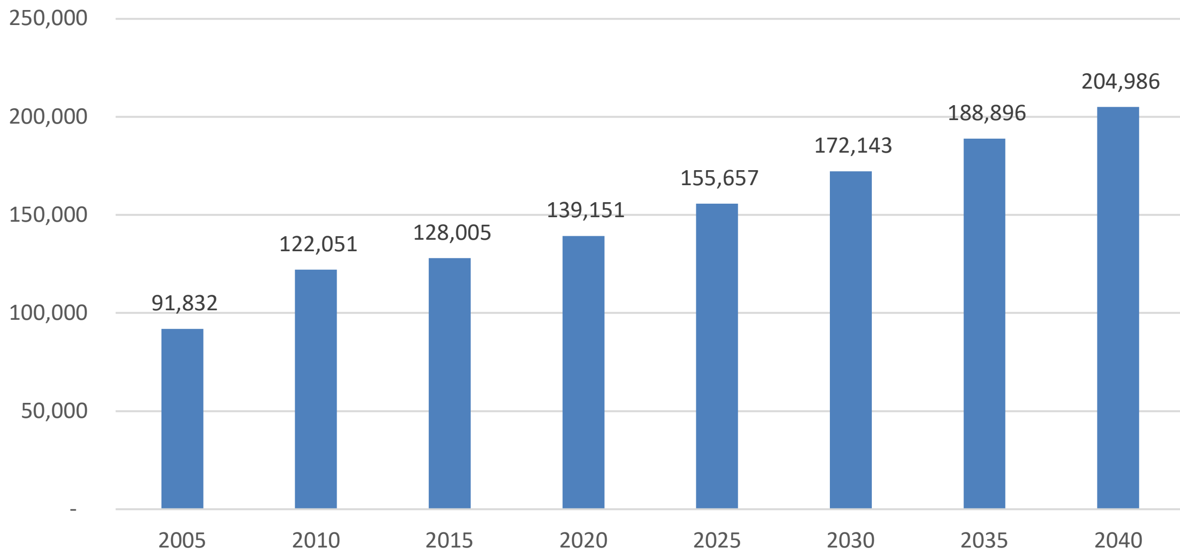



**Figure 1-2. Historical, Current and Projected Population**

### 1.3.4 Wastewater Treatment

Wastewater that is generated within the City is collected via a sewer system owned and operated by the City. A portion of the collection system conveys wastewater to the IWTP that is owned and operated by the District. The rest of the collection system discharges to a regional interceptor, which conveys the wastewater flows to a regional wastewater treatment plant (WWTP) located on Shay Road in Victorville that is owned and operated by the Victor Valley Wastewater Reclamation Authority (VVWRA). The locations of both treatment plants are shown on Figure 2-2.

In 2010, the District began operation of the IWTP, a domestic and industrial wastewater treatment plant at the SCLA with a design capacity of 2.5 MGD. The IWTP is designed to treat wastewater using both anaerobic (for high strength industrial wastewater) and aerobic (for sanitary wastewater) treatment processes. The combined flows then undergo a complete-mix activated-sludge treatment and solids separation process using membrane bioreactor (MBR) technology. The final process is ultraviolet disinfection, resulting in tertiary treated RW that meets Title 22 requirements. Sludge from the facility is currently discharged to VVWRA's WWTP for treatment and disposal. The portion of treated effluent from VWFT that is not reused at SCLA is conveyed to the VVWRA WWTP site for disposal at Percolation Pond 14, which is owned and operated by the District.

VVWRA is a Joint Powers Authority consisting of the City, Town of Apple Valley, City of Hesperia, City of Adelanto, and County Service Areas of Oro Grande (Number 42) and Spring Valley Lake (Number 64). The VVWRA WWTP has a current capacity of 14 MGD and is located within the City, between SCLA and the Mojave River. VVWRA's regional WWTP discharges disinfected tertiary effluent to the Mojave River and supplies RW to the District for distribution to RW customers at SCLA.

CHAPTER 2

# Existing Recycled Water System

The following chapter describes the District's existing RW infrastructure including, reservoirs, booster pump stations and pipelines, as well as the existing RW uses at SCLA.

## 2.1 Overview

The District owns and operates a RW system that includes approximately 6.6 miles of pipeline, one elevated storage reservoir, one at grade storage pond and one booster pump station (BPS) within the SCLA area. There is also an effluent storage tank and an effluent BPS located at the IWTP that is maintained by IWTP staff. The system is operated as a single pressure zone. The following sections describe the District's facilities in more detail. A RW System Diagram is shown in Figure 2-1 and the locations of the District's RW users and facilities are shown in Figure 2-2.

IN THIS CHAPTER

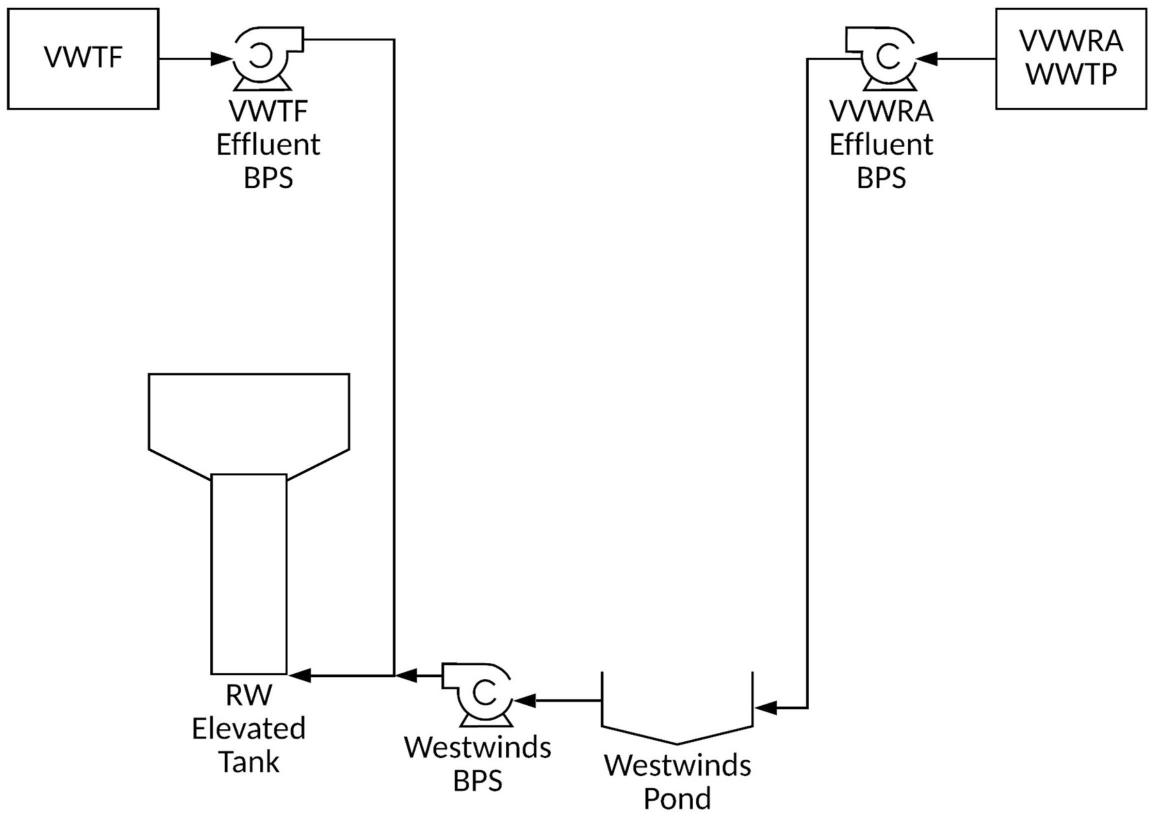



**Figure 2-1. Recycled Water System Diagram**

## 2.2 Hydraulic Grade Line (HGL)

The District's RW system consists of one distribution pressure zone with an HGL of 2,979 ft, based on the mid-tank level of the elevated storage tank.

The potable water pressure zone that serves SCLA has an HGL of 3170 ft. Because the potable water system HGL is higher than the RW system HGL, this reduces the risk of backflow of the RW into the potable water system in an event of a cross connection.

## 2.3 Storage

The District's RW system has one 1 million gallon (MG) elevated tank that sets the pressure for the system and serves as the primary storage to accommodate daily fluctuations in demand. RW is pumped from IWTP to the elevated tank, were it is then gravity fed to the RW system. The elevated tank is also equipped with a potable water backup that can supplement the tank with potable water via an air-gap on the top of the tank if the RW supply is interrupted or insufficient to meet demands.

The system also includes one at grade RW storage pond with a capacity of approximately 0.6 MG, located adjacent to the elevated tank. RW from the VVWRA WWTP can only be pumped into this pond, where it can then be transferred to the elevated tank via booster pump. RW from the IWTP can also be diverted to this pond if the elevated tank is full or offline.

In addition, the IWTP includes an effluent storage tank with an approximate capacity of 65,000 gallons, which is operated as part of the IWTP, rather than the RW distribution system. Therefore, this storage volume is not included in the RW system analysis presented in this report.

Table 2-1 details the RW storage characteristics and the storage locations are presented in Figure 2-2.

**Table 2-1. RW Storage Summary**

| Storage | Location | Year Constructed | Ground Elevation (ft) | Low Water Level Elevation (ft) | Diameter/ Dimensions (ft) | Depth (ft) | HWL (ft) | Capacity (MG) |
|---|---|---|---|---|---|---|---|---|
| Elevated Tank | Westwinds Rd. | 2009 | 2,876 | 2,960 | 74.5 diameter | 44 | 2,997 | 1.0 |
| Westwinds Pond[1] | Westwinds Rd. | 1960 | 2,876 | 2,865 | ~140 diameter | 9 | 2,874 | 0.6 |
| 1 MG Westwinds Reservoir | Westwinds Rd. | 2020 | 2,876 | 2,865 | 76 | 30 | 2,874 | 1.0 |
| IWTP Storage Tank | IWTP | 2010 | 2,807 | 2,817 | 12 x 30 rectangular | 24 | 2,831 | 0.06 |
| | | | | | | | **Total RW Storage** | **2.66** |

[1]To be replaced with 1 MG Westwinds Reservoir.

## 2.4 Booster Pump Stations

The District operates two BPS that pump supply to the RW system. The IWTP Effluent BPS pumps RW to the elevated tank, Percolation Pond 14 and Westwinds Pond. The Westwinds BPS pumps RW from the Westwinds Pond to the Elevated Tank. Table 2-2 provides a summary of the booster pump stations, and Figure 2-2 presents the BPS locations within the District's RW system.

VVWRA also operates a VVWRA Effluent BPS to convey RW to the Westwinds Pond. This BPS is owned and operated by VVWRA and is not evaluated in this RWMP.

**Table 2-2. RW BPS Summary**

| Facility Name | Location | Pump Type | Ground Elevation, ft | # of Pumps | Name-plate Hp | Design Head, ft | Design Capacity, gpm |
|---|---|---|---|---|---|---|---|
| IWTP Effluent BPS | IWTP Site | Horizontal Centrifugal, Variable Speed | 2,820 | 3 | 40 | 180 | 500 |
| Westwinds BPS | Elevated Tank & Westwinds Pond Site | Vertical Turbine, Constant Speed | 2,878 | 3 | 100 | 254 | 1000 |

## 2.5 Transmission and Distribution Pipelines

The District's RW system includes approximately 6.6 miles of RW pipelines ranging from 8 to 24 inches in diameter. Most of the existing pipes are the backbone (18-inch and 24-inch) to the RW system which is approximately 66% of the total length. Currently, 8-inch and 12-inch piping makes up a small portion of the RW system. Some RW pipelines were installed along with street improvements for new developments but are not yet connected to the RW system; these pipes will be connected in the future as the RW system is expanded with development as SCLA.

## 2.6 Recycled Water Fill Stations

The District has installed two RW fill stations where permitted users can fill trucks with RW and haul it to approved use sites for land application. The fill stations consist of a RW hydrant connected directly to the RW backbone. One is located on Perimeter Road and the other is located on the IWTP site.

## 2.7 Recycled Water Use

All current RW uses at SCLA are covered under the California Regional Water Quality Control Board, Lahontan Region (Regional Board) Board Order No. R6V-2014-0002, *New Waste Discharge Requirements and Revised Water Recycling Requirements for the City of Victorville Water District Industrial Wastewater Treatment Plant and Victor Valley Wastewater Reclamation Authority, City of Victorville* (hereafter referred to as "WDR"). The WDR is provided in Appendix A. The WDR authorizes the following RW use areas at SCLA:

- High Desert Power Project for cooling water
- The Westwinds Golf Course for irrigation

The WDR also enables the District to serve RW for the following additional uses at SCLA:

- Firefighting water for the fire pump deluge system at SCLA
- Irrigation for parks, greenbelts, etc. at the SCLA Industrial Park
- Construction water for future projects
- Dust Control for the SCLA runways

To obtain authorization to serve RW to such additional users at SCLA, the District must submit a separate Engineering Report for each new use site to the State Water Quality Control Board Division of Drinking Water (DDW) and the Regional Board.

As of the date of this report, the following RW use sites at SCLA have been approved by the Regional Board:

- High Desert Power Project for cooling water
- High Desert Power Project for irrigation
- The Westwinds Golf Course for irrigation
- Schmidt Park for irrigation
- Westwinds Sports Center Baseball Field for irrigation
- SCLA airfield for dust control (via RW fill station and hauling)
- SCLA construction sites for dust control (via RW fill station and hauling)
- High Desert Solar site for dust control and possible future solar panel washing (via RW fill station and hauling)

The Regional Board and DDW letters authorizing these uses are in Appendix B.

Currently, the District serves RW to the High Desert Power Plant (HDPP) for cooling water and irrigation and to Schmidt Park and the Westwinds Sports Center Baseball Field for irrigation use. RW was historically applied at the Westwinds Golf Course for irrigation; however, the golf course is now closed, and this use has been discontinued. The District currently has temporary authorization by the Regional Board to discharge into VVWRA's lower ponds and is pursuing a permanent permit amendment for this activity. The District is not currently serving RW from its RW fill stations but can issue permits and begin doing so when the demand arises. RW users are presented in Figure 2-2. Existing demands by the RW users are discussed in further detail in Section 4.2.

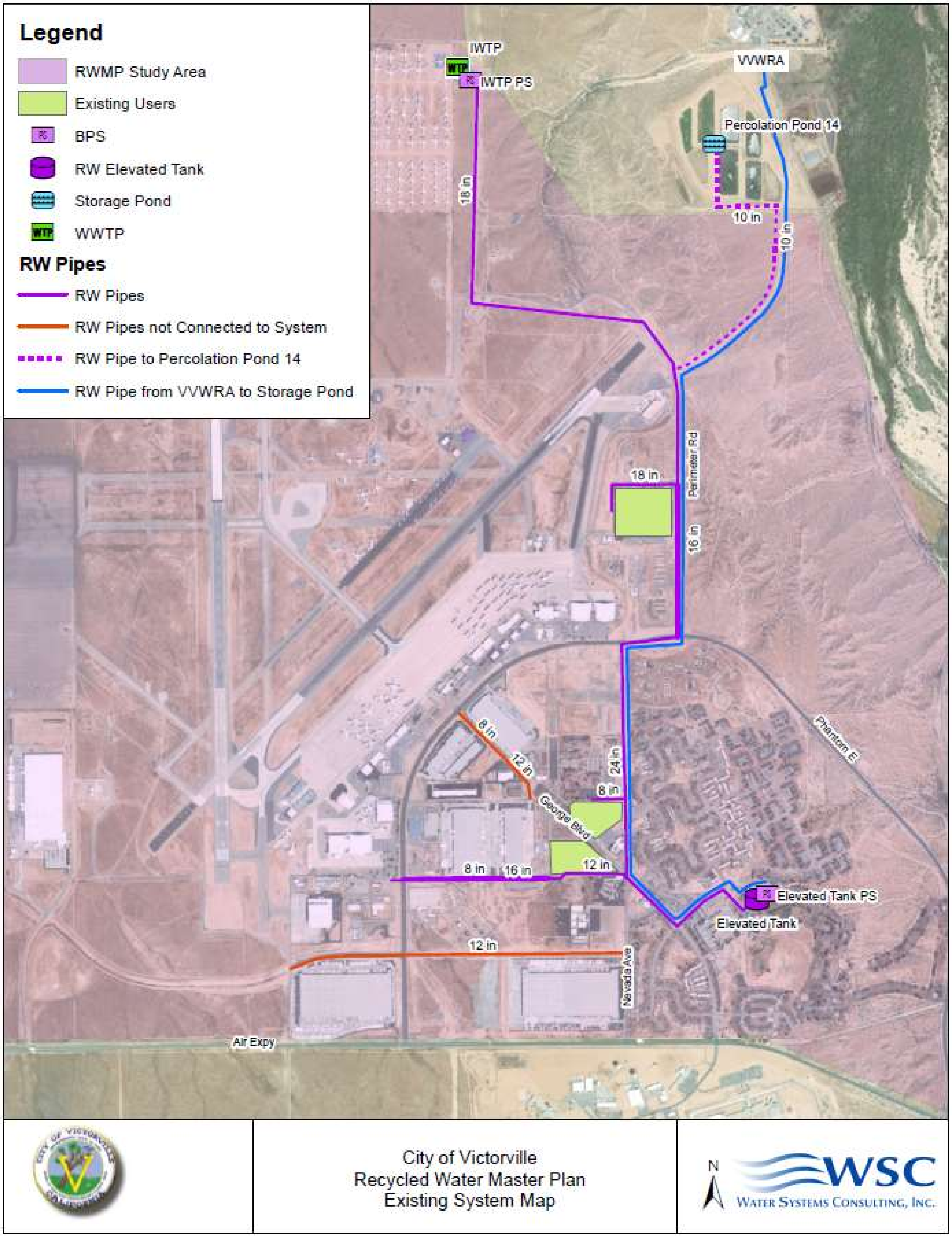



Figure 2-2. Existing RW System Facilities Map

CHAPTER 3

# Evaluation Criteria

This chapter presents the evaluation criteria to be used for the evaluation of the existing and future RW facilities.

IN THIS CHAPTER



## 3.1 System Pressure

The system pressure of a RW system is shall be at least 10 ft lower than the potable water system to reduce the risk of cross-connection.

The District prefers to maintain a minimum pressure between 30 psi and 60 psi at peak hour demand (PHD) for the RW system to meet the operating requirements for most sprinkler systems. For the purposes of this evaluation, the minimum pressure at PHD is 35 psi. If the Westwinds Golf Course reopens and uses RW for irrigation, a higher minimum pressure may be required due to the type of sprinkler systems used on golf courses. Table 3-1 summarizes the pressure requirements. The District desires to maintain distribution system pressures below 125 psi regardless of whether connections are equipped with pressure regulators.

**Table 3-1. System Pressure Evaluation Criteria**

| System Pressure | Evaluation Condition | Value |
|---|---|---|
| Maximum | ADD | 125 psi |
| Minimum | PHD | 35 psi |

## 3.2 Distribution Pipelines

### 3.2.1 Standard Pipeline Sizes

In order to meet the District's level of service objectives and operational preferences, the following criteria are recommended for new pipelines:

- Minimum diameter for new pipelines shall be 6 inches, unless otherwise specified by the District.
- Dead-end pipes shall be terminated with a blow-off, where specified by the District. Blow-offs shall be equipped with a locking screw cap and buried operating stem.

- New pipelines shall be based on standard diameter; the District considers 10-inch and 14-inch to be non-standard. Pipelines 18-inch and greater shall be ductile iron pipe (DIP) only.

### 3.2.2 Velocity and Headloss

The velocity and headloss evaluation criteria for existing and proposed RW pipelines align with those used in the 2019 Water Master Plan are presented in Table 3-2.

**Table 3-2. Velocity and Headloss Evaluation Criteria**

| | Evaluation Condition | Value |
|---|---|---|
| **Pipeline Velocity** | | |
| Existing Pipelines | PHD | 7 fps |
| New pipelines (≤ 12-in diameter) | PHD | 5 fps |
| New pipelines (≥ 16-in diameter) | PHD | 4 fps |
| **Pipeline Headloss** | | |
| Existing Pipelines | PHD | 10 ft/1000 ft |
| New pipelines | PHD | 5 ft/1000 ft |

## 3.3 Storage Volume

Storage facilities for the RW system provide operational storage to equalize the daily supply and demand. Excess RW not used or stored will be disposed of at Percolation Pond 14. For the RW system, the District has established that the operational storage volume shall be equal to the greater of:

- MDD, less the daily supply from the IWTP.
- 8 hours of PHD, less the hourly supply from the IWTP. The period of 8 hours was selected because irrigation demands are assumed to take place over an 8-hour period at night.

The effluent storage volume at the IWTP is small and meant only for minor equalization, so the pumps at the IWTP operate almost continuously to convey the entire plant flow into the RW system. Therefore, this constant supply enables a reduction in the required storage volume to meet MDD and PHD.

## 3.4 Booster Pump Stations

The IWTP Effluent BPS is operated as part of the IWTP and is subject to separate design criteria specific to the plant operation and reliability requirements and is not evaluated in this RWMP.

The Westwinds BPS is operated only when additional RW supply is needed from VVWRA, beyond the supply available from the IWTP. Therefore, the reliable pumping capacity of this BPS shall be sufficient to meet MDD less the IWTP supply with the largest pump out of service, allowing for normal operations during typical repairs or replacements.

In the event that any of the BPSs are not able to fill the tank, there is a potable backup supply to the tank that can be used to supplement supply and maintain service to RW customers, if needed.

# Recycled Water Supply and Demand

This chapter summarizes the District's historical, current, and projected RW supply and demand, and factors accounting for seasonal, daily, and hourly fluctuations in RW demands.

IN THIS CHAPTER



## 4.1 RW Supply Analysis

### 4.1.1 Existing RW Supply

The 2019 annual average flow treated at the IWTP was 1.86 MGD or 5.71 acre-feet (AF). All of this flow is available to the District as RW supply.

In 2019, the average treated flow at the VVWRA WWTP was 10.5 MGD or 32.2 AF; however, not all of this flow is available to the District as RW supply. The City consumed approximately 2.45 MGD of this RW supply in 2019. In 2003, VVWRA executed a Memorandum of Understanding (MOU) with the California Department of Fish and Game (now California Department of Fish and Wildlife or "CDFW") which requires VVWRA to discharge 9,000 AFY of available recycled water to the Mojave River. The MOU includes a provision to allow reduced discharges as long as a minimum flow of 15,000 AFY is measured at the Lower Narrows gage along the Mojave River. In 2005, VVWRA and the City executed a Second Amended and Restated Agreement for Reclaimed Water Service with a perpetual term that entitles the City to take delivery of all the treated effluent from VVWRA's WWTP in excess of the amount required to be discharged under the MOU. Treated effluent which is not discharged to the Mojave River or purchased by the City is disposed of via onsite percolation ponds. The annual volume of RW supply available to the District from VVWRA is equal to the total treated effluent less the volume required to be discharged to the Mojave River under the MOU with CDFW.

VVWRA recently completed the construction of two sub-regional treatment plants in Hesperia and Apple Valley that have an initial capacity of up to 1.0 MGD each. The sub-regionals began limited operation in 2018 and will reduce the flows received and treated at the VVWRA WWTP. Future flows to be diverted to the sub-regional plants are unknown at this time. In addition, reductions in wastewater flows have occurred as a result of conservation efforts driven by the recent drought. The District, VVWRA, and CDFW are in ongoing discussions regarding changes in available recycled water at VVWRA.

### 4.1.2 Projected 2040 RW Supply

For this RWMP, RW supply was projected up to year 2040. Additional effluent flows between 2016 and 2040 were determined for each WWTP based on data provided in the 2016 SMP and the 2019 WMP.

To estimate available RW supply in 2040, a return to sewer factor was first calculated based on 2015 water use and sewer flow data. The return to sewer factor is the percent of total water use that is discharged to the sewer and generally represents indoor water use. The remainder of the water is either consumed or used outdoors. Water use within the District but outside the City boundary was excluded from this analysis because the wastewater from these areas is currently disposed of via septic systems and does not flow to either of the treatment plants. These areas were also excluded from the analysis in the 2016 SMP. Based on the 2015 data, a return to sewer factor of 46% was calculated for the City.

Wastewater flow data from the 2016 SMP was then used to determine the percent of the City's wastewater that flows to each of the treatment plants. The 2016 SMP stated that the 2015 wastewater flow for the City is 8.15 MGD (9,136 AFY). The 2015 IWTP flow was 1,558 AFY; therefore, the City's 2015 flows to VVWRA were 7,578 AFY. Based on this, approximately 17% of the City's wastewater flows to the IWTP and 83% flows to VVWRA as of 2015.

The 2019 WMP projected the increase in water demand between 2016 and 2040 for areas within the City boundary to be 12.14 MGD or 13,605 AFY. Using the return to sewer factor of 46%, the total increase in wastewater flows between 2016 and 2040 is projected to be 5.58 MGD (6,260 AFY). Note that the 2016 SMP estimated that the increase in wastewater flows between 2016 and 2040 would range between 12.93 MGD and 15.49 MGD, which is substantially higher. For the purposes of RW supply planning, it was decided that the lower value (5.58 MGD) based on water use projections and the return to sewer factor should be used in this report to be conservative and avoid over allocating RW supply. Wastewater flows and RW supply can be reevaluated in the future as more information becomes available.

Applying the 2016 SMP assumptions for areas tributary to the IWTP, the resulting increase in wastewater flow between 2016 and 2040 is projected to be 2.98 MGD (3,337 AFY) to IWTP and 2.61 MGD (2,922 AFY) to VVWRA. This equates to 53% of the additional flow tributary to the IWTP and the remaining 47% tributary to VVWRA.

The 2016-2040 additional flows and total 2040 flows for each WWTP are summarized in Table 4-1.

**Table 4-1. 2040 Wastewater Flows**

| | IWTP | VVWRA (City flows only) | Total |
|---|---|---|---|
| 2015 Wastewater Flow (AFY)[1] | 1,558 | 7,578 | 9,136 |
| 2015 Water Use within City boundary (AFY) | | | 19,898 |
| Return to Sewer Factor[2] | | | 46% |
| 2040 Additional Water Use (AFY)[3] | 7,254 | 6,351 | 13,605 |
| **2016 - 2040 Additional Effluent Flow (AFY)[4]** | **3,337** | **2,922** | **6,259** |
| **2040 Total Effluent Flow (AFY)** | **4,895** | **10,500** | **15,395** |

1. Per City, the 2015 wastewater flow at the IWTP is 1,558 AFY. Per the 2016 SMP Table 2-5, the total wastewater flow within the City is 8.15 MGD (9,136 AFY); therefore, VVWRA flows are 7,578 AFY. The 2016 SMP evaluated flows within the City boundary only.
2. Return to Sewer Factor was determined by dividing 2015 Wastewater Flow by the 2015 Water Use.
3. The 2040 additional water use is based on Table 4-7 of the 2019 WMP for areas within the City boundary only. Total additional water use is allocated to each plant by applying the 2016 SMP assumptions for areas tributary to the IWTP.
4. The 2040 additional effluent flow was calculated by applying the return to sewer factor of 46% to the 2040 additional water use for each tributary.

Note that the projected 2016-2040 flows to VVWRA in Table 4-1 include only those contributed by the City. Although the other VVWRA member agencies are expected to contribute additional flow to VVWRA between 2016 and 2040, the construction of the subregional treatment plants and drought related flow reductions will impact future flows and updated total flow projections for VVWRA were not available at the time of this report. To be conservative, the RW supply projections in Table 4-2 are based only on additional flows contributed by the City. Once comprehensive flow projections become available from VVWRA, the City's RW supply can be re-evaluated.

All of the effluent from the IWTP is available to the City as RW supply. The CDFW MOU requires VVWRA to discharge a minimum base flow plus at least 20% of future RW flows to the Mojave River. Therefore, the additional flow contributed to VVWRA by the City is reduced by 20% for the purposes of calculating available RW supply. The City's projected 2040 RW supply is summarized in Table 4-2.

**Table 4-2. 2040 Available RW Supply**

| | IWTP | VVWRA (City flows only) | Total |
|---|---|---|---|
| 2015/2016 RW Supply Available (AFY) | 1,558 | 1,081[1] | 2,639 |
| 2016 - 2040 Additional Effluent Flows (AFY) | 3,337 | 2,922 | 6,258 |
| Less New Flow River Obligation (20% of New Flows to VVWRA) | - | (584) | (584) |
| **2040 RW Supply Available** | **4,895** | **3,419** | **8,313** |

1. As provided by VVWRA in October 2017, the available RW supply from VVWRA in 2016 was 2,426 AFY, accounting for downstream flow obligations and the CDFW MOU discharge requirements. VVWRA estimated that the subregionals would divert a total of 1.2 MGD (1,345 AFY) from the VVWRA WWTP once they came online in 2018. Therefore, the net available RW supply from VVWRA in 2016 was estimated to be 1,081 AFY. More current projections were not available at the time of this report.

### 4.1.3 IWTP Expansion

In 2017, Woodard & Curran prepared an expansion evaluation for the IWTP to evaluate options to increase the capacity to treat the projected flows and loads through 2040, as projected in the 2016 SMP (1). The evaluation considered maximizing the biological and hydraulic capacity of the existing treatment train using additional MBR cassettes. This option requires only installation of additional equipment within existing tanks at the IWTP and provides a relatively low-cost method to increase the capacity to 3.5 MGD in the near term. To accommodate 2040 flows, the evaluation conducted that two additional treatment trains, similar to the current train, would need to be constructed to increase the capacity to 7.55 MGD. The District will monitor increases in flows and loads and determine the timing of the IWTP expansion needs based on updated flow projections.

In 2017, an Ion Exchange (IX) System operated by Suez and consisting of two (2) 50-feet trailers came online. The IX system was designed to treat approximately 300 to 400 gpm of side stream effluent and blend with the final IWTP effluent to reduce TDS. The vendor estimated that each trailer removed approximately 2,600 pounds of TDS. When one trailer is exhausted, Suez removes the exhausted unit and replaces it with a regenerated unit and continues treatment.

## 4.2 RW Demand Analysis

### 4.2.1 Existing RW Uses

As stated in Section 2.6, there are currently three RW users – HDPP (for cooling water), Schmidt Park and Westwinds Baseball Complex. Historical, current, and projected annual average demand for the existing RW users are shown in Table 4-3. Additionally, the District applied 165 AF of RW to the Westwinds Golf Course as irrigation in 2015; however, the Westwinds Golf Course is now closed, and the District no longer provides RW to this user so that historic data is not included in this analysis.

HDPP's RW demand ranged from 611 to 749 AFY between 2014 and 2019 and the average use was approximately 650 AFY. HDPP's total cooling water use is approximately 2,900 AFY and their permit requires at least 20% RW, which is being met. In recent years, HDPP considered converting to 100% RW use for cooling water (2,900 AFY); however, there are constraints within their onsite treatment system that limit the amount of RW they can use. In April 2020, HDPP stated that they do not have any plans to increase their RW use. The District and HDPP signed an agreement in September 2010 whereby the District would supply HDPP with up to 4,000 AFY of RW, but the District does not currently expect their use to increase beyond 650 AFY.

The District has also installed two RW fill stations at SCLA that can be used to fill water trucks for dust control near the SCLA runways or for construction projects at SCLA. Dust control uses to date have been minimal and future uses will be variable and are difficult to project; therefore, RW demands for dust control are not included in the projected RW use estimates. The District will prioritize RW over potable water for dust control purposes at SCLA, subject to availability, but the District does not intend to reserve RW for this purpose if the supply can be allocated to other continuous RW uses.

**Table 4-3. RW Historical, Current, and Projected Annual Average Demand for Existing Users, AFY**

| Existing RW User | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|
| **HDPP - Cooling Water** | 611 | 650 | 650 | 650 | 650 | 650 |
| **Schmidt Park[1] and Westwinds Baseball Complex[2]** | 0 | 37 | 37 | 37 | 37 | 37 |
| **Total** | **611** | **687** | **687** | **687** | **687** | **687** |

Notes:

1. Schmidt Park RW use began in 2017 and is assumed to remain the same
2. Westwinds Baseball Complex RW use began in 2018 and is assumed to remain the same

### 4.2.2 Future RW Uses

The District plans to continue to pursue opportunities to expand RW use at SCLA. The SCLA SP is currently under development and proposes development with a variety of land uses including approximately for Business Park, Industrial and Public Open Space. RW could be utilized at future developments throughout SCLA for irrigation of landscaped areas. Some developments may also be able to use RW for cooling or other industrial uses; however, demands for industrial uses are highly dependent on the specific process and water quality needs. Any projections of future industrial demands would be particularly uncertain so the District decided to limit the evaluation of future RW demands to landscape uses throughout SCLA for the purposes of this RWMP. The District will continue to coordinate with new developments at SCLA to identify additional RW uses and will make RW available for suitable industrial purposes whenever possible.

There are several existing warehouse/manufacturing and office buildings at SCLA that are not currently connected to the RW system and use potable water for irrigation. To determine the potential irrigation demand for these existing and similar future developments, the irrigated acreage and irrigation water use for these existing buildings were analyzed to estimate irrigation water use per acre (or water demand factors). The landscaped areas consist of ornamental landscaping around parkways and fences of properties and are consistent with the Water Efficient Landscaping required in the Victorville development Code. Water demand factors can be applied to future development acreages to determine potential irrigation demand. Using existing customer irrigation meter records and landscaped areas measured using Geographical Information Systems (GIS) and aerial imagery, it was estimated the existing SCLA customers use approximately 3.3 AFY per acre of landscaped area.

This analysis also showed that landscaped areas for existing developments, on average, cover approximately 6.6% of the total lot areas they overlay. However, the SCLA SP includes new Development Standards that will require all development lots that abut a dedicated street to have a 5-foot wide planter strip along the entire property abutting the street and a minimum of 3% landscaped area for all parking areas. These standards were applied to existing developments to estimate the adjusted total landscape area. Additionally, the City's Development Department provided the landscaped area ratios for three proposed future developments that meet the new landscape standards. Based on this information, it was estimated that the total landscaped area for development lots at SCLA will be approximately 9.6% of the total site area. More detailed information for the irrigation demand factor and site area calculations are presented in Appendix C.

Stirling Development, who is leading development of the SCLA SP, provided estimates of development acreage by phase. The SCLA SP breaks up the development into six phases, as shown in Figure 4-1. The first five phases occur within the central portion of SCLA. These phases are broken down into timeframes of 5 years and include development of a total of 1,444 acres, including lots that are already developed. Phase 6 accounts for potential development north of the airport 25 to 50 years out, covering an additional 3,275 acres. Of this area, approximately 600 acres northeast of Helendale Road and Colusa Road is being developed as a solar farm by High Desert Solar. Construction will begin in 2020 and will use RW for dust control. Once construction is complete, RW may be needed at the site for periodic dust control and could also be used to clean the solar panels, although that use is not anticipated at this time. Landscape irrigation is not planned for this site, so the 600 acres are excluded from future landscape demand projections discussed in this section.

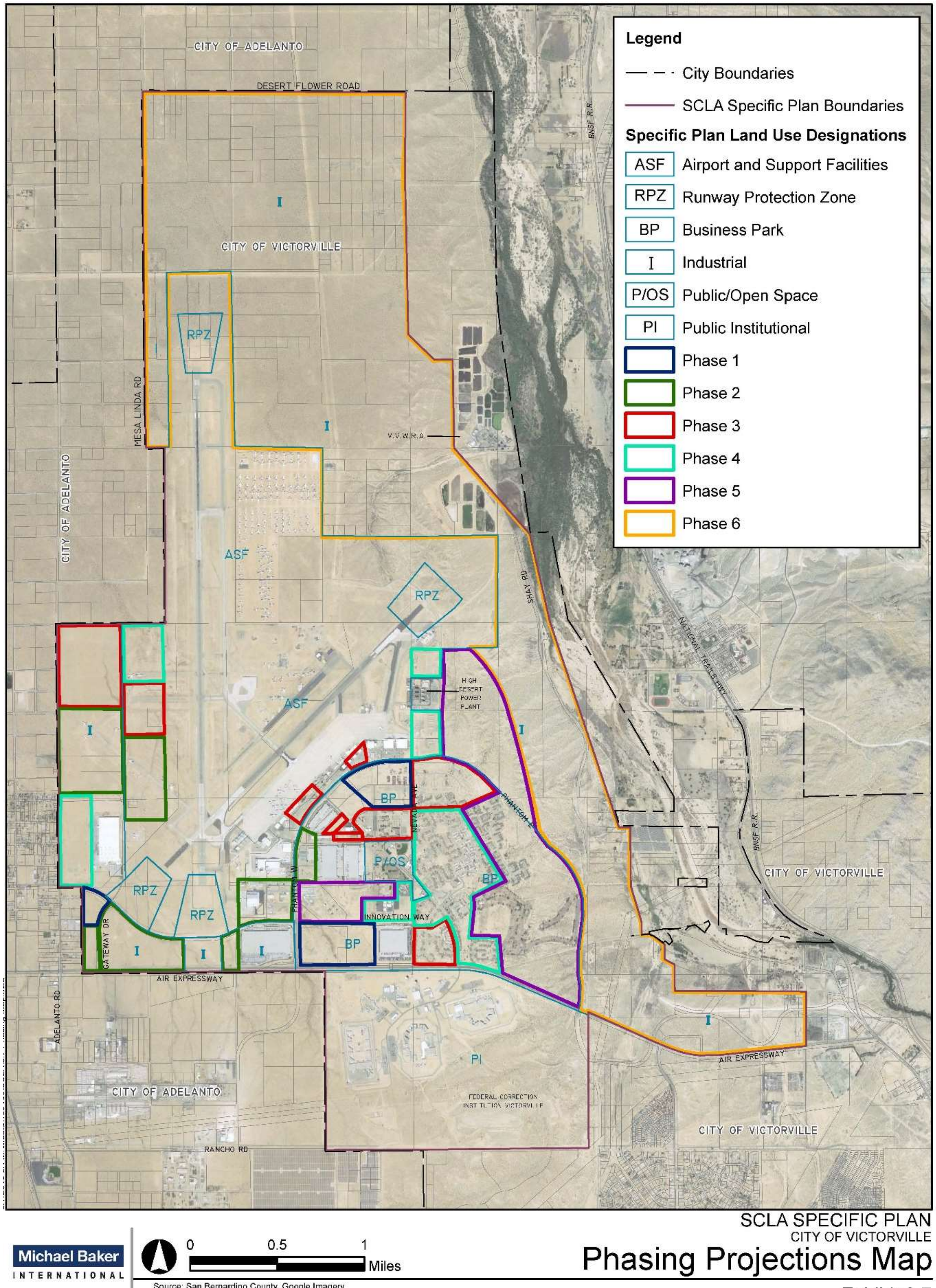
Using the acreage per development identified in the SCLA SP and applying landscape percentage and water demand factors calculated in this section, RW demands were calculated for each phase. Assuming 9.6% of the 1,444 acres within the central portion of the SCLA SP area would be irrigated area using 3.3 AFY per acre, the potential RW demand for existing developments and proposed developments in Phases 1-5 is 462 AFY. The additional 2,675 acres (excluding the 600 acres for High Desert Solar) that could be developed in Phase 6 would result in as much as 848 AFY of additional RW demand for Phase 6. Projected RW demands are shown in Table 4-4.

**Table 4-4. Potential Future Recycled Water Use**

| Phase | Developed Acres per Phase[1] | Irrigated Area Per Phase (acres)[2] | Irrigation Demand Per Phase (AFY)[3] |
|---|---|---|---|
| **Existing** | 196 | 19.0 | 63[4] |
| **Phase 1 (1-5 years)** | 124 | 12.0 | 40 |
| **Phase 2 (5-10 years)** | 298 | 28.6 | 95 |
| **Phase 3 (10-15 years)** | 294 | 28.3 | 94 |
| **Phase 4 (15-20 years)** | 300 | 28.8 | 96 |
| **Phase 5 (20-25 years)** | 232 | 22.3 | 74 |
| **Total Through Phase 5** | **1,444** | **139** | **462** |
| **Phase 6 (25-50 years)[5]** | 2,675 | 257 | 848 |
| **Grand Total** | **4,719** | **396** | **1,310** |

Notes:

1. Based on SCLA SP phasing assumptions provided by Stirling Development in July 2018
2. Assumes 9.6% of total site area is irrigated acreage
3. Assumes irrigation demand is 3.3 AFY per irrigated acre
4. Existing demand includes existing developments that are currently using potable water for irrigation because the RW distribution system has not been extended to serve them. These customers would need to be converted to RW once the RW facilities are available nearby.
5. Excluding 600 acres for High Desert Solar development




SCLA SPECIFIC PLAN
CITY OF VICTORVILLE
Phasing Projections Map
Exhibit 3.7

**Figure 4-1. SCLA Specific Plan Proposed Phasing Map**

## 4.3 Peaking Factors

Peaking factors account for fluctuations in demands on a seasonal, daily or hourly basis and are referred to as maximum month demand (MMD), maximum day demand (MDD) and peak hour demand (PHD). Peaking factors for the following uses were developed:

- HDPP Cooling Towers
- General Landscape Irrigation
- Parks and Sports Fields

The following sections provide an overview of the peaking factor development methodology and Table 4-5 summarizes the peaking factors used in this RWMP for each user type.

**Table 4-5. Peaking Factors**

| User Types | ADD:MMD | MMD:MDD | MDD:PHD | ADD:PHD |
|---|---|---|---|---|
| **HDPP Cooling Tower** | 1.5 | 2.3 | 1.0 | 3.4 |
| **General Landscape Irrigation** | 1.7 | 1.3 | 3.0 | 6.6 |
| **Parks and Sports Fields** | 1.8 | 1.3 | 3.0 | 7.0 |

### 4.3.1 HDPP Cooling Towers

Based on 2018 and 2019 daily meter data provided by the District, the HDPP cooling tower demands have an annual variation as shown in Figure 4-2. The highest demand months are generally July to November, but it varies from year to year based on market conditions and other operational considerations. HDPP typically shuts down for maintenance twice a year: once for 3-4 weeks in April or May and again for a shorter period in the fall. From 2018-2019, the maximum month demand of 30 MG occurred in July 2018, but the maximum day demand of 2 MGD occurred in December 2019.

Maximum day and peak hour demands are the controlling factors for the hydraulic evaluation in this RWMP, so 2019 data was used to calculate HDPP peaking factors to be conservative.

Hourly flow data for HDPP was not available, but the District stated that HDPP has been requesting consistent flow throughout the day, so an hourly peaking factor was not applied and PHD is assumed to be the same as MDD.



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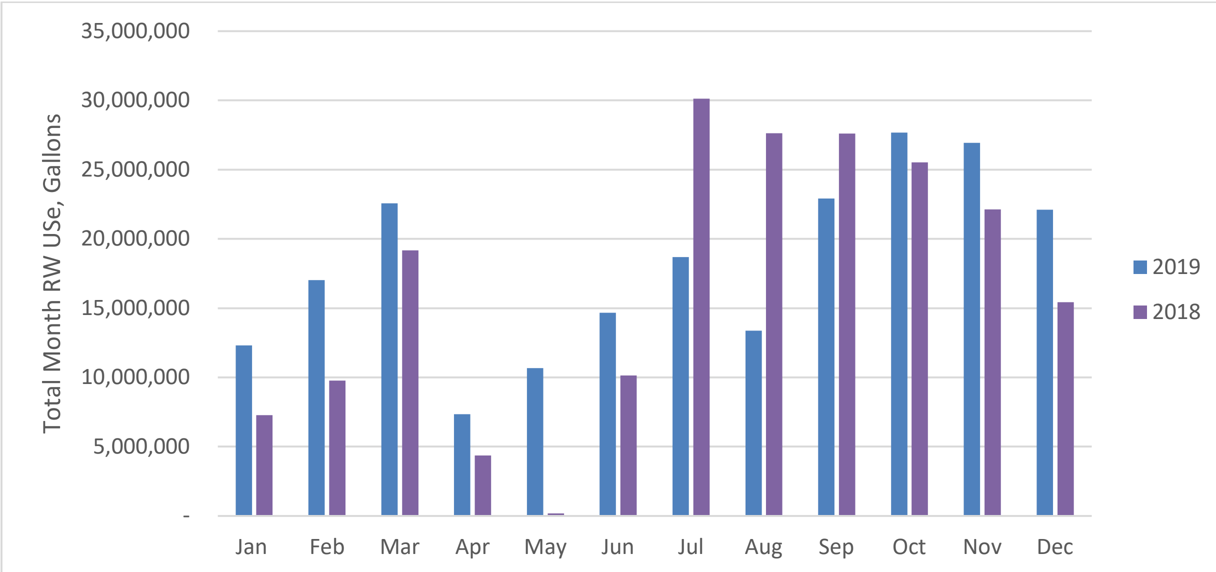


**Figure 4-2. HDPP Monthly RW Use 2018-2019**

### 4.3.2 General Landscape Irrigation and Park and Sports Field Peaking Factors

Seasonal, daily and hourly peaking factors were developed for general landscape irrigation users and for parks and sports fields.

The seasonal peaking factor was developed using the Landscape Coefficient Method (1), which uses local evapotranspiration rates measured at a specialized weather station and crop coefficients for specific crops to determine water needs for a given crop or type of landscaping. Based on the average monthly precipitation and the estimated monthly water needs, the estimated irrigation needs for each month can be calculated. This analysis determined that the maximum month irrigation demand occurs in August. The irrigation demand for landscaping at commercial/industrial facilities is lower than for parks because commercial/industrial facilities are required to use water efficient landscaping, where parks and sports fields primarily use turf. Therefore, the MMD peaking factor varies between the two uses and two MMD peaking factors will be used in this RWMP. The MMD peaking factor is 1.7 for general landscape irrigation and 1.8 for parks and sports fields.

The daily peaking factor was determined by dividing the maximum daily evapotranspiration in August by the 10-year average evapotranspiration rate for the month of August. This yielded an MMD to MDD peaking factor of 1.3, which applies to general landscape irrigation as well as parks and sports fields.

It is assumed that RW irrigation will occur over a period of 8 hours at night due to RW use restrictions; therefore, the PHD peaking factor is 3 for general landscape irrigation as well as parks and sports fields.

See Appendix C for additional detail on irrigation peaking factor development.

## 4.4 RW Supply and Demand Summary

This section presents a summary of projected recycled water demand (Table 4-6), recycled water supply (Table 4-7) and comparison of recycled water supply and demand.

**Table 4-6. Projected Recycled Water Demand Summary**

| RW Demand | 2020 | 2025 | 2030 | 2035 | 2040 | Beyond 2040 |
|---|---|---|---|---|---|---|
| Existing Customer ADD, AFY[1] | 687 | 687 | 687 | 687 | 687 | 687 |
| Future Customer ADD, AFY[2] | 103 | 198 | 292 | 388 | 462 | 1,310 |
| **Total Projected ADD, AFY** | **790** | **885** | **979** | **1,075** | **1,149** | **1,997** |
| **Total Projected ADD, MGD** | **0.7** | **0.8** | **0.9** | **1.0** | **1.0** | **1.8** |
| **Total Projected MMD, MGD[3]** | **1.1** | **1.2** | **1.4** | **1.5** | **1.6** | **2.9** |
| **Total Projected MDD, MGD[3]** | **2.2** | **2.4** | **2.6** | **2.8** | **2.9** | **4.6** |
| **Total Projected PHD, GPM[3]** | **1,940** | **2,330** | **2,720** | **3,110** | **3,410** | **6,880** |

Notes:

1. Total from Table 4-3.
2. For the purposes of this demand summary, SCLA SP Existing and Phase 1 demands from Table 4-4 are assumed to begin in 2020. Demands from each subsequent phase are additive and assumed to begin 5 years later.
3. Peaking factors from Table 4-5 were applied to ADD for each use type

**Table 4-7. Projected Recycled Water Supply Summary**

| RW Supply | 2020 | 2025 | 2030 | 2035 | 2040 | Beyond 2040 |
|---|---|---|---|---|---|---|
| **IWTP, AFY[1]** | 1,959 | 2,463 | 3,097 | 3,893 | 4,895 | TBD |
| **IWTP, MGD** | 1.75 | 2.20 | 2.76 | 3.47 | 4.37 | TBD |
| **VVWRA, AFY[1]** | 1,361 | 1,713 | 2,157 | 2,715 | 3,419 | TBD |
| **VVWRA, MGD** | 1.21 | 1.53 | 1.95 | 2.42 | 3.05 | TBD |
| **Total Projected RW Supply, AFY** | **3,320** | **4,176** | **5,254** | **6,609** | **8,313** | **TBD** |
| **Total Projected RW Supply, MGD** | **2.96** | **3.73** | **4.71** | **5.89** | **7.42** | **TBD** |

Notes:

1. 2040 RW supply from Table 4-2; interim years between 2015 and 2040 were calculated assuming a uniform growth rate.

As shown in Table 4-8 and Figure 4-3, the District will have significant excess RW supply from both sources through 2040 and beyond based on the average annual demands identified in this RWMP. During maximum demand periods, the excess supply available on a daily basis is reduced, as shown in Table 4-9 and Figure 4-4.

**Table 4-8. Annual Average Projected Excess RW Supply Available, AFY[1]**

| | 2020 | 2025 | 2030 | 2035 | 2040 | Beyond 2040 |
|---|---|---|---|---|---|---|
| **Total Projected RW Supply, AFY** | 3,320 | 4,176 | 5,254 | 6,609 | 8,313 | TBD |
| **Total Projected RW Average Day Demand, AFY** | 790 | 885 | 979 | 1,075 | 1,149 | **1,997** |
| **Excess RW Available, AFY** | **2,530** | **3,291** | **4,275** | **5,534** | **7,164** | **6,316[2]** |

Notes:
1. Based on annual average supply and demand
2. Minimum excess based on 2040 supply; actual excess will be greater as wastewater flows increase after 2040

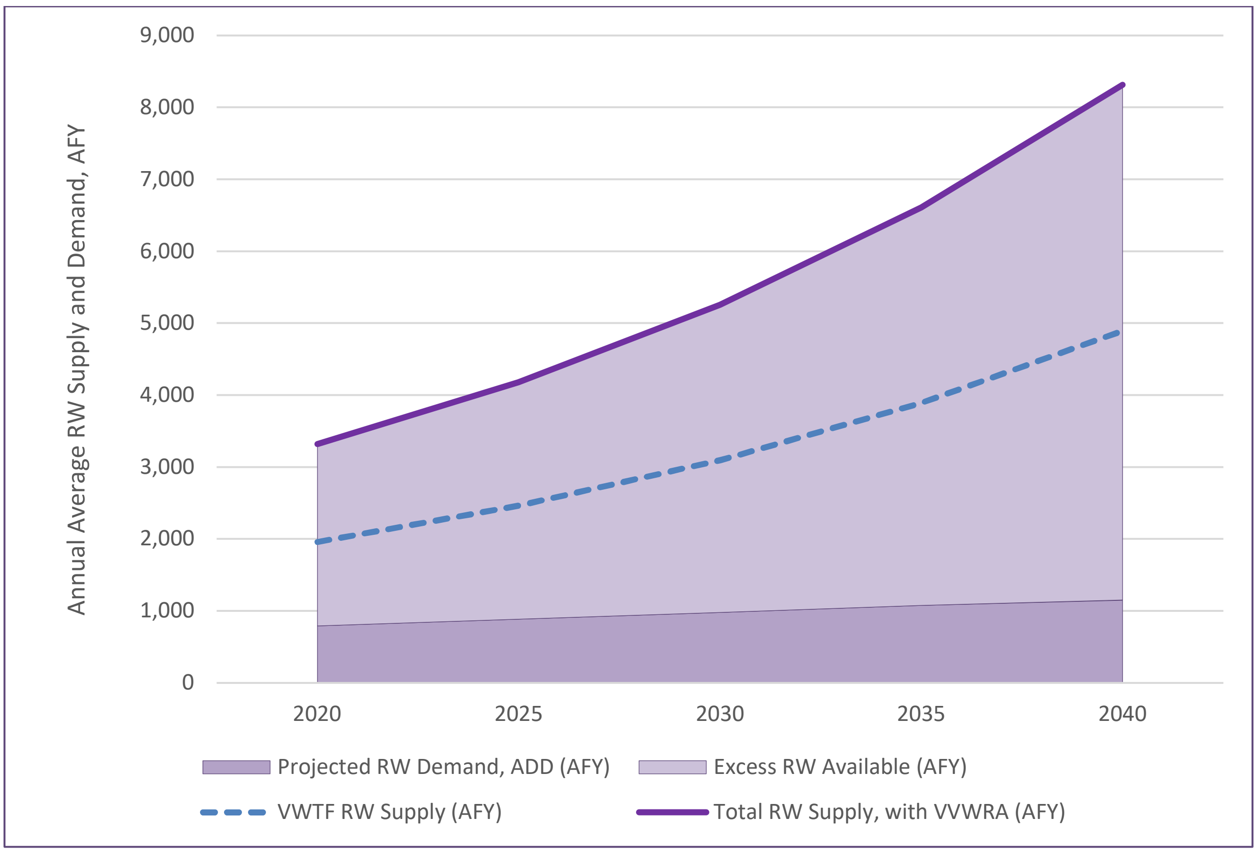


**Figure 4-3. Annual Average Projected Recycled Water Supply and Demand Comparison**

Due to the seasonal nature of the irrigation and cooling tower demands identified in this RWMP, more of the demand is concentrated in the summer and fall months so the total excess supply shown in Table 4-8 and Figure 4-3 is reduced during those months and at a minimum during MDD. As shown in Figure 4-4, the District will have excess RW supply from both sources by 2030 based on the MDD identified in this RWMP.

**Table 4-9. Maximum Day Projected Excess RW Supply Available, MGD[1]**

| | 2020 | 2025 | 2030 | 2035 | 2040 | Beyond 2040 |
|---|---|---|---|---|---|---|
| **Total Projected RW Supply, MGD** | 3.0 | 3.7 | 4.7 | 5.9 | 7.4 | 7.4 |
| **Total Projected RW MDD, MGD** | 2.2 | 2.4 | 2.6 | 2.8 | 2.9 | 4.6 |
| **Excess RW Available, MGD** | 0.7 | 1.3 | 2.1 | 3.1 | 4.5 | 2.8[2] |

Notes:
1. Based on annual average supply and maximum day demand
2. Minimum excess based on 2040 supply; actual excess will be greater as wastewater flows increase after 2040

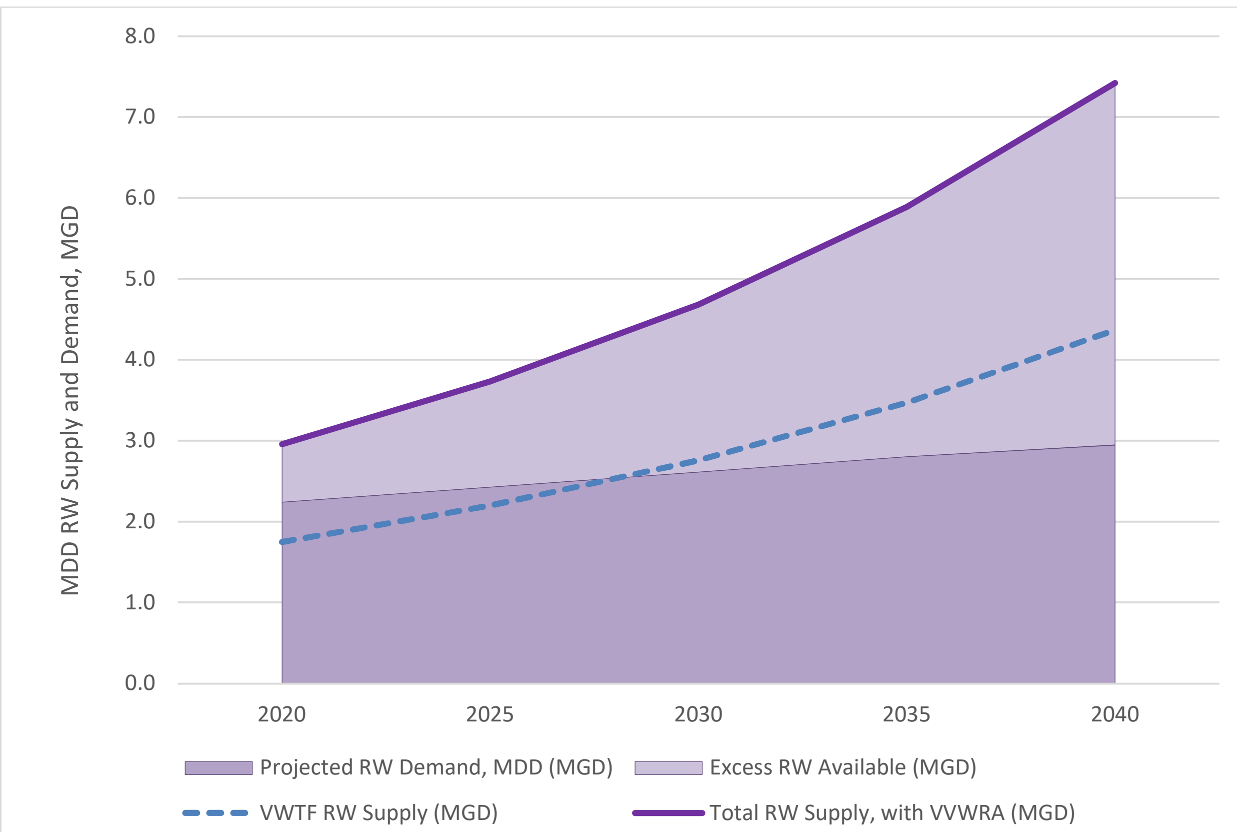


**Figure 4-4. Maximum Day Projected Recycled Water Supply and Demand Comparison**

The excess RW supplies could be used for additional demands not included in this study, including, but not limited to:

- **Additional industrial RW demands at SCLA.** As noted in Section 4.2.2, some developments at SCLA may be able to use RW for cooling or other industrial uses, in addition to irrigation use. Potential industrial RW uses are highly dependent on the specific process and water quality needs of each development and will be determined in consultation with future developments during the early planning stages. The District's contract with HDPP allows for delivery of up to 4,000 AFY of RW but the HDPP demands are not currently expected to increase.
- **Non-potable RW use south of SCLA within the City.** The District is considering potential expansion of the RW system south of SCLA to serve additional RW uses within the City. Potential RW customers and demands outside of SCLA have not yet been evaluated, but this RWMP includes facility sizing for a RW pipeline extension to the south that could convey the excess supply (see Sections 5 and 6).
- **Groundwater recharge (groundwater augmentation).** In 2014, the state amended the California Code of Regulations, Title 22 to include final regulations for Groundwater Recharge (now known as groundwater augmentation). Title 22 allows recycled water to be used to recharge groundwater basins if the recycled water is either advanced treated (with reverse osmosis and advanced oxidation processes) or blended with another source of water that is equivalent in quality to potable water. The required volume of blend water begins at 80% but can be reduced over time if other requirements are met. In order to implement groundwater augmentation, the District would need the upgrade the IWTP to include advanced treatment, or secure sufficient imported water to use as a blending source. The District has not evaluated opportunities for groundwater augmentation with RW, but this could be the subject of a future study, potentially in collaboration with Mojave Water Agency and VVWRA.
- **Direct Potable Reuse.** There are two types of Direct Potable Reuse (DPR):
  - Raw water augmentation, which means the planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system
  - Treated drinking water augmentation, which means the planned placement of recycled water directly into a public water system's potable water pipelines or tanks for distribution to customers.

  Additional treatment, monitoring, and/or an engineered buffer would be required to provide protection of public health and response time in the event that the purified water does not meet specifications. The State Water Board is required to adopt uniform water recycling criteria for DPR through raw water augmentation on or before December 31, 2023. A timeline has not yet been established to adopt regulations for treated drinking water augmentation.

If the District decides to pursue evaluation of additional RW uses not included in this RWMP, there are planning grants available from the State Water Resources Control Board Water Recycling Funding Program to fund up to 50% of the cost of such studies.

CHAPTER 5

# Recycled Water System Analysis

This chapter describes the assumptions, methodology and the findings of the RW system analysis for the existing and future system. The RW system analysis evaluated storage and hydraulic performance (system pressure and pipeline velocity).

IN THIS CHAPTER



## 5.1 System Hydraulic Analysis

A hydraulic analysis was performed in a hydraulic model of the RW distribution system which assessed the existing system and the buildout system performance in terms of system pressure and pipeline velocity. Evaluation criteria for each of these elements are summarized in Chapter 3. The following sections discuss the hydraulic model development and hydraulic analysis assumptions.

### 5.1.1 RW Hydraulic Model

WSC used the City's current GIS mapping and existing RW distribution system record drawings to create a hydraulic model in InfoWater, Innovyze's GIS based hydraulic model software. The RW hydraulic model was not calibrated; however, pressures at existing customers were checked to verify that the model predicted pressures within a reasonable range.

In addition to the existing RW system facilities, proposed pipes were added to the model based on the proposed future street layout shown in the SCLA SP. Future demands were allocated in the model using the location of the existing SCLA warehouse and office buildings and the proposed locations of developments specified in the SCLA SP. The model captures facility size, status, construction phase, pipe segment name, operational settings and scenarios.

### 5.1.2 Model Scenarios

Based on discussions with the District, the future RW use evaluated in this RWMP is limited to existing users plus future landscape irrigation uses throughout SCLA, as discussed in Section 4.2.2.

However, since the available RW supply exceeds the demands identified at SCLA, the District is also considering the possibility of expanding the RW system south towards the City. This RWMP evaluates the existing system as well as two future system scenarios in order to size the expansion of the RW system. The future system scenarios are summarized below:

**Future 2040 System Peak Hour Demand**

- This scenario evaluates demands from existing users and future demand from Phases 1 – 5 in the SCLA SP. SCLA SP Phase 6 is not included in this scenario since it is 25-50 years in the future. The 2040 PHD shown in Table 4-6 is loaded in the model for this scenario.

**2040 Extended System Peak Hour Demand**

- This scenario is similar to the 2040 System scenario, but also includes SCLA SP Phase 6 and an extension to the south to convey excess RW supply to other parts of the City. The Beyond 2040 PHD shown in Table 4-6 is loaded in the model for this scenario.
- The projected PHD for SCLA SP Phase 6 is 3,470 gpm, which was all loaded onto a single node at the intersection of Helendale Road and Colusa Road for the purposes of sizing the backbone pipeline to serve Phase 6. Depending on the actual distribution of demands in Phase 6, additional pipes will be needed to distribute RW throughout the Phase 6 area.

This scenario includes a demand at Air Expressway and Phantom East to represent future flows to the south. As shown in Table 4-8 and Figure 4-3, the District will have significant excess RW supply from both sources through 2040 and beyond based on the average annual demands identified in this RWMP. During maximum demand periods, the excess supply available on a daily basis is reduced, as shown in Table 4-9 and Figure 4-4.

- Table 4-8, the minimum excess RW supply available beyond 2040 is projected to be 6,313 AFY, or approximately 3,900 gpm, which was loaded into the model at the intersection of Phantom East and Air Expressway for the purposes of sizing the pipe to the south.
- Note that location and magnitude of actual demands in SCLA SP Phase 6 and to the south are unknown and may be higher or lower than assumed in the RWMP. A more thorough analysis should be performed once additional information is available prior to constructing these extension pipes. The recommended pipe size presented in this RWMP is meant for information purposes only.

In both scenarios, the RW supply from the IWTP is on and the Elevated RW Tank is 50% full.

There are 10 total scenarios in the model, as summarized in Table 5-1.

**Table 5-1. Model Scenarios**

| Scenario Name | Description of Scenario | Child Scenario of | Demand Condition |
|---|---|---|---|
| Base | Base Network Scenario (Do Not Run) | - | - |
| Existing System | Folder to Hold Existing System Scenarios (Do Not Run) | Base | - |
| Ex ADD | Existing System Average Day Demand | Existing System | ADD |
| Ex MDD | Existing System Max Day Demand | Existing System | MDD |
| EX PHD | Existing System Max Day Demand | Existing System | PHD |
| Future System | Folder to Hold Future System Scenarios (Do Not Run) | Base | - |
| Future ADD | Future 2040 System Average Day Demand | Future System | ADD |
| Future MDD | Future 2040 System Max Day Demand | Future System | MDD |
| Future PHD | Future 2040 System Peak Hour Demand | Future System | PHD |
| Future PHD_Extended | Future Beyond 2040 System PHD with SCLA SP Phase 6 and South Extension | Future System | PHD |

### 5.1.3 Hydraulic Analysis Results

Since there is relatively little demand in the existing RW system, all criteria were met.

The Future 2040 System Peak Hour Demand and 2040 Extended System Peak Hour Demand were also evaluated and the model was used to size future facilities to meet the pressure, velocity and headloss criteria established in Chapter 3.

In the 2040 Extended System Peak Hour Demand scenario, the pressure at the nodes along Innovation between Nevada and Gateway and at the south end of Gateway is approximately 30-33 psi, which is just below the desired minimum pressure criteria of 35 psi. However, these nodes are relatively high in elevation and served primarily by existing pipelines so the small pressure drop does not warrant upsizing or installation of parallel pipes to resolve this minor deficiency. Additionally, a minimum of 30 psi is likely to be sufficient for a landscape drip irrigation system.

All other existing pipelines meet the criterion with future demands.

The existing 24" pipeline between the RW Elevated Tank and HDPP has excess capacity in all scenarios. Under the 2040 Extended System Peak Hour Demand scenario, which is the most conservative, the maximum velocity of 5.5 fps occurs in the outlet pipe from the RW Elevated Tank. The headloss in this segment is approximately 4 ft per 1,000 ft. These values are both lower than the evaluation criteria shown in Table 3-2 for existing facilities, which indicates there is excess capacity in the existing 24" pipeline, even with excess supply of 3,900 gpm flowing to the south. If excess supply is not sent to the south, the maximum velocity in the existing 24" pipe is 1.8 fps and the maximum headloss is 1.3 ft per 1000 ft, indicating substantial excess capacity is available. If new developments with large industrial RW demands are proposed, locating them in the vicinity of this pipeline may enable the City to serve such additional customers without upsizing the pipelines shown in Figure 6-1.

### 5.1.4 System Improvement Recommendations

The RW system was sized to accommodate future demands and the possibility of expansion for SCLA SP Phase 6 and towards the south. Since the SCLA SP is proposing the development of the SCLA area to occur in phases, the proposed RW pipelines are expected to be phased in the same way, or as development occurs. Chapter 6 summarizes the size, length and phasing of proposed pipeline improvements.

## 5.2 Storage Analysis

The District currently has one 1.0 MG elevated tank that provides storage and pressure for the RW system, Westwinds Pond, which provides 0.6 MG of storage at ground level, and a small 0.06 MG effluent storage tank at the IWTP, which is not included in this analysis. The District has experienced operational and water quality problems with the Westwinds Pond, which requires a high level of maintenance because of algae growth and debris issues. The District plans to replace the Westwinds Ponds with an enclosed 1 MG tank at ground level near the existing pond and elevated tank to improve the reliability and water quality of the reclaimed water system and reduce ongoing maintenance requirements.

As discussed in Section 3.3, the required operational storage volume shall be equal to MDD, less the daily supply from the VWFT. Table 5-2 presents the results of the existing system storage analysis based on 2020 supply and demand and the future 2040 storage analysis based on projected supply and Beyond 2040 buildout demands. The future scenario captures the 1 MG tank that will replace the RW pond. There is excess storage in both the existing and future systems, with the addition of the new 1 MG tank.

**Table 5-2. Existing and Buildout Storage Analysis**

| System | MDD, MGD[1] | PHD, GPM[1] | IWTP Supply, MGD (GPM)[2] | Required Storage based on MDD, MG[3] | Required Storage based on PHD, MG[4] | Available Storage, MG | Storage Surplus/ (Deficit), MG[5] |
|---|---|---|---|---|---|---|---|
| **Existing (2020)** | 2.2 | 1,940 | 1.7 (1,210) | 0.50 | 0.35 | 1.6 | 1.1 |
| **Future Beyond 2040** | 4.6 | 6,880 | 4.4 (3,030) | 0.25 | 1.8 | 2.0 | 0.2 |

Notes:
1. From Table 4-6
2. From Table 4-7, converted to MGD and GPM
3. MDD less supply from IWTP; see Section 3.3 for explanation of criteria
4. 8 hours of PHD less supply from IWTP; see Section 3.3 for explanation of criteria
5. Available storage less the greater of the MDD or PHD Required Storage

There is sufficient existing and future storage capacity; therefore, no additional storage is required to meet the evaluation criteria.

Due to operational and water quality challenges, the District intends to replace the Westwinds Pond with a 1 MG enclosed tank at ground level as noted previously.

## 5.3 Booster Pump Station Analysis

As discussed in Section 3.4, the Westwinds BPS is operated only when additional RW supply is needed from VVWRA, beyond the supply available from the IWTP. Therefore, the reliable pumping capacity of this BPS shall be sufficient to meet MDD less the IWTP supply with the largest pump out of service, allowing for normal operations during typical repairs or replacements. The IWTP Effluent Booster Station and VVWRA Effluent BPS are excluded from this analysis. Table 5-3 presents the results of the existing 2020 and future 2040 BPS analysis based on projected supply and 2040 demands. As shown, the existing capacity of the Westwinds BPS is sufficient to meet the 2020 needs. As discussed in Section 4.4, by 2030, the IWTP supply is projected to be sufficient to meet all of the demands identified in this RWMP so the Westwinds BPS may not be needed beyond that time unless additional RW uses are identified.

**Table 5-3. Existing and Future BPS Analysis**

| System | RW Demand, MDD[1] | IWTP Supply, MGD[2] | Supply Needed from VVWRA, MGD[3] | Required Westwinds BPS Capacity, gpm | Westwinds Reliable BPS Capacity, gpm[4] |
|---|---|---|---|---|---|
| **Existing (2020)** | 2.24 | 1.75 | 0.49 | 410 | 2,000 |
| **Future (2040)** | 2.95 | 4.37 | None | None | 2,000 |

There is sufficient existing and future BPS capacity; therefore, no BPS improvements are required to meet the evaluation criteria.

# Capital Improvement Program

The purpose of this Capital Improvement Plan (CIP) is to provide the District with a guide for planning and budgeting RW system improvements. The CIP summarizes the proposed facilities, phasing, and cost estimates for the recommended RW system improvements identified in this RWMP.

IN THIS CHAPTER

Cost Estimating Basis and Assumptions

CIP Summary

The RW system was sized to accommodate future demands and the possibility of expansion for SCLA SP Phase 6 and towards the south. Since the SCLA SP is proposing the development of the SCLA area to occur in phases, the proposed RW pipelines are expected to be phased in the same way, or as development occurs. The pipelines in this CIP are broken into segments to enable the District to plan and construct the RW system incrementally as needed.

The proposed future RW system is presented in Figure 6-1. The CIP presented in Table 6-1 lists each proposed pipeline segment recommended along with the size and length of the improvement, the cost estimate and the phase each improvement is planned to be implemented.

## 6.1 Cost Estimating Basis and Assumptions

The cost opinions (estimates) with the recommended projects in this CIP have been prepared in conformance with industry practices as planning level cost opinions and are classified as Class 4 Conceptual Report Classification of Opinion of Probable Construction Costs as developed by the Association for the Advancement of Cost Engineering (AACE International). The purpose of a Class 4 Estimate is to provide a conceptual level of effort that is expected to range in accuracy from -30% to +50%. A Class 4 Estimate also includes an appropriate level of contingency so that it can be used in future planning and feasibility studies. The design concepts and associated costs presented in this CIP are conceptual in nature due to the limited design information that is available at this stage of project planning. These cost estimates have been developed using a combination of data from RS Means CostWorks® and recent bids, experience with similar projects, current and foreseeable regulatory requirements, and an understanding of necessary project components. As the projects progress, the designs and associated costs could vary significantly from the project components identified in this CIP.

The recommended projects and these cost opinions are based on the following assumptions:

1. For projects where applicable cost data is available in RS Means CostWorks® (e.g. pipeline installation), cost data released in Quarter 4 of 2018, adjusted for San Bernardino, is used. Materials prices were further adjusted in some cases to provide estimated that align closer with actual local bid results and material quotes from local vendors.
2. 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.
3. Cost opinions are escalated to 2020 dollars based on an ENR Construction Cost Index of 11396 from February 2020. When budgeting for future years, appropriate escalation factors should be applied. The past 5 year average increase of the ENR CCI 20 City Average is considered a reasonable factor to use for escalation.
4. Cost opinions are "planning-level" and may not fully account for site-specific conditions that will affect the actual costs, such as soil conditions and utility conflicts.
5. Construction Totals include the following mark-up:
    a. 20% construction contingency based on construction sub-total
6. Total Project Costs include the following allowances:
    a. 15% of Construction Total for project development, including administration, alternatives analysis, planning, engineering, surveying, etc.
    b. 10% of Construction Total for construction phase support services, including administration, inspection, materials testing, office engineering, construction administration, etc.

## 6.2 CIP Summary

The pipes identified in Phase 1 will complete the missing links in the existing RW system and enable the District to convert most of the existing irrigation users from potable to RW. The subsequent phases can be constructed as development occurs.

The location and magnitude of actual demands to the south of SCLA (served by Segment 5-4) and SCLA SP Phase 6 (Segments 6-1 and 6-2) are unknown and a more thorough analysis should be performed based on additional information prior to constructing these segments. The recommended pipe sizes presented in this RWMP for these segments are meant for planning and information purposes only.

**Table 6-1. CIP Summary Table**

| Phase | Segment | Length (ft) | Diameter (in) | Segment Cost |
|---|---|---|---|---|
| Phase 1 | Segment 1-1 | 980 | 8 | $ 121,000 |
| | Segment 1-2 | 1,970 | 8 | $ 243,000 |
| | Segment 1-3 | 1,200 | 24 | $ 485,000 |
| **Phase 1 Total** | | **4,150** | | **$ 849,000** |
| Phase 2 | Segment 2-1 | 1,730 | 12 | $ 271,000 |
| | Segment 2-2 | 2,550 | 12 | $ 400,000 |
| | Segment 2-3 | 2,070 | 8 | $ 153,000 |
| | Segment 2-4 | 820 | 8 | $ 101,000 |
| | Segment 2-5 | 1,880 | 12 | $ 295,000 |
| | Segment 2-6 | 1,460 | 12 | $ 229,000 |
| | Segment 2-7 | 1,360 | 16 | $ 276,000 |
| **Phase 2 Total** | | **11,040** | | **$ 1,725,000** |
| Phase 3 | Segment 3-1 | 1,000 | 24 | $ 404,000 |
| | Segment 3-2 | 4,100 | 8 | $ 505,000 |
| **Phase 3 Total** | | **5,100** | | **$ 909,000** |
| Phase 4 | Segment 4-1 | 2,360 | 8 | $ 291,000 |
| | Segment 4-2 | 1,760 | 8 | $ 217,000 |
| | Segment 4-3 | 1,670 | 20 | $ 534,000 |
| | Segment 4-4 | 980 | 8 | $ 121,000 |
| **Phase 4 Total** | | **6,770** | | **$ 1,163,000** |
| Phase 5 | Segment 5-1 | 1,160 | 8 | $ 142,000 |
| | Segment 5-2 | 2,090 | 20 | $ 669,000 |
| | Segment 5-3 | 2,060 | 20 | $ 659,000 |
| | Segment 5-4 | 1,900 | 20 | $ 608,000 |
| **Phase 5 Total** | | **7,200** | | **$ 2,078,000** |
| Phase 6 | Segment 6-1 | 11,080 | 20 | $ 1,939,000 |
| | Segment 6-2 | 12,590 | 8 | $ 2,171,000 |
| **Phase 6 Total** | | **23,670** | | **$ 4,110,000** |
| **Grand Total** | | **57,930** | | **$ 10,834,000** |

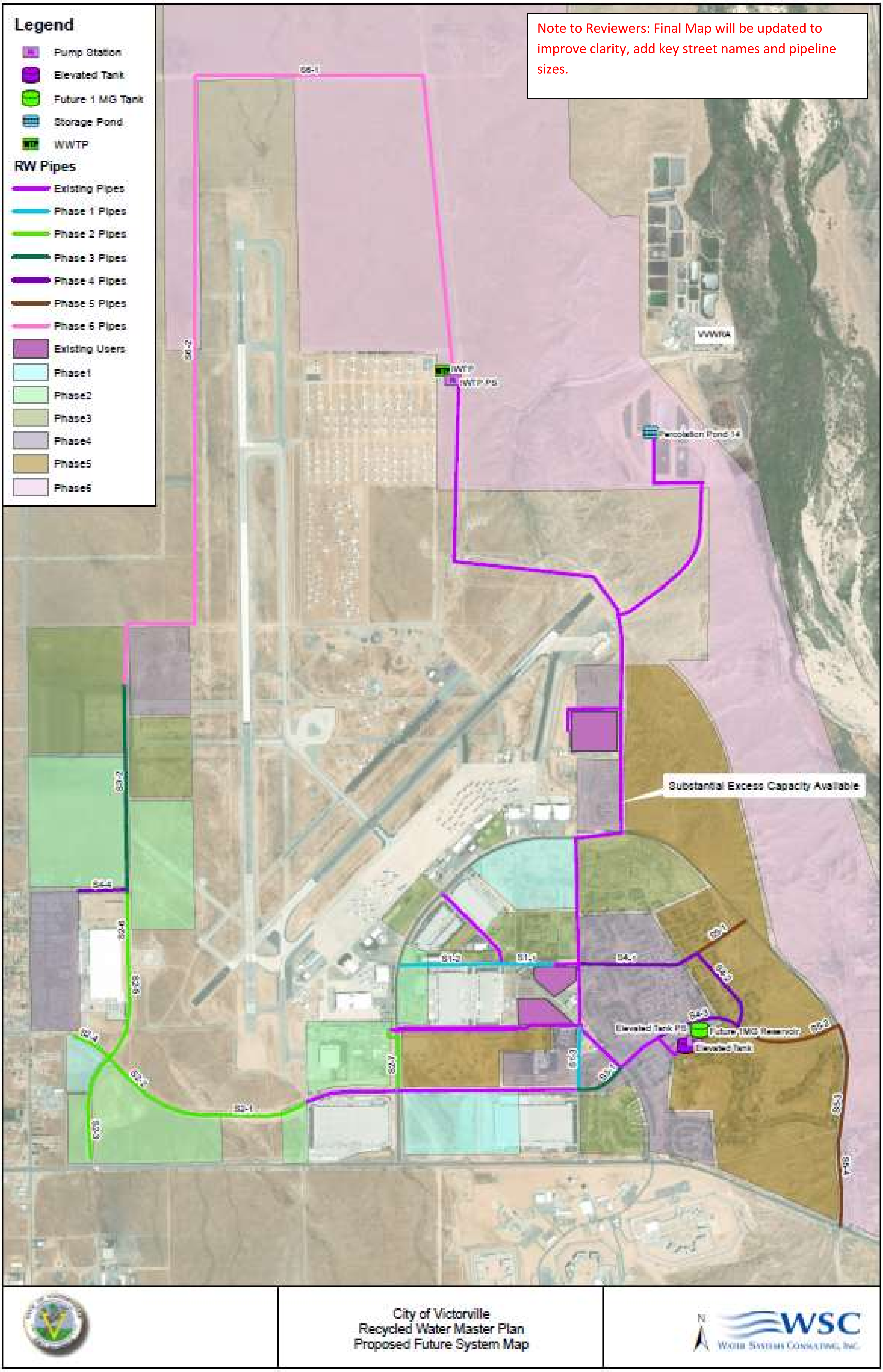


Figure 6-1. Proposed Future System Map

# References

1. **University of California Cooperative Extension and California Department of Water Resources.** *A Guide to Estimating Irrigation Water Needs of Landscape Plantings in California.* 2000.

2. **David Evans and Associates, Inc.** *Sewer Master Plan.* 2016.

3. **Water Systems Consulting, Inc. .** *2015 Urban Water Management Plan.* 2016.

4. **Water Systems Consulting, Inc.** *City of Victorville 2019 Water Master Plan.*

# Appendix A – Lahontan Region Board Order No. R6V-2014-0002 WDR

# Appendix B – Regional Board and DDW Authorization Letters

# Appendix C – Irrigation Demand Factor and Peaking Factor Development

# Appendix D –

# Appendix E –

# Appendix F –

# Appendix G –