

## Water and Wastewater Sector Introduction

Climate change can have significant effects on the reliability and operation of water and wastewater infrastructure, including water supply resources, treatment infrastructure, and conveyance mechanisms. Given the critical importance of the water and wastewater sector, utilities, regulatory agencies and local governments will need to implement effective climate preparedness actions for related infrastructure. This gap analysis identifies the programs and initiatives that are currently in place or planned to help reduce the potential impacts of climate change on water and wastewater assets (i.e. treatment plants, sewer pipes, storm drain pipes, distribution pipes, pumps, and groundwater aquifers) within Santa Clara County.

The major water provider in Santa Clara County is the Santa Clara Valley Water District (SCVWD), which manages wholesale water and sells to municipal and private retailers. SCVWD manages 10 dams and surface water reservoirs, 400 acres of recharge ponds, 275 miles of streams and waterways, and three water treatment plants. City-owned utilities, such as the City of Palo Alto Utilities (CPAU) and the Santa Clara Water and Sewer Utilities, provide water distribution and sewage collection services, as well as investor-owned public utilities, such as the San Jose Water Company. The San Jose–Santa Clara Regional Wastewater Facility provides the majority of wastewater treatment, serving 1.4 million residents of eight cities in Santa Clara County (San Jose, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Monte Sereno, and Saratoga). The Regional Water Quality Control Plant is owned and operated by the City of Palo Alto for the communities of Los Altos, Los Altos Hills, Mountain View, Palo Alto, Stanford University and the East Palo Alto Sanitary District. South County Regional Wastewater Authority (SCRWA) manages the treatment of wastewater for Gilroy and Morgan Hill. The Donald M. Somers Water Pollution Control Plant services the city of Sunnyvale.

Subsequent sections in this chapter describe the various vulnerabilities faced by the water and wastewater sector as a result of climate change, and the extent to which these vulnerabilities have been addressed in the region.

## Climate Change Vulnerabilities in the Water and Wastewater Sector

The water and wastewater sector in Santa Clara County is vulnerable to the following climate change variables:

- Sea level rise
- Storm surge
- Annual temperature pattern change, and extreme temperature events (heatwaves)
- Seasonal precipitation change - drought and extreme rainfall resulting in riverine flooding
- Wildfires

For more information on the nature and projected trends in these variables, refer to the Silicon Valley 2.0 Climate Variables Memorandum. The assets and services of the energy sector that are affected by

## Silicon Valley 2.0 - Climate Preparedness Gap Analysis

these climate change variables, the nature of impacts on the assets and services, as well as the utilities affected by the impacts are summarized below in Table 1.

**Table 1: Climate Change Variables and Impacts relevant to the Water and Wastewater Sector in Santa Clara County**

<b>Climate Change Variable</b>	<b>Assets/Services Affected</b>	<b>Nature of Impact</b>	<b>Relevant Utilities</b>
Sea Level Rise and Storm Surge	Wastewater treatment plant and collection infrastructure; water supply plant and delivery infrastructure (e.g. pumps, pipes)	- Permanent inundation or temporary flooding of coastal, low-lying treatment plants causing contamination leading to potential health and safety risks - Inundation of below-ground pipes with corrosive saltwater	Cities of Sunnyvale, Palo Alto, and San Jose
	Stormwater infrastructure	- Loss of stormwater infrastructure capacity near the coast (impairment of gravity-fed systems)	City governments (Palo Alto, Mountain View, Sunnyvale, Santa Clara, San Jose)
	Groundwater Aquifers	- Saltwater intrusion into freshwater coastal aquifers	SCVWD; private entities
Storm events – localized flooding from extreme rainfall	Stormwater infrastructure	- Increased wear and/or damage to stormwater infrastructure from more turbidity / debris in floodwater	City governments
	Wastewater treatment plant and collection infrastructure; water supply plant and delivery infrastructure (e.g. pumps, pipes)	- Temporary flooding of wastewater treatment plants causing contamination leading to potential health and safety risks	Cities of Sunnyvale, Palo Alto, and San Jose
Warmer Average Temperatures, Extreme Heat Events, and Precipitation Changes (Annual and Seasonal)	Wastewater treatment plant and collection infrastructure	- Lower water volumes from warmer temperatures and decreases in precipitation means an effective increase in pollutant and waste concentrations	SCVWD; City governments
	Water supply plant and delivery infrastructure (e.g. pumps, pipes)	- Drier conditions as a result of warmer temperatures and decreases in precipitation mean increased demand at the same time as a reduction in supply	SCVWD; City governments
	Reservoirs	- Increased temperature and evaporation causes greater net loss of stored water, coupled with lower supply / in-flow volumes	SCVWD
	Groundwater Aquifers	- Drier conditions as a result of warmer temperatures and decreases in precipitation mean increased groundwater pumping and decreased recharge volumes, potentially resulting in land subsidence	SCVWD
Wildfires	Reservoirs	- Potential water quality contamination from increased erosion and sedimentation	SCVWD

## Existing Efforts to Address Water and Wastewater Sector Vulnerabilities to Climate Change Water and Wastewater Infrastructure

This section provides an overview of existing water and wastewater sector climate change preparedness efforts in the county. This section is organized by climate change variable and specific type of asset vulnerability. An overview of the asset vulnerability is provided, followed by descriptions of the existing effort(s), the level of implementation (i.e., vulnerability assessment, risk assessment, strategy development, or strategy implementation), and the relevant organizations.

### Efforts Addressing Sea Level Rise and Accompanying Storm Surge

Sea level rise and increased storm surges, can impact water and wastewater plants and delivery systems, stormwater infrastructure, and groundwater aquifers.

#### Description of Water and Wastewater Plant and Delivery System Vulnerability

Wastewater treatment plants are often located in low-lying coastal areas, to optimize gravity transmission, which also makes them more vulnerable to flooding, and subsequent shutdowns and water damage. In Santa Clara County, three of the four wastewater treatment plants (Palo Alto Wastewater Treatment Plant; Sunnyvale Industrial Wastewater Treatment Plant; San Jose / Santa Clara Regional Wastewater Facility) are coastal and vulnerable to sea level rise. Santa Clara County also has an advanced water purification plant called the Silicon Valley Advanced Water Purification Center, which treats the effluent from the San Jose / Santa Clara Regional Wastewater Facility for variety of non-drinking purposes such as landscaping, agriculture and industrial uses. This plant is located on the Bay Shore and vulnerable to sea level rise and storm surge. Higher sea levels could cause permanent inundation of water and wastewater treatment plants; and storm surges could temporarily flood plants, damage facilities, and interrupt operations. The inundation and flood risks of sea level rise are exacerbated by land subsidence.

Sea level rise affects not only plants, but also pipes, pumps, and other conveyance infrastructure. Underground delivery infrastructure will be affected by sea level rise, where areas become inundated and pipes become submerged in saltwater. Salty water can cause corrosion of pipes and other underground infrastructure. Submerged outfalls cannot be easily inspected or maintained.<sup>1</sup> There is also the risk of salt water intrusion into potable water suppliers and reservoirs from rising sea levels.

#### Existing Climate Change Preparedness Efforts

To date, sea level rise climate preparedness efforts for water and wastewater plant and delivery systems in the region have focused on planning-level vulnerability assessments and strategy development. The primary effort is described below.

#### *Integrated Regional Water Management Plan (IRWMP) – Climate Change Chapter*

- Description: The Integrated Regional Water Management Coordinating Committee (IRWMCC) developed the guiding document, the Integrated Regional Water Management Plan (IRWMP), which includes a chapter on climate change, cataloging climate change vulnerabilities in the water

---

<sup>1</sup> Ann-Ariel Vecchio 2013, oral communication, 8<sup>th</sup> November.

and wastewater sector and strategies to address these vulnerabilities. The nine-county effort aims to coordinate regional water and wastewater issues, one of which is adapting and mitigating climate change. Regarding sea level rise, the document recommends, as a climate preparedness strategy, considering the relocation of critical infrastructure out of inundation and flooding hazard zones, increasing the resiliency of existing infrastructure by retrofitting with waterproof or corrosion-resistant materials, and elevating sensitive components.

- **Implementation Level:** Vulnerability Assessment; Adaptation Strategy Development (high-level)
- **Relevant agencies:** SCVWD as lead agency, with other stakeholders (Santa Clara County, City governments, water agencies, other Special Districts, watershed groups, NGPs, private entities, and others).
- **Documentation of efforts:** 2013 San Francisco Bay Area Integrated Regional Water Management Plan (IRWMP)<sup>2</sup>.

### Description of Stormwater Infrastructure Vulnerability

Higher sea levels near the coast, where outfalls are typically located, can reduce elevation differences along pipe networks, impairing gravity-fed systems. Gravity-operated stormwater systems would experience poor drainage, backflow, and maintenance challenges. Backflow of saltwater can cause corrosion of pipes. Even concrete pipes are susceptible to saltwater corrosion, especially where pipes are not permanently submerged, but rather repeatedly in contact with saltwater.<sup>3</sup> Submerged stormwater outfalls present a maintenance challenge, because they cannot be visually inspected. Pumping mechanisms to enforce drainage are expensive to install.

Aside from pipe flow dynamics, violent storm surges can also pull much debris and trash into floodwaters that accelerate deterioration of stormwater drainage systems through wear-and-tear and incidental damage.

### Existing Climate Change Preparedness Efforts

The gap analysis did not identify any efforts to mitigate the effects of sea level rise on stormwater infrastructure.

### Description of Groundwater Aquifer and Reservoir Vulnerability

Sea level rise, and the subsequent saltwater intrusion, can result in saltwater penetrating freshwater coastal aquifers and reservoirs. The amount of saltwater intrusion into an aquifer can vary, from rendering the water source mildly briny to completely transforming a freshwater source into saltwater.

---

<sup>2</sup> Available online at [http://bairwmp.org/docs/2013-bairwm-plan-update/2013-final-plan/San%20Francisco%20Bay%20Area%20IRWMP%20Final\\_September%202013.pdf](http://bairwmp.org/docs/2013-bairwm-plan-update/2013-final-plan/San%20Francisco%20Bay%20Area%20IRWMP%20Final_September%202013.pdf)

<sup>3</sup> Concrete exposed to saltwater in a tidal zone will deteriorate as a result of chemical processes (reactions between salts and cement hydration products), as well as mechanical processes (erosion). Permanently submerged concrete structures often develop a protective crust of brucite that slows chemical degradation and are subjected to less erosive force. See Mishra, Gopal. "Concrete in Seawater." *The Constructor Civil Engineering Home*, n.d. Web. 11 Nov. 2013.

### Existing Climate Change Preparedness Efforts

The gap analysis did not identify any efforts to mitigate future climate change-related salt water intrusion impacts on freshwater aquifers.

### Parallel Efforts with Climate Change Preparedness Benefits

While no climate change-focused initiatives were identified, existing efforts have been in place for decades to prevent saltwater intrusion of freshwater aquifers.

#### *Saltwater Intrusion Prevention Program*

- Description: Improperly constructed groundwater wells in coastal areas can act as conduits, allowing saltwater to infiltrate fresh groundwater reserves. In the 1980s, SCVWD instituted a Saltwater Intrusion Prevention Program that identified and subsequently decommissioned a list of 45 potentially problematic wells. Strict well construction and decommissioning ordinances were established to ensure that all future groundwater wells do not become saltwater conduits. While all improper wells have been destroyed, SCVWD continues to monitor saltwater intrusion through monitoring wells, and to rigidly enforce well construction and destruction ordinances.
- Implementation Level: Strategy implementation
- Relevant agencies: SCVWD
- Documentation of efforts: Santa Clara Valley Water District Groundwater Management Plan<sup>4</sup>

### Efforts Addressing Storm Events (More Intense and Longer Duration Rain Events)

Storm events, with the associated localized flooding from heavy rain, can impact stormwater infrastructure.

#### **Description of Stormwater Infrastructure Vulnerability**

Intense storms can result in high volumes of fast-moving stormwater. The speed and energy of the stormwater runoff picks up sediment, debris, and trash, resulting in turbid water. High volumes of fast-moving stormwater carrying debris, trash and/or sediments can wear and/or damage stormwater infrastructure, as debris and sediments pass through drainage pipes and abrade them.

### Existing Climate Change Preparedness Efforts

No existing climate preparedness efforts have been identified to mitigate the effects of storm events on stormwater infrastructure.

### Parallel Efforts with Climate Change Preparedness Benefits

#### *Updates to flood maps*

- Description: SCVWD is currently revising flood maps to update hydrology and hydraulics characteristics of the watersheds in the county. This effort could potentially be leveraged to incorporate projected changes in climate.

---

<sup>4</sup> Available online at

[http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Ca%20Water%20Service%20Co%20-%20Los%20Altos%20Suburban%20District/CWSC%20LA%20Appendix\\_H\\_-\\_GWMP.pdf](http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Ca%20Water%20Service%20Co%20-%20Los%20Altos%20Suburban%20District/CWSC%20LA%20Appendix_H_-_GWMP.pdf)

- Implementation Level: Vulnerability Assessment
- Relevant agencies: SCVWD and FEMA
- Documentation of efforts: Based on consultation with SCVWD staff.

## **Efforts Addressing Warmer Average Temperatures, Extreme Heat Events, and Precipitation Changes (Annual and Seasonal)**

As described in the Climate Variables Memo, studies indicate that, while annual precipitation is anticipated to change very little, seasonal precipitation patterns may change significantly. Winter precipitation is projected to increase by mid-century, with more precipitation falling during winter storm events; and less precipitation is projected in the spring and fall. A shift of precipitation timing away from the warmer seasons, coupled with warmer temperatures, could result in substantial impacts to the wastewater treatment plants and water supply plant and delivery services.

### **Description of Wastewater Treatment Plant and Collection Infrastructure Vulnerability**

Lower flows, as a result of precipitation changes and warmer temperatures, mean the concentration of any water pollutant will be higher given lower water volumes. Water with higher pollutant concentrations will need additional treatment processes in treatment plants. Operating treatment facilities with less water, but the same waste load taxes the treatment machinery and can increase cleaning needs and system corrosion.

### **Existing Climate Change Preparedness Efforts**

No existing climate preparedness efforts have been identified to mitigate the effects of warmer temperatures and precipitation changes on wastewater treatment plant and collection infrastructure.

### **Description of Water Treatment Plant and Delivery Infrastructure (e.g. Pipes, Pumps) Vulnerability**

The vulnerability of water treatment plant and delivery infrastructure is not hardscape infrastructure vulnerability, but rather resource vulnerability. The *supply* of water (to be treated and delivered by treatment and delivery infrastructure) is vulnerable to climate change variables.

Warmer air and water temperatures result in overall drier conditions, due to increased evaporation rates. Warmer temperatures also decrease the amount of snowpack in the Sierra Nevada Mountains and the subsequent runoff to the Hetch-Hetchy water supply system, which supplies approximately half of the water for Santa Clara County.

Precipitation changes exacerbate dry conditions, with less rainfall and longer dry periods. With less rainfall, there is less groundwater recharge, which decreases the groundwater supply from aquifers.

Existing usage records show that water use typically varies significantly seasonally between the summer (dry season) and the winter (wet season). During dry weather, water usage is much higher, primarily due to increased outdoor use for lawn and landscape watering. The spike in summer water use can be two to four times more water than the remainder of the year.

Given these supply and demand patterns, higher quantities of water will be demanded while water supplies are low: while warmer temperatures and longer dry periods are increasing evaporation (including reservoir evaporation), reducing imported supplies (Sierra snowmelt), and decreasing groundwater recharge, warmer temperatures and longer dry periods are causing people to demand larger quantities of water. As a result, the vulnerability to temperature and precipitation change is not infrastructure vulnerability, but rather a supply and demand vulnerability. As such, climate preparedness efforts focus on supply and demand management.

### **Existing Climate Change Preparedness Efforts**

No explicit climate preparedness efforts to mitigate the effects of warmer temperatures and precipitation changes on water treatment plant and delivery infrastructure were identified within the analysis.

### **Parallel Efforts with Climate Change Preparedness Benefits**

While not explicitly initiated as a climate change-related effort, the following efficiency and conservation initiatives could help mitigate the anticipated effects of warmer temperatures and precipitation changes.

#### ***Water-Wise House Call Program***

- **Description:** Free home water use survey that helps identify conservation opportunities & educate users on calculating water use and reading water meters, specifically:
  - Replace leaking toilet flapper valves if needed/requested
  - Measure showerhead flow rates & install free showerheads if needed/requested
  - Measure faucet flow rates & provide faucet aerators for kitchens & bathrooms
  - Evaluate irrigation system efficiency, and provide personalized irrigation schedule
  - Identify irrigation leaks, broken/mismatched sprinkler heads, high water pressure & other common irrigation problems
  - Prioritize water use efficiency measures
- **Implementation Level:** Parallel Effort with Climate Change Preparedness Benefits
- **Relevant agencies:** Santa Clara Valley Water District (SCVWD)
- **Documentation of efforts:** Information is available at <http://www.valleywater.org/programs/rebates.aspx>

#### ***Water Conservation Rebates***

- **Description:** Rebates are offered for the following water conservation efforts:
  - High-Efficiency Clothes Washer Rebates (residential and commercial)
  - High-Efficiency Toilet Rebates (residential and commercial)
  - Landscape Rebates (residential and commercial)
  - Submeter Rebates (condominium buildings and mobile home parks)
  - Commercial Rebates (miscellaneous other commercial appliances such as ice machines)
- **Implementation Level:** Parallel Effort with Climate Change Preparedness Benefits
- **Relevant agencies:** Santa Clara Valley Water District (SCVWD)
- **Documentation of efforts:** Unavailable.

### *Free Water Conservation Devices*

- Description: Program that offers educational materials and free devices, including:
  - Showerheads
  - Bathroom aerators
  - Kitchen aerators
  - Leak detection dye tablets
  - Toilet flappers
  - Shower timers
  - Water efficient landscaping and plumbing literature
  - Posters, flyers, signs, stickers, table tents, door hangers and bookmarks
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)
- Documentation of efforts: Information is available at <http://www.valleywater.org/programs/FreeConservationItems.aspx>

### *Water Efficient Landscape Ordinance (WELO)*

- Description: All Californian cities are obligated to notify the California Department of Water Resources (DWR) as to whether the City has adopted its own water-efficient landscape ordinance. In Santa Clara County, Sunnyvale, Palo Alto, Morgan Hill, Milpitas, Lynwood, Los Altos, Cupertino, and Campbell have adopted WELO's, which include restrictions on watering method, watering duration, lawn square footage, and so on.
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Department of Water Resources (DWR); City governments
- Documentation of efforts: Model Water Efficient Landscape Ordinance<sup>5</sup>.

### *Landscape Survey Program*

- Description: Free irrigation surveys for 5,000+ square feet of irrigated landscape - evaluates site specific water efficiency recommendations
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)
- Documentation of efforts: Information is available at <http://www.valleywater.org/Programs/LandscapeSurveyInformation.aspx>

### *Landscape Conversion Rebate Program*

- Description: Rebates for replacing high water-using landscape (i.e. irrigated grass) with a minimum of 50% plant coverage consisting of low water-using plants from an Approved Plant List
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)

---

<sup>5</sup> Available online at <http://www.water.ca.gov/wateruseefficiency/docs/MWEL009-10-09.pdf>; WELOs for individual cities also available online (links not included).



- Documentation of efforts: Information is available at <http://www.valleywater.org/Programs/LandscapeReplacementRebates.aspx>

### ***Irrigation Equipment Upgrade Rebates***

- Description: Rebates available for residents, businesses, or institutions for upgrading irrigation hardware to more water-efficient hardware
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)
- Documentation of efforts: Information is available at <http://valleywater.org/Programs/IrrigationEquipmentUpgradeRebates.aspx>

### ***Agricultural Water Use Efficiency***

- Description: Encourages efficient irrigation methods and scheduling to manage water supply/pumping costs and minimize fertilizer use by providing:
  - Irrigation system evaluations and calculators
  - California Information Management Irrigation System (CIMIS) Hotline
  - Mobile lab testing program
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)
- Documentation of efforts: Information is available at [www.valleywater.org/programs/agriculture.aspx](http://www.valleywater.org/programs/agriculture.aspx).

### ***Silicon Valley Advanced Water Purification Center***

- Description: District approved two agreements with City of San Jose to build an advanced water treatment facility (to be completed in early 2013) that will produce up to 10 MGD of highly purified recycled water to expand use for irrigation and industrial purposes
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: Santa Clara Valley Water District (SCVWD)
- Documentation of efforts: Information is available online at [www.valleywater.org/SVAWPC.aspx](http://www.valleywater.org/SVAWPC.aspx)

### ***South County Recycled Water Master Plan***

- Description: SCVWD and the South County Regional Wastewater Authority (SCRWA) partnered to develop the South County Recycled Water Master Plan to expand the use of recycled water to meet long-term water supply and wastewater needs in south Santa Clara County, specifically in and near the cities of Morgan Hill and Gilroy. The plan defines immediate-term, short-term, and long-term capital improvement programs
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: SCVWD; SCRWA

- Documentation of efforts: 2004 South County Recycled Water Master Plan<sup>6</sup>

#### ***Recycled Water Facility Plan***

- Description: Study that identified recommended projects for recycled water use, including a funding strategy and an implementation plan.
- Implementation Level: Strategy development
- Relevant agencies: City of Palo Alto Utilities (CPAU)
- Documentation of efforts: City of Palo Alto Recycled Water Facility Plan<sup>7</sup>

#### ***Drought management planning in local Urban Water Management Plans***

- Description: Each city within Santa Clara County prepares an Urban Water Management Plan (UWMP). Each UWMP includes drought planning and drought management measures (e.g. mandatory water use prohibitions at given drought levels; tiered water pricing to discourage excessive water consumption).
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: cities in Santa Clara County
- Documentation of efforts: All City UWMPs are available online via the individual City websites.

#### ***Water Saving Hero Campaign***

- Description: SCVWD and other Bay Area and state water agencies launched a media campaign in 2007 to encourage and educate residents about simple by effective steps to conserve water in daily residential use. The campaign was re-launched in 2008 and 2009.
- Implementation Level: Parallel Effort with Climate Change Preparedness Benefits
- Relevant agencies: SCVWD
- Documentation of efforts: Campaign website is [www.watersavinghero.com](http://www.watersavinghero.com)

#### **Description of Groundwater Aquifer and Reservoir Vulnerability**

As described in the previous section, warmer temperatures, coupled with shifts in seasonal precipitation, may result in lower flows with simultaneous increases in water demand. Greater demand, while supplies are depressed, may result in increasing withdrawal from groundwater aquifers. Lower flows in both local and imported water supplies may result in decreased groundwater recharge. The combination of increased pumping and decreased recharge can result in land subsidence.

#### **Existing Climate Change Preparedness Efforts**

No explicit initiatives were identified that prepare the sector for climate change-related increases in average temperatures, extreme heat events, and precipitation changes.

---

<sup>6</sup> Available online at

[http://www.cityofgilroy.org/cityofgilroy\\_files/city\\_hall/community\\_development/engineering/master\\_plans/SouthCountyRecWatMP.pdf](http://www.cityofgilroy.org/cityofgilroy_files/city_hall/community_development/engineering/master_plans/SouthCountyRecWatMP.pdf)

<sup>7</sup> Available online at <http://www.cityofpaloalto.org/civicax/filebank/documents/15103>

### **Parallel Efforts with Climate Change Preparedness Benefits**

Existing efforts to mitigate aquifer overdraft and the subsequent land subsidence include water conservation measures and incentives (discussed in the previous section) and concerted recharge programs.

#### ***Groundwater Recharge***

- **Description:** Under SCVWD's management, approximately one quarter of all imported water (from the South Bay Aqueduct and the Santa Clara Conduit) is devoted to groundwater recharge. The current recharge program includes 10 reservoirs, 393 acres of percolation ponds, and 159 miles of conduits and pipelines. Groundwater levels are monitored and maintained above specified thresholds, even during drought times. SCVWD surveys hundreds of benchmarks annually and collects data from two 1,000-foot deep compaction wells to help monitor land subsidence. Subsidence has been essentially arrested since 1969.
- **Implementation Level:** Parallel Effort with Climate Change Preparedness Benefits
- **Relevant agencies:** Santa Clara Valley Water District (SCVWD)
- **Documentation of efforts:** Information is available at <http://pubs.usgs.gov/circ/circ1182/pdf/05SantaClaraValley.pdf>

### **Efforts Addressing Wildfires**

Wildfires can potentially cause water quality contamination from increased erosion and sedimentation, leading safety and health risks.

#### **Description of Groundwater Aquifer and Reservoir Vulnerability**

The gap analysis did not identify efforts to mitigate future climate change-related wildfire impacts on groundwater aquifers and reservoirs.

#### **Existing Climate Change Preparedness Efforts**

No explicit initiatives were identified that prepare the sector for climate change-related increases in wildfires.

### **Parallel Efforts with Climate Change Preparedness Benefits**

While no climate change-focused initiatives were identified, existing efforts have been in place for decades to manage wildfires in the county.

## **Key Actors and Decision Makers for Climate Change Adaptation Planning and Implementation**

The water and wastewater sector consists of a network of public and private agencies, each of which has a role to play in advancing climate change adaptation planning. These agencies are identified below, along with a description of their roles.

#### **State Regulatory Agencies**

- **California Department of Water Resources (DWR):** This agency is responsible for the conservation, management, development, and sustainability of California's watersheds, and

water resources. DWR also partners with other agencies to prevent and respond to water-related natural disasters such as floods and droughts. DWR plays an important role in advancing climate change adaptation.

- California State Water Resources Control Board (SWRCB): As one arm of the California Environmental Protection Agency (CEPA), the SWRCB is entrusted with a broad mandate to preserve and enhance the state water resources. Working jointly with DWR, the SWRCB administers the Integrated Regional Water Management Coordination Committee (IRWMCC). The IRWMCC is a nine-county effort to manage water resources in the Bay Area, including a consideration of climate change impacts.

### Municipal Governments

- Local governments have the ability to advance climate change adaptation planning at the community scale. Local governments can incorporate climate change considerations into their locally enforceable general plans. Specifically with regard to the water and wastewater sector, local governments can influence water use in their communities by making revisions to City policies and codes to encourage water conservation. Along with Santa Clara County, the cities in the County will play a crucial role in the implementation of local level adaptation strategies that will be identified as part of this project.

### Utilities

Santa Clara County receives water and wastewater services primarily from municipal public utilities, both City-owned and investor-owned (San Jose Water Company). Municipal utilities can incorporate climate change considerations into their operations.

### Stakeholder Agencies

Other stakeholder agencies that help manage and direct the water and wastewater sector in Santa Clara County include:

- Santa Clara Valley Water District (SCVWD): SCVWD is a Special District, responsible for wholesale water provision and water resource management in Santa Clara County. SCVWD works to understand the risks posed by climate change to water supplies and water resources, and addresses these risks in planning processes. As the primary (wholesale) water provider, responsible for dams, reservoirs, recharge ponds, and water treatment plants, SCVWD has the ability to advance climate change adaptation planning through infrastructure adaptation projects and voluntary water conservation incentive programs.
- South County Regional Wastewater Authority (SCRWA): SCRWA is a joint powers authority (JPA) established to manage wastewater treatment in the Cities of Gilroy and Morgan Hill. Together with SCVWD, the SCRWA operates a wastewater treatment plant and a recycled water facility.
- Joint Powers Authority (JPA) between San Jose and Santa Clara: the JPA operates the San Jose/Santa Clara Water Pollution Control Plant, a wastewater treatment plant that services the Cities of San Jose, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Monte Sereno, and Saratoga.

## Summary of Existing Efforts to Address Vulnerabilities

Table 2 summarizes existing efforts in the water and wastewater sector to address anticipated impacts from climate change in the region. In terms of mitigating vulnerabilities, the most developed measures relate to threats to water supply. Warmer air temperatures and changes in precipitation patterns, such as longer dry periods and seasonal shifts in precipitation timing, could result in water supply challenges, where flows are lower, water demand is high, and storage reserves are diminished. To combat these water supply challenges, a number of programs exist to encourage water conservation. Rebate programs for water efficient fixtures, sub-meters, and landscape types are all ongoing efforts by SCVWD to reduce water demand, especially in residential, agricultural, and landscape uses. Several supply-side initiatives are underway regarding recycled water, including the construction of a recycled water plant, and several implementation projects and funding studies for recycled water facilities. While not yet at construction or operation stages, these plans indicate a real, near-term commitment to expanding recycled water infrastructure, which would alleviate some water supply concerns by increasing water supply. A third mitigation effort is the comprehensive drought response plans included in the city-scale urban water management plans (UWMPs). Each city in Santa Clara County has a UWMP with a mandated drought response plan that outlines water use restrictions, conservation campaigns, and pricing for various drought scenarios. A detailed framework, with thresholds and directions, for dealing with drought conditions represents a valuable adaptation resource in the event of drought emergencies. The potential for land subsidence during dry times (where aquifers are overdrawn and recharge is constrained) is well-managed by SCVWD, with a concerted recharge program and regular monitoring of land and water levels.

These water conservation programs, planning efforts for recycled water, and recharge efforts represent the climate change preparedness strengths in the water and wastewater sector, in particular to mitigate water supply challenges. Informational tools, media campaigns, and rebate programs exist, in well-established ways, to moderate water usage and decrease water demand. Implemented, operational programs inform residents and businesses about water conservation and supply them with devices (or rebates for devices) for water-efficiency. The commitment (of funds) to detailed studies and planning work for recycled water (as well as the ongoing construction and commissioning of the Silicon Valley Advanced Water Purification Center in San Jose) paves the way for future implementation of recycled water supply infrastructure. The well-established groundwater recharge program has essentially held land subsidence in check for the past several decades.

## Silicon Valley 2.0 - Climate Preparedness Gap Analysis

**Table 2: Existing Efforts to Address Water and Wastewater Sector Climate Change Vulnerabilities**

Climate Change Variable	Asset	Macro-category of Effort	Description of Effort	Climate Change Preparedness Category	Stakeholder
Sea Level Rise and Storm Surge	Water and Wastewater Plant and Delivery System (Pipes; Pumps)	Policy/Planning	Vulnerability assessment of water and wastewater sector assets; development of high-level strategies to address these vulnerabilities; and coordination of regional water and wastewater issues	Vulnerability Assessment; Adaptation Strategy Development (high-level)	SCVWD
Sea Level Rise (Saltwater intrusion)	Groundwater Aquifers	Programmed Effort Monitoring/ Measuring Policy/Planning	Saltwater Intrusion Prevention Program operated to shut down high-risk wells that could act as conduits for saltwater intrusion. Subsequent monitoring and commissioning/decommissioning ordinances are still in effect.	Parallel Effort with Climate Change Preparedness Benefits	SCVWD
Extreme rainfall events	Water and Wastewater Plant and Delivery System (Pipes; Pumps)	Programmed Effort Monitoring/ Measuring	Revision of flood maps to update hydrology and hydraulics characteristics of the watersheds in the county.	Parallel Effort with Climate Change Preparedness Benefits	SCVWD
Warmer Temperatures; Precipitation Changes	Water Supply Plant and Delivery Systems (Pipes; Pumps)	Education/Communication/Out reach Water Demand Reduction	Numerous rebate and conservation / efficiency programs for water use conversation in residential, commercial, and agricultural arenas	Parallel Effort with Climate Change Preparedness Benefits	SCVWD
Warmer Temperatures; Precipitation Changes	Water Supply Plant and Delivery Systems (Pipes; Pumps)	Policy/Planning	Inclusion in all City UWMPs of drought response and management plans	Parallel Effort with Climate Change Preparedness Benefits	Municipal Governments
Warmer Temperatures; Precipitation Changes	Water Supply Plant and Delivery Systems (Pipes; Pumps)	Policy/Planning	Planning efforts to increase the consumption and production capacity of recycled water	Parallel Effort with Climate Change Preparedness Benefits	SCVWD; SCRWA; CPAU
Warmer Temperatures; Precipitation Changes	Groundwater Aquifers	Programmed Efforts Monitoring/Measuring	Network of conduits, reservoirs, and percolation ponds, fed by imported water, to recharge groundwater aquifers; continual monitoring of benchmark points, compaction wells, and groundwater levels	Parallel Effort with Climate Change Preparedness Benefits	SCVWD
All	Multiple	Policy/Planning	Inclusion of climate change discussion in high-level planning document (IRWMP) for water / wastewater resources	Overall climate change adaptation planning	SCVWD and others

## Summary of Existing Gaps in Climate Change Preparedness Efforts in the Water and Wastewater Sector

Table 3 provides a summary of existing efforts and gaps in the water and wastewater sector climate change preparedness efforts. The table lists the existing vulnerabilities of various assets in the energy sector to climate change variables, along with an identification of whether climate change preparedness efforts are in place to address these vulnerabilities, as well as a qualitative rating of the level of those climate change preparedness efforts.

The major gap lies in considering climate change impacts in water and wastewater infrastructure upgrades. Treatment plants, as an infrastructure unit, will be more and more subject to flooding as sea level rises. Conveyance structures will experience increased wear and tear from more frequent and intense storms and storm surges. Underground pipes in coastal areas will be subjected to corrosive saltwater and backflow. Gravity-fed networks may require new or increased pumping mechanisms, as sea level rises. These infrastructure “hardware” concerns are largely unaddressed by policy and programmed efforts, representing the major gap in the sector’s regional climate change preparedness.

**Table 3: Level of Climate Change Preparedness Efforts in the Water and Wastewater Sector**

Climate Change Variable	Assets/Services Affected	Nature of Impact	Existing Climate Change Preparedness Efforts?	Level of Regional Climate Change Preparedness
Sea Level Rise and Storm Surge	Wastewater treatment plant and collection infrastructure; water supply plant and delivery infrastructure (e.g. pumps, pipes)	- Permanent or temporary inundation of coastal, low-lying treatment plants - Inundation of below-ground pipes with corrosive saltwater	Yes	Medium
	Freshwater Aquifers	- Sea level rise-induced saltwater intrusion into coastal freshwater aquifers	No	None, but Parallel Efforts Exist
	Stormwater infrastructure	- Loss of stormwater infrastructure capacity near the coast (impairment of gravity-fed systems)	No	None
Storm events	Stormwater infrastructure	- Increased turbidity and debris can tax and/or damage stormwater infrastructure	No	None, but Parallel Efforts Exist
Warmer Average Temperatures, Extreme Heat Events, and Precipitation Changes (Annual and Seasonal)	Wastewater treatment systems	- Lower flows, and higher concentrations of water pollutants will require additional treatment processes in treatment plants	No	None
	Water treatment systems	- Overall drier conditions, due to increased evaporation rates will increase demand for water and require additional water treatment	No	None, but Parallel Efforts Exist
	Groundwater Aquifers	- Warmer temperatures and shifts in seasonal precipitation, may result in lower flows, increased water demand and increased withdrawal from aquifers	No	None, but Parallel Efforts Exist