Upper Pajaro Watershed Setting Report

Prepared for the Upper Pajaro Watershed Plan

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Chapter 1 Introduction

Valley Water has played a critical role in managing water resources in Santa Clara County since 1929, first overseeing the County's water supply, and later adding flood risk mitigation and environmental stewardship to its responsibilities. As the water resources infrastructure built over the last century ages, it has become clear that the cost of repairing and replacing critical infrastructure is high, monetarily and environmentally. How can Valley Water learn from the past and incorporate the best of our current collective knowledge to build a better future for water resources management? The best approach is looking to watersheds. Watersheds are, by nature, interconnected systems. The water within them must be managed in ways that acknowledge and respond to the local ecosystem, geology, and hydrology. It is within the context of a watershed that communities either have too much water, too little water, or poor-quality water. It is within the watershed context that communities must reconcile their water demands with the imperative to sustain the resource for future generations.

A watershed plan is a way to account for and address water resources and environmental needs holistically. One Water is Valley Water's framework for watershed management, intended to assess existing environmental and physical systems, identify areas needing improvement, and prioritize future actions to address deficiencies. As part of this process, One Water seeks to collaborate with many jurisdictions, agencies, and other stakeholders and firmly establish Valley Water's commitment to multi-benefit projects. Through the One Water program, Valley Water will create a Watershed Plan for each of the five watersheds in Santa Clara County. This Upper Pajaro Watershed Setting Report (Setting Report) was prepared to inform the Upper Pajaro Watershed Plan (Plan).

This Setting Report describes past, present, and anticipated future conditions in the Upper Pajaro watershed with respect to Land Use, Ecological Resources, Water Supply, Water Quality, and Flood Risk Reduction. It considers historical records, establishes a baseline for present conditions, and a discusses trends, opportunities, and challenges that will frame the future of the watershed's management. This Setting Report also identifies existing needs and deficiencies with respect to ecosystem stewardship, flood protection, water supply and water quality to inform the priority actions discussed in Chapter 3 of the Plan.

Where is the Pajaro River Watershed?

The Pajaro River Watershed is a 1,300 square-mile catchment area draining portions of the Santa Cruz, Gabilan, and Diablo Mountain Ranges. The Pajaro River is approximately 30 miles long, originating near San Felipe Lake on the border of Santa Clara and San Benito counties, and flowing southwest into the Monterey Bay. The Pajaro River has five major tributaries that drain into it and hundreds of minor tributaries. Major tributaries include the San Benito River and Corralitos, Uvas, Llagas and Pacheco creeks. Figure 1-1 illustrates the location and extent of major hydrologic features found within the watershed.

The Pajaro watershed overlaps portions of four counties situated south of San Francisco Bay: Santa Cruz, Santa Clara, San Benito, and Monterey (see Figure 1-1). Major cities within the Pajaro River Watershed include, Morgan Hill, Gilroy, portions of southern San Jose, and the community of San Martin in Santa Clara County; Watsonville and the community of Corralitos in Santa Cruz County; and Hollister, San Juan Bautista, and the communities of Ridgemark, Tres Pinos, and Paicines in San Benito County. The Pajaro Watershed is home to a population of approximately 265,000 people (U.S. Census Bureau, 2019).

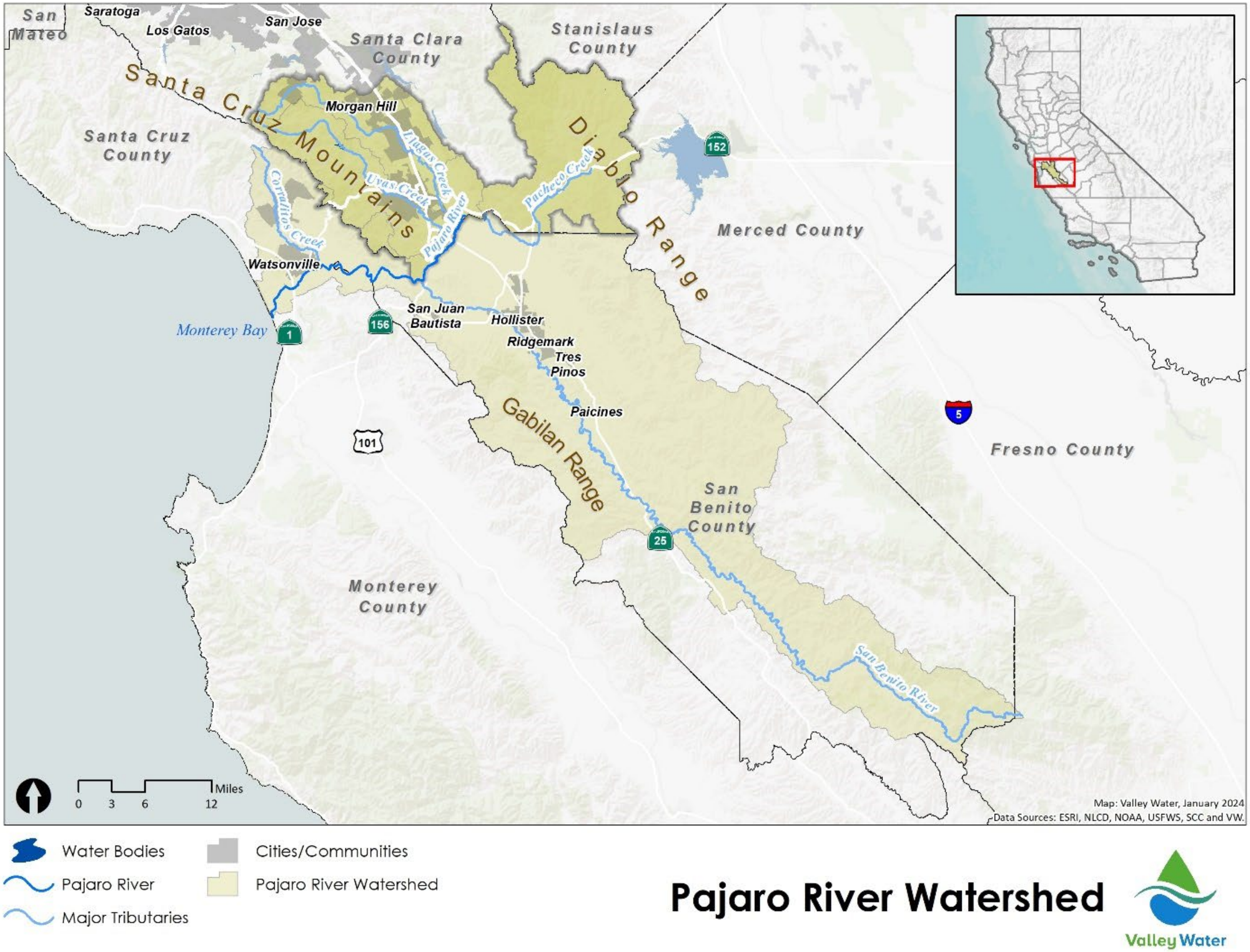

Figure 1-1: Pajaro River Watershed

UPPER PAJARO WATERSHED

360

Watershed area in square miles

353

Approximate total length in miles of creeks in watershed

110

Approximate total length in miles of major creeks

83

Approximate total length of Valley Water owned or easement creek

The scope of this Plan focuses on the portion of the Pajaro watershed within Santa Clara County, referred to as the Upper Pajaro watershed (also referred to as the Uvas/Llagas watershed at Valley Water). The Upper Pajaro watershed, with area limits highlighted in Figure 1-2, is located within Valley Water's service area.

The Upper Pajaro watershed is composed of five subwatersheds illustrated in Figure 1-3. The five subwatersheds, Pajaro River, Uvas Creek, Llagas Creek, Pacheco Creek, and Tequisquita Slough, are portions of the watershed further delineated into smaller hydrologic units. Approximately 5% of the Tequisquita Slough subwatershed is located within Santa Clara County with the remainder located in San Benito County. Accordingly, this area has been excluded from the Plan scope.

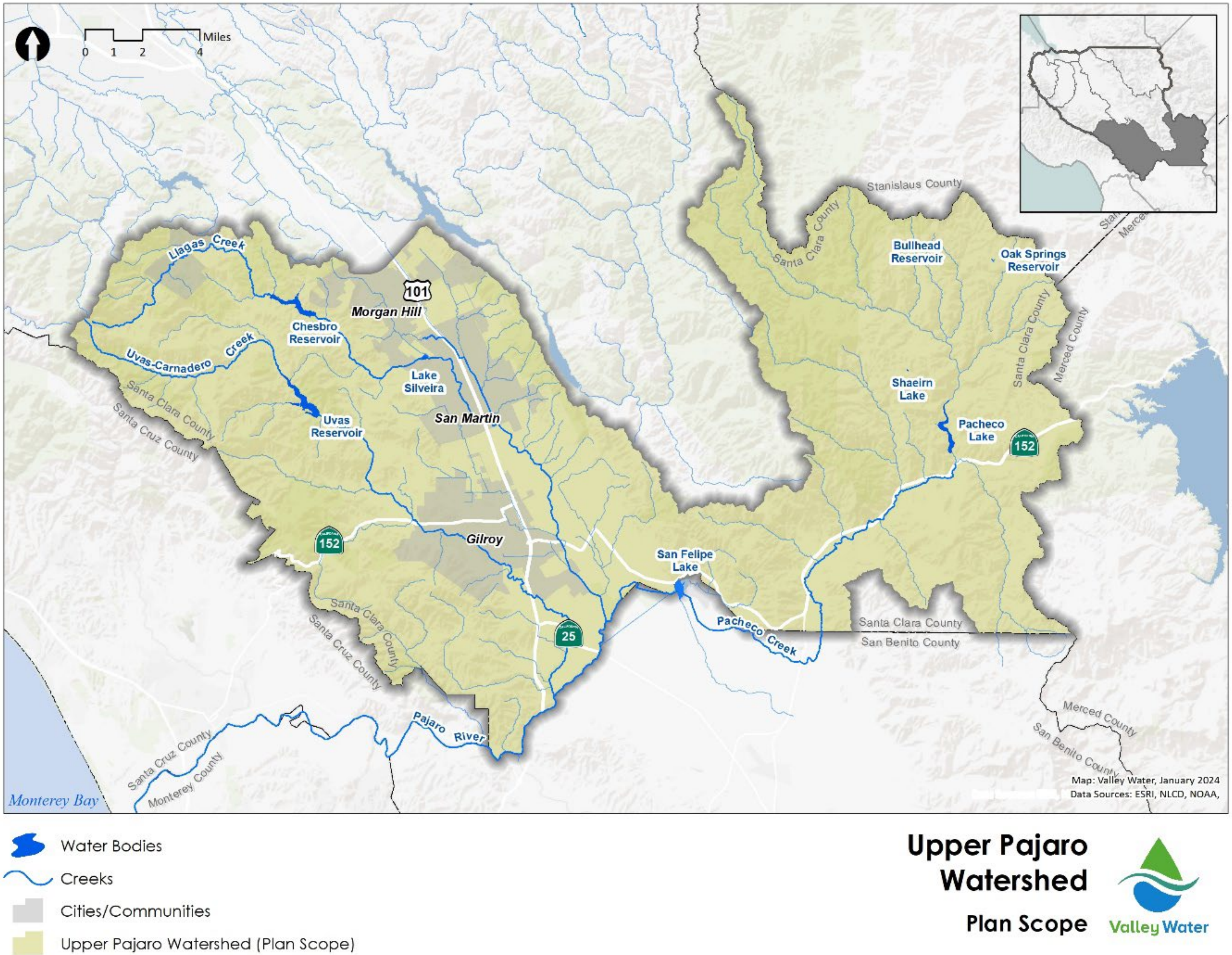

Figure 1-2: Upper Pajaro Watershed Plan Scope

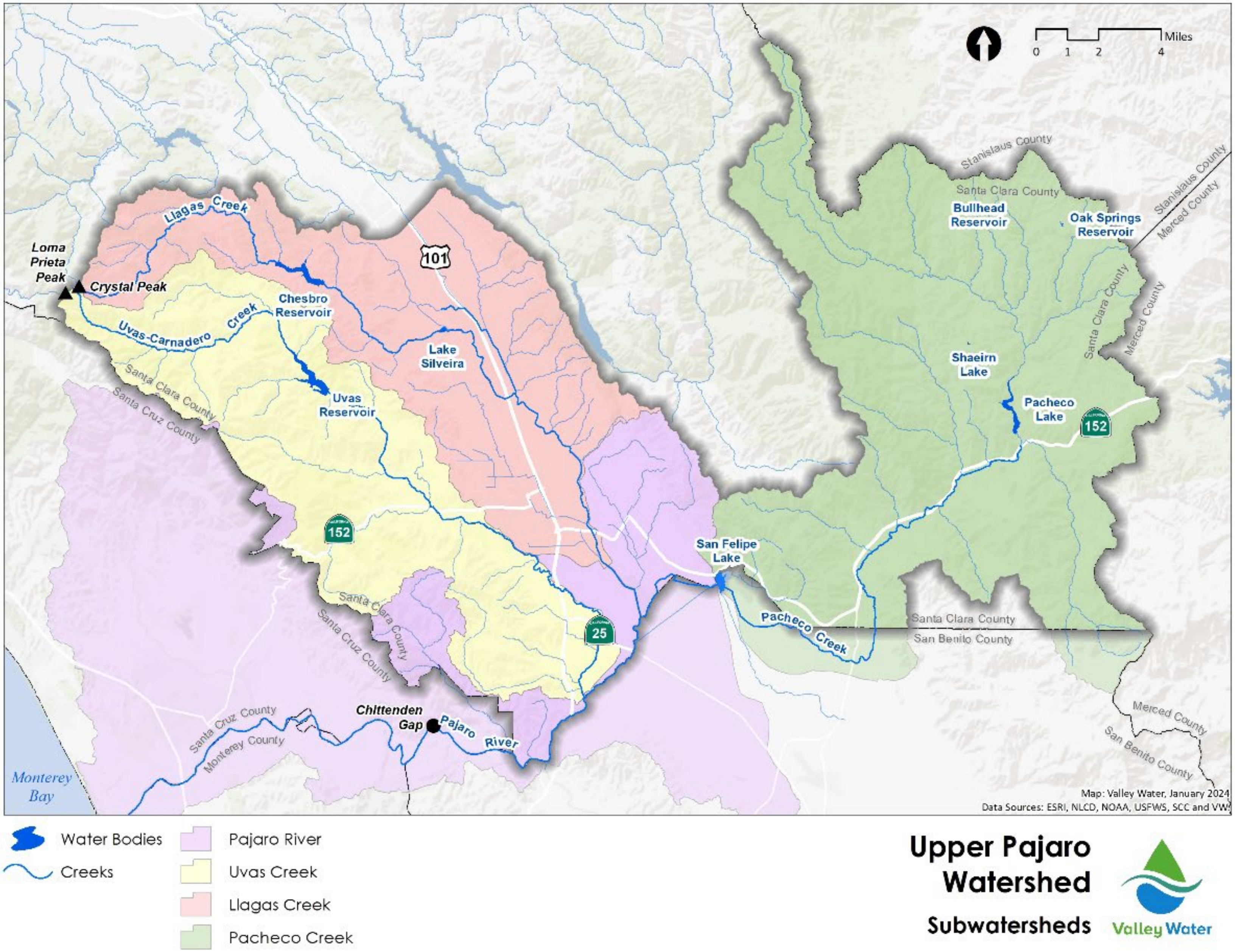

Figure 1-3: Subwatersheds of Upper Pajaro Watershed

Uvas Creek Subwatershed

The Uvas Creek subwatershed drains the eastern slopes of the Santa Cruz Mountains in the southern areas of the County. Its primary drainage is Uvas Creek, a 29.5-mile stream originating on Loma Prieta and a confluence with the Pajaro River along the southern County boundary. The creek flows through Uvas Canyon County Park in its upper reaches and is impounded by Valley Water's Uvas Reservoir near San Martin. Uvas Dam and Reservoir are located about two miles upstream from the intersection of Watsonville and Uvas Roads. The reservoir's capacity is 9,688 acre-feet of water and it has a surface area of approximately 287 acres. Below Uvas Reservoir, Uvas Creek passes through the Uvas Creek Preserve and the Christmas Hill Park in Gilroy. Below Highway 101, the creek is known as Uvas-Carnadero Creek. Major tributaries to Uvas Creek include Little Uvas Creek, Little Arthur Creek, Bodfish Creek, Gavilan Creek, Tick Creek and Tar Creek.

Llagas Creek Subwatershed

The Llagas Creek subwatershed drains a portion of the Santa Cruz Mountains, Morgan Hill, San Martin, and Gilroy via Llagas Creek, a perennial 31-mile stream tributary to Pajaro River. Llagas Creek's headwaters are on the eastern side of Crystal Peak near Loma Prieta and its confluence with the Pajaro River along the southern County boundary. Valley Water's Chesbro Dam and Reservoir impound Llagas Creek in the hills to the west of Morgan Hill. Chesbro Reservoir has a storage capacity of 7,967 acre-feet of water and a surface area of approximately 271 acres. Below Chesbro Reservoir, Llagas Creek passes by the Church Avenue Ponds in Gilroy, a system of off-stream groundwater recharge ponds that can be supplied with local water from a stream diversion on Llagas Creek. Major tributaries to Llagas Creek include West Little Llagas Creek, East Little Llagas Creek, and San Martin Creek.

Pacheco Creek and Pajaro River Subwatersheds

The Pacheco Creek subwatershed drains a portion of the Diablo Range in the southeastern portion of the County via Pacheco Creek, an 18-mile stream. To the north of Highway 152, the Pacheco Creek's north fork is impounded by the Pacheco Reservoir, which has an operational capacity of 5,500 acre-feet of water and an approximate surface area of 197 acres. The Pacheco Reservoir was created by the construction of the North Fork Dam in 1939 and is owned by the Pacheco Pass Water District. The North and South Forks of the Pacheco Creek converge to form the mainstem of Pacheco Creek below the Pacheco Reservoir, which flows alongside Highway 152 until reaching San Felipe Lake to the southeast of Gilroy in San Benito County. San Felipe Lake is the small northeast remnant of the larger Soap Lake floodplain that retains seasonally lake-like conditions today. The Pajaro River's mainstem begins just west of San Felipe Lake and follows the southern County boundary through agricultural areas, ultimately continuing into Santa Cruz and Monterey Counties and draining into the Monterey Bay.

Chapter 2 Land Use

Land use describes the use, management, and modification of land by humans. Land use designations present in the Upper Watershed include agricultural, residential, commercial, industrial, and recreational, among others Land use practices can have specific and cumulative positive or negative effects on the environment, the economy, and on human health and safety (Environmental Protection Agency, 2021). While Valley Water does not have land use planning authority, land use decisions made by other jurisdictions within Valley Water's service area directly affect the work that Valley Water does in providing Santa Clara County residents with safe, clean water flood protection, and environmental stewardship. This section presents past, present and anticipated future land use trends in the Upper Pajaro Watershed in order to provide a basis to identify challenges and opportunities with respect to land use.

2.1 Past Conditions

Native Land Management (Pre-1769)

The earliest evidence of human presence within the Upper Pajaro watershed dates to approximately 4,200 years ago (Grossinger et al., 2008). Prior to the Spanish occupation in 1769, the Upper Watershed was inhabited by the Amah Mutsun and Awaswas people, as illustrated in Figure 2-1. The Amah Mutsun and Awaswas belong to the larger Ohlone peoples, a group of more than 50 distinct landholding groups dispersed across the Monterey Bay and San Francisco Bay regions. The Amah Mutsun community was historically comprised of approximately 20 to 30 contiguous villages throughout the Pajaro River Basin. Today, Awaswas people are members of the Amah Mutsun Tribal Band (Amah Mutsun Tribal Band, 2023).

Many of the written records describing Indigenous land use and management prior to Spanish occupation are derived from the accounts of Spanish explorers. These records indicate that the Ohlone people fished, hunted, and gathered within the Upper Watershed (Grossinger et al., 2008). Abundant evidence of fire management was also documented within the upper watershed, such as the use of controlled fires to manipulate vegetation patterns and maintain or increase plant productivity (Grossinger et al., 2008). Native land management declined rapidly in the early 19^{th} century due to forced relocation of Indigenous people, and a combined effect of disease and genocide brought about by the Spanish colonization (Grossinger et al., 2008).

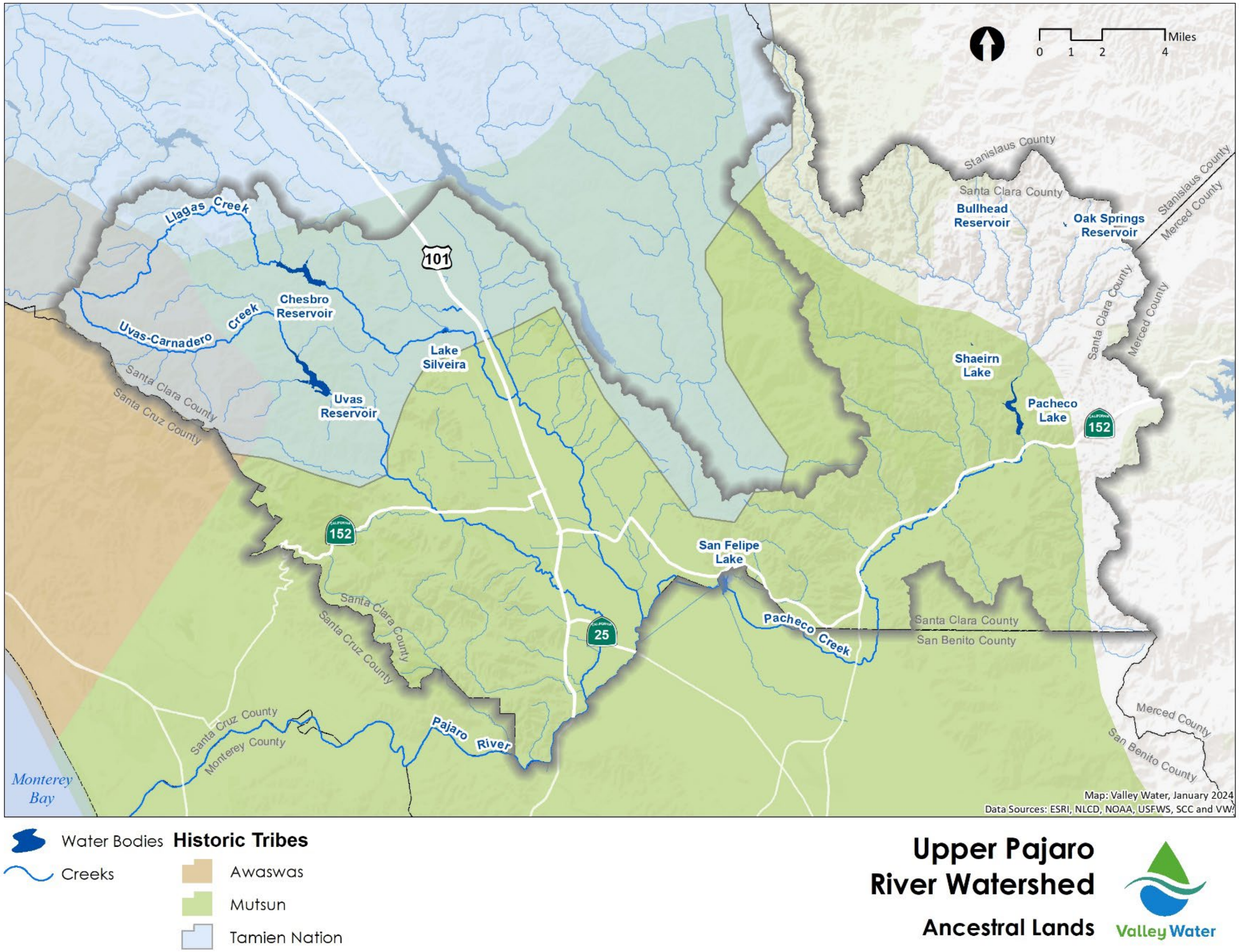

Figure 2-1: Indigenous Land

Colonial Land Management (1769-1822)

Spanish explorers first entered the vicinity of the Upper Pajaro watershed arrived in 1769 and established the San Juan Bautista Mission in 1797 within a few miles of the Pajaro River (San Jose, 2021). The Mission introduced livestock into the area, mainly cattle and sheep, which introduced ranching activities to the region and required a water source. Water for livestock was provided by the wet meadows and the low-lying areas in the south Santa Clara Valley. Early records from the San Juan Bautista Mission indicate that the Mission owned between 10,000 to 11,000 cattle and between 9,500 to 15,000 sheep in the period between 1816 to mid-1820s (Grossinger, et al., 2008, p. 20).

Mexican Era Land Management (1822-1846)

With the passing of the Secularization Act of 1833 under Mexican rule, the Missions' land holdings declined rapidly, and land ownership was transferred to prominent Mexican residents (Milliken, Shoup, & Ortiz, 2009). These private land grants were called Ranchos. During this process, the Ohlone people were ignored by the land grantees and became the servants of the rancheros or Ranch owners (Campbell & Moriarty, 1969). By 1836, the San Juan Bautista Mission livestock holdings had dwindled to 869 cattle and 4,120 sheep and no livestock was present by 1842 (Grossinger, et al., 2008, p. 21).

At the same time, the Mission system was diminishing, private land and livestock holdings increased. Most rancheros used their newly acquired land grants for cattle and sheep grazing and to cultivate home gardens. As a result, while the Mission era livestock holdings decreased to the point of becoming non-existent, the livestock density of private landowners increased even higher than at the peak of the Mission era (Grossinger, et al., 2008, p. 22)

The Gold Rush Era (1846-1874)

In 1851, in the midst of the Gold Rush, the U.S. Congress passed the *Ascertain and Settle Private Land Claims in the State of California Act*. This Act placed the burden of proof of title on landowners where rancheros were required to prove the validity of the land grants they had received and establish exact boundaries. The burden of defending their land claims left many rancheros financially strained and forced many to sell part or all of their lands to the new American settlers and gold seekers (Grant, 2021).

A combination of climatic factors, such as the Great Flood of 1862, which affected most of the state, followed by the extreme drought of 1862-1864, diminished open range, cattle-ranching operations within the Upper Watershed. This decline in cattle ranching brought about important land use changes as new settlers and ranchers turned to sheep, dairy cattle, and wheat cultivation in the lowlands which had richer soils and relegated heavier cattle operations to upland areas (Grossinger, et al., 2008, p. 23)

During and following the drought period, sheep overtook cattle as the primary livestock reared in the Upper Pajaro watershed. However, by the end of the 1880s, historical references and descriptions pertaining to large sheep herds began to disappear. This was attributed in part to the development of the Southern Pacific Railroad in the area in the late 1860s, which opened new markets for farmers in the Upper Watershed who before had no efficient way to move perishable products north to the San José and San Francisco markets (Grossinger, et al., 2008, p. 24).

Agricultural Expansion (1874-1930)

By the early 1870s, residents in the area in need of water for irrigation and other land operations began to drill for artesian wells. Due to the seemingly ample free-flowing artesian[1] water source, alfalfa and orchards, largely dependent on irrigation, began taking center stage in the area, just as wheat production became less profitable. Artesian water wells in combination with the Southern Pacific Railroad made fruit and dairy products valuable markets for the communities of Gilroy and Morgan Hill (Grossinger, et al., 2008, p. 25). In 1870, the Town of Gilroy was incorporated as a city, with early city leaders lobbying for railroad access. In 1869, a connecting rail line was completed which made Gilroy an agricultural hub (City of Gilroy, 2021). In 1906, Morgan Hill became an incorporated city. By the 1920's, Morgan Hill was known for its agricultural products including prunes, apricots, peaches, pears, apples, walnuts, and almonds (City of Morgan Hill, 2021).

The low-lying land around the confluences of Llagas and Uvas creeks with Pajaro River, called "willow land" (present day Soap Lake), was particularly attractive to pasture dairy cattle. One of the first dairies in the southern Santa Clara Valley, Rea's dairy, was founded in South Gilroy in 1863 on drained willow land along Carnadero Creek (lower Uvas Creek). By the late 1890s, Gilroy's principal product was cheese, producing 1,300,000 pounds annually, which was about one fifth of the entire product in California (Grossinger, et al., 2008, p. 27).

Historical records indicate that in the year 1890, orchards covered only 10% of the agricultural land in Santa Clara Valley, but by 1905 the City of Gilroy was described to have "half the prune and apricot trees in the United States" (Grossinger, et al., 2008, p. 29). By the 1930s, approximately 65% of the total cropland in south Santa Clara County was covered in orchards, mainly prunes. With the exception of poorly drained areas such as lower Llagas Creek, the Soap Lake areas and wetlands east of Gilroy, which remained alfalfa, dairy farms and grazing land, the alluvial valley floor between Morgan Hill and Gilroy was densely planted with deciduous fruits and grapes (Grossinger, et al., 2008, p. 29).

Modern Agricultural and Urban Growth (1930-2000s)

By the 1930's row crops began to penetrate the Upper Watershed landscape. While orchards still dominated the well-drained alluvial soils within the Pacheco Valley and north of Gilroy, low-lying areas to the south and east of Gilroy were dominated by vegetable crops. By the 1980s, orchards were no longer the dominant agricultural land use. This continues today where crops such as lettuce, bell peppers, spinach, garlic and mushrooms are dominant in the area (Grossinger, et al., 2008, p. 36). After the 1960s, particularly in the City of Gilroy, tomatoes, sugar beets, and garlic began dominating the landscape (City of Gilroy, 2021).

In the 1970s, the Upper Watershed landscape began to shift from an agricultural base to an urban service-oriented area with a thriving suburban residential community concentrating around the major cities of Gilroy and Morgan Hill and the community of San Martin. Growth began to accelerate in the latter part of the 20th century as Santa Clara County transformed into the heart of Silicon Valley and high-tech workers were attracted to the area in search of a small-town atmosphere and reasonable house prices (City of Morgan Hill, 2021). This growth trend continues to date. In the 1980s and 1990s, population expansion in the southern Santa Clara Valley began to outpace growth in the north valley.

[1] Artesian: Relating to or denoting a well bored perpendicularly into water-bearing strata lying at an angle, so that natural pressure produces a constant supply of water with little or no pumping (Oxford Dictionary).

Gilroy tripled in size between 1970 and 2000, to 41,464 people. In that same period, Morgan Hill grew to six times its population, to 33,556, ranking as the County's 10th largest city and approaching Gilroy's size (Grossinger, et al., 2008, p. 37).

2.2 Present Conditions

The type and distribution of land uses throughout a watershed have profound impacts on stream corridors, groundwater recharge, flooding, and water quality, among other aspects. Land use within the Upper Pajaro Watershed is a combination of urban and rural, with significant agricultural, ranchland and open space areas. Generally, urbanized areas are surrounded by less developed land on the valley floor and adjacent uplands dominated by ranches and open space. Figure 2-2 shows a map of Santa Clara County General Plan (General Plan) Land Use Designations (Santa Clara County Planning Office, 1994) in the watershed and Figure 2-3 breaks down land use types by percentage of total watershed area (Santa Clara County Planning Office, 2016).

Riparian Corridors

As shown in Figure 2-2, land uses along the watershed's major creeks and rivers vary considerably. In the northwestern portion of the watershed, Uvas-Carnadero Creek and Llagas Creek traverse open spaces and ranchlands in the Santa Cruz Mountains upstream of the Uvas and Chesbro reservoirs, respectively. Below the reservoirs, these creeks flow south into the Santa Clara Valley. Uvas-Carnadero Creek flows through residential areas in southern Gilroy and crosses Highway 101 near Bolsa Road, ultimately crossing agricultural fields and Highway 25 just before its confluence with the Pajaro River along the southern County boundary. Llagas Creek flows west of Morgan Hill before turning east to flow through residential and commercial land uses in southern Morgan Hill and San Martin. It crosses Highway 101 just north of Masten Avenue and travels through agricultural lands east of Gilroy, ultimately crossing Highway 152 before its confluence with the Pajaro River along the County boundary. Pacheco Creek, including its north fork above the Pacheco Reservoir and south fork, primarily flows through ranchlands and protected open space in the eastern portion of the watershed. The mainstem below the Pacheco Reservoir travels alongside Highway 152 and briefly crosses into San Benito County before reaching San Felipe Lake. The Pajaro River's mainstem begins just west of San Felipe Lake and follows the southern County boundary through agricultural areas, ultimately continuing into Santa Cruz and Monterey Counties.

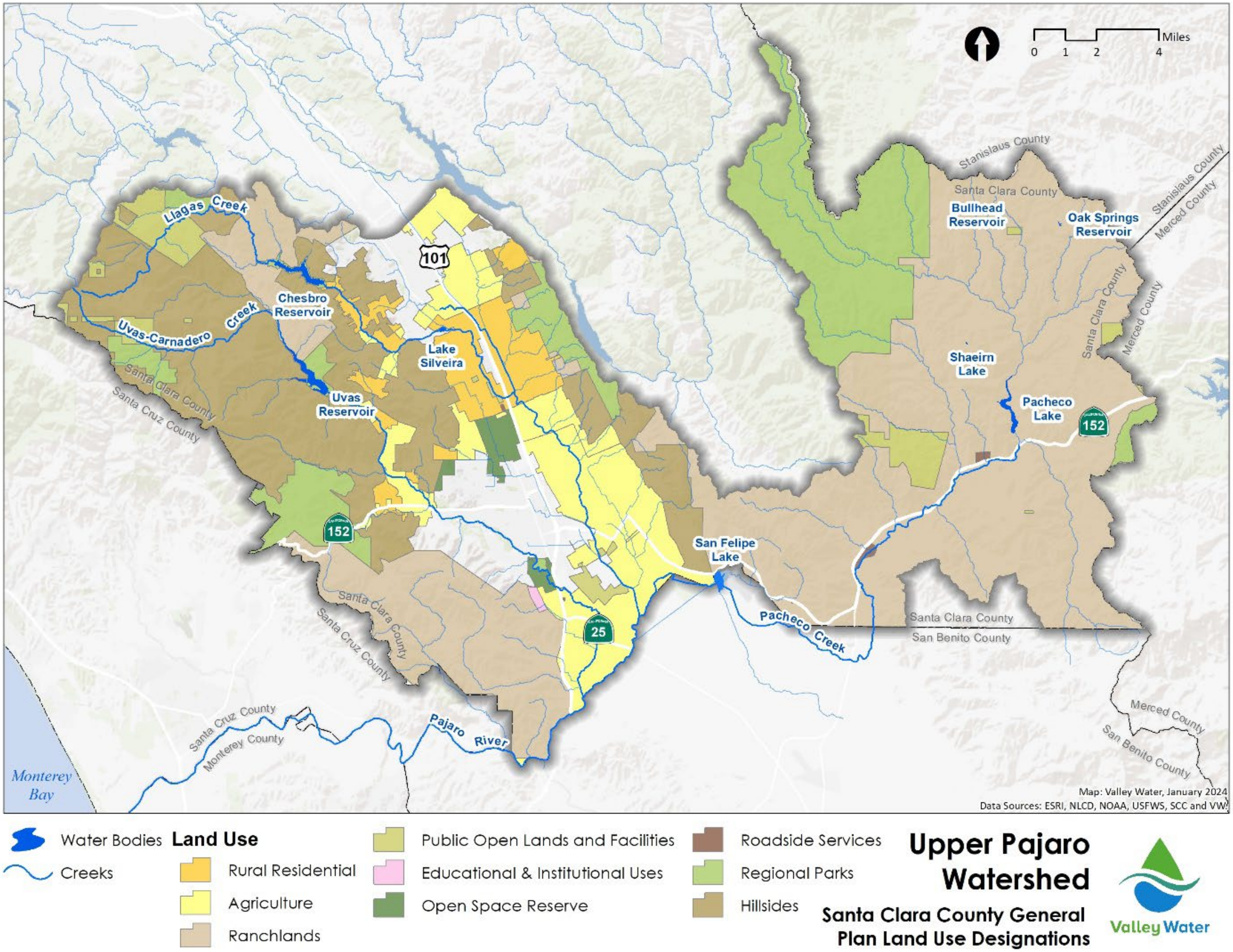

Figure 2-2: Non-Urban Land Use in the Upper Pajaro Watershed

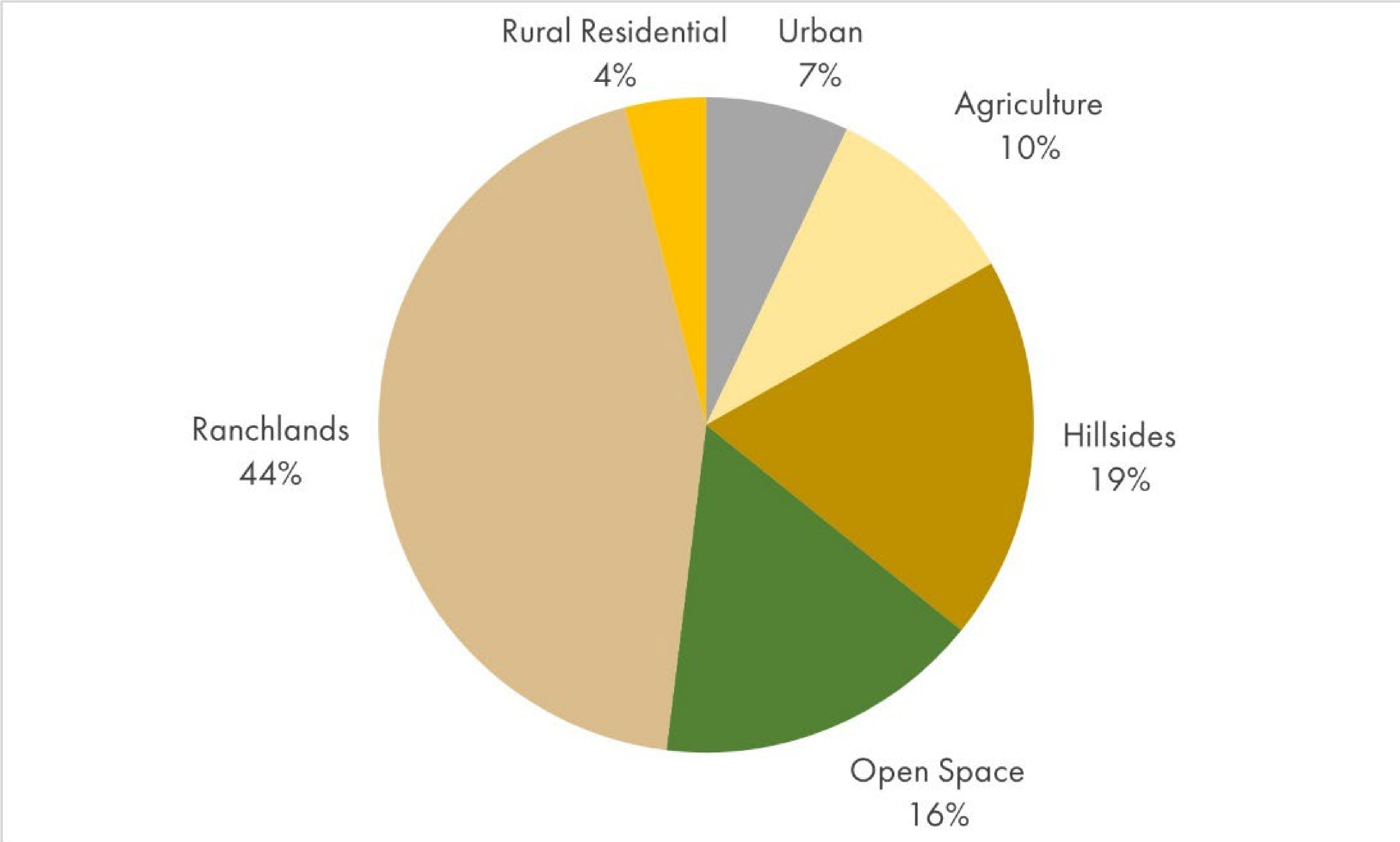

Figure 2-3: Upper Pajaro Watershed Land Uses by Percentage

Urban Areas

Urban landscapes and activities influence watersheds by virtue of creating impermeable surfaces, generating polluted runoff, and disturbing natural land covers, among other impacts. These types of impacts can be reduced or managed with a variety of strategies, such as urban greening, low impact development, and green stormwater infrastructure.

About 8% of the watershed's area is comprised of urban or suburban land uses, with rural, low-density residential occupying about 4%. The cities of Gilroy and Morgan Hill along with the unincorporated community of San Martin are entirely within the watershed. General Plans for the cities and County contain land use designations and zoning policies to regulate acceptable land uses. General plans also establish urban boundaries to limit sprawl and impacts of new development on existing city services while preserving open space, agriculture, and other natural resources. The cities of Gilroy and Morgan Hill have established urban service areas (USAs), which define the area within city limits where basic infrastructure and services for urban development are provided. Both cities are largely built out within their USAs. As of 2020, Gilroy reached a population of 59,520 and Morgan Hill reached a population of 45,483 (US Census Bureau QuickFacts, 2023a-b). Additional residential development may occur on their edges, especially on western and eastern edges along hillsides, to accommodate further population growth.

Transportation Infrastructure

Major roadways traverse north-south and east-west in the watershed, with roadways concentrated in and around Gilroy and Morgan Hill. Highway 101 is the major north-south route in the area that serves interregional traffic and provides local connections to Gilroy, San Martin, Morgan Hill, and other cities in the County. Highway 101 connects with other major transportation routes, including Highways 152 and 25. Highways 152 is an east-west route that traverses through the Santa Cruz Mountains, Gilroy, and Pacheco Pass within the watershed. The Santa Clara Valley Transportation Authority (VTA) provides local and regional bus services in Gilroy, Morgan Hill, and San Martin, and regional commuter rail service is provided by Caltrain (operated by the Peninsula Corridor Joint Powers Board) with stops at the Morgan Hill and Gilroy stations.

Agricultural Areas and Ranchlands

Agricultural fields and pastures are permeable and may contribute to groundwater recharge and absorption of flood waters. These working landscapes can also provide buffer habitats, migratory corridors, and ecosystem services that benefit the watershed. However, farmlands and ranchlands also disturb natural land cover and can be a source of pollutant runoff that impacts downstream areas.

Despite its urbanization, the watershed predominantly maintains a rural character marked by significant agricultural and ranching uses. Farmlands and ranchlands predominate the watershed, combining to span across approximately 54% of the Upper Watershed. Farmlands occupy approximately 9% of watershed land and are primarily located on the valley floor outside of Gilroy and Morgan Hill. An array of crops are grown on these farmlands, including nursery crops such as vegetable seedlings, fruit trees, and shrubs, mushrooms, lettuces, bell peppers, and tomatoes (Santa Clara County Department of Agriculture, 2023).

Ranchlands occupy vast portions of the watershed as shown in Figure 2-3, accounting for approximately 45% of its land area. According to the General Plan, ranchlands are lands predominantly used for livestock ranching in rural unincorporated areas of the county, remote from urbanized areas and generally less accessible than other mountain lands (Santa Clara County Planning Office, 1994). A large area of contiguous ranchlands is present in the eastern portion of the watershed, to the north and south of the Highway 152 corridor and surrounding Pacheco Reservoir. Other significant ranching areas include hillsides south of Gilroy and east of Highway 101 and west of Morgan Hill. In addition to serving as working lands, these ranchlands contain important ecological resources, as described in Section 2.5.

Open Space

Along ranchlands, open space is prevalent throughout the watershed. The General Plan classifies open spaces according to the following designations (Santa Clara County Planning Office, 1994):

- Open Space Reserve (OSR) lands include rural unincorporated areas contiguous to a USAs for which no permanent land use designation has been applied pending future studies of desired long term land use patterns.
- The Regional Parks designation is applied to publicly accessible park lands of the County, cities, state, and federal agencies which serve a region-wide population.
- The Other Public Open Lands designation is applied to lands in Open Space which are owned by various public agencies for purposes other than public parks and general recreational use.
- The Hillsides designation is applied to mountainous lands and foothills unsuitable and/or unplanned for annexation and urban development.

Collectively, these open spaces comprise approximately 34% of the watershed's land area. As shown in Figure 2-2, lands designated as open space and hillsides are widely distributed. Major parks and open space areas in the watershed include portions of Henry Coe State Park, Coyote Lake County Park, Calero Reservoir County Park, and the entirety of Mount Madonna County Park, Uvas Reservoir County Park, Uvas Canyon County Park, Chesbro Reservoir County Park, Rancho Cañada del Oro Open Space Preserve, and Cañada de Los Osos Ecological Reserve.

2.3 Future Conditions, Challenges, and Opportunities

Challenges

Jurisdictional Complexity

Valley Water does not have authority over city or countywide land use and development patterns. The ability to directly regulate land use lies with individual cities and the County, which establish zoning and general plan designations and have the authority to approve development proposals. As such, Valley Water has little influence over land use. This represents a fundamental challenge to Valley Water's ability to provide flood protection and steward natural resources in the Upper Pajaro Watershed.

Access and Equity

A disadvantaged community is an area whose residents are disproportionately impacted by a combination of economic, health, and environmental burdens, such as poverty, high unemployment, environmental pollution, the presence of hazardous waste, or environmental degradation. These communities often are comprised of people who have suffered historical discrimination based on race, color, national origin, tribe, culture, income, immigration status, or English language proficiency. Disadvantaged communities in the Upper Pajaro Watershed, shown in Figure 2-4, are both a challenge and an opportunity for Valley Water, and are a focus of the Racial Equity Diversity and Inclusion (REDI) Office. Conducting meaningful outreach to engage disadvantaged communities in planning and decision-making processes and ultimately providing them with the resources and services they have historically lacked are critical Valley Water priorities.

Climate Change

Climate change is recognized as a threat multiplier for natural disasters like wildfire, drought, severe storms, and floods. These natural disasters historically occur in the Upper Pajaro Watershed and climate change will continue to enhance their potential severity and frequency. As such, promoting land use planning that accounts for climate-related risks and development practices that promote climate adaptation should be central to land use decision-making moving forward.

Opportunities

Land Use Coordination

By identifying linkages between One Water and the General Plans of Gilroy, Morgan Hill, and the County, Valley Water and its partners can work together to support mutual goals. Shared goals for the watershed include the protection of water supplies and quality, water conservation, promoting efficient water use and reuse in new developments by requiring water-efficient fixtures and appliances as well as drought tolerant landscaping, access to open space, riparian protection, and green stormwater infrastructure.

Ecological Connectivity

Since much of the open spaces and recreational areas in the watershed are not owned by Valley Water, partnerships to enhance ecological connections are a critical piece to making progress. Prioritizing, protecting, and expanding linkages between habitats can benefit flood risk reduction and water quality as well as the environment. Similarly, acquiring land for use as open space or recreation in locations near waterways can provide opportunities to expand floodplains and enhance natural processes.

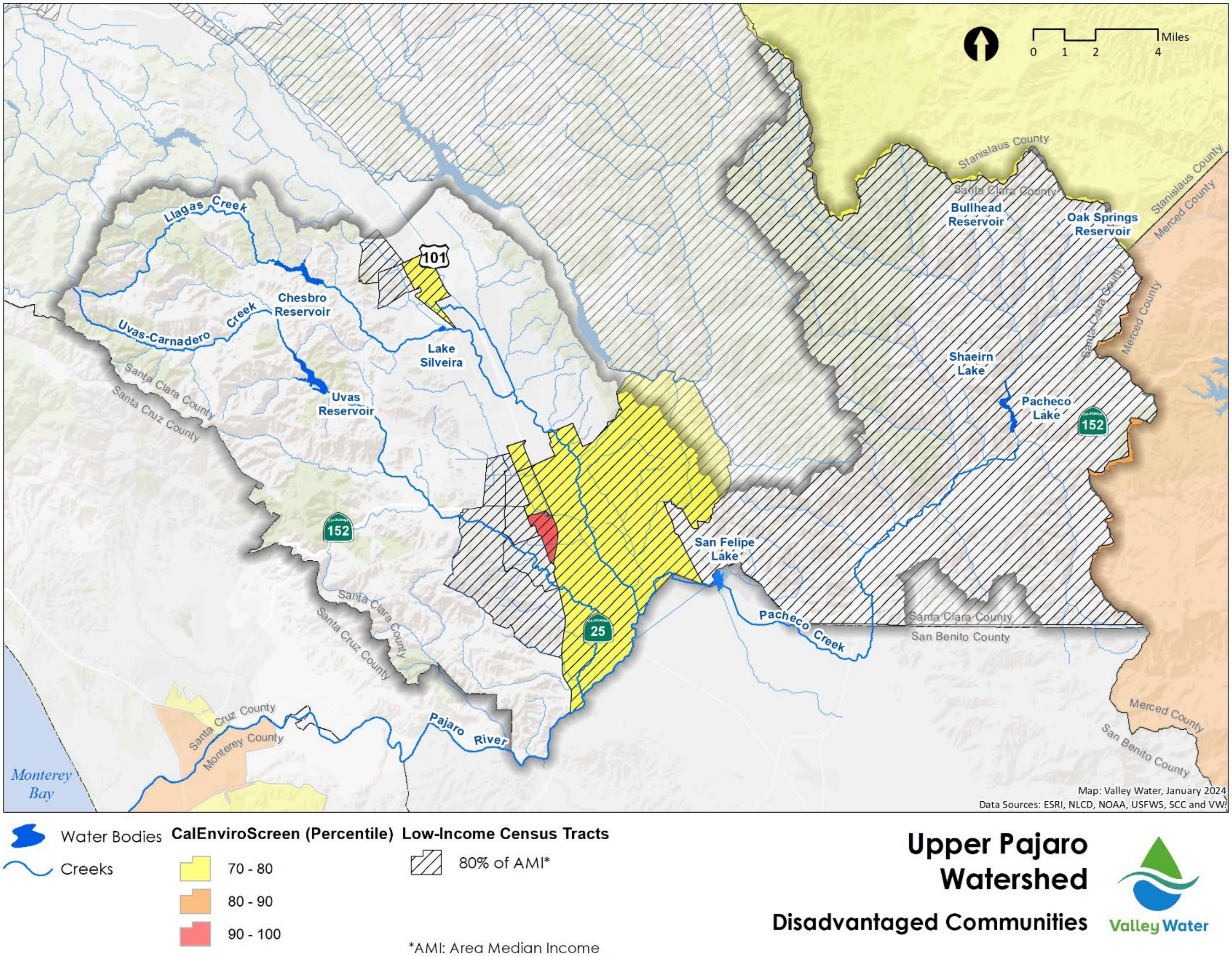

Figure 2-4: Upper Pajaro Watershed Disadvantaged Communities

Chapter 3 Ecological Resources

The Upper Pajaro watershed has a diversity of habitats and plant and wildlife species. Only 10% of the watershed, limited to the valley floor, has been intensely developed for residential and commercial land. While over 50% of the watershed supports irrigated agriculture and pastures for grazing, these land uses – particularly grazing – provide some value for wildlife and can be compatible with adjacent habitats and associated wildlife. These habitats, landscape features, and fish and wildlife are ecological resources that provide ecosystem services, may be protected by state and federal regulations, and are threatened by habitat fragmentation, land conversion and development intensification, invasive species, and climate change (The Pajaro Compass, 2016). As such, the Watershed's ecological resources are essential elements of integrated planning. This section summarizes historical and current ecological resource conditions to provide context that can inform strategies and priorities for conservation, enhancement, and restoration of ecological resources.

3.1 Past Conditions

Historically, southern Santa Clara Valley supported a diverse array of habitats, from dense valley oak woodlands in the north to wetland mosaics in the south (Grossinger et al., 2008). Figure 3-1 depicts a conceptual landscape model of habitat patterns in southern Santa Clara County prior to widespread Euro-American modification (Grossinger et al., 2008). Many of the physical characteristics, like topography and high groundwater, that shaped these habitats remain today, at least in part. The influence of the watershed's native peoples, however, is gone. appropriate for persistent or modified physical conditions, ensuring conservation strategies are effective and resilient.

Oak Woodlands and Grasslands

Oak woodlands once covered most of the northern now-developed portion of the Upper Pajaro Watershed. Their extent in southern Santa Clara Valley has been reduced by 98% as a result of clearing and land use conversion (Grossinger et al. 2008). Outside of the valley floor however, oak woodlands, grassland, and chaparral scrub habitat persist due to large tracts of undeveloped land in the hills and mountains of the watershed.

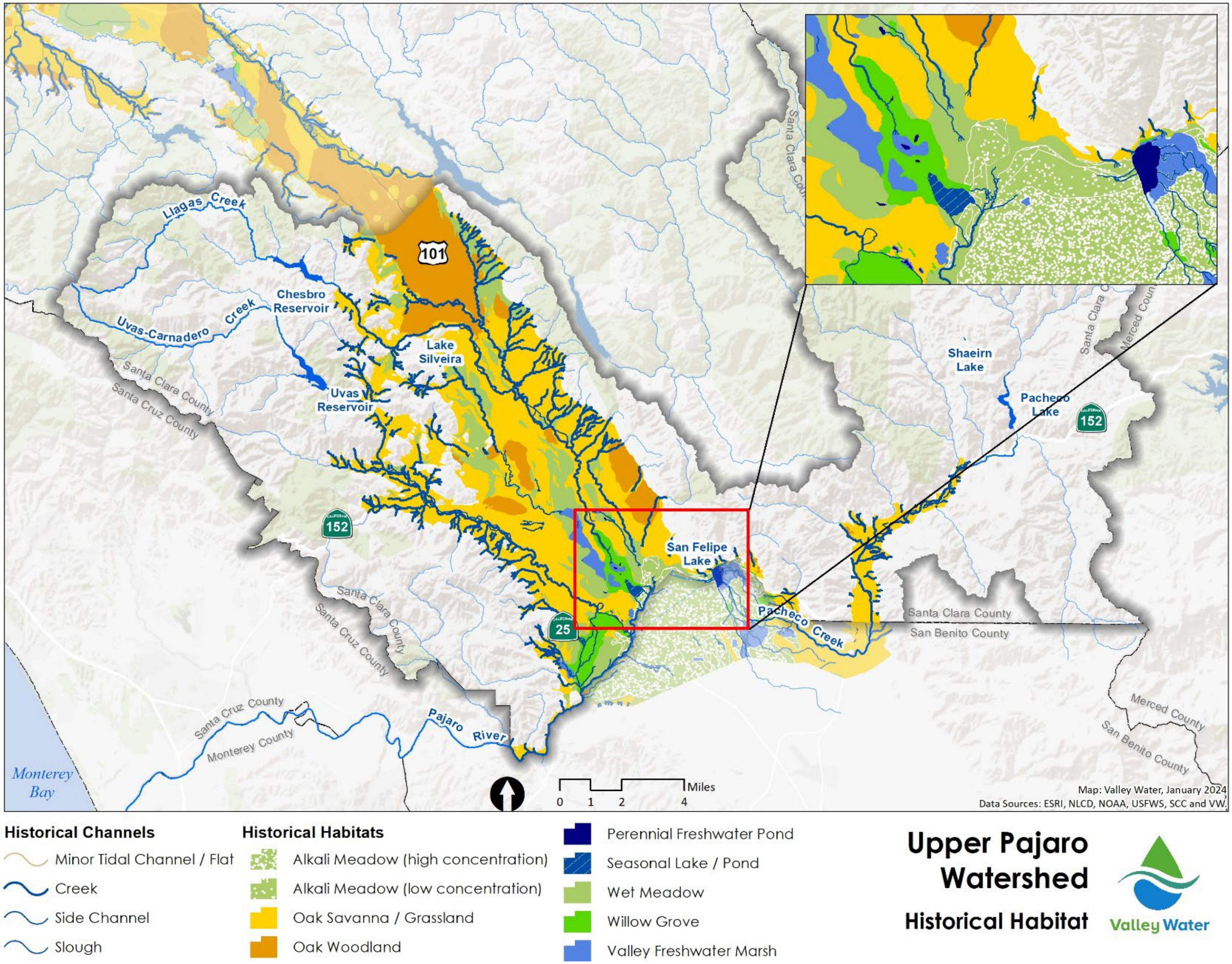

Figure 3-1: Historical Habitat Patterns in Southern Santa Clara County and Northern San Benito Counties (Grossinger et al., 2008).

Creeks and Rivers

Prior to Euro-American settlement, the drainage network in the southern Santa Clara Valley was discontinuous and diffuse. In the hills, steeper topography and narrower valleys contained streams in defined channels. Once those channels met the flatter and wider valley floor, streams typically did not follow a defined course, but rather sank into broad, braided alluvial fans, recharging groundwater, or where soils were finer and groundwater levels higher, spreading into sloughs and wetlands (Figure 3-1). Some stream reaches, like Uvas-Carnadero, Llagas, and Pacheco creeks, were intermittent, characterized by dry reaches in summer and high, but relatively short duration, winter pulse flows. These diverse and dynamic historical riverine processes were some of the primary drivers, along with topography, geology, and groundwater, that shaped the types and conditions of historical natural communities around creeks. Concerns over flood risk and streambank erosion in developed areas, as well as the historical desire to effectively drain agricultural, commercial, and residential areas, resulted in over 100 miles of creek being channelized, lined in concrete, or placed into underground culverts (Lowe et al. 2016).

Willow Groves, Wet Meadows, and Marsh

Historically, the streams of the southern Santa Clara Valley converged with Pacheco Creek and other smaller drainages from the east into the Bolsa (Spanish for "pocket"). This low-lying area bridging the Santa Clara-San Benito County line was part of a 22,000-acre wetland complex prior to Euro-American drainage efforts (Figure 3-1). The area has alternatively been called San Felipe Sink (Milliken et al. 1993), the Pajaro Plains (Taylor 1850), and the Soap Lake floodplain (RMC 2005). Multiple streams spread runoff and fine sediment from the hills over this flat lowland area, building and supporting extensive sloughs and seasonal wetlands. Due to the evaporation of seasonal ponds, the Bolsa soils were prone to high salinity. As a result, these soils had limited agricultural value, but did contribute to the areas cattle industry, providing late-summer pasture when the hills were dry. The small northeast remnant of the Soap Lake floodplain that retains seasonally lake-like conditions today is referred to as San Felipe Lake.

In addition to the seasonal wetlands, the stream channels and sloughs draining into and running along the valley floor fed the high groundwater table and, from occasional flooding, supported 1,700-2,000 acres of perennial freshwater marshes and willow groves (Grossinger et al., 2008). Most of these wide riparian forests were cleared for timber, fuel, and farming. Levees and the land uses they protected limit the width of riparian corridors in much of the valley floor. Downstream of major dams, however, riparian vegetation adapted to perennial flow has expanded and become denser due to water releases in the summer and fall for groundwater recharge (Grossinger et al., 2008).

Pathogens

Chytrid fungus and ranavirus are emerging pathogens that can cause mass mortality of amphibians. Both have been detected in Santa Clara County (Valley Water 2021) but no mass mortality has yet been documented in the Upper Pajaro Watershed. Prevention in the Upper Pajaro Watershed is of utmost importance to protect amphibian species.

3.2 Present Conditions

The following sections provide a summary of the ecological resources of the Upper Pajaro Watershed, with an emphasis on resource condition, and key opportunities and challenges to conserving and enhancing these resources. The information presented in this section is intended to concisely explain the need for recommended actions in the Plan and provide the essential elements of a watershed approach[2] to identifying appropriate and most essential areas for conservation and enhancement.

Natural communities are an assemblage of plant and animal species that co-locate in the same habitat or area and interact through functional ecological relationships. The major creeks and rivers, primary land cover types and associated natural communities found in the Upper Pajaro watershed are mapped in Figure 3-2, listed in Table 3-1, and described in more detail below. Several of these natural communities, depending upon co-occurring species and habitat quality, are considered sensitive by California Department of Fish and Wildlife (CDFW 2018) and, as such, are required to be analyzed under CEQA and serve as focal points for conservation and enhancement efforts that preserve biodiversity. The diversity and extent of natural communities of the Watershed support about 80 special-status wildlife and plant species (Table 3-2), though it is important to note that sensitive natural communities do not always contain special-status species. Descriptions of present-day ecological resources in the watershed are presented by natural community type, with a strong emphasis on the riverine and riparian communities that Valley Water works in.

[2] Watershed Approach refers to an analytical process for evaluating the environmental effects of a proposed project and making decisions that support the sustainability or improvement of aquatic resources in a watershed (State Water Resources Control Board 2021). The term is used by regulatory agencies with permitting authority over projects that involve waters under the jurisdiction of the United States and State, including the United States Army Corps and Regional Water Quality Control Boards.

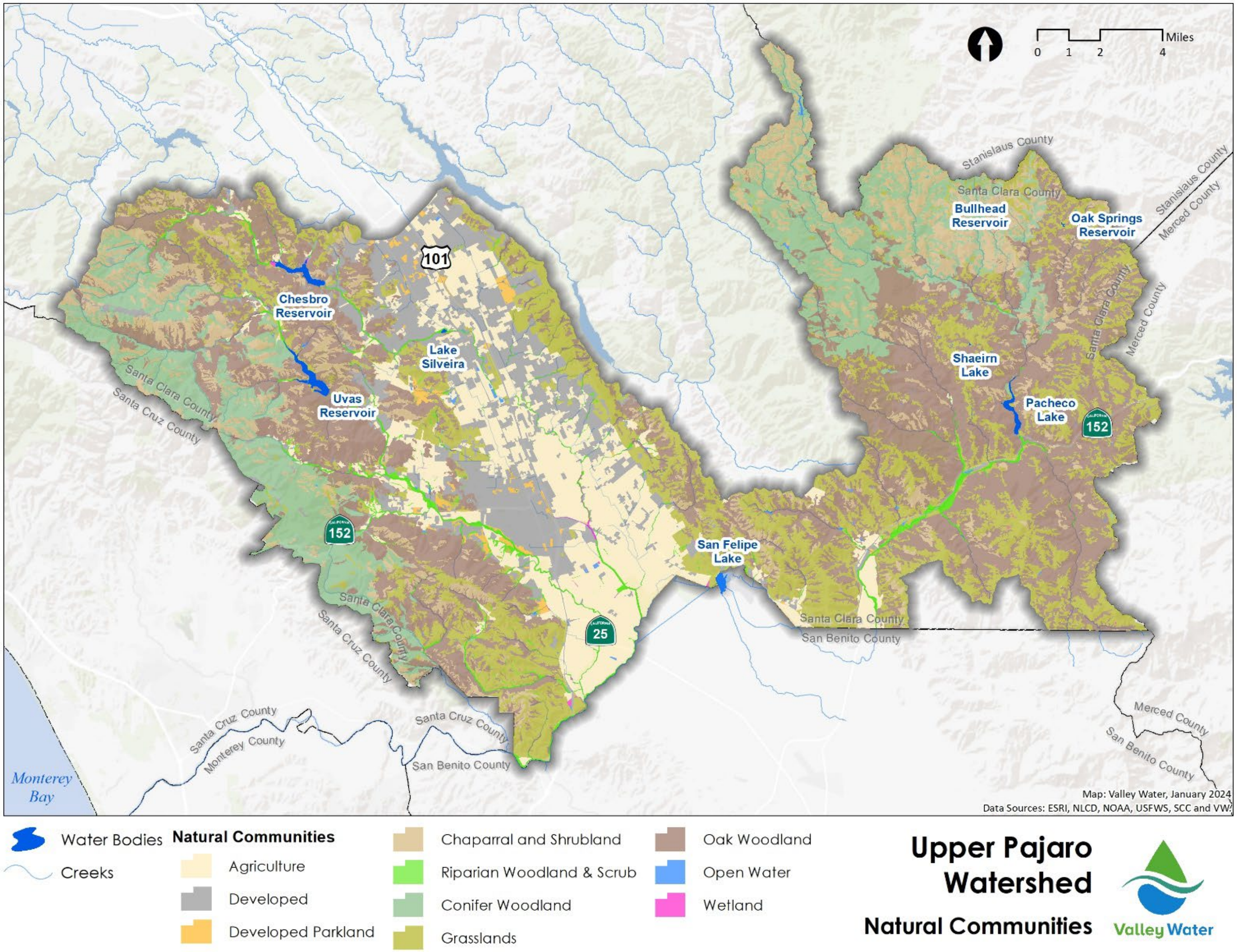

Figure 3-2: Natural Communities of the Upper Pajaro Watershed

Table 3-1: Natural Communities and Land Cover Types of the Upper Pajaro Watershed

Natural Communities	Acres	Percent of Watershed	Detailed Land Cover Type	Acres	Percent of Watershed
Oak Woodland	73,027	32%	Blue Oak Woodland	7,991	3%
			Coast Live Oak Forest and Woodland	14,777	6%
			Mixed Oak Woodland and Forest	45,230	20%
			Valley Oak Woodland*	5,029	2%
Grasslands	45,184	20%	California Annual Grassland	43,351	19%
			Rock Outcrop	60	<1%
			Serpentine Bunchgrass Grassland*	1,701	1%
			Serpentine Rock Outcrop*/ Barrens	72	<1%
Conifer Woodland	29,579	13%	Foothill Pine - Oak Woodland	14,086	6%
			Knobcone Pine Woodland	704	<1%
			Mixed Evergreen Forest	5,156	2%
			Ponderosa Pine Woodland	3	<1%
			Redwood Forest*	9,630	4%
Agriculture	28,079	12%	Agriculture Developed	1,440	1%
			Grain, Row-crop, Hay and Pasture, Disked	23,521	10%

			Orchard	1,728	1%
			Vineyard	1,390	1%
Chaparral and Shrubland	26,208	11%	Coyote Brush Scrub	49	<1%
			Mixed Serpentine Chaparral*	2,189	1%
			Northern Coastal Scrub / Diablan Sage Scrub	5,867	3%
			Northern Mixed Chaparral / Chamise Chaparral	18,103	8%
Developed	21,993	10%	Barren	47	<1%
			Landfill	82	<1%
			Rural Residential	8,910	4%
			Urban - Suburban	12,954	6%
Riparian Woodland and Scrub	3,499	2%	Central California Sycamore Alluvial Woodland*	203	<1%
			Mixed Riparian Forest and Woodland	2,379	1%
			Willow Riparian Forest and Scrub	917	<1%
Developed Parkland	1,372	1%	Golf Courses / Urban Parks	1,283	1%
			Ornamental Woodland	89	<1%
Open Water	1,148	0.5%	Pond	494	<1%

			Reservoir	654	<1%
Wetland	189	0.1%	Coastal and Valley Freshwater Marsh*	137	<1%
			Seasonal Wetland*	39	<1%
			Serpentine Seep*	13	<1%
Totals	**230,278**	**100%**		**230,278**	**100%**

* = sensitive land cover as defined by the Santa Clara Valley Habitat Plan or the California Natural Plant Community List.

Sources: ICF International. 2012. Santa Clara Valley Habitat Plan Land Cover. Available at: https://scv-habitatagency.org
California Department of Fish and Wildlife. 2022. California Natural Community List. Available at: https://wildlife.ca.gov/Data/VegCAMP/Natural-Communities

Table 3-2: Special-Status Species of the Upper Pajaro Watershed

Scientific Name	Common Name	Listing Status[1]	Associated Natural Communities
		Invertebrates	
Danaus plexippus	Monarch butterfly	FC[3]	Grassland, riparian, wetland, woodland, urban
Euphydryas editha bayensis	Bay checkerspot butterfly	FT	Chaparral scrub, grassland, wetland (serpentine seep)
Bombus crotchii	Crotch's bumble bee	CC[2]	Chaparral scrub, oak woodland, grassland
Fish			
Cottus gulosus	Riffle Sculpin	SSC	Creeks
Entosphenus tridentatus	Pacific lamprey	SSC	Creeks
Lavinia exilicuada harengus	Monterey Hitch	SSC	Creeks, open water (reservoirs and ponds)
Hesperoleucus venustus subditus	Southern coastal roach	SSC	Creeks, open water (reservoirs and ponds)
Oncorhynchus mykiss irideus	Steelhead – South Central California Coast Distinct Population Segment	FT	Creeks
		Amphibians	
Ambystoma californiense	California tiger salamander - Central California Distinct Population Segment	FT; CT	Oak woodland, grassland, open water (ponds), freshwater wetland
Anedies flavipunctatus niger	Santa Cruz Black Salamander	SSC	Oak woodland, conifer woodland, creeks, riparian
Dicamptodon ensatus	California giant salamander	SSC	Oak woodland, conifer woodland, creeks, riparian
Rana boylii	Foothill yellow-legged frog	FT; CE	Chaparral scrub, conifer woodland, creeks, oak woodland, riparian

Rana draytonii	California red-legged frog	FT; SSC	Creeks, open water (reservoirs and ponds), freshwater wetland
Reptiles			
Actinemys marmorata	Western pond turtle	SSC[3]	Oak woodland, creeks, riparian, open water (reservoirs and ponds), wetland
Anniella pulchra	Northern California legless lizard	SSC	Oak woodland, chaparral scrub, grassland, conifer woodland, riparian forest and scrub
Arizona elegans occidentalis	California glossy snake	SSC	Chaparral scrub, oak woodland, grassland
Coluber flagellum ruddocki	San Joaquin coachwhip	SSC	Chaparral scrub, oak woodland, grassland
Phrynosoma blainvillii	Coast horned lizard	SSC	Oak woodland, chaparral scrub, grassland
Birds			
Agelaius tricolor	Tricolored blackbird	CT; SSC	freshwater and tidal wetland, grassland, irrigated agriculture, open water (reservoirs and ponds)
Ammodramus savannarum	Grasshopper sparrow	SSC	Grassland
Aquila chrysaetos	Golden eagle	CFP	Conifer woodland, oak woodland, Chaparral scrub, grassland
Asio flammeus	Short-eared owl	SSC	Grassland, irrigated agriculture, wetland
Asio otus	Long-eared owl	SSC	Conifer woodland, grassland, oak woodland, riparian
Athene cunicularia	Burrowing owl	SSC	Developed, grassland, irrigated agriculture
Aythya americana	Redhead	SSC	Wetland, creeks, open water
Bucephala islandica	Barrow's goldeneye	SSC	Wetland, creeks, open water
Buteo swainsoni	Swainson's hawk	CT	Grassland, irrigated agriculture, oak woodland, riparian

Chaetura vauxi	Vaux's swift	SSC	Conifer woodland, developed, grassland, oak woodland, open water (reservoirs and ponds), riparian, freshwater and tidal wetland
Circus cyaneus	Northern harrier	SSC	Oak woodland, grassland, freshwater and tidal wetland
Contopus cooperi	Olive-sided flycatcher	SSC	Conifer woodland, oak woodland
Cypseloides niger	Black swift	SSC	Conifer woodland, oak woodland, riparian, open water (reservoirs and ponds)
Elanus leucurus	White-tailed kite	CFP	Oak woodland, grassland, riparian, agriculture, freshwater and tidal wetland
Empidonax traillii	Willow flycatcher	CE	Conifer woodland, oak woodland, riparian
Falco peregrinus anatum	American peregrine falcon	CFP	Conifer woodland, developed, grassland, oak woodland, open water (reservoirs and ponds), riparian, freshwater and tidal wetland
Haliaeetus leucocephalus	Bald eagle	CE; CFP	Conifer woodland, developed, grassland, oak woodland, open water (reservoirs and ponds), riparian, freshwater and tidal wetland
Icteria virens	Yellow-breasted chat	SSC	Oak woodland, riparian
Lanius ludovicianus	Loggerhead Shrike	SSC	Chaparral scrub, oak woodland, grassland
Pelecanus erythrorhynchos	American white pelican	SSC	Wetland, creeks, open water
Progne subis	Purple martin	SSC	Conifer woodland, oak woodland, riparian
Setophaga petechia	Yellow warbler	SSC	Riparian
Vireo bellii pusillus	Least Bell's vireo	FE; CE	Riparian

Mammals			
Antrozous pallidus	Pallid bat	SSC	Chaparral scrub, conifer woodland, grassland, oak woodland
Corynorhinus townsendii	Townsend's big-eared bat	SSC	Chaparral scrub, conifer woodland, oak woodland, riparian
Eumops perotis californicus	Western mastiff bat	SSC	Oak woodland, chaparral scrub, conifer woodland
Lasiurus blossevillii	Western red bat	SSC	Oak woodland, conifer woodland, riparian
Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	SSC	Chaparral scrub, oak woodland, riparian
Puma concolor	Mountain lion	CC[2]	Chaparral scrub, conifer woodland, oak woodland, riparian
Taxidea taxus	American badger	SSC	Chaparral scrub, oak woodland, grassland
Vulpes macrotis mutica	San Joaquin kit fox	FE; ST	Chaparral scrub, oak woodland, grassland
Plants			
Arctostaphylos andersonii	Anderson's manzanita	CRPR 1B.2	Oak woodland, chaparral
Balsamorhiza macrolepis	big-scale balsamroot	CRPR 1B.2	Chaparral, grassland (sometimes serpentinite soils)
Campanula exigua	chaparral harebell	CRPR 1B.2	Chaparral
Castilleja affinis* var. *neglecta	Tiburon paintbrush	CRPR 1B.2, CT, FE	Grassland
Castilleja rubicundula* var. *rubicundula	pink creamsacs	CPRP 1B.2	Chaparral, meadows and seeps, grassland (serpentinite)
Ceanothus ferrisiae	Coyote ceanothus	CRPR 1B.1, FE	Chaparral, coastal scrub, grassland (serpentinite)
Chlorogalum pomeridianum* var. *minus	dwarf soaproot	CRPR 1B.2	Chaparral

Cirsium fontinale* var. *campylon	Mt. Hamilton thistle	CRPR 1B.2	Chaparral, grassland (serpentinite, seeps)
Collinsia multicolor	San Francisco collinsia	CRPR 1B.2	Conifer forest, coastal scrub (serpentine sometimes)
Delphinium californicum* ssp. *interius	Hospital Canyon larkspur	CRPR 1B.2	Chaparral, coastal scrub
Dudleya abramsii* ssp. *setchellii	Santa Clara Valley dudleya	CRPR 1B.1, FE	Grassland (rocky, serpentinite)
Eryngium aristulatum* var. *hooveri	Hoover's button-celery	CRPR 1B.1	Vernal pools
Eryngium spinosepalum	spiny-sepaled button-celery	CRPR 1B.2	Grassland, vernal pools
Extriplex joaquinana	San Joaquin spearscale	CRPR 1B.2	Scrub, meadows and seeps, playas, grassland (alkaline)
Fritillaria liliacea	fragrant fritillary	CRPR 1B.2	Coastal scrub, grassland (serpentine often)
Hoita strobilina	Loma Prieta hoita	CRPR 1B.1	Chaparral, riparian woodland (mesic, serpentinite usually)
Legenere limosa	legenere	CRPR 1B.1	Vernal pools
Leptosyne hamiltonii	Mt. Hamilton coreopsis	CRPR 1B.1	Woodland
Lessingia micradenia* var. *glabrata	smooth lessingia	CRPR 1B.2	Chaparral, grassland, roadsides, often serpentinite
Malacothamnus arcuatus	arcuate bush-mallow	CRPR 1B.2	Chaparral, woodlands
Malacothamnus hallii	Hall's bush-mallow	CRPR 1B.2	Chaparral, coastal scrub
Monolopia gracilens	woodland woollythreads	CRPR 1B.2	Oak woodland, chaparral, conifer forest, grassland, serpentinite
Navarretia prostrata	prostrate vernal pool navarretia	CRPR 1B.2	Coastal scrub, meadows and seeps, grassland, vernal pools, mesic
Penstemon rattanii* var. *kleei	Santa Cruz Mountains beardtongue	CRPR 1B.2	Chaparral, conifer forest

Plagiobothrys glaber	hairless popcornflower	CRPR 1A	Marshes, meadows, and seeps
Puccinellia simplex	California alkali grass	CRPR 1B.2	Vernally mesic alkaline scrub, meadows and seeps, grassland, vernal pools, lake margins
Sanicula saxatilis	rock sanicle	CRPR 1B.2	Oak woodland, chaparral, grassland, rocky, scree, talus
Streptanthus albidus* ssp. *albidus	Metcalf Canyon jewelflower	CRPR 1B.1, FE	Grassland
Streptanthus albidus* ssp. *peramoenus	most beautiful jewelflower	CRPR 1B.2	Serpentinite chaparral, grassland
Trifolium hydrophilum	saline clover	CRPR 1B.2	Marshes, grassland, vernal pools

Sources: Special Animals List April 2023; CNDDB Government Version May 2023; BIOS V6.0; Calflora Database May 2023; CNPS Rare Plant Program v9.5; Valley Water Biologists

[1] Listing status codes:

CC= Candidate for listing under CA Endangered Species Act (CESA)

CE= Listed as endangered under CESA

CFP= Designated as Fully Protected by CA Department of Fish and Wildlife (CDFW)

CT= Listed as threatened under CESA

FC= Candidate for listing under federal Endangered Species Act (ESA)

FE= Listed as endangered under ESA

FT= Listed as threatened under ESA

SSC= Designated as Species of Special Concern by CDFW

CRPR = CA Rare Plant Rank by CDFW

1A= Presumed extinct in CA and rare/extinct elsewhere

1B.1= Rare, threatened, or endangered in CA and elsewhere; seriously threatened in CA

1B.2= Rare, threatened, or endangered in CA and elsewhere; fairly threatened in CA

[2] Species is currently under review for listing under the California Endangered Species Act (CESA). The species is temporarily-afforded the same legal protection as listed threatened and endangered species under the CESA.

[3] Species is currently under review for listing under the Federal Endangered Species Act (FESA). The species does not receive legal protection under the FESA unless it is officially listed as threatened or endangered under the FESA.

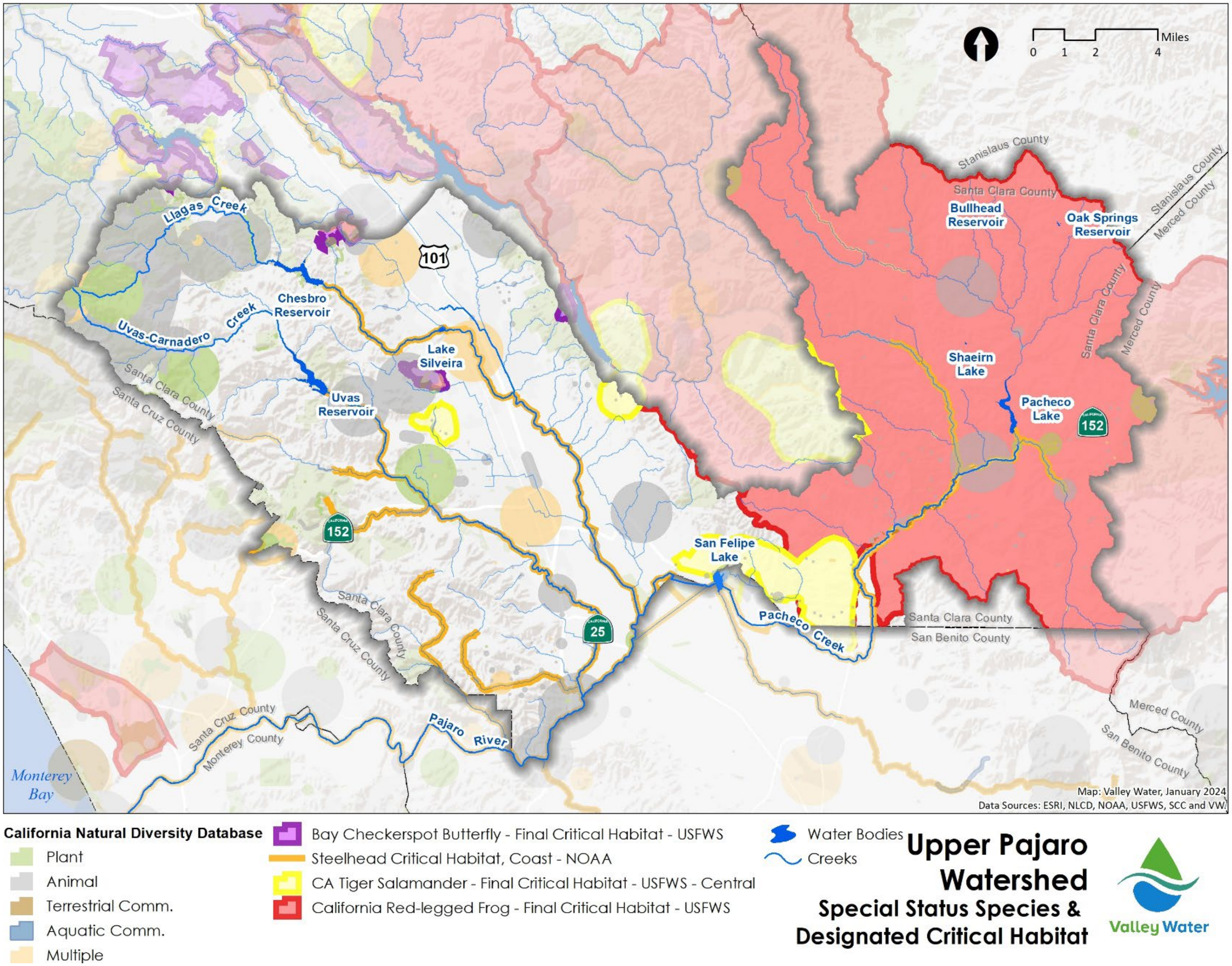

Figure 3-3: Special-Status Species Occurrences and Designated Critical Habitat in the Upper Pajaro Watershed

Riverine and Riparian

Along with the benefits riverine and riparian resources provide to wildlife and plants, rivers and creeks convey stormwater runoff, recharge groundwater, attenuate high flows that would otherwise result in flooding, and provide aesthetic, recreational, and educational resources to communities. The benefits people derive from ecosystems are commonly referred to as ecosystem services. Riparian ecosystems provide a disproportionately high quantity of services relative to their spatial extent on the landscape (Theobold et al. 2010). As such, these habitats are protected under a variety of local, state, and federal regulations, and their condition and management are a key concern for Valley Water. For these reasons, this plan focuses on riverine and riparian communities.

Creeks in the Upper Pajaro watershed include perennial, intermittent and ephemeral waterways. In normal rainfall years, perennial streams support year-round flow, intermittent streams have flows through the wet season (November-April) and are dry most or all of the dry season (May-October), and ephemeral streams typically carry water only during or immediately following a rainfall event, or until spring. The Santa Cruz mountains in the west have a rain shadow effect on the Diablo Range in the east contributing to very different hydrological processes across the watershed ranging from arid and intermittent in the east to more verdant and perennial in the west.

Pacheco Creek has one of the largest and highest quality stands of remaining sycamore alluvial woodland (SAW) in the state, a CDFW-designated sensitive natural community. SAW is characterized by open canopy woodlands dominated by California sycamore. The understory is typically scoured by high winter flows, with sparse or patchy herbaceous vegetation. Given sycamores' ability to thrive with limited summer water and intermittent flows (and high subsurface flow or a high groundwater table), SAW may be a sustainable restoration target given future climate projections, if supportive physical conditions can be re-established (SFEI and HTH 2017). That said, it is challenging to find genetically pure seed, due to hybridization with nonnative London plane trees, and to propagate native sycamores. SAW also cannot persist without the associated natural hydrology and channel forming flows and scour that historically characterized many of the creeks in the foothills of the watershed.

Riparian Vegetation - In the hills of the watershed, riparian, or creek-side, vegetation can consist of the oak woodland and chaparral scrub vegetation types (Figure 3-2). Along most creeks, however, riparian vegetation consists of one of the following natural communities (Figure 3-2 and Table 3-1):

Mixed riparian forest and woodland - Forests and woodlands of dense, mature red, arroyo, and/or yellow willows and Fremont or black cottonwood, with California sycamore, valley oak, coast live oak, California bay, California black walnut, California buckeye, white alder, and bigleaf maple.

Willow riparian forest and scrub - Scrub of scattered red, arroyo, and yellow willows, as well as sand bar willow and mulefat, occurring in and along the margins of open sandy washes.

Central California sycamore alluvial woodland – Dominated by California sycamore that are scattered across broad floodplains and terraces with relatively course substrates, or in narrow canyons with strong geomorphic processes that scour the channel bed.

The presence and width of riparian vegetation, whether forested, shrubland, or meadow, around a creek channel, which is referred to as the riparian corridor, influences the degree to which that vegetation can provide ecosystem services and other ecological functions. Function and services include sunning or shading of the channel, which moderates water temperature, stream bank stabilization, providing leaf litter and large woody debris that supports the aquatic ecosystem, slowing and filtering stormwater runoff, and supporting fish and aquatic, semi-aquatic, and terrestrial wildlife, such as Pacific treefrog, coast garter snake, Skilton’s skink, white-breasted nuthatch, red-shouldered hawk, striped skunk, bobcat, and several special-status species (Table 3-2).

Only 5% of the creek channels in the watershed, most of which is in the forested uppermost reaches, support riparian corridors wide enough to provide a full suite of ecosystem services (Lowe et al. 2016). Lower reaches of the watershed historically supported very wide riparian corridors, but these have been significantly reduced by historical clearing for fuel supply and agriculture; depressed groundwater levels from historical pumping; and urbanization and levee building. More recently food safety concerns within the agriculture industry have led to removal of riparian and other native vegetation communities that are near farmland, without documented improvements in food safety and in reversal of previous water quality and wildlife habitat conservation practices on farms (RCD of Monterey County 2007). As a result, nearly 30% of creek channel length in the watershed now supports little to no riparian vegetation (Lowe et al. 2016). Additional analysis of where narrow riparian corridors can be effectively widened and enhanced could provide targets or priorities to address the most degraded reaches. Valley Water’s Carnadero Preserve, along lower Uvas-Carnadero Creek, is an example of efforts being made in the valley floor to expand riparian corridors while maintaining agricultural land uses, but more efforts are necessary to restore the watershed benefits of riparian corridors.

Because of the more reliable water availability, riparian areas are prone to invasion by nonnative plants. Invasive plants tend to thrive and spread aggressively, negatively altering native vegetation distribution, habitat suitability for wildlife, soil stability, and water quality, thus degrading habitat quality and the overall ecological value of a site. In addition, invasive plants can exacerbate flooding and fire danger, undermine structural assets, and obstruct access to roads, levees and trails. A few examples of invasive plants in the watershed include giant reed, Cape ivy, eucalyptus, and stinkwort. Figure 3-4 depicts occurrences of nonnative, invasive plant communities in the watershed that may be appropriate to serve as targets or priorities for removal efforts. These are certainly not the only occurrences of nonnative plants in the watershed, but where an invasive species is dominating the vegetation.

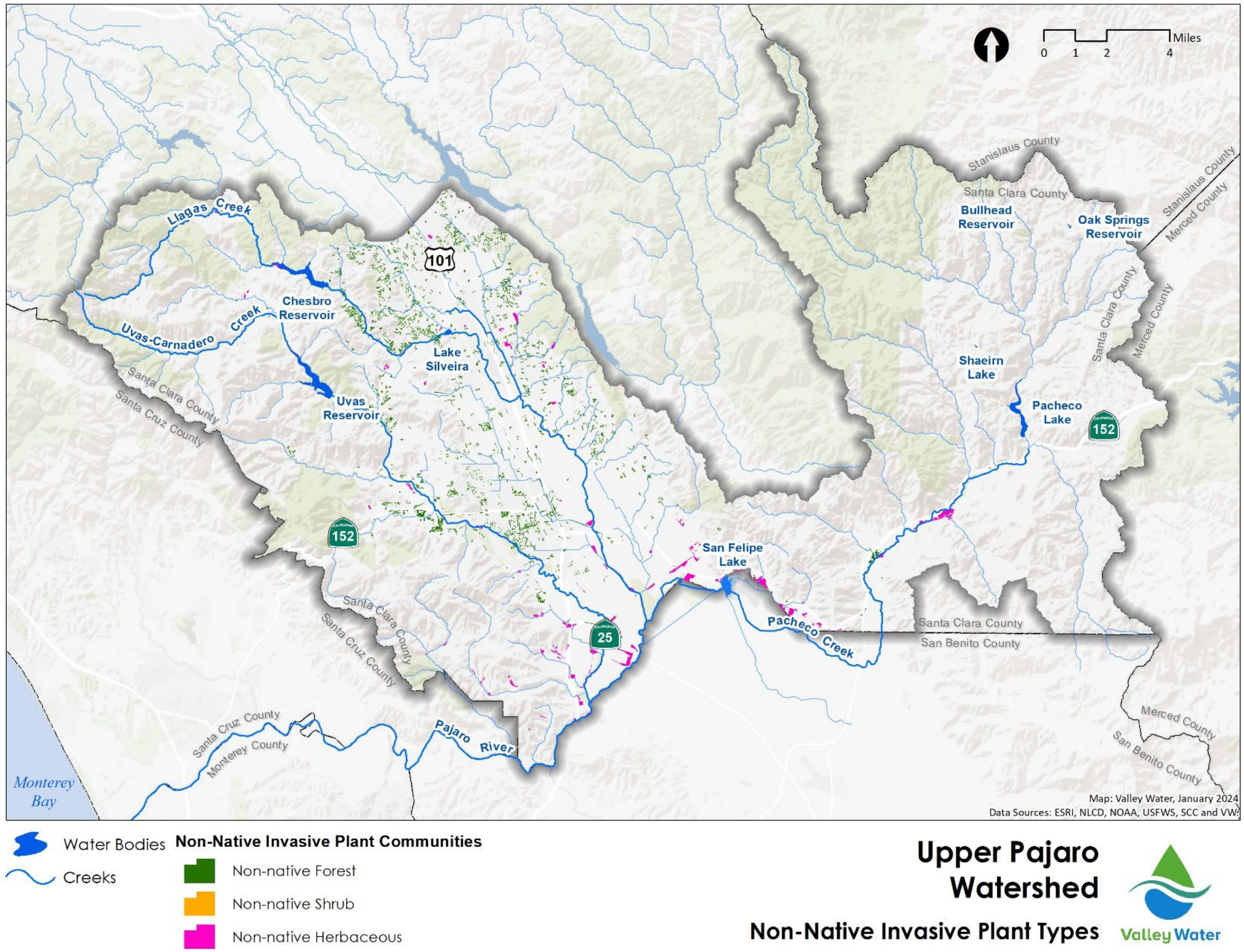

Figure 3-4: Nonnative Invasive Plant Communities in the Upper Pajaro Watershed

Riverine and Riparian Condition - Channel morphology, stream network connectivity, and the overall drainage system have been modified, particularly on the valley floor, to accommodate land uses such as farming, urban infrastructure, transportation corridors, new drainage networks, and bank stabilization efforts (Grossinger et al., 2008), while the upper watershed has remained largely unmodified. Compared to historical conditions, the total length of channels in the Upper Pajaro watershed has increased, due to the construction of unnatural channels, and about half of the stream miles are considered "unnatural" or modified due to excavation of drainage channels, channelization, and hardening (Lowe et al. 2016). Channelization and levees limit the floodplain width of miles of watershed creeks, which leads to changes in sediment movement, narrowing of the riparian corridor, and simplification of aquatic habitat. Other development-related impacts to creeks include the addition of lateral drainages and outfalls (increasing scour and erosion), groundwater pumping (contributing to channel incision and hydrologic alterations), and impervious surfaces (increasing the amount and rate of runoff entering creeks and reducing groundwater infiltration). Structural changes to and planting of trapezoidal channels will be necessary to achieve One Water metrics for ecological resources in the watershed.

The varying levels of modification and land use are reflected in the quality and quantity of riverine habitat found throughout the watershed. (Assessment of riverine aquatic habitat conditions specific to fish are discussed in the Fish Habitat Quality section below.) More than half of the streams in the watershed are considered in fair ecological condition, about 40% are in good condition and only about 8% are in poor condition (Lowe et al., 2016). Figure 3-5 maps sites with poor condition riverine habitat on the valley floor by landownership, which may be appropriate to serve as targets or priorities for enhancement efforts, as well as sites with good condition that may be appropriate for conservation and maintenance.

> The condition of upper Pajaro watershed creeks is based on California Rapid Assessment Method (CRAM) surveys conducted in 2015 at 80 sites representing the range of stream and land use patterns in the watershed (Lowe et al., 2016). CRAM is a standardized, cost-effective tool for assessing the overall health of wetlands, streams, and their riparian areas. CRAM surveys quantify buffer and landscape context; hydrologic connectivity; physical conditions in the channel; and vegetation in and around the channel. In addition to assessing ambient conditions at various spatial scale, CRAM can be used to plan and assess restoration and mitigation projects. Valley Water will reassess creek conditions in the watershed using CRAM surveys in 2025. For more information on CRAM: http://www.cramwetlands.org.

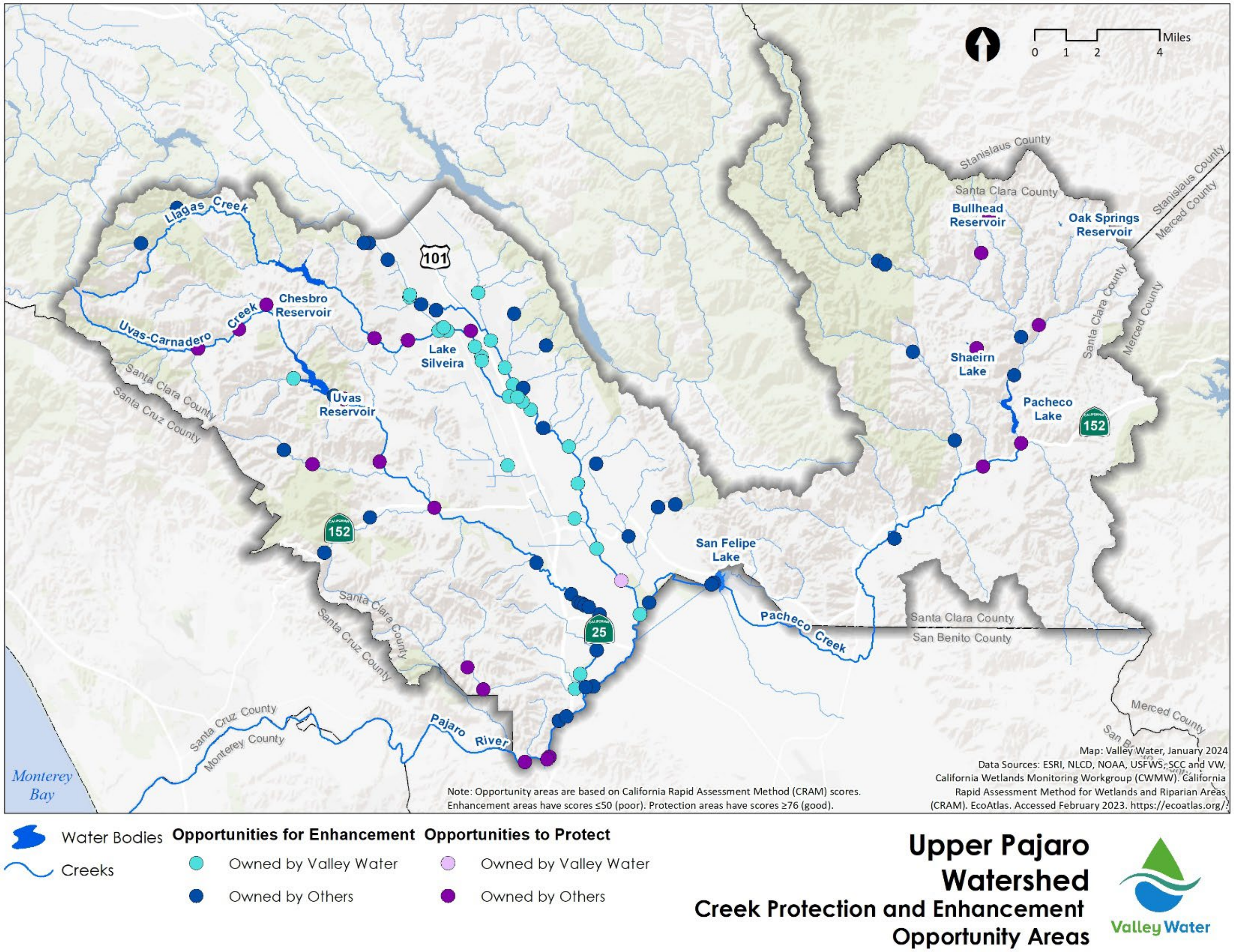

Figure 3-5: Poor Condition Riverine Habitat in the Upper Pajaro Watershed

Good conditions are most common in the upper reaches of the watershed and stream condition generally decreases downstream, as the intensity and diversity of land uses increase. In the Upper Pajaro watershed, poor riverine conditions are most often associated corridors with lack of riparian vegetation; proximity to roadways that limit corridor width and introduce trash and other pollutants; with adjacent land uses and associated trash and trampling; and invasion by nonnative vegetation (Lowe et al., 2016). Despite the dramatic alterations, urban and agricultural reaches of the watershed continue to support native and special-status fish and wildlife, and the preservation and enhancement of those reaches is necessary to sustain those species. As such, poor condition reaches should be focal areas for enhancement to make substantive improvement in watershed health and support wildlife, but will require additional analysis and planning to identify the most appropriate actions and sites.

Fish Community - The watershed's riverine habitat supports the migration, spawning, rearing, and persistence of numerous native fish species and several special-status species (Table 3-2). Recent fish surveys have documented nine native fish species in the Upper Pajaro watershed (Table 3-3). This assemblage is similar to that of the earliest accounts of fish in the watershed (Snyder 1912), but the native diversity has declined while the non-native species in the watershed have increased (Table 3-3) (Smith 2011, Lowe et al. 2016). Three historical species - thicktail chub, tule perch and Sacramento perch – are now extirpated from the watershed (Moyle 2002).

New Zealand mud snails are very small aquatic snails native to New Zealand but have spread to many western states. This highly invasive species can establish dense populations that reduce the number of native macroinvertebrates, which are also important food sources for fish. Once established there is no way to eradicate this species from a water body. Based on the USGS nonindigenous Aquatic Species program New Zealand Mud Snails have been identified in many of Santa Clara County's streams but no observations of New Zealand mud snails have been recorded in the Upper Pajaro Watershed to date. It is imperative that BMPs be observed and the public is informed of this devastating invasive species and what can be done to prevent introduction to intact water bodies.

Table 3-3: Fish Species in the Upper Pajaro Watershed

Scientific Name	Common Name	Native/Nonnative
Catostomus occidentalis	Sacramento sucker	Native
Oncorhynchus mykiss[FT]	Steelhead/rainbow trout	Native
Hesperoleucus venustus subditus[SSC]	Monterey roach	Native
Ptychocheilus grandis	Sacramento pikeminnow	Native
Cottus asper	Prickly sculpin	Native
Cottus gulosus[SSC]	Riffle Sculpin	Native
Lavinia exilicauda[SSC]	Monterey hitch	Native
Gasterosteus aculeatus	Threespine stickleback	Native
Entosphenus tridentatus[SSC]	Pacific lamprey	Native

Gambusia affinis	Western moquitofish	Non-native
Micropterus salmoides	Largemouth bass	Non-native
Lepomis cyanellus	Green sunfish	Non-native
Lepomis macrochirus	Bluegill	Non-native
Lepomis gibbosus	Pumpkinseed	Non-native
Cyprinus carpio	Common Carp	Non-native
Carassius auratus	Goldfish	Non-native
Pimephales promelas	Fathead minnow	Non-native
Percina macrolepida	Bigscale logperch	Non-native
Menidia beryllina	Inland Silverside	Non-native
Notemigonus crysoleucas	Golden shiner	Non-native
Dorosoma petenense	Threadfin shad	Non-native
Sources: Snyder 1912, VW 2003, SFEI 2008, Casagrande 2010 and 2011, Smith 2013 and 2015, Casagrande 2016, Smith 2016 and 2017, Casagrande 2018, ICF 2021		
FT = Listed as federally threatened under ESA SSC = Designated as Species of Special Concern by CDFW		

Portions of the Upper Pajaro watershed are home to the Federally Threatened South Central California Coast Distinct Population Segment of steelhead. These fish have a diverse life history in which they are born in freshwater streams and migrate to the ocean to live as adults through a process called anadromy. Mature adults then return to their natal creeks and rivers to spawn, and the process starts over again. The non-anadromous, or resident, form of this species is known as rainbow trout. Rainbow trout and steelhead are the same species. The distribution and number of steelhead in the naturally accessible portions of the watershed is believed to be considerably reduced since the first accounts of the species (NMFS 2006, Grossinger et al. 2006), however, rainbow trout are still present above barriers to anadromy. Maintaining these fish is a high priority for Valley Water watershed planning efforts in efforts to help manage the populations of and improve conditions for these special fish.

Fish Habitat Conditions – South Central California Coast steelhead in the Upper Pajaro Watershed are listed as threatened under the federal Endangered Species Act. Parts of the watershed are designated critical habitat for steelhead/rainbow trout (Figures 3-6, 3-7, and 3-8) and the species is a valuable indicator of overall aquatic habitat connectivity and health. As such, descriptions of fish habitat conditions in this plan are focused on steelhead.

Barriers to passage, poor water quality (e.g., high stream temperatures, low dissolved oxygen, turbidity, nutrient impairment), lack of suitable habitat for different life stages, and nonnative species are primary challenges to riverine steelhead/rainbow trout in California (Smith 2002, Casagrande 2011, Titus et al. 2010). (They face myriad different challenges during their life-stages in estuaries and the ocean.) Water extraction, altered hydrology, gravel and flashboard dams, drop-structures, and culverts all contribute to challenging passage conditions. Higher water temperatures can lead to conditions that are sub-optimal for certain life history stages. (To date, water temperature monitoring in the Upper Pajaro Watershed has been sparse and baseline conditions are difficult to characterize. A pilot program to gather temperature data in Uvas, Tar, Bodfish, Little Arthur, Llagas and Pacheco creeks was started in 2022.) Additionally, warmer water temperatures and pool or pool-like habitat can give non-native predatory fish an advantage over native fish. Nonpoint sources of pollution (e.g., urban and agricultural runoff and fine sediment), pesticides, and trash also degrade aquatic habitat quality. In addition to directly affecting habitat suitability for fish, poor water quality may limit benthic macroinvertebrate production which is a primary food source for fish and other aquatic species. and can serve as an indicator for overall stream health. Reaches downstream of dams or other creek impoundments, that otherwise have suitable flow and water temperatures for steelhead/rainbow, typically have reduced supply of coarse sediment and large woody debris that is critical to certain life-stages. Fortunately, many of these challenges can be ameliorated with targeted restoration and management efforts.

Conditions in the major subwatersheds – Uvas, Llagas, and Pacheco Creeks - for steelhead/rainbow trout are summarized in Table 3-4 and Figures 3-6, 3-7, and 3-8. The subwatersheds have varying habitat conditions due to the spectrum of urban centers like Gilroy and preserved and protected areas such as Calero County Park or Henry Coe State Park. This range of quality provides opportunity for restoration in degraded areas and preservation in high-quality areas. However, in most subwatersheds, additional analysis is needed of which conditions are most limiting to steelhead in the subwatersheds, where enhancement effort will be most effective and efficient, and to make meaningful and strategic use of enhancement funding. Where such analyses have been done, such as in Uvas Creek as part of the Study of Santa Clara County Steelhead Streams to Identify Priority Locations for Gravel Augmentation and Large Woody Debris Placement Santa Clara County, California (Balance Hydrologics, 2018), recommended enhancements have been implemented.

The **Pescadero Creek** subwatershed (portions of which may be referred to as Star Creek) originates in the southern-most Santa Cruz Mountains in Santa Clara County, but crosses through Santa Cruz County before joining the Pajaro River in San Benito County. The Pescadero Creek subwatershed is undeveloped, with no formal water supply or flood protection infrastructure. There is high oversummering habitat potential for steelhead in parts of the subwatershed and it is accessible in all but the driest of years (Boughton et al. 2006, ESA 2001).

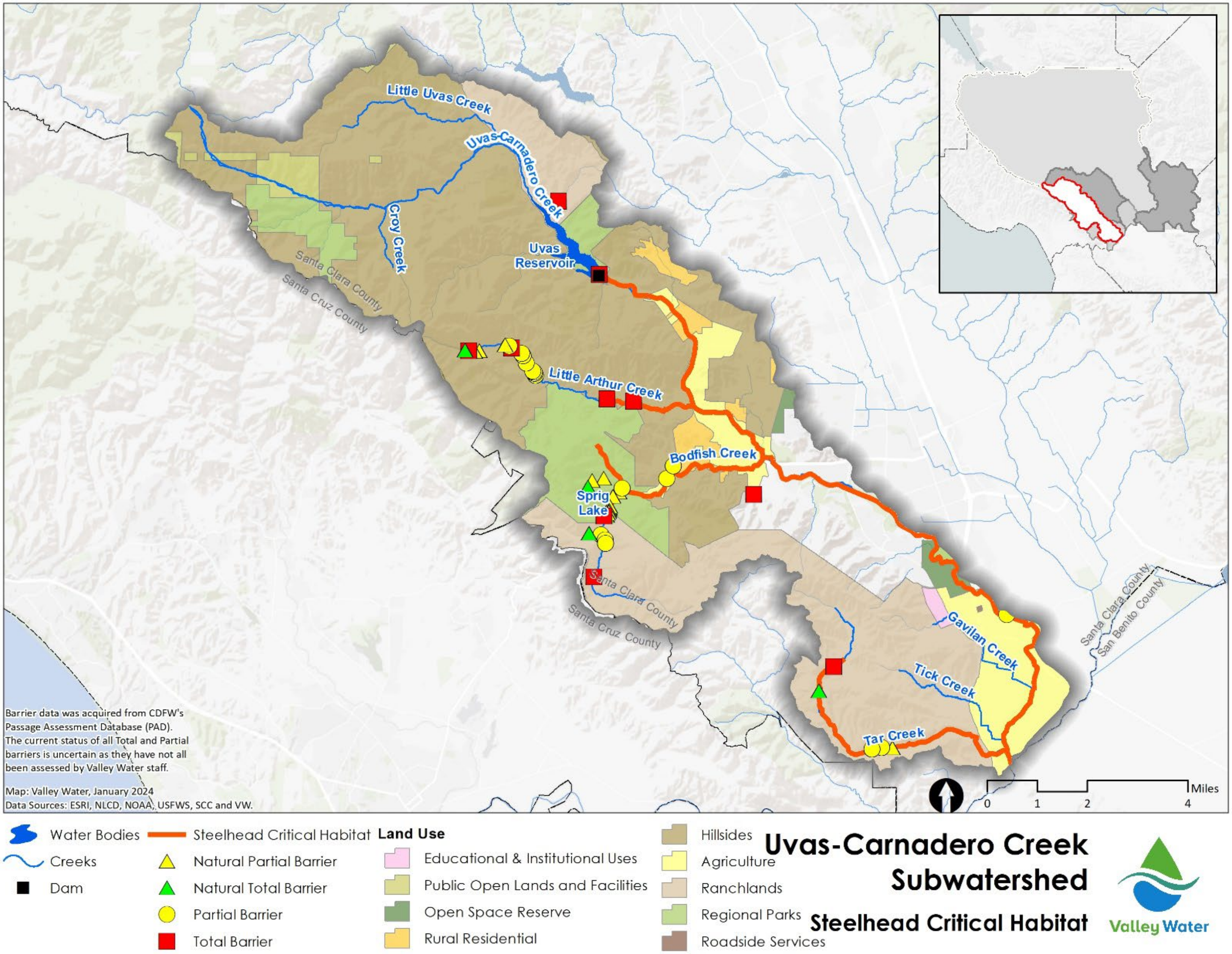

Figure 3-6: Steelhead Critical Habitat and Passage Impediments in the Uvas-Carnadero Creek Subwatershed

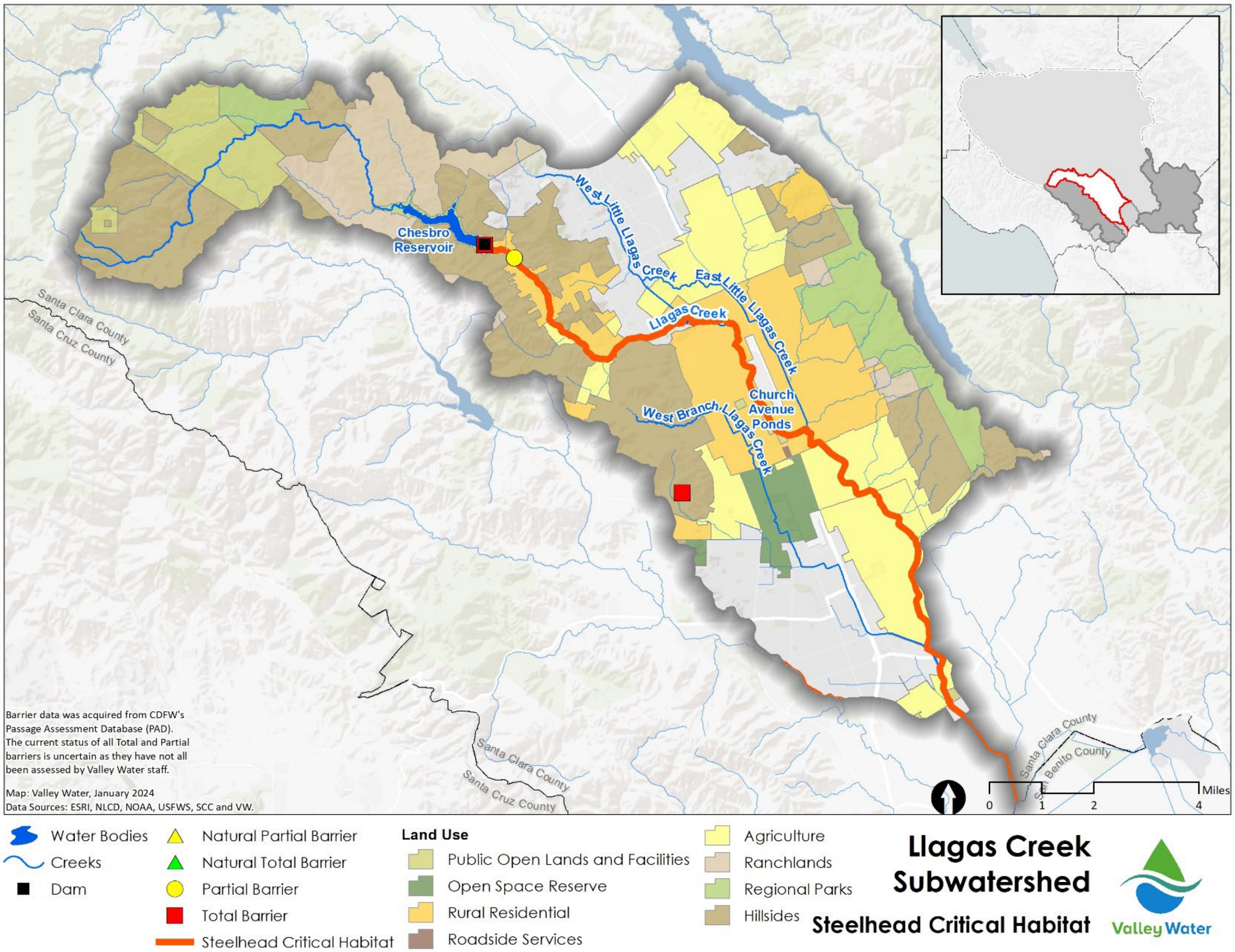

Figure 3-7: Steelhead Critical Habitat and Passage Impediments in the Llagas Creek Subwatershed

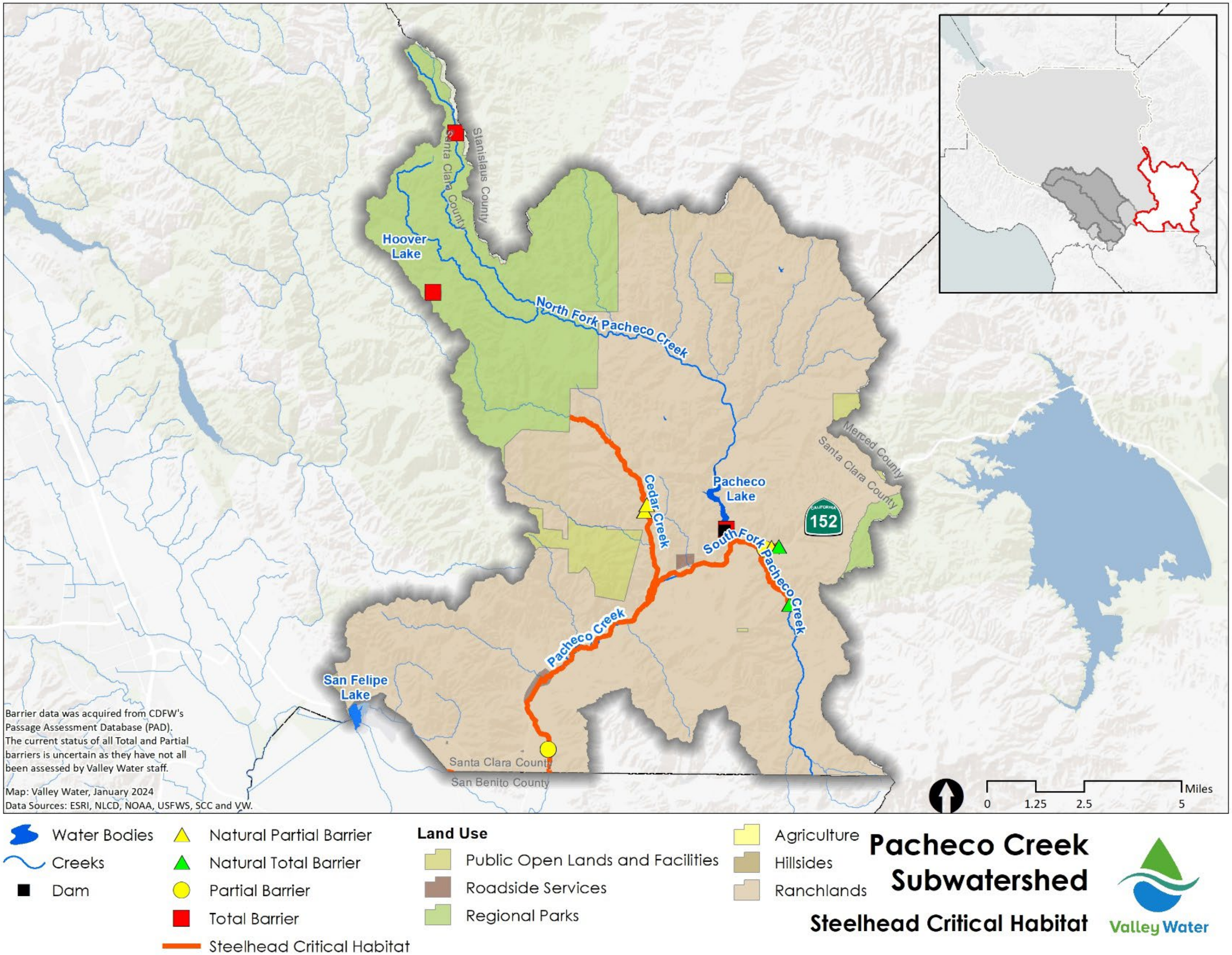

Figure 3-8: Steelhead Critical Habitat and Passage Impediments in the Pacheco Creek Subwatershed

Table 3-4: Summary of Aquatic Habitat Conditions for Steelhead/Rainbow Trout in Upper Pajaro Watersheds

Condition	Uvas Creek	Llagas Creek	Pacheco Creek
Fish Passage Impediments[1]	• Complete barriers - Three dams on Little Arthur Creek • Partial impediment -flashboard dam on Bodfish Creek • Complete barrier - Sprig Lake Bodfish Creek • Partial impediments - two culverts on Tar Creek • Uvas Dam (end of anadromy)	• Partial impediment - Concrete ford with four culverts 600m downstream of Chesbro Dam • Chesboro Dam (end of anadromy)	• Partial impediment – decommissioned diversion dam at Barnheisel Rd. • Pacheco Dam (end of anadromy)
Water Quality Impairment[2]	• Turbidity • Dissolved oxygen • Water temperature • pH	• Turbidity • Dissolved oxygen • Water temperature • pH • Salinity Sedimentation/siltation • Pesticides (chlorpyrifos) • E. coli • Nutrients (nitrate) • Fecal coliform	• Turbidity • Dissolved oxygen • Fecal coliform
Other Habitat Conditions[3]	• Modified channels in developed areas	• Modified channels in developed areas	• Lack of summer flow due to natural watershed conditions

	• Little to no coarse sediment or woody debris supply to some reaches • Reduced summer streamflow on Little Arthur Creek due to diversions	• Little to no coarse sediment or woody debris supply to some reaches • Impaired BMI community	• Little to no coarse sediment or woody debris supply to some reaches • Impaired BMI community
Completed Enhancement Projects	Passage impediment remediation at railroad crossing of Uvas Creek at Bolsa Road	Llagas Creek restoration at Lake Silviera	Pacheco Creek Restoration Project
Enhancement Priorities	• Remediate passage impediment at Pickle Dam on Little Arthur Creek • Enhance summer streamflow in Little Arthur Creek • Remediate passage impediment at Sprig Lake on Bodfish Creek • Plan and implement gravel and large woody debris augmentation in priority locations[4]	Plan and implement gravel and large woody debris augmentation in priority locations[5]	Plan and implement gravel and large woody debris augmentation in priority locations[5]

[1] See Figures 3-6, 3-7, and 3-8 for locations. List excludes natural barriers. Sources: California Department of Fish and Wildlife, Passage Assessment Database, (August 2023).

[2] California 2018 Integrated Report (Clean Water Act 303(d) List/305(b) Report). California State Water Resources Control Board.

[3] ESA 2001, Boughton et al. 2006, Casagrande 2018, Smith 2001, Smith 2002, Casagrande, pers. comm., 2023, Lowe et al. 2016, Rehn et al. 2015,

[4] Balance Hydrologics. 2018. Study of Santa Clara County Steelhead Streams to Identify Priority Locations for Gravel Augmentation and Large Woody Debris Placement. Santa Clara County, California.

[5] AECOM. 2024. Second Phase Study of Santa Clara County Steelhead Streams to Identify Priority Locations for Gravel Augmentation and Large Woody Debris Placement Project.

Lakes, Reservoirs, and Ponds

Open water areas in the upper Pajaro watershed are primarily human-made. Except for San Felipe Lake in San Benito County, none of the naturally occurring lakes or ponds that existed historically remain.

Stock ponds are human-made ponds that provide water for grazing livestock and can support a range of open water, wetland, and riparian natural communities depending on site conditions and land uses. They can provide valuable habitat for special-status species such as California tiger salamander, California red-legged frog, western pond turtle, and tricolored blackbird, all of which are found breeding at stock ponds. Stock pond condition, and habitat value for such wildlife, is typically influenced most strongly by presence and intensity of grazing. Stock ponds with grazing are likely to have more open water, which is used by pond-breeding amphibians, sparser vegetation, and hoof trampling disturbance in and along the pond margins. Stock ponds without grazing can be densely vegetated by willows, cattails, reeds, bulrushes, sedges, and tules if the appropriate soils and hydrology is also present, but such vegetation can take over open water habitat.

Percolation ponds are located where gravels and sands have been naturally deposited at or near ground level and where water can easily soak into the underlying aquifer. When filled with water, which is typical in spring, summer, and fall, these ponds have lake-like conditions. In the Upper Pajaro watershed, Valley Water manages the off-channel Church Avenue ground water recharge ponds along lower Llagas Creek as well as the Madrone, Main Avenue, and San Pedro Percolation Ponds. Due to changes in water levels and periodic sediment maintenance to maximize recharge, there is very little perennial wetland or aquatic vegetation in percolation ponds, although annual species may establish when water levels are high. For these same reasons, percolation ponds do not tend to provide much wildlife habitat, although many birds may use the open water habitat to rest and forage.

Reservoirs on Uvas Creek (Uvas Reservoir), Llagas Creek (Chesbro Reservoir), and Pacheco Creek (Pacheco Lake) store water for release in the summer and fall to maintain groundwater supplies and provide recreation. Pacheco Reservoir, owned and operated by Pacheco Pass Water District, also falls within Santa Clara County but is not currently operational for groundwater management. Fluctuations in water levels affect the type of vegetation present along reservoir shorelines. If reservoir edges are shallow, plant species similar to those of ponds and wetlands can be present. Nonnative and invasive plants are more likely to establish on reservoir shorelines during drawdowns. Reservoirs provide habitat for many bird and fish species, including most of the non-native fish documented in the watershed. Fish in reservoirs can make their way out of reservoirs and persist in downstream creek reaches.

Wetlands

Wetlands are areas subject to seasonal or perennial flooding or ponding or possessing saturated soil conditions and support predominantly hydrophytic (water-loving) herbaceous plant species. Plants growing in wetlands can tolerate lengthy periods of inundation and low levels of soil oxygen. Wetlands provide important ecosystem services, such as filtering runoff, facilitating groundwater recharge, sequestering carbon, buffering storm surges, and providing wildlife habitat. In addition to the special-status species that may occur in wetlands (Table 3-2), common wildlife species include: Pacific treefrog, killdeer, mallard, and red-winged blackbird. Wetlands provide foraging habitat for species like the great blue heron and northern raccoon.

> Lake Silveira was an approximately 8-acre artificial lake formed in the late 1970s when a berm separating Llagas Creek from an abandoned quarry was breeched. Llagas Creek flowed into and filled the quarry pit and 2,000 feet of Llagas Creek ran dry as a result. In 2020 Valley Water separated Lake Silveira from Llagas Creek as a part of the Upper Llagas Flood Protection Project, restoring the creek channel and replacing some of the lake habitat with more ecologically beneficial wetlands.

The Upper Pajaro Watershed, and the Bolsa in particular, once supported vast tracks of diverse wetland types. Most were cleared and drained to make way for agriculture. There are several ecologically significant wetland systems that remain in the upper watershed and that provide logical focal points for restoring the ecosystem services that wetlands can provide. San Felipe Lake is an example of such a site that could potentially benefit from more diffuse flow and inundation patterns. Despite years of drainage, grazing, and crop production, there is remnant wetland with intact soil structure (fine clays) and depressional topography. As a result, Lowe et al. (2016) identified the San Felipe Lake area as having the “highest restoration potential for non-Bayland wetlands within Santa Clara County.” Hydrological reconnection could restore habitat for shore birds, water birds, fish and could provide a “power growth” zone for out-migrating steelhead in Pacheco Creek, similar to the rice fields/Yolo Bypass in Sacramento.

Upland Natural Communities

Oak Woodlands - The most common land cover type in the watershed consists of upland hardwood trees: roughly 33% of the watershed is characterized by various species of oak, typically sparsely distributed in a grassland matrix (Table 3-1, Figure 3-2). While one or more species of oak—coast live oak, valley oak, and/or blue oak—is typically the dominant species in these woodlands, bay laurel, buckeye, and foothill pine are commonly associated trees and snow berry, poison oak, and California blackberry are commonly associated shrubs (if a shrub layer is present at all). In the Upper Pajaro Watershed, oak woodlands are found primarily along the summit and middle elevations/foothills of the Diablo Range to the east and of the Santa Cruz Mountains to the west. They are also the dominant riparian habitat along many seasonal channels.

In addition to the special-status species that may occur in oak woodlands (Table 3-2), common wildlife species in these natural communities include California alligator lizard, oak titmouse, acorn woodpecker, California deer mouse, and bobcat. Oak woodlands also provide upland habitat for amphibian species such as California newt and California toad.

In the developed and agricultural areas of the valley the historical distribution of oak woodlands, particularly valley oak woodland, has been more or less eliminated due to clearing for agriculture and urban development (Grossinger et al. 2008). The plant pathogen *Phytophthora ramorum* that causes Sudden Oak Death (SOD) has, so far, not been detected in the Upper Pajaro Watershed (https://www.calflora.org/entry/pathogen.html?id=pth1). Keeping it out or reducing its spread, through the measures such as those recommended by CalPhytos.org, will be important to the long-term health of numerous natural communities as well as to the success of habitat enhancement efforts.

Grasslands - Grasslands make up roughly 21% of the Upper Pajaro Watershed. These areas are dominated by grasses and forbs (herbaceous flowering plants that are not grasses), with little to no tree or shrub cover. Most grassland in the watershed is now classified as California annual grassland, which is dominated by nonnative annual grasses that have become naturalized in California. In the hills, however, there are still areas of native grassland (such grasslands associated with serpentine soils are described below.) Grassland is found along the eastern and western sides of the watershed bordering the foothills.

In addition to the special-status species that may occur in grasslands (Table 3-2), common wildlife species in these natural communities include: yellow-faced bumble bee, valley garter snake, western meadowlark, California ground squirrel, Botta's pocket gopher, California vole, and coyote. Burrows and cracks in grasslands provide subterranean habitat for insects, amphibians, and reptiles, and grasslands also serve as foraging habitat for raptors, such as American kestrels and red-tailed hawks. Even when dominated by nonnative grasses, grasslands provide pervious surfaces that absorb rain and filter runoff. This slows runoff and reduces nutrient and sediment pollution flowing into creeks and reservoirs.

Many areas of grassland in the watershed support livestock grazing. Livestock rangelands, which are primarily grazed by cattle but can include goats and sheep, make up the largest agricultural zone of the county. Grazing is one of the primary management tools used in grasslands to promote conservation values. When well-managed, grazed rangelands provide the same habitat values and functions as non-grazed grasslands, and have been found to support higher native plant and wildlife diversity. When grazing intensity is too high, however, vegetation removal and hoof trampling can reduce the infiltration capacity of soil, increase erosion, and prevent the establishment of vegetation. There are also roughly 28,000 acres of grain, hay, and other farmlands in the watershed, which may provide grassland habitat values depending on the timing of crop production. Although they can be a source of nutrients and sediment to nearby creeks when poorly managed, farmlands preserve rural space from urban development, facilitating movement of native species between bordering habitat fragments, and provide undeveloped space adjacent to streams.

Chaparral Scrub - Chaparral scrub is characterized by dense stands of drought- and often fire-adapted evergreen woody shrubs with little or no understory, interspersed with grassy openings. Dominant shrubs include chamise, manzanita, scrub oak, ceanothus, sagebrush, and coyote brush, but hollyleaf cherry, leather oak, toyon, coffeeberry, sticky monkeyflower, and black sage also occur. Chaparral scrub makes up about 11% of the watershed area, and is found in the upper elevations of the Diablo Range and Santa Cruz Mountains, with smaller patches scattered throughout the foothills.

Chaparral scrub provides valuable habitat and food resources for many species. In addition to the special-status species that may occur in chaparral scrub (Table 3-2), common wildlife species in this natural community include: yellow bumble bee, western fence lizard, Pacific gopher snake, California quail, wrentit, rufous-crowned sparrow, brush rabbit, and gray fox. In addition to wildlife habitat, chaparral scrub provides pervious surfaces that absorb rain and filter runoff. This slows runoff and reduces nutrient and sediment pollution flowing into creeks and reservoirs.

Conifer Woodland - The highest elevations of the watershed support native conifer woodlands. These areas, which make up about 13% of the watershed, are commonly dominated by foothill pine or, less often, Ponderosa pine, with a typically dense understory of scattered shrubs, such as those found in adjacent chaparral and scrub communities, and native grasses or nonnative annual grasses and forbs. Associated tree species include blue oak, interior live oak, coast live oak, and buckeye, and associated shrubs can include ceanothus, manzanita, and coffeeberry. There are also many planted conifers, both native and nonnative, in the developed portions of the watershed. The conifer woodland land cover type includes the following more-detailed natural communities:

In addition to the special-status species that may occur in conifer woodlands (Table 3-2), common wildlife species in this land cover type include: California slender salamander, Steller's jay, Cooper's hawk, Western gray squirrel, and black-tailed deer. Like oak woodlands, and chaparral scrub, conifer woodlands provide pervious surfaces that absorb rain and filter runoff, slowing runoff and reducing nutrient and sediment pollution flowing into creeks and reservoirs. Like chaparral scrub, foothill and knobcone pine are adapted to, and reliant on, occasional low-intensity fire for seed germination and/or creating the physical conditions necessary for young plant establishment and growth. Suppression of natural wildfires, in combination with intensive livestock grazing and competition with annual grasses, can limit the extent and alter the composition of conifer woodlands.

Habitat Connectivity

Habitat loss and fragmentation are the leading threats to biodiversity (Penrod et al. 2013). Due to these threats, protecting, restoring, and enhancing habitat connectivity has become a conservation imperative to protect the species that remain in our current landscapes, now, and into the future. Connectivity can also help bolster resilience to directional climate change and can also help with recolonization or redistribution post natural disaster, such as flood or fire. For many years, conservationists have recognized the importance of habitat connectivity via landscape linkages at the regional scale and wildlife corridors at the local scale.

Numerous separate state, regional, and local connectivity assessments and conservation plans recognize the importance of the Upper Pajaro Watershed for habitat connectivity, and four landscape linkages specifically (Figure 3-9). Collectively, these landscape linkages make up a significant percentage of the watershed overall, 59%. The primary goal of conserving and restoring these landscape linkages is to promote wildlife movement and ecological processes between the **existing large landscape blocks** (Penrod et al. 2013).

Connectivity is defined as "the degree to which the landscape facilitates or impedes movement" (Taylor et al. 1993).

Landscape linkages refer to broad areas that allow for the movement of wildlife and plant species from one area of suitable habitat to another and that support ecological processes (Ament et al. 2014).

Corridors are distinct linear features whose primary function is to connect two or more significant habitat areas (Beier and Loe 1992).

Large Landscape Blocks are areas of high ecological integrity that build upon the existing conservation network of lands in the area (Penrod et al. 2013). Also referred to as core habitats.

In the upper watershed, the Santa Cruz Mountains and the Diablo Range support continuous natural habitats that have not experienced significant land conversions, and connectivity conservation efforts are focused on the permanent protection of these areas and improving connectivity within them. The ability for wildlife to safely cross SR-152 and the southern section of US-101, which are shown in Figure 3-9, are two of the top three priority barriers to habitat connectivity in the Bay Area and two out of the twelve top priority barriers statewide (CDFW 2022). The Pacheco Pass Wildlife Overpass Planning Project targets one of these barriers: together with its various partners, the Santa Clara Valley Habitat Agency is working to install a wildlife overpass in Pacheco Pass over SR-152.

In between these mountain ranges, the valley floor has experienced significant land conversion. Most of the northern valley floor has been converted to commercial and residential land uses, while the southern portion is largely agricultural land uses. Because agricultural lands still provide some value for wildlife movement, especially along the remaining riparian areas that traverse through these agricultural areas, connectivity conservation efforts are focused on the southern valley floor to enhance connectivity between the Santa Cruz Mountains and the Diablo and Gabilan ranges. Such efforts include riparian restoration along the Pajaro River, such as the Santa Clara Valley Open Space Authority's Pajaro River Agricultural Preserve, which at a regional scale is considered both an essential connectivity area (Spencer et al. 2010) and a major choke-point for the Santa Cruz Mountain-Diablo Range landscape linkage (Penrod et al. 2013); riparian restoration along creeks that serve as wildlife corridors at the local scale; promoting wildlife friendly agricultural practices; and, improving the ability for wildlife to safely cross highways and roads.

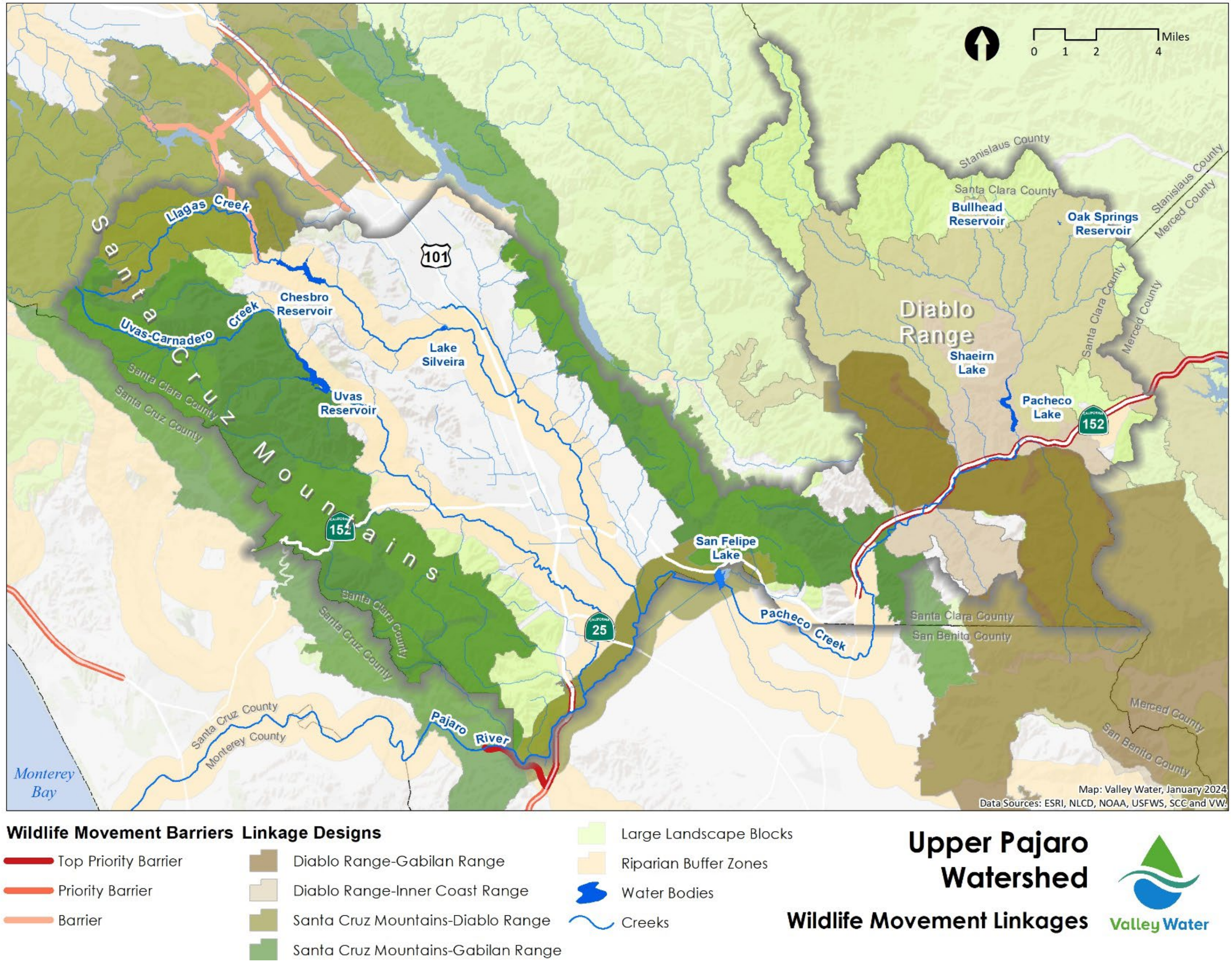

Figure 3-9: Critical Habitat Connectivity Linkages in the Upper Pajaro Watershed

3.3 Future Conditions, Challenges and Opportunities

Vision for Future Conditions

One Water provides an opportunity to articulate an informed vision for the future conditions of ecological resources that accounts for past and current conditions, the challenges, and opportunities to improving those conditions, and the relevant vision and objectives of other programs and plans. The One Water objectives and metrics provide a vision, listed below, for ecological resources in the Upper Pajaro watershed. Elements of these vision statements are referred to as attributes in One Water and are directly tied to metrics and targets that are intended to track and document progress toward the vision. Secondary bullets in the list below are other ways of stating the vision or provide more specificity for the Upper Pajaro watershed.

- Fish can travel freely in the watershed's rivers and streams
    - There is unimpeded access to suitable habitat
- Wildlife can move freely in the watershed
    - Natural lands and rangelands are conserved, expanded, enhanced, and connected to facilitate wildlife movement.
- Streams are healthy and can support aquatic life
    - There is suitable spawning and rearing habitat for steelhead
    - There should be suitable fish habitat in a variety of accessible reaches to help make fish populations more resilient to drought and climate change.
- Ecological conditions of streams are consistently improved
    - Modified channels are enhanced to improve ecological condition and human communities
    - The watershed's natural sources and transport of gravel and coarse sediment should be prioritized to build and maintain aquatic habitat.
- Riparian habitat is increasingly protected and improved

The following plans complement One Water and should be used to inform and prioritize future ecological resource enhancement efforts:

The **Pajaro Compass** is a network for voluntary conservation that brings together land owners, public agencies, conservation organizations, elected officials and more to engage in efforts to maintain a healthy watershed.

The **Santa Clara Valley Habitat Plan** provides a framework to protects natural resources and endangered species while streamlining permitting for covered projects.

The **San Benito County HCP/**NNCP provides a framework to protect natural communities and species in San Benito County and helps provide more efficient and transparent guidance on permitting, mitigation, compensation and review for persons carrying out Covered Actions.

The **Santa Clara Valley Resource Conservation Investment Strategy** is the first of its kind and promotes the conservation of natural resources in Santa Clara County through the identification of actions and priorities that can help guide investments and/or identify high priority opportunities for mitigation.

The **State Wildlife Action Plan** is a statewide plan that assesses the health of the state's natural resources, identifies immediate and future challenges and outlines actions to be taken to address these challenges before species and habitats become to rare or costly to restore.

The **South-Central California Steelhead Recovery Plan (NMFS)** is a guidance document that identifies recovery actions that contribute to the protection and recovery of SCCC steelhead throughout the DPS.

    - Native vegetation communities around creeks are sufficient in width and structural complexity to filter runoff, stabilize banks, contribute to aquatic habitat, provide habitat, and facilitate wildlife movement.
    - Unique natural communities such as alkali meadows, seasonal wetlands, and sycamore alluvial woodland are preserved and protected
- Fundamental to achieving these visions is the preservation, expansion, and protection of undeveloped buffers around creeks. Figure 3-10 depicts the protection status of creek channels in the watershed; those mapped as unprotected may be appropriate to serve as targets or priorities for protection and expansion of buffers.

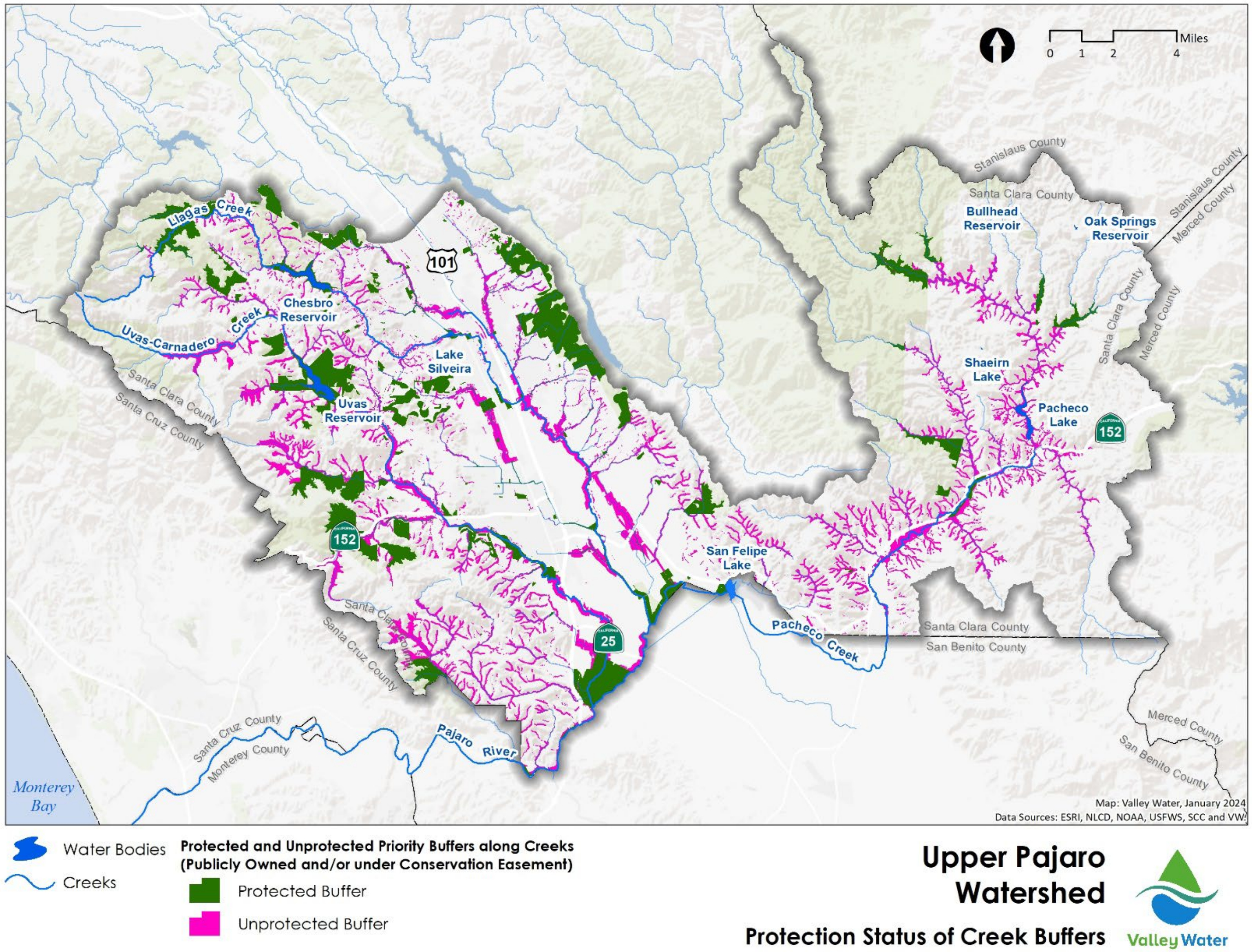

Figure 3-10: Protected and Unprotected Creek Channels in the Upper Pajaro Watershed

Challenges and Opportunities

The following factors are identified as major opportunities and constraints for preserving and enhancing ecological resources in the future.

Cross-Jurisdictional Resource Management

The Pajaro River watershed spans three counties, numerous cities and towns, and countless property owners. While jurisdictional boundaries may be an effective means to govern and manage society, they rarely align with the governing forces of a landscape. It is Valley Water's challenge and opportunity as a public agency entrusted with stewarding the waters in Santa Clara County to look beyond the boundaries delineated by votes and landownership to truly begin to manage ecological resources effectively. Heller and Zavaleta (2008), in their review of biodiversity in the face of climate change, call for strategies that are implemented not just by one agency but through partnerships and collaborative efforts. There are inspiring examples of such planning and management already in the Upper Pajaro watershed, such as the Pajaro Compass and the Pajaro River Watershed Flood Prevention Authority. There are also numerous stakeholders in the watershed with a focus or strong interest in ecological resource protection and enhancement. These include, but are not limited to, local Tribes, non-profit organizations, regulatory agencies, land use planning groups, and municipalities and community groups. Coordination with and between these stakeholders can bring technical and regulatory expertise to efforts; improve project designs and capture additional benefits; provide additional funding resources; and facilitate project implementation; among other things.

Conservation

Conservation is easier than restoration. Although the Watershed cannot be returned to its historical condition, Valley Water and its partners can move forward with a conscious effort to maintain, support, and enhance existing and emerging ecosystem services.

- Bold action is needed to conserve the unique natural landscapes and the rich biodiversity that surround and exist within communities in the San Francisco Bay Area. Millions are anticipated to be added to the Bay Area's population is expected, which is expected to reach 10.3 million by 2050. (MTC 2021). With current housing needs at crisis level, land will need to be developed to accommodate a growing population and create affordable housing and ancillary infrastructure such as roads and commercial services. Preservation of land at the regional level is necessary to ensure the long-term resilience of the region's diverse species and ecological communities, especially in the face of challenges such as climate change, drought, and population growth.
- Working rangelands support habitat and biodiversity; keeping them in production is central to achieving regional habitat conservation goals. The voluntary sale or donation of property development rights through conservation easements by range and forest landowners can ensure their operational viability while the lands continue to support invaluable habitat and provide landscape connectivity and services.
- In addition to providing food and jobs, the conservation of prime farmland in the valley floor helps control flood levels in the Pajaro River as far downstream as its mouth at the Pacific Ocean. Development of this farmland would displace the flood attenuation capacity of the land and create more impervious surface that would increase flows in creek channels. While drainage and development for agriculture has impacted ecological resources in numerous and severe

ways in the watershed, it can be managed to support many ecosystem services and is a better neighbor to habitat and wildlife than commercial or residential land uses.

- Protected lands provide buffers and refugia from the stressors of climate change in addition to anthropogenic pressure on the landscape. Protected lands create a mosaic of refugia on the landscape among inhospitable land-use types. This mosaic is often referred to as “stepping stones” as organisms can use these protected places to make shifts in their ranges or habitat usage. Protected lands form the region’s life support system by purifying, storing, and conveying water, producing food, sequestering carbon, and so much more. The healthier and more connected these natural areas remain, the better able they will be to provide life-giving benefits to people and wildlife while withstanding the effects of population increases and climate change in the coming decades (Chan et al. 2006).

Multi-Benefit Projects

As the One Water planning process seeks to demonstrate, management and enhancement actions for ecological resources can and do provide benefits for other water management priorities. Wider floodplains can store more high flow and reduce flood risk. Wider and denser riparian corridors slow and filter stormwater runoff and improve water quality. Water management for groundwater recharge can help sustain natural communities that qualify as groundwater dependent ecosystems. Reservoir and dam operations can be managed to protect and enhance downstream fish and aquatic habitats, which also supplying water and reducing flood risk. Structural changes to and planting of trapezoidal channels will be necessary to achieve One Water metrics for ecological resources in the watershed; such improvements could be incorporated when significant maintenance or alteration of modified channels is required. Expansion of habitat for wildlife or other ecosystem services has potential to offset greenhouse gas emissions. When management or infrastructure changes are being planned for one of these water management priorities, the others can be considered and included when feasible. The multiple benefits provided should be considered and quantified when evaluating costs.

Slow, Spread, and Sink

Slow, spread, and sink approaches to streamflow management can reduce flood risk, improve water quality, and enhance habitats. Opportunities to implement this approach where it will be most feasible and effective for multiple benefits and can be done in a manner that benefits, rather than conflicts with, agricultural land uses, should be investigated. Municipalities and other partners will need to be included since opportunities are likely to cross county and property boundaries.

Landowner and Farmer Education and Incentives

Much of the valley floor and hills are the watershed are in private ownership and are actively grazed or farmed. When managed, these lands can provide numerous ecosystem services that benefit the environment and people. Providing opportunities to educate, engage, and incentive landowners and farmers to manage their lands in these ways is both a challenge and opportunity and, fortunately, a focus of Resource Conservation District, non-profit organizations, and State Water Resources Control Board effort. For example, on Little Arthur Creek, water diversions and groundwater pumping decrease flow and limit fish habitat in the summer. Trout Unlimited and Coastal Habitat Education and Environmental Restoration (CHEER) installed a water tank to store water in the rainy season with the agreement that the landowner would not pump from the creek during the driest months. Similar coordination, incentives, and technical support could be used to: transition flood-prone farmland to habitat in exchange for improvements that make adjacent farmland more productive or profitable; to grow crops or use farming methods that are provide more ecosystem services; provide alternatives to the use of rodenticides that can poison non-target species and linger in the food chain; promote wider buffers around creeks; and orienting farm furrows parallel to streams instead of perpendicular to reduce turbidity, nutrients, and pesticides in the environment.

Homeless Encampments

Llagas Creek and its riparian corridor within and around Gilroy has been significantly impacted by encampments and related uses of unhoused individuals, which are on the rise. Riparian vegetation, which normally acts to slow or buffer natural wildfire, has been burned, in some places repeatedly, by fires that start from campfires or intentional arson. Trees and shrubs have been removed for campfire fuel, to make space for encampments, and to build or camouflage structures. In addition to destroying habitat that does not readily recover from burning, fires in riparian areas create hard soil surface crusts repellant to water, and when combined with loss of vegetation can lead to sheet or gully erosion that not only impacts water quality but also has the potential to damage infrastructure and adjacent private property. Encampment trash is a pollutant and appears to invite and exacerbate illegal dumping. Hazardous waste is regularly encountered at encampments, such as batteries, generators, oils, pesticides, aerosol cans, and various electronics, as is biological waste, which pollutes waterways, spreads disease, and creates unsafe conditions for field staff, volunteers, and the public. Encampment-related impacts are not only diminishing the condition and quality of existing creeks and riparian areas, but they are precluding the ability for Valley Water and others to implement successful enhancement and mitigation projects. Valley Water and others in Santa Clara County have undertaken numerous and costly efforts to reduce the environmental harm of encampments. Until sufficient housing and health services are available to reduce the unhoused population along urban creek corridors, however, efforts to conserve and enhance riverine and riparian ecological conditions will be extremely limited, less successful, and more expensive.

Chapter 4 Water Supply

Ensuring a reliable source of safe, clean water for a healthy life, environment and economy is central to Valley Water's mission, and consequently, is integrated into the One Water Framework and this Plan. The following subsections present the history of water supply within the study area, current water supply conditions, and anticipated future water supply challenges and opportunities.

Some information below references areas outside of Santa Clara County in order to provide holistic information on regional water resources.

4.1 Past Conditions

Indigenous Use of Water Resources (Pre-1769)

Historical records indicate that indigenous people fished in ponds, lakes, and streams. Records also indicate that most of the Indigenous peoples' villages were located within alluvial plains, in foothills, along creeks, and on the shore of lakes. For example, present day San Juan Bautista, known as Terentak or "place of small waters" or "the spring," was one of the main village locations for the Mutsun people (Grossinger, et al., 2008, p. 15). The confluence of the San Benito and Pajaro Rivers, was an important Mutsun, and possibly Uñijaima ceremonial site, called Juristak, or "place of the big head." (Grossinger et al. 2008, p. 16). Spanish Mission records also indicate that a large Ausaima village, called Poitoquix, was located along Pacheco Creek where evidence of seasonal freshwater ponds was found (Grossinger, et al., 2008, p. 17).

Early Agriculture and Artesian Groundwater Supply

As agriculture and ranching began to expand towards the end of the 19th century and beginning of the 20th century, free-flowing artesian wells provided ample water supply in the study area. As stated by staff at the San Benito Well Boring Company in 1889, people could "strike artesian water anywhere between San Felipe and Poverty Hill," near present day Hollister. According to historical census data and records, by 1888, there were at least 150 artesian wells in the Gilroy area and another 119 in northern San Benito County (Grossinger, et al., 2008, p. 25). Records demonstrate that groundwater was used on 80% to 90% of irrigated land by the late 19th century. There is evidence of irrigation ditches, but these were limited to those areas without access to artesian wells or used for supplemental winter irrigation. (Grossinger, et al., 2008, p. 31). Major groundwater basins and subbasins within the Pajaro River are described in detail in section 4.2.

In areas that lacked ample groundwater supply, dams and reservoirs were built. Uvas Creek was dammed in the 1870s, just south of the Uvas/Watsonville Road intersection, which would later become the site of Uvas Reservoir. (Grossinger, et al., 2008, p. 31). In 1874, with the intention of converting the freshwater wetland area of Soap Lake into viable grazing land, Miller's Canal, a narrow 3-mile-long canal, was completed. Miller's Canal, connected San Felipe Lake to Pajaro River, partially drained Soap Lake and converted approximately 6,000 to 7,000 acres into land suitable for cattle grazing. Additional canals were built to drain the Soap Lake area during the early 20th century (Grossinger, et al., 2008, p. 31). Prior to this hydromodification, San Felipe Lake connected to Pajaro River via an undefined sequence of seasonal and perennial freshwater wetlands. (Grossinger, et al., 2008, pp. 31-32)

Early Groundwater Management

By 1910, most wells required pumping, as artesian wells were becoming increasingly unreliable due to increased use of groundwater and hydrological conditions. The increase in pumping, coupled with the electrification of rural areas and the development of vertical turbine pumps in the 1930s, exacerbated the decline in groundwater levels, as groundwater pumping became even more ubiquitous. Water tables throughout the watershed dropped rapidly and by 1936, the water table dropped between 35 and 40 feet in areas with the most intense groundwater pumping within the Upper Pajaro watershed (Grossinger, et al., 2008, p. 33).

Recognizing the ongoing groundwater depletion, several agencies and special water districts were formed in the 1920s and 1930s, including the Santa Clara Valley Water Conservation District, the precursor to Valley Water.

Imported Water

As population within the Pajaro River Watershed continued to grow during the 1940s and 1950s, well drilling continued, which exacerbated groundwater depletion. Groundwater recharge provided by dams in the area was insufficient. As a result, water resource managers began to fill between available water supply and demand with imported water. In the early 1960s, the Santa Clara County Board of Supervisors purchased annual rights to 100,000 acre-feet from the State Water Project, operated by the California Department of Water Resources, to be delivered via the South Bay Aqueduct (Department of Water Resources, 2001). Santa Clara County also began receiving imported water from the Central Valley Project, operated by the Bureau of Reclamation, via the San Felipe Division upon its completion in 1987. (California State Water Resources Control Board, 1994).

4.2 Present Conditions

Valley Water manages Santa Clara County's water supply using a variety of sources including local surface water, imported water conveyed from the Sacramento-San Joaquin Delta, and recycled water. These supplies are used to replenish local groundwater aquifers, treated at Valley Water’s three drinking water treatment plants, sent directly to water users, and released to local creeks to meet environmental needs and regulations. Long-term water conservation and demand management efforts are another important component of the water supply portfolio. Valley Water’s countywide water supply and distribution system includes reservoirs, canals, water supply diversions, groundwater recharge ponds, controlled in-stream recharge, raw and treated water pipelines, pumping stations, and water treatment plants. Figure 4-1 shows water supply infrastructure including major streams, reservoirs, groundwater recharge ponds, and pipelines within the Upper Pajaro Watershed.

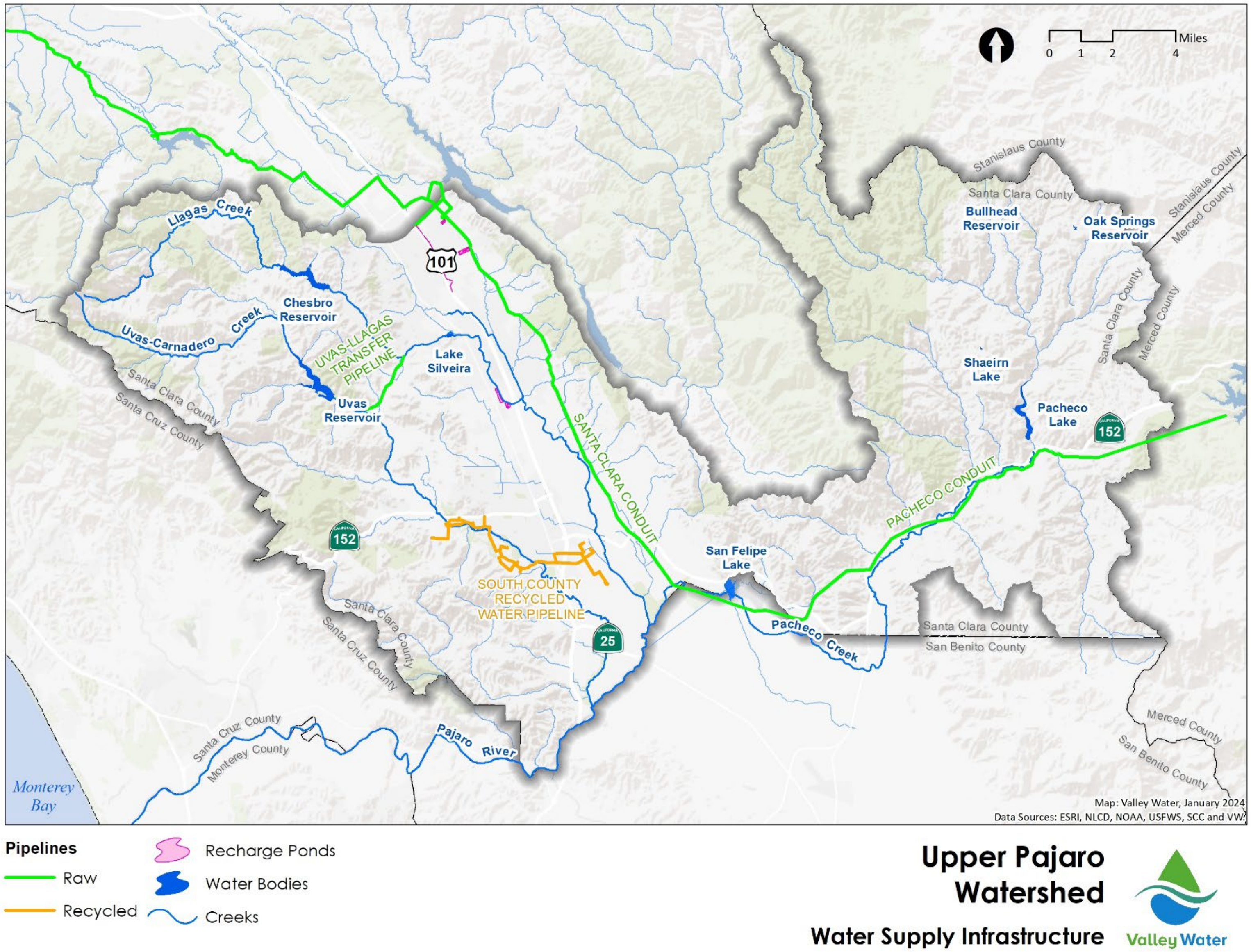

Figure 4-1: Water Supply Infrastructure in Upper Pajaro Watershed

UPPER PAJARO WATERSHED
17,655
Acre-feet of Valley Water reservoir capacity
21,900
Acre-feet per year of average natural recharge (Upper Pajaro watershed area of the Llagas Subbasin)[3]
2,100
Acre-feet of recycled water delivered to customers

In addition to Valley Water, the San Benito County Water District and Pacheco Pass Water District provide water supplies in portions of the Pajaro River Watershed (Appendix A). This section focuses on water supply infrastructure and operations located in the Upper Watershed that are managed by Valley Water.

The total water demand estimated within the Upper Watershed was approximated to be 45,000 acre-feet. This estimated water demand is distributed between municipal, industrial, and agricultural uses. The major source of water used within the upper watershed is groundwater, providing about 95% of water supply to the area with untreated surface water and recycled water sources making up the rest. Valley Water replenishes groundwater with local and imported surface water supplies.

Groundwater

A groundwater basin is defined as an aquifer or a stacked series of aquifers with well-defined boundaries in a lateral direction and a definable bottom, based on features that, in general, impede groundwater flow. A groundwater subbasin refers to a subdivision of a groundwater basin based on geologic and hydrologic barriers or institutional boundaries (California Department of Water Resources, 2021). Based on the California Department of Water Resources, Bulletin 118 2020 update, which includes the official publication on the occurrence and nature of groundwater, there are ten groundwater basins partially or completely located within the boundary of the Pajaro River Watershed. Of these ten basins, two groundwater subbasins partially overlap with the Upper Watershed: the Gilroy-Hollister Valley Llagas Area subbasin (Llagas Subbasin) and Gilroy-Hollister Valley North San Benito subbasin (North San Benito Subbasin). As shown in Figure 4-2, the Llagas Subbasin underlies the floor of the Santa Clara Valley and the North San Benito Subbasin only overlaps with small portions of the Upper Pajaro watershed.

The Sustainable Groundwater Management Act (SGMA) of 2014 lists Valley Water as the exclusive Groundwater Sustainability Agency (GSA) within Santa Clara County, which includes all of the Llagas Subbasin and the small portions of the North San Benito Subbasin in the county. Because the North San Benito Subbasin is largely within San Benito County, San Benito County Water District (SBCWD) has led SGMA compliance for the basin, with support from Valley Water. Both GSAs have been compliant with SGMA, including submitting all required reports and periodic updates to the Department of Water Resources (DWR). As of 2019, Valley Water has a DWR approved an Alternative to a Groundwater

[3] 10-yr average (2012 to 2021) of natural recharge in the Llagas Subbasin

Sustainability Plan (GSP), which includes the Llagas Subbasin. In 2021, Valley Water submitted the first period update to the Alternative, which is Valley Water's 2021 Groundwater Management Plan for the Santa Clara and Llagas Subbasins (Valley Water, 2021b). In 2023, DWR approved the North San Benito GSP that was submitted by SBCWD and Valley Water. The 2021 Groundwater Management Plan and North San Benito GSP include detailed information about Valley Water and SBCWD's groundwater management programs and investments to ensure the long-term sustainability of these groundwater resources.

Table 4-1: Water Supply Management in the Upper Pajaro Watershed

Water Use (Average Acre-Feet per Year)	
Groundwater Pumping*	42,500
Groundwater Recharge Capacity (Acre-Feet per Year)**	
Upper Llagas Recharge System	
Madrone Channel	8,055
East Little Llagas	1,100
Main Avenue Ponds	2,700
San Pedro Ponds	4,700
Lower Llagas Recharge System	
Uvas Creek	8,100
Llagas Creek	5,800
Church Ponds	7,300
Total Recharge Capacity	37,755
* Reported as the average annual from 2012 to 2021 from the Llagas Subbasin. ** Managed recharge systems in the Llagas Subbasin.	

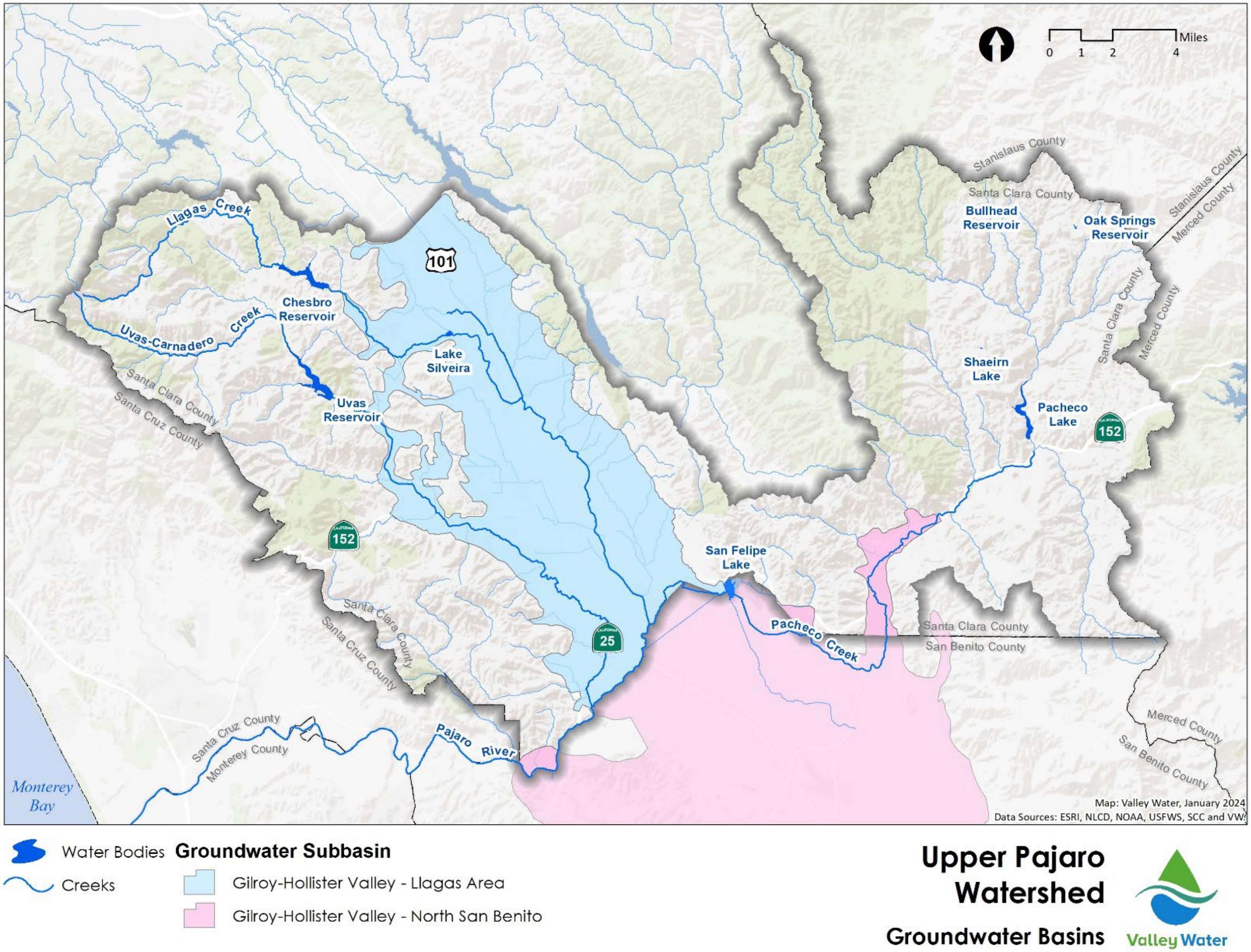

Figure 4-2: Upper Pajaro Watershed Groundwater Basins

Llagas Subbasin

The Llagas Subbasin is located entirely within the boundary of the Upper Pajaro Watershed and is managed by Valley Water. The Llagas Subbasin covers an area of 56,000 acres and is bounded by the Santa Cruz Mountains to the west, the Diablo Range to the east, Cochrane Road near Morgan Hill to the north, and the Pajaro River to the south.

The Llagas Subbasin is recharged naturally and by Valley Water's managed recharge facilities and operations. Natural recharge includes the deep percolation of rainfall, septic system and/or irrigation return flows, and natural seepage through creeks. Valley Water's managed recharge program uses both surface water runoff captured in local reservoirs and imported water delivered by the raw conveyance system. In the Llagas Subbasin, Valley Water operates the Upper Llagas Recharge System and Lower Llagas Recharge System (Table 4-1), which includes both instream and off-stream percolation pond facilities. Natural and managed recharge quantities vary each year due many factors including hydrology, imported water allocations, water demand, groundwater conditions, and environmental needs. Total operational storage capacity for the Llagas Subbasin has been estimated to range between 152,000 and 165,000 acre-feet (Valley Water, 2021b). The 10-year average groundwater pumping from the Llagas Subbasin is 42,500 acre-feet per year (Table 4-1). During 2022, total pumping within the Llagas Subbasin was 42,500 AF with agricultural use accounting for 57% (24,400 acre-feet), municipal and industrial use accounting for 39% (16,500 acre-feet), and domestic pumping accounting for approximately 4% (1,600 acre-feet).

The Llagas Subbasin is the main water source for public water systems like the cities of Morgan Hill and Gilroy, the San Martin County Water District, and the West San Martin Water Works. Thousands of privately owned wells used for domestic, agricultural, and industrial purposes also share the same groundwater basin.

Gilroy-Hollister Valley/North San Benito Subbasin

The Gilroy-Hollister Valley/North San Benito Subbasin (North San Benito Subbasin) is a consolidation of four subbasins: the Bolsa Area Subbasin, the Hollister Area Subbasin, the San Juan Bautista Subbasin, and the Tres Pinos Valley. The North San Benito Subbasin is 131,000 acres with approximately 97% of the subbasin located within San Benito County and the rest located within Santa Clara County. The portion of the subbasin located within San Benito County is managed by the San Benito County Water District while Valley Water is the GSA for the portion of the subbasin located within Santa Clara County (San Benito County Water District, 2021).

The North San Benito Subbasin is bounded in the north by Pajaro River and Pacheco Creek as well as part of the Santa Clara-San Benito County line, in the southwest by the San Andreas Fault and the Gabilan Range, and in the east by the Diablo Range (Bolsa Area Subbasin and Hollister Area Subbasin).

Local Surface Water

As described in Chapter 1, the Upper Pajaro Watershed is comprised primarily of the Llagas, Uvas, Pacheco, and Pajaro subwatersheds. These subwatersheds contain numerous small and unnamed creeks that flow into Llagas, Uvas, and Pacheco Creeks. These creeks ultimately drain to the Monterey Bay from the slopes of the Santa Cruz Mountains and Diablo Range via the Pajaro River. Major creek systems are shown by subwatershed in Figure 1-3.

Two reservoirs located in the watershed, Uvas and Chesbro, are operated by Valley Water and are designed to capture and store local rainfall runoff for downstream groundwater recharge. The Pacheco Reservoir, owned and operated by the Pacheco Pass Water District, impounds the Pacheco Creek's north fork and has an operational capacity of 5,500 acre-feet of water. San Felipe Lake is a natural lake located east of Gilroy in northern San Benito County near the border of Santa Clara County. San Felipe Lake is not used for water supply; however, it is an ecological asset important to the Upper Pajaro watershed and discussed further in Section 3.2.

Imported Water

The Upper Pajaro watershed receives imported water conveyed through the Delta from the federal Central Valley Project (CVP) via San Luis Reservoir. This water is used for managed recharge in Valley Water's Upper Llagas Recharge System.

Treated Water

The cities of Gilroy and Morgan Hill obtain municipal water supplies from groundwater well sources, most of which are within the Llagas Subbasin. The City of Gilroy currently operates nine groundwater wells, and the City of Morgan Hill operates 16 groundwater wells (City of Gilroy Water Department, 2022 and City of Morgan Hill, 2022). Water extracted from these wells is disinfected prior to delivery to residents, businesses, and other users. Valley Water does not supply treated water via its water supply system to the cities of Gilroy and Morgan Hill. However, Valley Water manages groundwater recharge as described above to support the reliability of safe, clean water supplies in the Upper Pajaro watershed.

Recycled Water

Recycled water is an important source of water for irrigation and industrial use in the Upper Pajaro watershed. In partnership with Valley Water, the South County Regional Wastewater Authority (SCRWA) produces recycled water at facility co-located at the SCRWA wastewater treatment plant in Gilroy. This recycled water is distributed via a network of pipelines dedicated to recycled water in the southern portion of Gilroy. The South County Recycled Water Pipeline, which is a new component of this pipeline network, was completed in 2023 and will distribute recycled water for irrigation, industrial, and agricultural uses. Figure 4-1 shows the recycled water pipelines located in the Upper Pajaro watershed.

Water Conservation

Valley Water and all major retail water providers partner in regional implementation of a variety of water-use efficiency programs (water conservation programs) to permanently reduce water use in the county. Valley Water's long-term savings target is to achieve 99,000 acre-feet per year (AFY) in water savings by 2030 and 109,000 AFY by 2040 (110,000 AFY when including stormwater capture projects). The Water Supply Master Plan 2040's "No Regrets" package includes water conservation programs designed to achieve this ambitious water savings target, as well as stormwater capture/recharge programs. Work is underway to establish a new target for the Water Supply Master Plan 2050 to increase our community's water supply reliability.

To identify strategies to achieve both Valley Water's aggressive long-term targets and the State's "Making Conservation a California Way of Life" regulatory framework's objectives, Valley Water completed a Water Conservation Strategic Plan (Strategic Plan) in 2021 (Valley Water, 2021c). The Strategic Plan details specific recommendations and strategies for increasing participation rates in water conservation programs, addressing geographic or demographic disparities in participation trends, and considering the creation of new programs and conservation policies. Importantly, the Strategic Plan determined that the type and variety of programs Valley Water offers are sufficient to meet the long-term savings target if resources are invested to increase participation rates. Adoption of local conservation policies such as a Model Water-Efficient New Development Ordinance have the potential to meet the long-term savings target earlier and more cost effectively than without such policies.

As of FY 2023, Valley Water's Water Conservation Programs and policies have saved over 83,000 acre-feet per year. Valley Water implements more than 20 different ongoing water conservation programs including incentives and rebates, free device installation, free delivery of water-saving devices and educational resources, one-on-one home visits, site surveys, and educational outreach to reduce water consumption in homes, businesses and agriculture. These programs are designed to achieve sustainable, long-term water savings and are implemented regardless of water supply conditions. Without these programs and the savings generated from them, Valley Water would need to develop or import an equal supply every year. Additional information about the Water Conservation Strategic Plan and available water conservation programs is available at www.watersavings.org.

Related Plans

Urban Water Management Plan

The Urban Water Management Plan (UWMP) is a long-range planning document that is required by the California Department of Water Resources (Valley Water, 2020). The UWMP is a state-mandated master plan that includes an agency's projected water supplies and demands over the next 25 years, as well as water shortage contingency planning and conservation efforts. The plan is required to be updated every five years, and failure to comply with this legal requirement will jeopardize an agency's eligibility for State funding. The plan was last updated in 2020 and the next update will be in 2025.

Water Supply Master Plan

The Water Supply Master Plan (WSMP) is Valley Water's guiding document for long-term water supply investments to ensure water supply reliability for Santa Clara County. Updated about every five years, this long-range plan assesses future county-wide demands and evaluates and recommends water supply and infrastructure projects to meet those demands to achieve Valley Water's level of service (LOS) goal through the planning horizon. Valley Water's level of service goal is "Meet 100 percent of annual water demand during non-drought years and at least 80 percent demand in drought years" (Valley Water, 2019). The most recent plan, Water Supply Master Plan 2040, was adopted by the Valley Water Board of Directors in 2019. Valley Water is currently developing the WSMP 2050, which extends planning horizon to 2050 and is expected to be completed by the end of 2024.

4.3. Future Conditions, Challenges, and Opportunities

Challenges

Climate Change

Climate change is predicted to bring impacts such as warming temperatures, shrinking snowpack, extreme weather, prolonged droughts, and wildfire. Some of these impacts are already being experienced across California and Santa Clara County. Future projections indicate that the Santa Clara Valley could experience a change in hydrologic patterns and an increase in rainfall averages, as well as an increase in the length and intensity of droughts. This means that the valley's extreme events (storms and droughts) could become even more extreme compared to historic conditions, changing the ways that Valley Water manages and utilizes its water supply. The reliability of local and imported surface water will become increasingly uncertain, and additional climate impacts such as increased wildfires could threaten water supply infrastructure and power supply. Collectively, climate-related impacts have the potential to compound and simultaneously impact multiple aspects of Valley Water's operations. Climate change will make it more challenging to balance priorities such as providing enough water supply to meet demand while maintaining stream flows and water quality amidst severe drought conditions.

Valley Water developed a Climate Change Action Plan (CCAP), which was adopted by the Board of Directors in July of 2021. The plan addresses Valley Water's climate vulnerabilities and provides actions to address them (Valley Water, 2021d). The 2021 Groundwater Management Plan (Valley Water, 2021b) presents a projected groundwater budget that incorporates future climate change and describes likely operational flexibility to compensate for changes in groundwater storage, and Valley Water's water supply planning team is evaluating how climate change could impact future local and imported water supplies.

Changes in Land Use and Water Demand

Changes in land use and new development can increase demand for water and, if not offset with new supplies or additional water conservation, can create water shortages. The uncertainties in water demand forecasting associated with climate change will make advanced planning for increased development even more challenging. It is important that planned water conservation savings (a One Water metric) are achieved in the Upper Pajaro watershed and throughout the County. However, effective One Water management will continue to require Valley Water's engagement with land use decisions in areas critical to supply and recharge.

Opportunities

Green Stormwater Infrastructure

Stormwater runoff in the urban environment is the largest pathway of pollution and hydromodification to urban waterways, but there is opportunity to capture, treat, and use this resource through green stormwater infrastructure (GSI). GSI is a broad term used to describe stormwater management techniques that make the developed landscape behave more like the natural landscape with respect to infiltration and runoff. This can include small-scale on-site measures like green roofs, rain gardens, and rain barrels to collect, clean, and infiltrate rainwater, or store it for later irrigation needs. Larger impervious areas can be treated using features like streetside, parking lot, or regional bioretention features. These can be integrated with open space or park land. These techniques are being increasingly implemented in response to regulatory requirements and public demand as areas are developed or redeveloped. Over time, GSI can have an increasingly large beneficial effect on water quality, water supply, environmental health, and general public wellbeing in urban areas. Increasing the implementation of GSI presents an opportunity to realize several concurrent benefits.

Expanding Water Supplies

There are several strategies that have the potential to increase water supply in Santa Clara County, or to enhance reliability of those supplies. Many of these strategies are fully explained in more detail in the Valley Water's Water Supply Master Plan. One strategy is to increase the use of recycled water by expanding the current distribution system to reach more users, as well as constructing advanced water purification plants to support potable reuse.

Expanding Groundwater Recharge

Through the Water Supply Master Plan, Valley Water is evaluating several projects that would expand managed recharge at the Madrone Channel, Main Avenue Ponds, and San Pedro Ponds within the Llagas Subbasin. Flood-Managed Aquifer Recharge (Flood-MAR) is an additional way in which groundwater recharge could be expanded to increase water supply and potentially reduce stormwater runoff into urban areas. A pre-feasibility study identified that capturing hillside runoff onto open space before it reaches roads and storm sewers may be the most feasible approach to Flood-MAR in Santa Clara County. Valley Water is continuing studies to assess the feasibility of Flood-MAR in Santa Clara County. Unlike our existing managed aquifer recharge operations or the large-scale Flood-MAR being piloted in the Central Valley, Valley Water expects the amount of water captured to be relatively small. Portions of the Upper Pajaro watershed, including the Llagas subbasin, may have opportunities for Flood-MAR and/or expanded groundwater recharge. Valley Water presents updates on Flood-MAR feasibility in Santa Clara County to the Water Conservation and Demand Management Committee.

Chapter 5 Water Quality

In a well-functioning watershed, natural processes work to sustain good water quality — water in which native fish and other biota thrive and that humans can safely use. However, several land uses and land management practices inhibit this water quality. These include mining, ranching, agriculture, urbanization, and construction of water management infrastructure, which have all altered the natural dynamics of many streams. In addition to changing natural hydrology, direct and indirect pollution from both human and natural sources undermines the quality of the water necessary for human and environmental use in Santa Clara County.

A general description of Valley Water's water quality protection and management activities throughout Santa Clara County, including the regulatory context, can be found in section 2.2.3 of the One Water Framework (OWF SCC VW 2021 pp.40-48), as well as its Appendix C. A discussion of how past conditions and land use changes affected water quality can be found in Section 2.1. of the Framework (pp. 11-22).

This section focuses on Valley Water's current water quality protection and management activities in Upper Pajaro watershed. Using data from existing water quality monitoring and creek health assessments, this section summarizes current conditions, describes key pollutants, and outlines district management actions, as well as key challenges ahead.

Water quality management is described as three types: source water (in reservoirs for eventual treatment for human use or groundwater recharge or for ecological purposes), surface water (in creeks and urban runoff), and groundwater. In general, primary water quality issues in the Watershed include sediment, trash, pathogens, urban and agricultural runoff, and algal blooms. While Valley Water's overall water quality goal remains to protect the beneficial uses of these waters, new thinking about the relationships between water quality, natural flood protection, water supply, and watershed restoration informs One Water planning.

5.1 Past Conditions

Water quality in Santa Clara County waterways, including those in the Upper Pajaro watershed, have been directly impacted by local and watershed-wide land use changes that date back to the time of Spanish and Mexican land grants in 18th and 19th century California. The rapid increase in the local population caused by the Gold Rush had an adverse impact on water quality due to agricultural draining and human stream modifications. Though the indigenous people actively managed the land prior to this time, any anthropogenic water quality impacts were minimal.

Cattle grazing beginning in the late 1700s negatively affected water quality in the Pajaro River watershed by adding pathogens and excess nutrients to the creeks, as well as causing stream bank erosion and increased sediment load to the creeks. These grazing impacts continue to this day in some portions of the upper Watershed. As discussed in Chapter 2, Orchards began to replace many pastures in the early 1900s, followed by the proliferation of row crops in the 1930s. During this time, the number of dairies also increased as the population of Santa Clara Valley grew. Water quality impacts from orchards included an increase in fine-grained sediment discharges to creeks as well as pesticide toxicity impairments. Dairies degraded water quality by introducing pathogens and excess nutrients to the waterways.

Moving through the second half of the 20th century, the Watershed underwent further urbanization and industrialization, as well as agricultural intensification. The use of fertilizers, pesticides, and herbicides increased the nutrient and chemical loading into the watershed. The construction of dams, levees, canals, wells, and pipelines altered the hydrology and geomorphology of the river system. The expansion of residential subdivisions, commercial centers, roads, and highways increased stormwater runoff volume and prevalence of urban pollutants. The mining of mercury, sand, and gravel introduced heavy metals and asbestos. Collectively, these activities contributed to the degradation of riparian vegetation which reduced the natural filtering and shading functions of the stream banks.

5.2 Present Conditions

Groundwater Quality

Gilroy-Hollister Valley/Llagas Area Groundwater Subbasin

The Gilroy-Hollister Valley/Llagas Area groundwater subbasin (Llagas Subbasin), is located in south Santa Clara County, within the boundary of the Upper Pajaro Watershed and is managed by Valley Water.

Groundwater in the Llagas Subbasin is generally of good quality that does not need treatment beyond disinfection at public water supply wells. The main water quality impairment observed within the Llagas Subbasin is nitrate (Valley Water, 2021b). The presence of nitrate in groundwater is commonly associated with fertilizer use, septic systems, and livestock waste. Since the 1990s, Valley Water has implemented many nitrate management programs and has worked with other agencies to: define the extent and severity of nitrate contamination, identify potential nitrate sources, reduce nitrate loading to groundwater, and reduce customer exposure to elevated nitrate. Current Valley Water efforts include continued groundwater recharge (which helps to dilute nitrate), groundwater monitoring (including free basic water quality testing for eligible domestic wells), public outreach, and collaboration with other agencies. Valley Water also led efforts to develop regional salt and nutrient management plans. The presence of elevated nitrate in many wells (primarily domestic wells) is an ongoing groundwater protection challenge for Valley Water. However, the 2010 to 2019 median principal aquifer nitrate concentration was 5.3 milligrams per liter (mg/L) N (below the California Division of Drinking Water Maximum Contaminant Level of 10 mg/L) and the concentration trends in the Llagas Subbasin remain relatively stable or decreasing (Valley Water, 2021b). For example, 91% of wells tested in the principal aquifer of the Llagas Subbasin had stable or decreasing nitrate concentration trends between 2008 and 2022 (Valley Water, 2023).

An additional constituent of concern within the Llagas Subbasin, mainly for private water well owners, is perchlorate. Perchlorate is a chemical that affects the normal function of the thyroid gland if consumed by humans in sufficiently high doses. For this reason, the California Division of Drinking Water has established a Maximum Contaminant Level (MCL) of 6 parts per billion (ppb) for public water systems. Olin Corporation, a signal flare manufacturing company that operated a manufacturing facility located in south Morgan Hill until 1997, released perchlorate that leached into the subbasin, creating a plume. When the perchlorate contamination plume was first delineated, it was approximately 9.5 miles in length and perchlorate was detected in hundreds of wells within the Llagas Subbasin. In 2003, the responsible party implemented a replacement water program for persons affected by perchlorate impacted domestic wells in conjunction with Valley Water, with 188 impacted wells initially in the program. The responsible party completed onsite soil cleanup in 2006 through a combination of excavation with offsite disposal and bioremediation. The responsible party has implemented onsite and offsite groundwater capture and treatment via 6 extraction wells and an onsite perchlorate ion exchange filtration system. As of 2023, only four of the initial 188 domestic wells remain in the replacement water program owing to declining perchlorate concentrations in the Llagas subbasin resulting from active cleanup efforts and natural attenuation of perchlorate. Remediation is ongoing with Olin Corporation continuing a comprehensive well sampling program to monitor the perchlorate plume within the Llagas Subbasin (State Water Resources Control Board, 2024).

Gilroy-Hollister Valley/North San Benito Subbasin

Groundwater in the North San Benito Subbasin is highly mineralized and of marginal water quality for drinking and agricultural purposes, which is typical of other Coast Range groundwater basins because of the geology (San Benito County Water District, 2021). Groundwater quality has also been impacted by human activities, including agricultural, urban, and industrial land uses (San Benito County Water District, 2021). Groundwater quality constituents of concern include total dissolved solids (TDS), nitrate, hardness, boron, perchlorate, and metals, including arsenic, chromium, iron, magnesium, and selenium (San Benito County Water District, 2021). The North San Benito GSP describes regional groundwater quality monitoring networks and other programs and activities focused on priority water quality issues.

Local Surface Water Quality

Section 303(d) of the 1972 Federal Clean Water Act requires states to identify water bodies that do not meet water quality objectives and are not supporting their designated beneficial uses. For the Upper Pajaro Watershed, several surface water bodies have been included on the State's 303(d) list as impaired. Impaired water bodies are shown in Figure 5-1 and their impairments are listed in Table 5-1. The sections below describe the currently impaired water bodies, their currently implemented water quality improvement programs through Total Maximum Daily Load (TMDL) requirements, and any additional challenges these surface water bodies face. The Upper Pajaro Watershed is largely agricultural with increasing urban land use. Contributors to impairments include agriculture, domestic animals/livestock, natural sources, collection system failure, urban runoff/storm sewers, grazing, habitat modification, highway/road/bridge construction, hydromodification, irrigated crop production, land development, logging road construction/maintenance, resource extraction, and silviculture. The impaired surface water bodies are organized by subwatershed and several may be included in a current TMDL for the entire watershed.

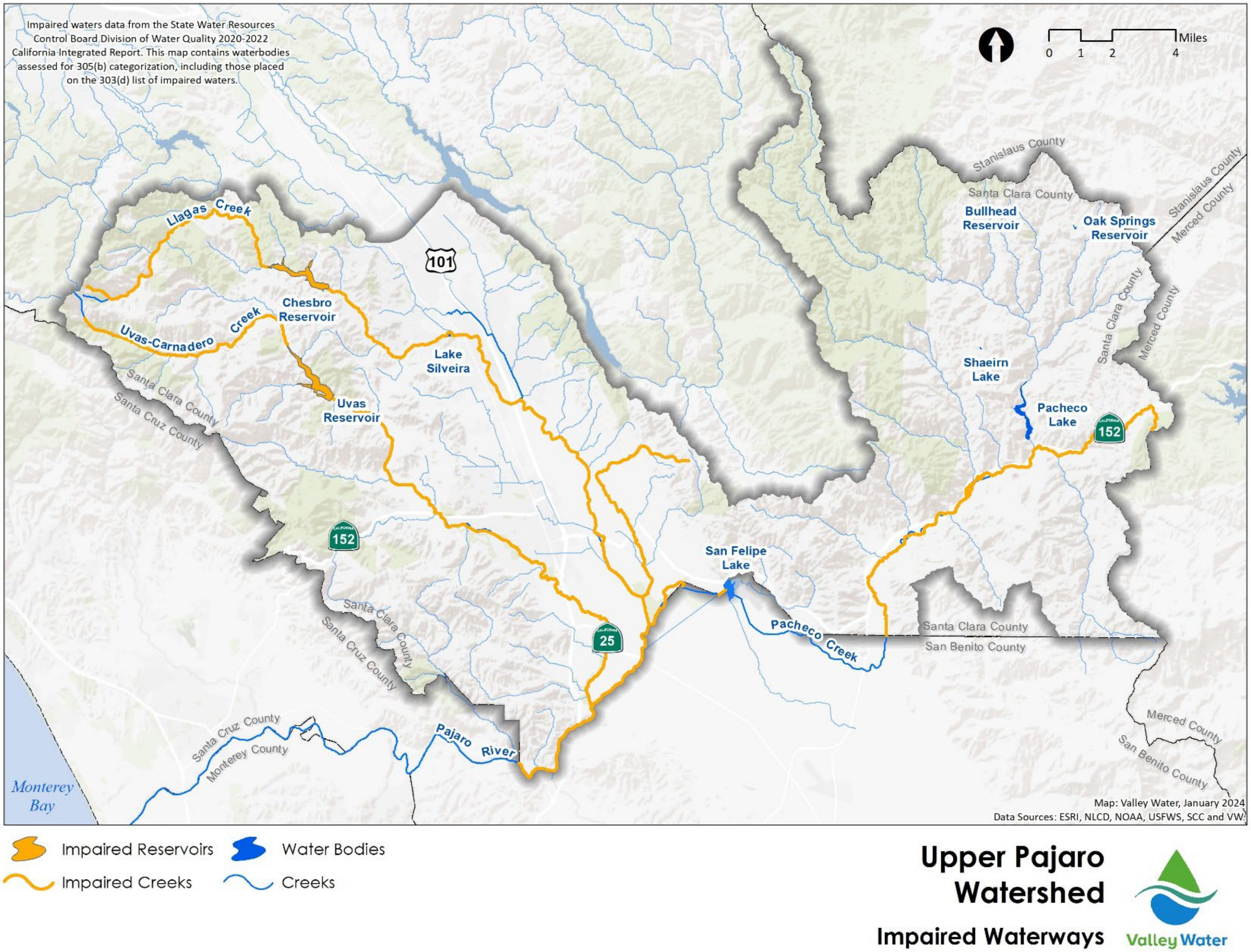

Figure 5-1: Impaired Water Bodies in the Upper Pajaro Watershed

Table 5-1: Water Body Impairments

Water Body	Pollutants Listed
Carnadero Creek (Uvas Creek below Bloomfield Road)	Escherichia coli (E. coli) Imidacloprid Nitrate Oxygen, Dissolved Toxicity Turbidity
Chesbro Reservoir	DDT (Dichlorodiphenyltrichloroethane) Mercury
Furlong Creek	E. coli Fecal Coliform Imidacloprid Nitrate Selenium Toxicity Turbidity
Llagas Creek (above Chesbro Reservoir)	pH Temperature
Llagas Creek (below Chesbro Reservoir)	Benthic Community Effects Chloride Chlorpyrifos Copper E. coli Manganese Nitrate Oxygen, Dissolved Sedimentation/Siltation Selenium Sodium Specific Conductivity Total Dissolved Solids Toxicity Turbidity
Millers Canal	Arsenic Chlorophyll-a Nitrate Oxygen, Dissolved pH Selenium Temperature Toxicity Turbidity
Pacheco Creek	Oxygen, dissolved

	Turbidity
Pajaro River	Benthic Community Effects Boron Chlordane Chloride Chlorpyrifos Chromium DDD (Dichlorodiphenyldichloroethane) DDE (Dichlorodiphenyldichloroethylene) DDT Dieldrin Escherichia coli Imidacloprid Manganese Nickel Nitrate Oxyfluorfen Oxygen, Dissolved PCBs (Polychlorinated biphenyls) pH Sedimentation/Siltation Selenium Sodium Toxicity Turbidity
Uvas Creek (above Uvas Reservoir)	pH Temperature
Uvas Creek (below Uvas Reservoir)	Oxygen, dissolved Turbidity
Uvas Reservoir	Mercury

Pacheco Creek Subwatershed

Pacheco Creek is listed on the State's 303(d) list of impaired waterbodies as impaired by turbidity and low dissolved oxygen. No TMDL has yet been established for turbidity, but dissolved oxygen is included under the Pajaro River Watershed Nutrient TMDL for Pacheco Creek. Fecal coliform was originally listed as an impairment for Pacheco Creek but was delisted due to applicable water quality standards being attained through the Pajaro River Watershed Fecal Coliform TMDL and changes in water quality standards (State Water Resources Control Board, 2022).

Pajaro River Subwatershed

Pajaro River has several listed impairments and crosses through multiple jurisdictions land uses (State Water Resources Control Board, 2022). It is the main stem that receives water from upstream tributaries (Pacheco Creek, Llagas Creek, and Uvas-Carnadero subwatersheds) and discharges to Monterey Bay. This subwatershed is largely agricultural with increasing urban land use. Only five of the 23 listed impairments (chlorpyrifos, nitrate, low dissolved oxygen (DO), sedimentation/siltation, and toxicity) have a source analysis available. Four TMDLs have been created for the entirety of the Pajaro River Watershed to guide water quality improvement programs for the Pajaro River that will address the five listed impairments. The Pajaro River Watershed TMDLs include Chlorpyrifos & Diazinon, Nutrients, Sediment, and Fecal Coliform. The remaining impairments are scheduled to have specific TMDLs developed over the next several years (State Water Resources Control Board, 2022).

Llagas Creek Subwatershed

There are two 303(d)-listed creeks and one reservoir within the Llagas Creek subwatershed – Furlong Creek, Llagas Creek and Chesbro Reservoir (State Water Resources Control Board, 2022). Furlong Creek is a tributary that joins Llagas Creek before the Pajaro River confluence. It has several listed impairments including fecal coliform and nitrate. Furlong Creek and these two impairments are addressed under the Pajaro River Watershed Fecal Coliform and Nutrient TMDLs. Several of the other listed impairments are similar to the lower portion of Llagas Creek (State Water Resources Control Board, 2022).

The impairments for Llagas Creek are separated by the Chesbro Reservoir (above and below). The reach of Llagas Creek above Chesbro Reservoir is listed as impaired by temperature and pH, for which no TMDLs have been developed. Chesbro Reservoir is currently listed for Mercury in Largemouth Bass and is one of 131 mercury-impaired reservoirs that will be addressed by the Statewide mercury control program for mercury. The reservoir is also listed for DDT (Dichlorodiphenyltrichloroethane), but there is currently no TMDL for DDT since its manufacture and use has been banned for many years. Llagas Creek below Chesbro Reservoir has several impairment listings, six of which (chlorpyrifos, E. coli, nitrate, low DO, sedimentation/siltation, and toxicity) are covered by the four TMDLs within the Pajaro River Watershed (State Water Resources Control Board, 2022).

Uvas-Carnadero Creek Subwatershed

There are two 303(d) listed creeks and one reservoir within the Uvas-Carnadero subwatershed – Uvas Creek, Carnadero Creek, and Uvas Reservoir (State Water Resources Control Board, 2022). The impairments for Uvas Creek are separated by the Uvas Reservoir (above and below). The reach of Uvas Creek above Uvas Reservoir is listed for temperature and pH, with no currently developed TMDLs. Uvas Reservoir is listed for Mercury in Largemouth Bass and is also one of 131 mercury-impaired reservoirs that will be addressed by the Statewide mercury control program for mercury. As such, there is no individual TMDL developed for the mercury impairment in this reservoir. Uvas Creek below the reservoir is listed for two water quality impairments (low DO and turbidity). The low dissolved oxygen is covered under the Pajaro River Watershed Nutrient TMDL. There is no current TMDL for turbidity, but likely sources are agricultural practices in the more rural reaches and urban runoff in the more urban reaches. While Uvas Creek is not listed as impaired for fecal coliform, it is covered under the current Pajaro River Watershed Fecal Coliform TMDL because it feeds into Carnadero Creek (State Water Resources Control Board, 2022).

Carnadero Creek is fed from Uvas Creek upstream before the Pajaro River confluence. It is listed for several impairments, three of which (E. Coli, nitrate, and low DO) are covered by two Pajaro River Watershed TMDLs (State Water Resources Control Board, 2022). Uvas creek (below the reservoir) and Carnadero Creek share two impairments: low DO and turbidity. The associated Pajaro River Watershed TMDLs include Nutrients and Fecal Coliform. Carnadero Creek was delisted for fecal coliform impairment due to applicable WQS attainment through the TMDL and due to changes in the WQS. Responsible agencies listed in the TMDLs are required to implement water quality improvement programs to attain load allocations (State Water Resources Control Board, 2022).

Imported Water Quality

The water quality of water supplies sourced from the CVP is influenced by various natural and human factors, such as climate, hydrology, geology, land use, and water management. CVP water used for groundwater recharge in the Upper Pajaro Watershed comes from San Luis Reservoir, which has historically been a reliable, high quality water source. However, low water levels in the reservoir during drought conditions have resulted in raw water quality challenges in the past. Such low level events have been associated with elevated turbidity, taste and odor (T&O) compounds, algal toxins, and manganese.

5.3 Future Conditions, Challenges, and Opportunities

Challenges

Agricultural Runoff

Agricultural runoff is a persistent stressor on water quality in the Watershed. Valley Water's role in addressing agricultural runoff is limited; however, it can support efforts led by organizations such as the Resource Conservation Districts, Natural Resource Conservation Service, the Santa Clara County Division of Agriculture, and the Central Coast Regional Water Quality Control Board (Water Board) to reduce pollution from agricultural runoff. There are ongoing opportunities to educate and assist farmers and landowners in implementing land management practices to improve water quality and enhance natural resources. Several TMDLs (Nutrients, Sediment, Fecal Coliform) could potentially help meet this with partnership between municipal agencies and local farmlands.

Urban Runoff

Stormwater runoff is a key pathway contributing to pollutants in the Upper Pajaro watershed. In particular, non-point source pollution from urban runoff can raise water temperatures, reduce biological conditions, scour channels, and mobilize various pollutants (e.g., trash, pesticides, sediment, PCBs, nutrients, pathogens, contaminants of emerging concern). Increasing temperatures due to climate change may increase the warming effects of urban runoff, reducing the potential for streams to support sensitive organisms such as steelhead. Continued sediment toxicity from new pesticides continues to be a challenge to control at the watershed level as regulation and use is controlled by the California Department of Pesticide Regulation (DPR). Hydrograph management also is a challenge for water quality in the urban reaches, especially related to sedimentation and erosion, however stormwater regulations have been adopted and implemented to minimize future effects.

Unsheltered Populations

Unhoused encampments are a challenge throughout the County and have a major impact on the amount of trash, erosion, and human pathogens entering waterways, including Uvas and Llagas Creeks. Joint agency homeless encampment cleanups and supportive services programs are expanding, but often cannot keep up with this significant societal issue.

Sediment Loads and Bacteria

Addressing erosion and sedimentation due to expanding areas of new urban development and agriculture is a continued challenge. However, there are potential opportunities to control erosion and sedimentation from urban development and potentially from agriculture lands through implementation of green stormwater infrastructure. Continued partnership with the Cities of Gilroy and Morgan Hill and Santa Clara County will also be necessary to identify opportunities and actions to reduce bacteria and sediment loads within Llagas and Uvas Creeks.

Imported Water Challenges

Climate change and future regulations are expected to pose significant challenges to the operations of the SWP and CVP. Climate change will impact water supply availability and water quality as droughts become more severe and as temperatures warm. Future regulations, such as those associated with the Bay Delta Plan, aim to improve the ecological health of the imported water watersheds. However, those regulations may also result in a decreased availability of imported supplies since more water will be released for environmental protection.

Opportunities

Water Quality Monitoring

Surface water quality metric assessments in this report are primarily reliant on the last 10 years of data from the State's Surface Water Ambient Monitoring Program (SWAMP). The SWAMP uses limited State resources to monitor water bodies throughout the state. Consequently, available water quality data for the watershed are limited and challenging to use at a programmatic level. Development of a more comprehensive water quality monitoring program is an opportunity to close critical data gaps and provide greater confidence in watershed or water body scale surface water quality assessments to track progress toward attainment of water quality standards. Monitoring activities could include quarterly surface and depth profiles for general water quality, seasonal sampling for algal toxins, and periodic fish monitoring for mercury and other contaminants (e.g., nutrients, metals, pesticides, etc.).

Green Stormwater Infrastructure

Erosion, sedimentation, and bacterial contamination issues stemming from urban development and agricultural activities present a continual challenge in the Upper Pajaro watershed. There are opportunities to implement the South Santa Clara County Stormwater Resources Plan and include regional green stormwater infrastructure projects, which can support water quality improvements by treating stormwater before it enters waterways, in collaboration with local municipalities. Significant progress has been made in the past several years to implement green stormwater infrastructure in an individual project/parcel-based manner. Larger "regional" green infrastructure projects in partnership with municipalities could result in significantly more water quality and other benefits at a much lower overall project lifetime cost. Implementing such projects will likely involve cooperation between multiple agencies.

Trash and Illegal Dumping

There are numerous areas in creeks throughout the Watershed that experience recurring illegal dumping and accumulation of trash. Partnerships with the Cities of Gilroy and Morgan Hill and Santa Clara County represent an opportunity to reduce and prevent trash dumping. In urban areas, multi-benefit projects that incorporate trash capture devices offer promising solutions to address trash pollution.

Chapter 6 Flooding

This section presents the past, present, and future conditions in the Upper Pajaro Watershed with respect to flood risk and describes methods used to manage and assess flood risk and vulnerability in the watershed.

Flood risk reduction involves keeping the water away from people and people away from the water during large storm events. For Valley Water and its federal and local partners, reducing flood risk involves maintaining the flow capacity of streams, reducing flood risk through capital investments, and communicating flood risk to communities and the public. Flood protection projects are designed and built to reduce the risk of flooding, but it is not possible to completely eliminate flood risk. There is always the potential of a storm event that could trigger flood flows beyond a flood protection project's designed capacity.

As described in Section 2.2.4 of the One Water Framework for Santa Clara County (pp. 49-58) (Valley Water, 2021e), flood protection begins with understanding local conditions. Various characteristics of Santa Clara County's physical and hydrologic landscape contribute to its flood risk. The steep-sided mountain ranges bordering the valley catch storms coming in from the Pacific and quickly send the rainfall to short, steep streams that abruptly transition to a flat valley floor. Floods can occur within a few hours of intense storms with little warning. Once the water reaches the valley floor, flows can overtop banks leading to widespread flooding. These floods typically produce shallow moving water that is dangerous for people and cars and can inundate homes, streets, and structures. Simultaneously, rainwater may pool on neighborhood streets, or carry clogging debris to street drains, overwhelming urban drainage systems.

This chapter considers historical records, present conditions in the study area, and a discussion of future conditions, trends, opportunities, and challenges that could frame the future of the watershed's management.

6.1 Valley Water Flood Management

As the primary agency with authority to provide flood protection in the County, Valley Water manages flood risk in partnership with local, state, and federal agencies. Valley Water manages this risk in three key ways: 1) communicating risk to the community through regular communications, preparedness, forecasting, and emergency action plans; 2) maintaining existing infrastructure; and 3) building new facilities to reduce risk.

Flood Communication and Preparedness

Valley Water partners with municipalities and the County to provide education and information to the public on the risks of flooding, to issue flood warnings, and to coordinate emergency responses during flood events. Valley Water started an annual flood awareness campaign in 2018 to educate property owners that are within a flood zone about what they can do to protect their homes and assets from flooding. Every winter Valley Water sends out pamphlets to those living in a FEMA flood zone (high-risk floodplain) with information on being flood-ready, preparedness tips and essential emergency phone numbers, and links to helpful resources, such as the FEMA website and AlertSCC. Valley Water also provides useful flood preparedness information on their public website, X (Twitter) account, Facebook account, and blog: valleywaternews.org.

The Community Rating System (CRS) is a voluntary program created under the National Flood Insurance Program (NFIP) to reduce flood damages through nonstructural activities such as increasing public awareness and preparing for flood emergencies. CRS points earned by Valley Water can be used by any participating community in the County to lower flood insurance premiums via the CRS scoring and rating system. The communities within the Upper Pajaro Watershed that participate in the CRS program include the cities of Morgan Hill and Gilroy. After adding their own CRS points to Valley Water's base of activities, each of these cities has a CRS rating of seven, allowing residents to receive a 15% discount on flood insurance (FEMA, 2023). In general, Valley Water's role is limited to providing structural measures to contain flows in creeks (or other connected infrastructure). It is more often a city's role to engage in land use planning and compliance with NFIP to protect people from flooding. These measures include construction of buildings so that their lowest floor is well above existing mapped flood elevations, land use planning to direct flood waters through streets and open areas, and storm water detention and infiltration facilities.

Flood Warning System

Valley Water has developed, and continues to update in real time, a web-based flood warning system for flooding hot-spots within Santa Clara County. It provides the public with flood-prediction maps based on real time rainfall forecasting and radar data. This system helps emergency managers and members of the public understand immediate flood risks to their communities and it will provide the public with flood-prediction maps based on real time rainfall forecasting and radar data.

Emergency Response

During heavy rainfall events, Valley Water monitors creek levels, makes use of its flood warning system and floodplain maps to help predict where flooding may occur, and communicates these risks to affected communities and agencies (e.g., cities, county, Caltrans, etc). This monitoring is conducted leading up to and during storm events. If the flooding risks are high enough, Valley Water may open its Emergency Operations center (EOC), which coordinates with other city/county EOCs to ensure that flooding risk areas are identified and communicated to the communities and resources (such as sandbags for the public and heavy equipment to remove large debris) are deployed to help mitigate flooding those risks during the event.

Stream Maintenance Program – Maintaining Existing Flood Protection Infrastructure

Valley Water watershed operation and maintenance crews maintain stream capacity across Santa Clara County to safely convey water during storm events. This critical flood protection work is primarily implemented through the Stream Maintenance Program (SMP). Valley Water is generally allowed to perform regular maintenance of the creeks in the Upper Pajaro Watershed only along reaches that it owns or for which it has easements. The program focuses on streams that have been improved with engineered flood protection projects to provide continued flood protection for homes and businesses. SMP work performed on natural streams without a completed flood project is limited due to potential negative impacts to natural habitat. Most of the maintenance work includes bank repair, sediment removal, vegetation removal, invasive species removal and weed control, and sometimes re-building of flood protection structures such as floodwalls and levees.

Asset Management

There are several additional programs within Valley Water to manage its infrastructure and maintain the level of service originally intended: The Safe Clean Water and Natural Flood Protection F8 program

(Sustainable Creek Infrastructure for Continued Public Safety) assesses and prioritizes existing creek and watershed infrastructure, prepares watershed asset management plans, and implements the recommendations provided in the asset management plans. The Watershed Asset Rehabilitation Program (WARP) provides stream maintenance work for projects outside the scope of SMP.

SCW and NFP Program F8: Sustainable Creek Infrastructure for Continued Public Safety

The F8 Program was created to support Valley Water's existing programs to manage its infrastructure and maintain the level of service originally intended. This program assesses and prioritizes existing creek and watershed infrastructure, prepares watershed asset management plans, and implements the recommendations provided in the asset management plans. This preserves the life and strengthens the reliability of the flood protection infrastructure.

WARP: Watershed Asset Rehabilitation Program

To supplement operation and maintenance resources or for projects outside the scope of SMP, stream maintenance work may also be performed through Valley Water's Watershed Asset Rehabilitation Program (WARP). These are considered small capital improvement projects.

Watershed Assets & Current Conditions

Figure 6-1 maps out the existing flood protection infrastructure in the Upper Pajaro Watershed and distinguishes between concrete and earthen constructed channels as well as leveed channels. The earthen channels may be a reach where the natural channel is expanded, earthen trapezoidal shaped reach, or a reach with earthen levees. The map shows that the majority of Llagas Creek, East Little Llagas Creek, and West Little Llagas Creek have some kind of flood protection provided along the channel and Uvas Creek has levees built along a highly urbanized reach of the creek. There is not much flood protection infrastructure built along the rest of the channels in the watershed.

Figure 6-1 is a map of the existing infrastructure in the Upper Pajaro Watershed and the corresponding BRE scores, which is based on the risk of failure related to each reach. It is separated into low, medium, and high risk. It is important to note that this risk of failure equates to the risk that an asset doesn't function as intended and is not the same as the risk of flooding discussed in the next section, 6.2. As can be seen from the map, the majority of the reaches are at low risk of failure but there is one high risk reach and several medium risk reaches along Uvas and Llagas Creeks. Along the lower portion of Lower Llagas River, from the Upper Pajaro River confluence up to Southside Drive, the channel is at high risk of failure due to vegetation not being maintained to the level of service it was designed to. Upstream of this reach, the majority of Llagas Creek up to the confluence with East Little Llagas is at medium risk, along with a short reach from San Martin Avenue up to Llagas Avenue. Uvas Creek has two medium risk reaches: leveed reach from W. Luchessa Avenue to Santa Teresa Boulevard and reach from Hollister Road (Highway 25) up to railroad tracks at Bolsa Road.

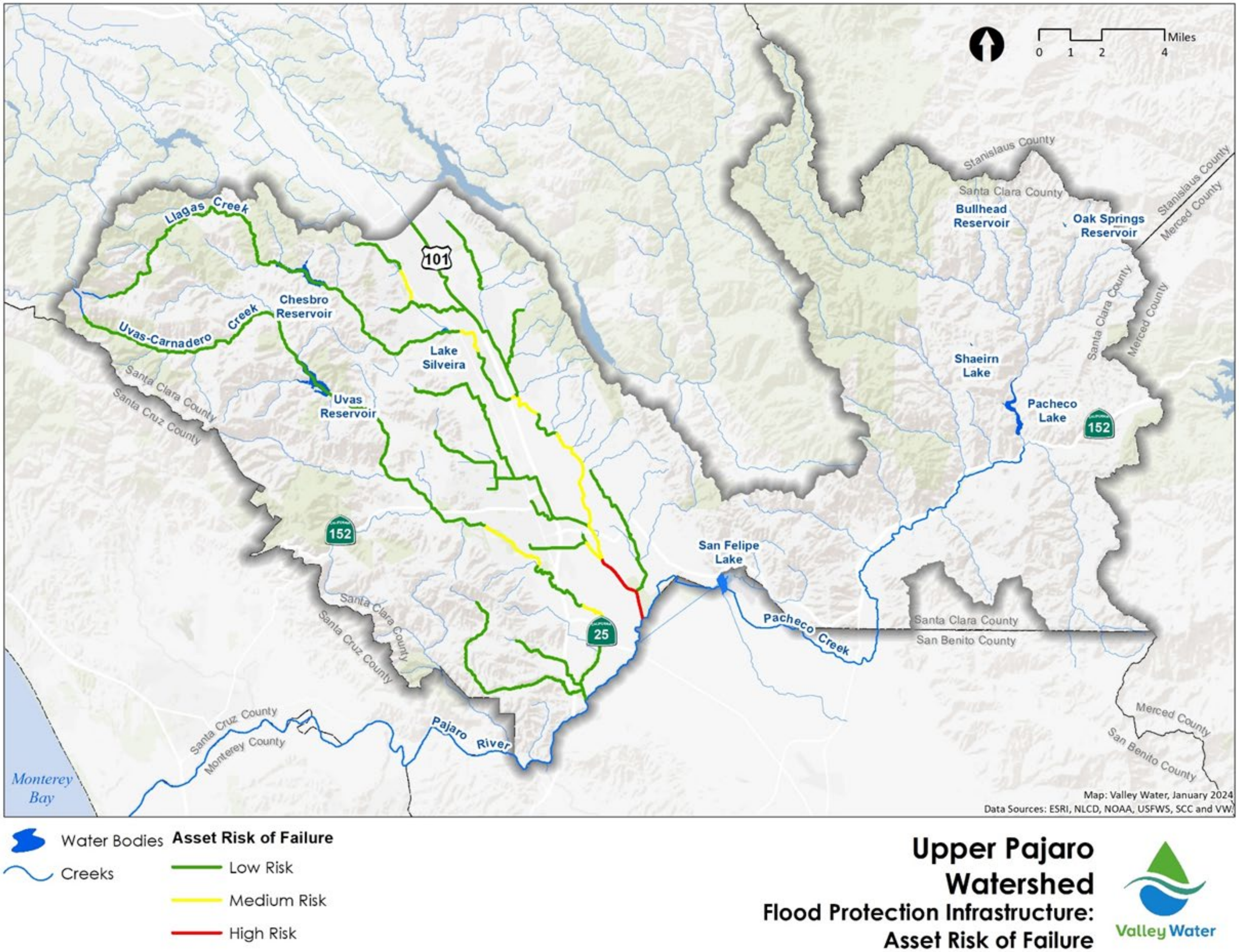

Figure 6-1: Flood Protection Infrastructure: Asset Risk of Failure (Not Flood Risk)

6.2 Assessing Flood Risk & Vulnerability

Risk and damage to people, property, and critical facilities such as fire and police stations, hospitals, transportation networks, utilities, drinking water and wastewater treatment plants are important safety concerns for flood managers. During a flood event, floodwater depths and velocity, as well as the amount of warning time, all interact to determine the level of risk to people. Although the economic risks of flooding can be estimated via computer modeling, risks to health and safety are harder to quantify. New tools and information, combined with historic indicators and flood risk maps updated by staff are helping Valley Water understand all these variables.

In the Upper Pajaro Watershed, Valley Water works to reduce the number of homes, schools, and businesses subject to flooding by maintaining creek capacity and building flood protection infrastructure, among other activities. Valley Water is only allowed to perform regular maintenance of the creeks and rivers in Upper Pajaro Watershed along reaches that it owns or for which it has easements. Under an agreement with Santa Clara County, Valley Water may also perform emergency maintenance on reaches of creeks owned by the County if there is a threat to life.

Hydrology – Water in the Environment

There are 14 stream gages located within the Pajaro Watershed, 12 of which are owned and operated by Valley Water; the remaining two are operated by the US Geological Survey. Valley Water also owns and operates 7 precipitation gages and two reservoir gages. Valley Water uses data from these gages to calibrate hydrologic and hydraulic models, measure water in the environment, and assess flood risk.

In addition to collecting hydrologic data, Valley Water also maintains a database of hydrologic models—most of which use the US Corps of Engineers “HEC-HMS” software—for modeling meaningful design storm scenarios for storms with different recurrence intervals such as the 25-year and 100-year flow events. Valley Water has computed flow distributions for various recurrence interval storms on all the larger creeks within the Upper Pajaro Watershed. The Uvas Creek hydrology is based on an updated USACE Hydrology Report of 1979 and the Llagas Creek hydrology is based on the original Natural Resource Conservation Service hydrology study of the 1970s and USACE update of 2006. This data can be used in steady and unsteady hydraulic modeling performed within the watershed.

The final design flows were taken from the 2020 “Design Flood Flow Manual for All District Watersheds” Report. The following table summarizes the design flows for various recurrence intervals at different creek locations:

Table 6-1: Design Flows in the Upper Pajaro Watershed

	Drainage Area ($Mile^2$)	2.33-year flood (Q43%)	5 year-flood (Q20%)	10-year flood (Q10%)	25-year flood (Q4%)	50-year flood (Q2%)	100-year flood (Q1%)
Llagas: Just D/S of Chesbro	**19.2**	**N/A**	**N/A**	**900**	**N/A**	**N/A**	**3,900**
Llagas: Just D/S of West Little Llagas	**33.05**	**N/A**	**N/A**	**3,690**	**N/A**	**N/A**	**5,850**
Llagas: D/S of East Little Llagas	**56.8**	**N/A**	**N/A**	**5,000**	**N/A**	**N/A**	**10,400**
Llagas: At Bloomfield Ave	**89.5**	**N/A**	**N/A**	**10,000**	**N/A**	**N/A**	**18,800**
Uvas: D/S of Uvas Reservoir	**68.71**	**973**	**2,830**	**5,277**	**9,615**	**13,582**	**18,167**

Hydraulics – Creek Behavior and Floodplain Analyses

Valley Water also maintains a library of computational flow models for creeks and floodplains within Santa Clara County. The most common program that is used to build these models is the US Corps of Engineers HEC-RAS program. Valley Water also collects high water marks after storm events and uses the data in conjunction with other data to calibrate models. As of late 2023, the only creeks with flood damage potential within the Pajaro watershed (urban, rural, or agricultural areas) with updated hydraulic models are Llagas Creek and Uvas-Carnadero Creek. Currently the hydraulic models for Lower Llagas Creek and West Branch Llagas Creek are being updated. Model runs have been created for a variety of flood scenarios, markedly improving Valley Water understanding of flood-prone areas in the Pajaro Watershed. But there are still many areas that need to be updated. Having detailed hydrologic and hydraulic analyses enables Valley Water to create detailed flood maps that illustrate neighborhoods subject to flooding.

The following table list the hydraulic models and the channel reaches included in each:

Table 6-2: Upper Pajaro Watershed Hydraulic Models

Creeks	Model limits
Upper Llagas Creek Flood Protection Project: HEC-RAS 1D/2D Model. Year: 2021	
Upper Llagas	Chesbro Reservoir to WBL Confluence near Hwy 152
West Little Llagas	Watsonville Road to Hwy 101
East Little Llagas	Hwy 101 to Llagas Creek confluence
Tennant/Corallitos Creeks	E. Dunne Ave down to ELL Confluence
new 1.5-mile-long Bypass	Watsonville Road to Llagas Road
Uvas-Carnadero Creek: HEC-RAS 1D/2D Model. Year: 2023	
Uvas Creek	Santa Teresa Road to Pajaro River Confluence
Lower Llagas Creek Flood Protection Project Model: HEC-RAS 1D/2D Model. Year: Ongoing.	
Lower Llagas Creek	Highway 152 to Pajaro River confluence
West Branch Llagas Creek HEC-RAS 1D/2D Model. Year: Ongoing.	
West Branch Llagas	Santa Teresa Blvd to Llagas Crk Confluence

Flood Hazards

Specific types of flood hazard common in the Upper Pajaro Watershed are described below.

Overbank Flooding from Creeks

Although many flood risk reduction projects have been completed in the watershed, developed land remain subject to flooding, because many miles of creek simply cannot convey large flood flows. After current projects are completed, 84 miles of creek and 8,170 acres watershed-wide will still be susceptible to overbanking and flooding from a 25-year flood event.

Dam Spills

Dams can both store water for supply and help provide flood protection in the form of spacing out releases over time. In periods of heavy rain, however, reservoirs can fill to capacity and overflow through the dam spillway. Spillways are essentially weirs sighted below the top of the dam to prevent the dam from being overtopped and damaged, which can lead to failure. Two dams in the Upper Pajaro Watershed could be subject to spills or, for extreme storm events, dam failures: Uvas and Chesbro dams. A breach of any of these dams at full capacity could have catastrophic consequences, including inundation of surrounding land.

Levee Failure and/or Overtopping

Although levees are constructed alongside creeks and rivers to increase flood protection, they can mask flood risks. Neighborhoods protected by levees may enjoy many benefits, including relief from insurance requirements and floodplain management regulations, as well as a certain level of protection. However, levees are also subject to overtopping if event exceeds design capacity and failure if damage occurs. Floods resulting from such a disaster could be even worse than without the levees in place. This is called "residual risk," because it is the (usually unacknowledged) risk that remains after a flood project is completed. Within the Upper Pajaro Watershed, there are approximately 10.6 miles of levees along Lower Llagas Creek, West Branch Llagas Creek, Lions Creek, and Uvas Creek.

Transportation Constrictions

Many roads and highways in the County traverse flood-prone areas, and can be subject to periodic flooding, which is dangerous for drivers and damaging to vehicles. When transportation infrastructure floods, it disrupts business and daily activities, causing "indirect" costs to the population. Transportation infrastructure itself can also interrupt, redirect, or exacerbate flooding and street drainage. Major transportation infrastructure in the watershed includes Highway 101, 152, and 25; as well as Monterey Road and the Union Pacific Railroad/Caltrain Tracks.

Storm Drain Overflow

Storm drains are designed and maintained by cities, typically for 10–25-year storm events. They often have insufficient drainage capacity or get blocked by trash or sediment buildup, causing localized flooding. These areas are also now being mapped by FEMA as Special Flood Hazard Areas, and thus subject to regulatory requirements.

Mud Damage from Flooding

Overbanking floodwater typically carries high sediment loads, which results in additional damage to structures and their contents and high clean-up or replacement costs for streets, parks, landscaping, and any affected buildings or vehicles.

Although muddy water will damage the length and breadth of any flooded area, the most susceptible locations for mud damage are the floodplains closest to creeks, since the sediment tends to settle out as soon as it leaves the creek. Although not as hazardous and damaging as in an urban area, mud and debris can severely damage the farmland and crops in the agricultural land along many of the creeks in the watershed.

Deep or High-Velocity Flooding

In the Pajaro Watershed, some areas are subject to deeper and higher velocity flooding during high flows. Valley Water's new techniques and modeling have identified areas susceptible to flood depths or water velocities that could create dangerous conditions. This type of data was not available in the past and will be used as part of the prioritization for completing projects and initiating new ones.

Physical characteristics of the floodwaters (i.e., depth, velocity, and area of floodwaters) were extracted from the models and used in the analysis. With the knowledge that floodwaters can be particularly destructive when it is flowing with high velocity or with high depth, areas exposed to these conditions were delineated as well.

The flood severity raster represents the combined effect of depth and velocity. Studies have been performed in multiple countries to categorize the depth x velocity result into various flood hazard or flood severity classifications. This helps communicate the combined effects of flood depth and velocity on structures, vehicles, and pedestrians. The upper limits for both depth and velocity are subjective and can be adjusted accordingly. The table below shows the flood hazard classifications used for this study and Figure 6-6 shows the results of the flood severity mapping for the 25-year storm event.

Table 6-3: Flood Severity/Hazard Characterization

Flood Severity Category	Depth*Velocity Range (Ft2/sec)	Description
Low	<2.2	Possibly unsafe for small vehicles
Medium	2.2 – 5.4	Unsafe for all vehicles, children, elderly.
High	5.4 – 16.1	Unsafe for all pedestrians and vehicles.
Very High	16.1 – 26.9	Unsafe for all pedestrians and vehicles. Buildings require special engineering design/construction.
Extreme	>26.9	Unconditionally dangerous. Not suitable for any type of development or evacuation access.

Social Vulnerability: Protecting People and Critical Facilities from Flooding

The previous section described areas with known flood hazards. Where physical hazards intersect areas of high vulnerability, the risks increase substantially. People and structures especially vulnerable to flood hazards include those without resources to fully recover from a flood event, as well as facilities that provide support to such populations or that would be expected to provide community assistance during or after a flood event.

Every community must prepare for and respond to hazardous events, including natural disasters such as earthquakes, floods, wildfires, or human-caused events like a chemical spill. Several factors including poverty, lack of access to transportation, and crowded housing may weaken a community's ability to prevent human suffering and financial loss in the event of a disaster. Valley Water used the following information and data to help determine those disadvantaged communities more vulnerable to flood risk.

CalEnviroScreen is an environmental health screening tool developed by the Office of Environmental Health Hazard Assessment within the California Environmental Protection Agency. The online mapping tool "analyzes data on environmental, public health and socioeconomic conditions in California's census tracts to provide a clear picture of cumulative pollution burdens and vulnerabilities in communities throughout the state." The data and information help determine those areas with disadvantaged communities that are more vulnerable to health and safety hazards such as pollution and flood risk. Valley Water is incorporating the data into the vulnerability assessment to help determine those areas more vulnerable to the risk of flooding. In general, those areas with population characteristics between the 70th and 100th percentile of the sensitive socioeconomic analyses are considered more vulnerable to flood risk.

The area median State statutory limits are based on federal limits set and periodically revised by the U.S. Department of Housing and Urban Development (HUD). HUD's limits are based on surveys of local area median income (AMI). In general, an 80% or less AMI is considered low income. This data was combined with the CalEnviroScreen information to map out those areas that are considered disadvantaged communities and more vulnerable to flood risk.

Critical Facilities

Critical facilities are important for maintaining health and safety services. Even people who don't live or work in a floodplain can be affected by flooding if a critical facility is flooded or is inaccessible due to flooded roadways. For the purposes of our flood analysis, critical facilities include fire stations, police stations, hospitals, and utilities.

Critical facilities can be damaged by flooding and be put out of service for long periods. In addition, flooding can isolate vital services from the people that need them. For some activities and facilities, even a slight chance of flooding is too great a threat. A critical facility should not be constructed in a floodplain whenever possible. This may include not only the 10% or the FEMA-mapped 1% special flood hazard area, but also the 0.2% (500-year) flood hazard area or residual risk areas protected by levees. If a critical facility already exists in a floodplain, it should be given specific attention in floodplain management and emergency response plans so that it can continue to function and provide services during and after the flood. This may include planning for specific mitigation or flood protection measures for individual facilities. There are 15 critical facilities within the Upper Pajaro Watershed (8 fire stations, 5 police stations, 1 hospital and 1 treatment plant) and 6 critical facilities within the 25-year storm event (1 hospital, 1 police station, 3 fire stations, and the Gilroy Sewage Treatment Plant). Figure 6-6 shows the known critical facilities in relation to the 25-year floodplain.

Flood Vulnerability Assessment

Traditionally, flood risk reduction projects focused on removing properties from the FEMA 100-year flood zone and were prioritized mainly based on a combination of politics, economic damages, costs, and flooding risk. Although some projects did target vulnerable communities such as Alviso, this approach did not specifically factor in vulnerability as part of project prioritization, in part because vulnerability studies had not been conducted. With the new Flood Vulnerability Assessment, the focus is on more frequently occurring flood events (25-year), deep and/or fast-moving floodwaters, and social vulnerability where residents are more vulnerable to flooding.

Valley Water's Flood Vulnerability Assessment combines physical and statistical hazards and considers socioeconomic conditions to create a holistic assessment of flood vulnerability in the County. Physical hazards in this analysis include flood depths and velocities and locations of critical facilities. Flood depths and velocities were modeled using the U.S. Army Corps of Engineers HEC-RAS software and combined to assess physical hazards to people and structures. Combined depth and velocity values were weighted on a scale based on severity. Critical facilities including hospitals, police stations, and fire stations, were also mapped.

This analysis also incorporated statistical hazards to address areas with continual flood issues. Statistical flood data included historic flood events documented since 1952 and known problem areas referred to as Flood Hot Spots by Valley Water's Flood Information Team.

Finally, socioeconomic conditions were included to account for an area's ability to access resources and recover from a flood event. The datasets for socioeconomic conditions were CalEnviroScreen 4.0, and Area Median Income. CalEnviroScreen incorporates data for various pollution sources, adverse health conditions, educational attainment, housing burden, and other characteristics to produce scores for all census tracts and identify disproportionately impacted communities. Locations with 80% or less of the Area Median Income were mapped as low income.

Physical hazards, statistical flooding, and socioeconomic conditions were given points and then combined to create a ranked hazard map. Areas with the most points contained the highest combined hazard physically, statistically, and socially. The hazard map then displays this ranking by color, with reds and dark oranges indicating a higher flood vulnerability and risk than light orange or yellow.

The sections below go into more detail on the past historical flooding issues within the study area, present conditions and flood reduction projects built or proposed, and the future challenges and opportunities to reduce the risk of flooding to the community while focusing on concepts that could provide multi-benefits to the community, economy, and to the environment.

6.3 Historical Conditions: Flooding & Flood Protection Infrastructure

Past Flood Events

Between 1952 and 2023, there were 15 years with recorded flood events within the Pajaro Watershed: 1952, 1955, 1958, 1963, 1980, 1982, 1983, 1986, 1993, 1995, 1997, 1998, 2009, 2017, and 2023. Figure 6-2 shows the footprint of all the documented historical flooding in the Upper Pajaro watershed since 1952. As discussed above, there have been flood protection projects built since the 1950s that have reduced the flood risk. The photos below show examples of recent flooding in the watershed. The first is a photo of flooding in Downtown Morgan Hill due to the banks of West Little Llagas Creek overtopping during a storm in October 2009. Morgan Hill has flooded many times in the past and there is currently a project in construction to provide 100-year protection along West Branch Llagas Creek. The second photo is of flooding along Highway 101 in Gilroy stemming from Uvas-Carnadero Creek during a storm in March 2023.

Flooding in Morgan Hill – October 2009. ***Uvas Creek Flooding at Highway 101 – March 2023.***

Table 6-4: Historical Flood Events in the Upper Pajaro Watershed

Flood Event Date	Summary of Event	Peak Discharge at just Downstream of Chesbro Gage (cfs)
Dec 1937	5000 acres of cropland flooded.	unknown
Winter of 1951/1952	Much of the cropland along Soap Lake area flooded. East Side Tributaries to Llagas Creek overflowed flooding much orchard land. Llagas Creek flooded at Bloomfield Ave.	unknown
1955	Most of flooding problems due to Uvas, Llagas, Tesquisquita Slough and Pacheck Creek. At least 82 homes flooded.	unknown
April 2 1958	Unknown	3,190 (50 to 100-year event)
1963	unknown	unknown
February 13-20 1980	Llagas Creek flooded to about 3 feet of depth along Watsonville Road. West Little Llagas Creek flooded along downtown Morgan Hill along the following streets: Hale Avenue, Main Avenue, Monterey Road, and Right Avenue to Fourth Street. Edmundson Creek confluence flooding. Uvas Creek flooded at confluence with Pajaro River, causing crop damage. Also flooded 1-2 miles below dam along Watsonville Road, washing out a bridge. A lot of heavy minor flooding with ponding along fields and streets.	1,610 (20- to 25-year event)
January 3-5 1982	West Little Llagas Creek flooded at Llagas Road with flood waters reaching the doorsteps of properties. and water was report to have reached the doorstep of houses and businesses in Morgan Hill. The most severe flooded area was around the confluence with Edmundson Creek. There was widespread flooding along West Branch Llagas Creek in San Martin with depths of 2 to 3 feet. The levees along Lower Llagas Creek overtopped causing serious flooding of the Gilroy Sewage Treatment plant, creating a potential health hazard. Both Lower Llagas Creek and Uvas creek overbanking flooded 200 acres to a depth of 2-9 feet near the confluence with Pajaro River (agricultural land). Uvas Creek flooded around Christmas Hill Park with depths getting as high as 6 feet and the integrity of the northerly levees were damaged by extensive erosion. It also flooded from Thomas Road down to Highway 101, with depths up to 5 feet.	1,500 (20-year event)
January 22-30 1983	Flooding along West Branch Llagas Creek causes the Gilroy Foods building and parking lot to flood. Flooding also impacted a number of homes along Llagas Creek in low lying areas of Morgan Hill, San Martin, and Gilroy; blocking access roads and damaging septic systems. At the Llagas and Uvas Creeks confluences with Pajaro River, flood waters covered about 1000 acres of agricultural land with depths between 2 to 10 feet.	1110
February 12-20 1986	Tennant Creek flooded at Hill Rd and Maple Ave and Corrallitos Creek flooded at confluence with Tennant Creek and downstream of Middle Avenue.	2,320 (40-year event)

	Llagas Creek flooded on both sides upstream of Rucker Avenue in Gilroy. It flooded mainly farmland around Rucker Avenue, Center Avenue and Buena Vista Avenue. Jones Creek overbanked at Dunlap Ave and Furlong Ave intersection. Uvas Creek overbanking upstream of Thomas Road led to most of the heavy damage with an estimated 170 homes flooded. There were also several bridges, Old Creek Road and Thousand Trails, that were submerged and a private bridge was lost.	
1993	unknown	Unknown
March 10 1995	Uvas Creek spilled its banks for about 3000 feet around the Uvas Road crossing. Burchell Creek (Uvas Tributary) flooded upstream of Burchell Road. West Branch Llagas Creek overbanked upstream of Day Road flooding agricultural land. West Little Llagas Creek flooded at SPRR, La Crosse Drive, Wright Avenue, upstream of Hale Ave, and at Llagas Road. Maple Leaf Recreational Vehicle Park flooded to 2 feet. East Little Llagas Creek overbanked between SPRR and Highway 101, flooding agricultural land. Day Creek flooded at Day Road and Santa Teresa Blvd. Rucker and Skillet Creeks (Llagas Creek tributaries) flooded at Omar Street and Foothill Blvd, respectively, flooding properties until spilled into Llagas Creek.	934 (17-year event)
January 23-29 1997	Some flooding at Masten Avenue. Fields on both sides of Bloomfield Road at Llagas Creek flooded with depths of 2 to 3 feet. Uvas Creek flooded just upstream of the Highway 101 crossing causing the closure of the highway. Plus flooded agricultural fields and Bolsa Road just upstream of the Bloomfield Avenue crossing.	Unknown
February 2-9 1998	West Little Llagas Creek overbanked at West Main Street and Hale Avenue flooding streets and garages. Tennant Creek overbanked upstream of Maple Avenue, flooding streets, fields, and a park. Corrallitos Creek flooded properties downstream of Colombet Avenue. East Little Llagas Creek flooded downstream of Monterey Road and at the Seymour Avenue Crossing. West Branch Llagas Creek flooded 10 homes just north of Day Road on Monterey Highway. Uvas Creek flooded fields adjacent to the Pajaro River confluence.	unknown
2009	West Little Llagas Creek flooded along downtown Morgan Hill at: Llagas Road, Hale Ave, between Main Ave and 5th Ave, neighborhood south of West Edmundson Ave and north of Watsonville Road. Flooding along Butterfield Blvd.	1,020
January 8 2017	West little Llagas Creek in Morgan Hill flooded at the Llagas Road crossing, along Main Street, and along Watsonville Road. This caused closure of many streets in the area. Uvas Reservoir spilled into Uvas Creek causing overtopping along Monterey Frontage Road in Gilroy and flooding some properties. Flooding also occurred at the Highway 101 bridge causing the closure of the highway.	unknown
2023	Review our info: flooded highway 101 at Uvas, Soap Lake flooding, especially south of Frazier Lake in San Benito County.	unknown

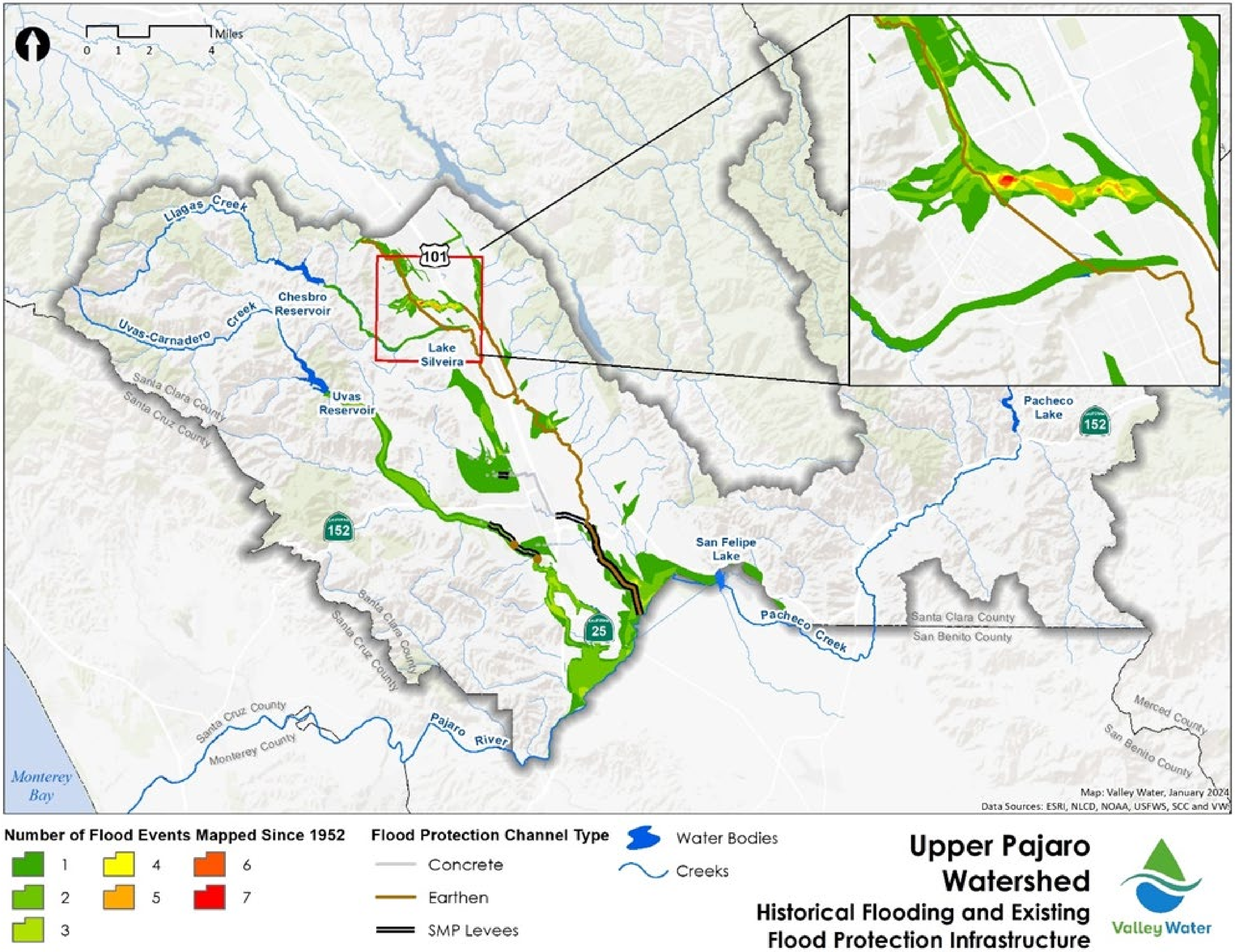

Figure 6-2: Historical Flooding and Existing Flood Protection Infrastructure in the Upper Pajaro Watershed

Soap Lake

The ponding that occurs during significant storm events in the lower portion of the Upper Pajaro Watershed is referred to as the Soap Lake. Figure 6-3 maps out the estimated limits of the 25-year storm event Soap Lake footprint with respect to the watershed. The ponding is caused by the limited capacities of the channels around the confluences of Uvas-Carnadero and Llagas creeks with the Pajaro River, as well as the flows from Pacheco Creek via San Felipe Lake. Soap Lake lies within Santa Clara County along the north side of Upper Pajaro River and within San Benito County along the south side of Upper Pajaro River. Soap Lake acts as a natural detention basin in the Upper Pajaro watershed, reducing peak flows that would otherwise increase flooding in the lower portion of the Pajaro River watershed in the counties of Santa Cruz and Monterey. Due to this flood risk reduction benefit, as well as ecological and water supply benefits, it is important to maintain this natural flood detention.

The Pajaro River Watershed Flood Prevention Authority (PRWFPA) was established in 2000 to identify, evaluate, fund, and implement flood reduction strategies in the Pajaro River watershed (including Soap Lake). In addition to flood protection, other benefits PRWFPA works to provide include water supply, groundwater recharge, support of rare or endangered species, preservation of wildlife habitat, and water quality. PRWFPA is implementing the Soap Lake Floodplain Preservation Project with the goal to protect approximately 9,100 acres of agricultural lands, the approximate Soap Lake area inundated by the 100-year flood, by preserving the natural floodplain characteristics and flood storage capacity through the acquisition of land and flood conservation easements (www.pajaroriverwatershed.org).

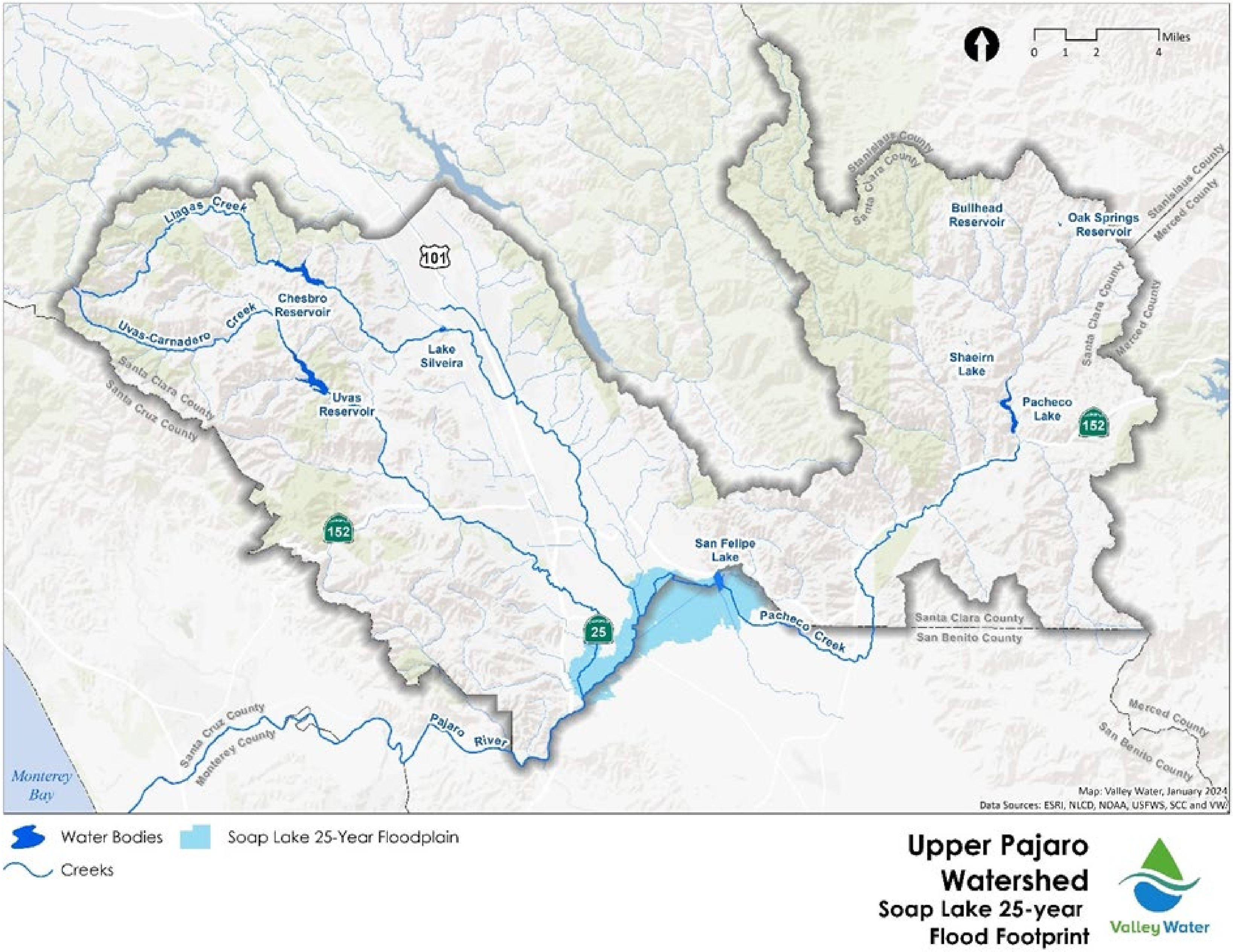

Figure 6-3: Soap Lake 25-year Flood Footprint

Past Flood Risk Reduction Projects

Relative to other watersheds in the County, the Upper Pajaro watershed is less densely populated, with significant agricultural, ranching, and open space areas. As such, fewer flood protection projects have been completed. Figure 6-2 shows the existing flood protection infrastructure within the Pajaro Watershed. Although there has been some significant work (completed and ongoing) along much of Llagas Creek, the majority of flood protection is only up to the 10-year event.

Construction of the Upper Llagas Creek Flood Protection Project started in 2022 and is scheduled to be completed in 2027. Figure 6-4 below maps out the project details along the channels. For the purposes of this watershed plan, the project is assumed to be completed and therefore post-project conditions are considered to be existing/present conditions. 100-year protection is being provided in the urban area of Morgan Hill with the project widening 3 miles of West Little Llagas Creek, from Watsonville Road to Llagas Road. A 1.5-mile-long bypass will also connect West Little Llagas Creek at Watsonville Road to Llagas Creek at Monterey Road. 10-year protection is being provided in the rural/agricultural areas of San Martin and Gilroy with channel modifications along 3.4 miles of East Little Llagas Creek, from Upper Llagas Creek to Corralitos Creek, and 5.8 miles of Upper Llagas Creek, from Buena Vista Avenue to Monterey Road.

In addition to the Upper Llagas Creek Flood Protection Project, levees were built along Uvas Creek, Lower Llagas Creek, and Lions Creek in the 1970s and 1980s. This includes 2.2 miles of levees along Uvas Creek from Santa Teresa Blvd. to downstream of Luchessa Avenue, 7 miles of levees along Lower Llagas Creek from the confluence with Pajaro River up to the West Branch Llagas confluence, 1 mile of levees along West Branch Llagas Creek from the confluence with Llagas Creek up to Highway 101, and 0.7 miles of levees along Lion Creek from the confluence with West Branch Llagas Creek to Kern Avenue.
The following is a list of past or ongoing projects that resulted in the construction of the existing flood risk reduction infrastructure.

The following table summarizes the flood protection infrastructure that has been built in the watershed:

Table 6-5: Existing Flood Protection Infrastructure

Year Built*	Creek	Downstream limit	Upstream limit	Flood protection infrastructure	Level of protection (year)
Current, 2004 original	Lower Llagas	Pajaro River Confluence	Highway 152	The levees do not meet the level of service they were designed to: The Lower Llagas River Capacity Restoration Project looks to restore the capacity of the channel to the design flows. 100-year flood risk reduction.	100 and 10
1992	Lions Creek Interceptor	Lions Creek confluence	Geri Lane	Concrete U Frame – approximately 3,300 ft of channel.	unknown
1996	Lions Creek	500ft D/S Wren Ave	Kern Ave	Levees along both banks, 12ft maintenance road on most of levees. 2,250ft along each bank, 4,500ft total levee length.	100
1989	North & South Morrey Channels	Lions Creek Confluence	Santa Teresa Blvd	Small engineered trapezoidal earthen channels.	unknown
1989	Lions Creek	West Branch Llagas Confluence	Santa Teresa Blvd	engineered trapezoidal earthen channels.	unknown
1987-88	Uvas Creek	Luchessa Ave	Santa Teresa Blvd	Levee along the east bank with maintenance road along the top of the levee.	100
1985	West Branch Llagas Creek	Highway 101	Lions Creek confluence	Engineered trapezoidal earthen channel with rock riprap slope protection alongside slopes, invert to about 50% of total channel depth.	unknown
Not known	(Lower) Llagas Creek	Highway 152 (Pacheco Pass)	Live Oak Creek confluence	Station 176+45 to 378+00. 20,155ft. reach 3. Engineered earthen trapezoidal channel confined by levees both sides. Maintenance road along east levee. Design Flow: 8,100 cfs	10
1984-85	(Lower) Llagas Creek	Bloomfield Ave	Hwy 152 (Pacheco Pass)	Station 47+50 to 176+45. 12,895ft. Reach 2. Engineered earthen trapezoidal channel confined by levees both sides. Maintenance road along east levee. Design Flow: 17,800-18,300 cfs.	100
1973	(Lower) Llagas Creek	Pajaro River confluence	Bloomfield Ave	Station 0 to 47+50. 4,750ft. Reach 1. Engineered earthen trapezoidal channel confined by levees both sides. Maintenance road along east levee. Design Flow: 10,000 cfs	10
1970s	Jones Creek	Llagas Creek confluence	Leavesley Road	Approximately 5 miles of engineered earthen trapezoidal channel.	unknown

1961	Princevalle Storm Drain	Lower Miller Slough	Princevalle Street	9,500 ft long constructed earthen trapezoidal channel with 12ft wide unsurfaced farm/maintenance road on south bank.	unknown
1874	Miller Canal	Pajaro River Confluence	San Felipe Lake (Pacheco Creek confluence)	Millers Canal was built creating a connection of of Pajaro River with San Felipe Lake and Pacheco Creek.	unknown

*Year Built: Approximate based on As-Builts or best available information

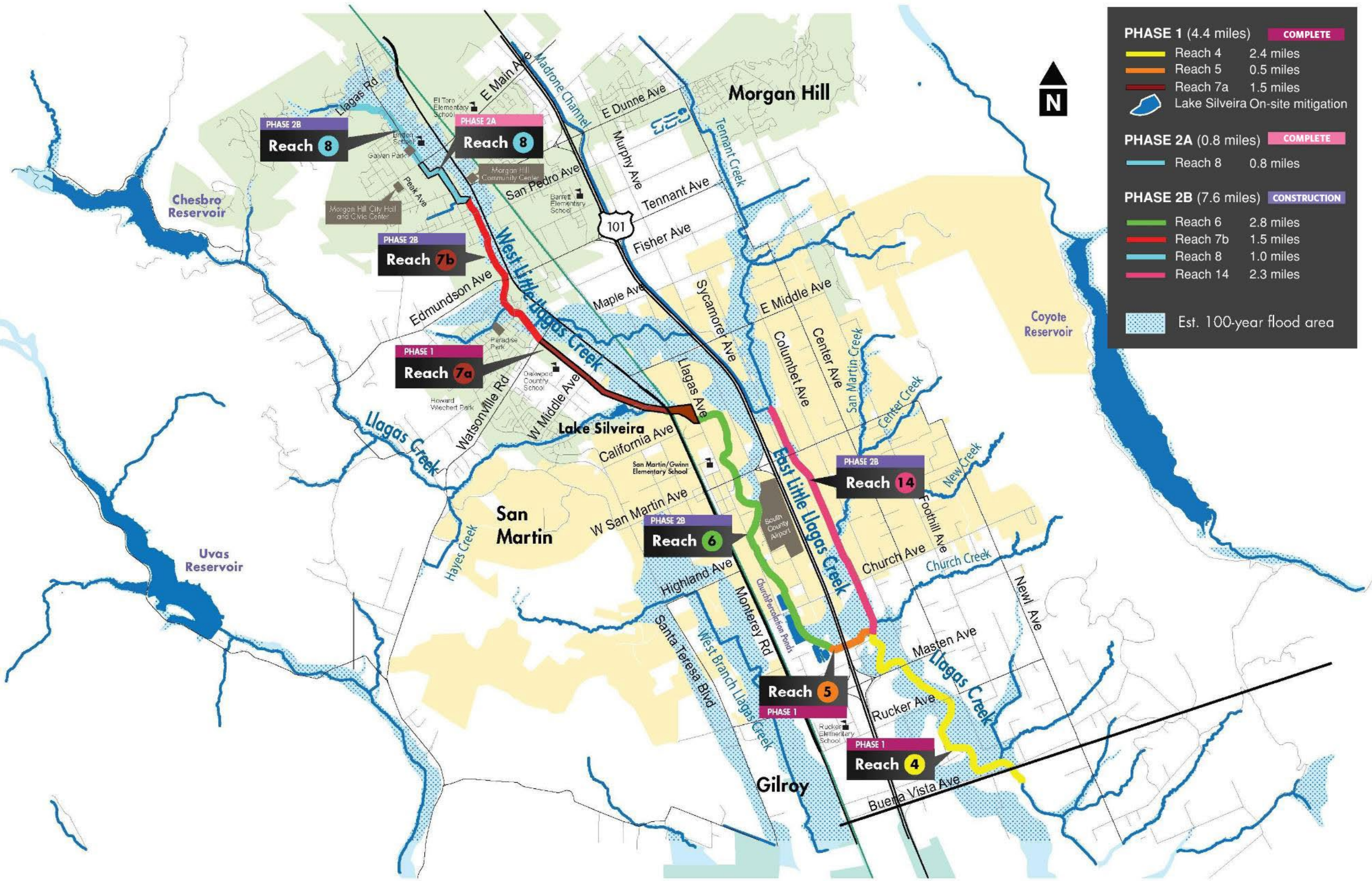

Figure 6-4: Upper Llagas Creek Flood Protection Project

6.4 Present Conditions: Existing Flood Risk & Vulnerability

The elements described in Section 6.2, Assessing Flood Risk & Vulnerability, have enabled Valley Water to create detailed flood risk and vulnerability maps that illustrate neighborhoods subject to flooding. With the new Flood Vulnerability Assessment, the focus is on health and safety during frequent flooding events, using the 25-year storm event as the basis for assessing flood risk.

Figure 6-5 shows the estimated depths for the 25-year event considering flooding only from Upper Llagas Creek, West Little Llagas Creek, East Little Llagas Creek, and Uvas Creek from Santa Teresa Blvd to the confluence with Pajaro River. There are an estimated 2,160 acres and 777 parcels within the 25-year floodplain of Upper Llagas, West Little Llagas, and East little Llagas Creek combined; and 2,200 acres and 166 parcels within the Uvas-Carnadero 25-year floodplain. Figure 6-6 shows the Flood Vulnerability Assessment results with low- to high-risk areas. The following description focuses on Upper Llagas Creek and Uvas Creek because this is where we have updated and detailed flood risk analysis.

The following sections focus on Upper Llagas Creek and Uvas Creek, where detailed flood risk analysis for a 25-year storm event have been completed using the new methodology.

Llagas Creek

Note: The Upper Llagas Creek Flood Protection Project will provide 100-year flood protection along West Little Llagas Creek in Morgan Hill and 10-year protection along the remainder of the project area.

Outside of Morgan Hill, West Little Llagas Creek would flood along both banks west of Highway 101 from Watsonville Road to the confluence with Madrone Channel. These flood flows would travel south for about 3 miles along the floodplain between Upper Llagas Creek and Highway 101, eventually flowing into Upper Llagas Creek. Flood depths would get as high as 5 feet adjacent to West Little Llagas Creek but would lessen to 1 foot or less for most of the flood area as the flows travel south (sheet flow). There is a disadvantaged community adjacent to West Little Llagas Creek that makes it more vulnerable to flooding. East Little Llagas and Corralitos would flood on the eastside of Highway 101 north of San Martin Avenue causing some ponding of flood waters with depths getting as high as 5 feet but most within the 1-to-3-foot range.

Downstream of Masten Avenue, Upper Llagas Creek would overflow along both banks from Buena Vista Avenue up to the confluence with East Little Llagas Creek. The flooding to the east of Llagas Creek travels south adjacent to the creek channel, with flood flows re-entering the creek upstream of Buena Vista Avenue. The flooding on the west side of the channel would continue flowing south along the floodplain for about 4 miles between the creek and Highway 101. A significant portion of the modeled flood area lies in a disadvantaged community south of Buena Vista Avenue, although the area is primarily farmland with few buildings and structures.

Focusing on the mid portion of the Pajaro watershed, Upper Llagas Creek overflows along both banks from Buena Vista Avenue up to the confluence with East Little Llagas Creek. The flooding to the east of Llagas Creek travels south adjacent to the channel, with flood flows re-entering the creek upstream of Buena Vista Avenue. The flooding on the west side of the channel would continue flowing south along the floodplain for about 4 miles between the creek and Highway 101. Although the majority of the flood area would be sheet flow with depths of 1 foot or less, there are significant areas of ponding with depths potentially reaching five feet. A significant portion of the estimated flood area lies in a disadvantaged community south of Buena Vista Avenue, although the area is primarily farmland with few buildings and structures.

Uvas-Carnadero Creek (Uvas Creek)

Uvas-Carnadero Creek would flood in some areas from just downstream of Luchessa Avenue in Gilroy to the confluence with Pajaro River. The potential flooding from Luchessa Avenue to Highway 101 is the most impactful. The flooding to the east would flood over Highway 101, which closed in this area as recently as 2022, due to flooding from high flow events, and continue east all the way to the banks of Lower Llagas Creek where ponding would occur causing flood depths up to 7 feet. These flood flows would potentially impact the Gilroy Wastewater treatment plant potentially causing safety hazards. The estimated overbanking to the west side of the channel would travel south along the floodplain for about 3.5 miles, causing flooding of Highway 101 and State Route (SR) 25 and structures near the Highway 101/SR-25 intersection. The majority of this flooding would be sheet flow with less than 1 foot of depth but there would be significant ponding areas with depths of 3-to 5-feet. There would be some minor flooding From Highway 101 to SR-25 along Uvas Creek. The capacity of the channel is limited downstream of SR-25 causing major flooding downstream to the Pajaro River confluence. This downstream flooding is connected to flooding of the Soap Lake floodplain. The majority of the potential flooding from Uvas Creek is within a disadvantaged community. Although this primarily includes agricultural land and few structures, there is still safety hazard considering many of the farm workers may not be aware of the flood risk.

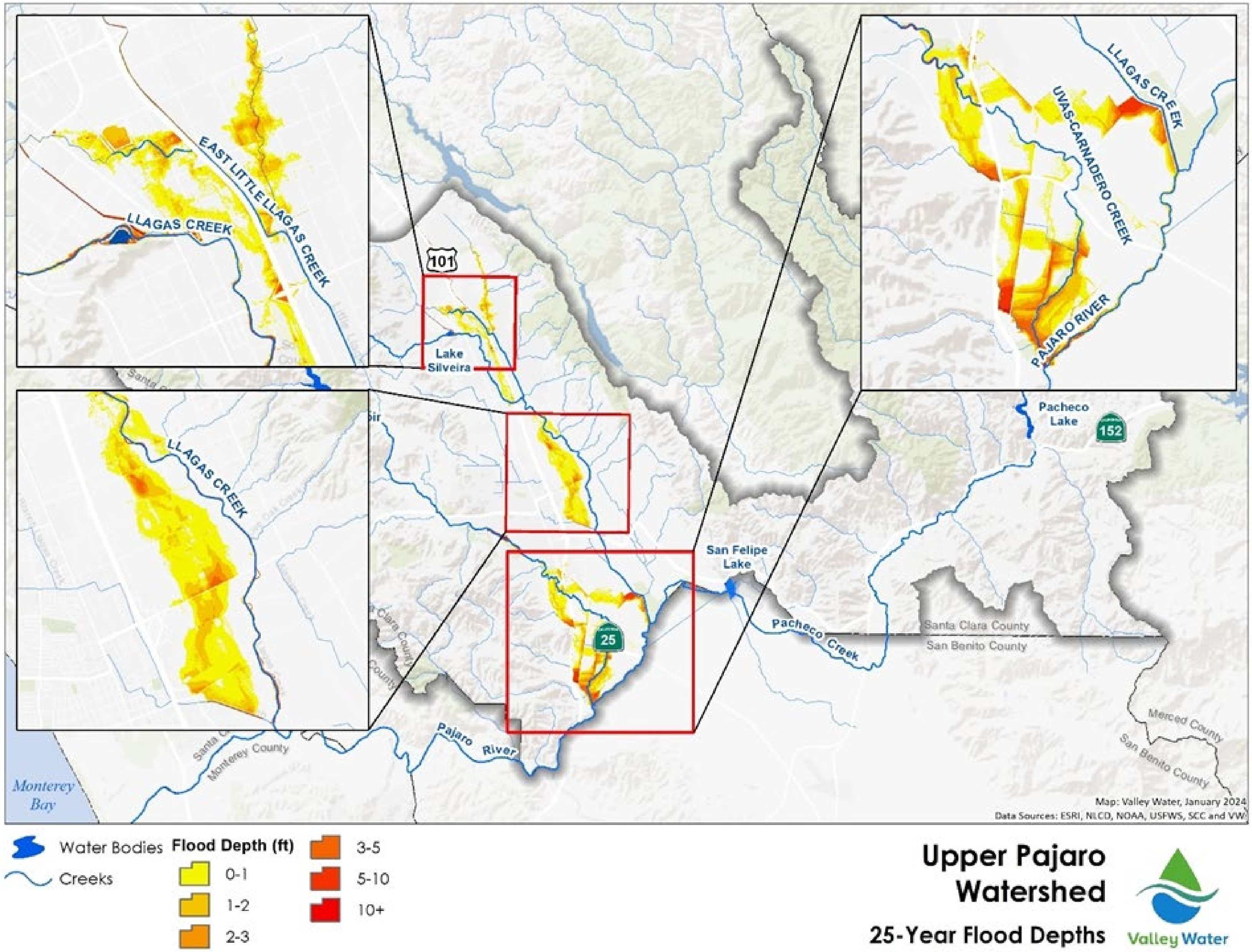

Figure 6-5: 25-year Estimated Flood Depths

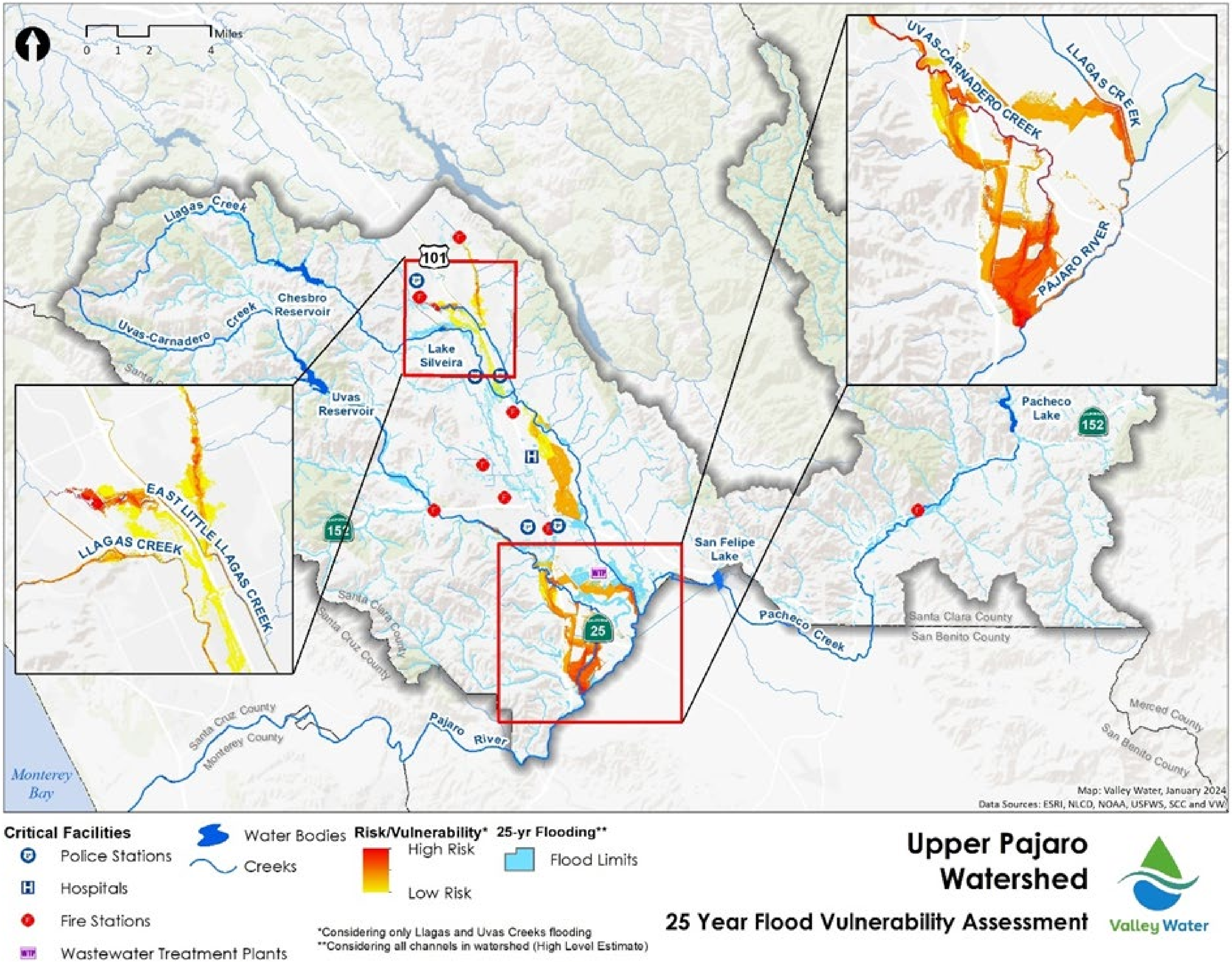

Figure 6-6: 25 Year Flood Vulnerability in Upper Pajaro Watershed

6.5 Future Conditions, Challenges, and Opportunities

Challenges:

Data Gaps

Pajaro Watershed is the least studied watershed in Santa Clara County regarding flood risk. Hydraulic and flood risk analyses are currently being prepared for West Branch Llagas Creek and its tributaries, as well as Lower Llagas Creek and Jones Creek. These results will be included in future updates to this plan and will provide a more complete assessment of flood risk throughout the Upper Pajaro Watershed. Other areas that need detailed hydraulic and flood risk analysis include Pacheco Creek and its tributaries, Uvas-Carnadero Creek (upstream of Santa Teresa Blvd) and its tributaries, Pajaro River, and a series of eastside tributaries leading from the foot of the Diablo Mountain range to Llagas Creek and East Little Llagas Creek. Figure 6-7 below maps out the reaches where Valley Water has hydraulic analyses completed, outdated, in progress or no hydraulic information/data.

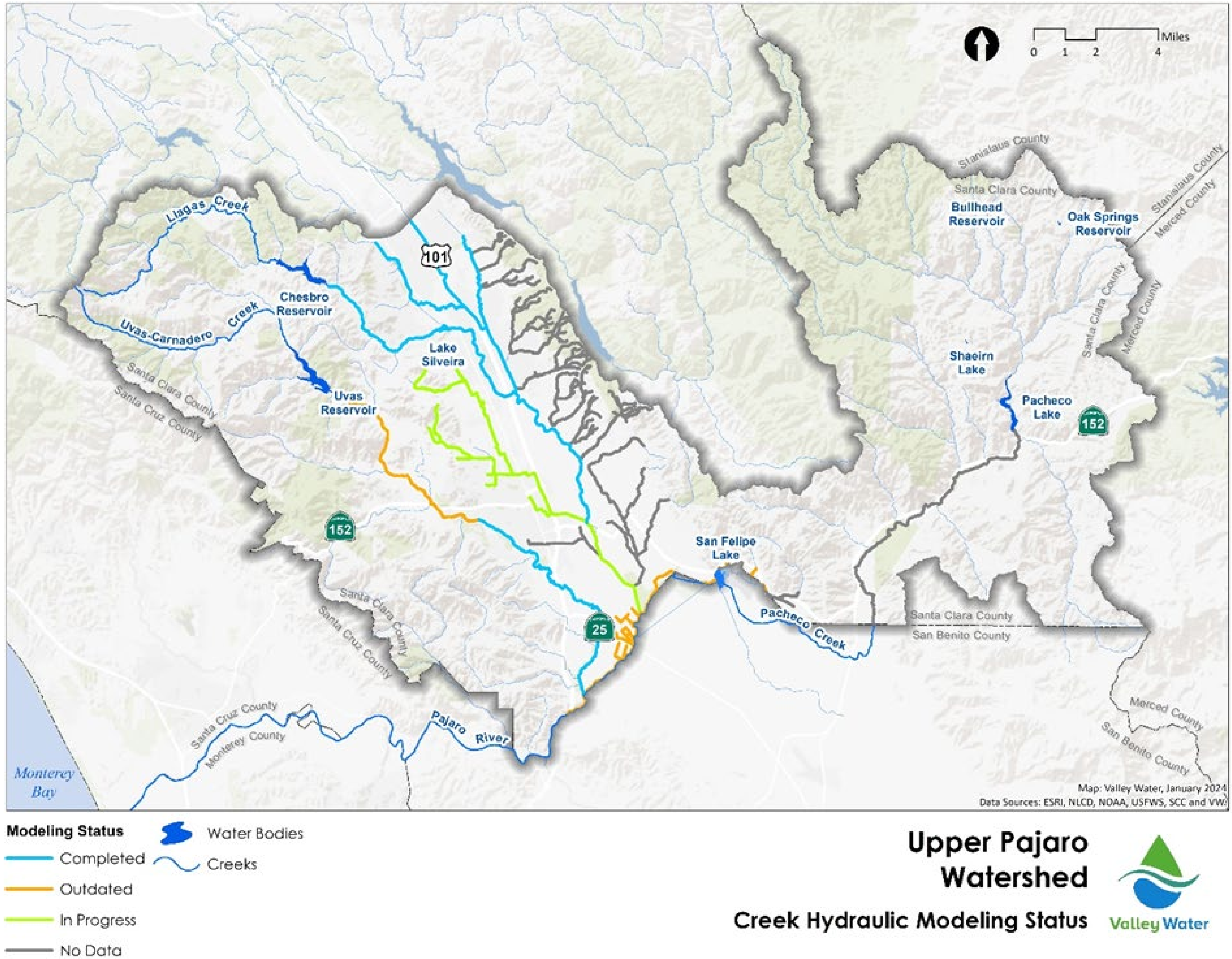

Figure 6-7: Hydraulic Modeling Status of the Channels within the Upper Pajaro Watershed

Limited Creek Corridor Right of Way and Maintenance Access:
Valley Water has the right to maintain or modify reaches of creeks that it owns or for which it has an easement. Where Valley Water lacks ownership or easement, often staff cannot access these creeks to assess and maintain their capacity.

Historically, urbanization in the Upper Pajaro Watershed led to the development of land within natural floodplains and in many cases, immediately adjacent to creek banks. These land use patterns physically confine creeks to a narrow corridor, separates the creek from its natural floodplain, and leaves little, if any, space to construct flood protection infrastructure. Re-establishing more natural hydrology and hydraulics in these areas would require expensive and logistically challenging real estate acquisitions, since the creek corridors are already narrow. This necessitates the consideration of alternative approaches to flood protection.

Climate Change:
Flood protection projects are designed based on statistical analysis of past events. The future is likely to be very different from the past due to climate change, with most models predicting more intense, but possibly less frequent, rainstorms in Santa Clara County. This reality calls for a new approach in planning for future flood protection measures. Additionally, if hydrologic conditions change from those assumed in design, previously constructed projects may not provide their level of protection.

Aging Infrastructure:
Some of the flood protection infrastructure in the watershed is approaching its design life of 50+ years. Rehabilitation may become a significant need in the near-term due to higher probability of failure as the infrastructure ages and requires more frequent maintenance. The main existing infrastructure of concern are the levees along Lower Llagas Creek and Uvas-Carnadero Creek.

Communication:
Significant portions of Upper Pajaro Watershed support farmland and the workers that tend and harvest crops, some of which are migrant workers. Although Valley Water has existing programs to communicate flood risk to communities throughout Santa Clara County, language barriers, access to technology, and mobility present challenges to effectively communicate an impending flood threat. Migrant workers may more significantly be impacted by these challenges.

Opportunities:

Planning Studies for Flood-Vulnerable Areas:
The Flood Vulnerability Assessment identified high vulnerability under a 25-year flood event adjacent to Lower Llagas Creek near its confluence with Pajaro River, Uvas Creek from southern Gilroy to its confluence with Pajaro River, and West Little Llagas Creek in Morgan Hill and San Martin (See Figure 6-6). Flood vulnerability associated with Lower Llagas Creek would be addressed by the Lower Llagas Capacity Restoration Project, which is a potential future Valley Water CIP project. Flood vulnerability associated with Uvas and West Little Llagas Creeks should be addressed by new planning studies to evaluate flood risk reduction alternatives and recommend a final project that can be designed and constructed.

The ponding of flood waters in the lower portion of the Upper Pajaro Watershed is referred to as the Soap Lake floodplain (Soap Lake). Soap Lake acts as a natural flood detention basin reducing peak flows that would otherwise increase flooding downstream in Monterey and Santa Cruz counties. Due to this flood risk reduction benefit, as well as ecological and water supply benefits, it is important to keep this natural flood detention. The Soap Lake Floodplain Preservation Project by the Pajaro River Watershed Flood Prevention Authority is designed to preserve the natural floodplain characteristics and flood storage capacity of Soap Lake through the acquisition of land and flood conservation easements.

Promoting Environmentally Friendly Development:

In looking at reducing flood risk holistically in the watershed, there is an opportunity to promote land development techniques, such as permeable pavement and Low Impact Development (LID), that support flood risk reduction. Holistically incorporating LID practices reduces the volume and speed of stormwater runoff and decreases costly flooding and property damage. One of the main ways to reduce flood risk is to promote building structures outside of the floodplain. These techniques may not have a large effect on reducing the riverine flood risk, but it can have a big impact on local flooding due to issues such as non-permeable surfaces and inadequate storm drain sizes. Also, these techniques help support groundwater replenishment, water quality, green development and impervious area removal, parks and open space for temporary stormwater capture and reuse.

Flood Detention (multi-use land and facilities for temporary flood storage):

Flood detention facilities could be used to expand flood storage capacity and reduce peak flows downstream by temporarily storing flood waters in basins of various types and sizes. During non-flood periods (most of the time), the basins would not be inundated and could serve as natural parks, recreational sports fields or even parking garages, depending on the needs of the public and desires of the landowner or agency who owns the facility. During the flood event, the basin would fill and afterwards naturally drain back to the creek and the basin land use would be restored.

Improvements with Rehabilitation:

Rehabilitation of capital projects, while very costly, may create opportunities to redesign older, hardscaped systems and replace them with more environmentally friendly systems. New and strategic partnerships could provide financial opportunities, ecological or geomorphic improvements, and increased community support. In addition to Valley Water maintenance of aging infrastructure, land use agencies can assist in allowing for future flood protection by minimizing density of development near streams.

Moving forward, Valley Water hopes to work with municipalities that have land use jurisdiction to plan development that is protected from existing or potential induced flooding.

Flood Forecasting:

Valley Water is developing a real time, web-based flood warning system for flooding hot-spots within Santa Clara County, including the Upper Pajaro Watershed. It will provide the public with flood prediction maps based on real time rainfall forecasting and radar data. This system will also help emergency managers understand immediate risks. Valley Water’s Forecast Informed Reservoir Operation (FIRO) can also be used to reduce flood risk.

Expanding Groundwater Recharge with Flood-MAR:

Flood-Managed Aquifer Recharge (Flood-MAR) is one way that groundwater recharge could be expanded to increase water supply and potentially reduce stormwater runoff into urban areas. A pre-feasibility study identified that capturing hillside runoff onto open space before it reaches roads and storm sewers may be the most feasible approach to Flood-MAR in Santa Clara County. Valley Water is continuing studies to assess the feasibility of Flood-MAR in the county.

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Appendix A: Water Districts that Provide Water Supply in the Pajaro River Watershed

<table>
<tr><th>Agency</th><th>Type</th><th>Service Area</th><th>Key Information</th></tr>
<tr><td rowspan="5">Valley Water[1]</td><td rowspan="5">Special District</td><td rowspan="5">Santa Clara County (1,300 square miles)</td><td>Founded: 1929</td></tr>
<tr><td>Population served: 2 million residents, 200,000 commuters</td></tr>
<tr><td>Services: Provides wholesale water supply, stream and watershed stewardship, and flood protection.</td></tr>
<tr><td>Water Sources:
• Approx. 55% Imported Water (State Water project, Central Valley Project, San Francisco Public Utilities Commission)
• Approx. 40% Local water (natural groundwater, from reservoirs to groundwater, from reservoirs to drinking water treatment plants)
• Approx. 5% Recycled water</td></tr>
<tr><td>Facilities operated/maintained:
10 Reservoirs, 3 Water Treatment Plants, 1 Advanced Water Purification Center, 275 miles of streams</td></tr>
<tr><td rowspan="5">San Benito County Water District[2]</td><td rowspan="5">Special District</td><td rowspan="5">San Benito County (1,400 square miles)</td><td>Founded: 1953</td></tr>
<tr><td>Population served: 62,808</td></tr>
<tr><td>Services: Manages water quantity and quality throughout San Benito County, wholesaler for Central Valley Project water supplies.</td></tr>
<tr><td>Water Sources:
• Approx. 54% Local water (natural groundwater, from reservoirs to groundwater)
• Approx. 45% Imported Water (Central Valley Project)
• Approx. 1% Recycled Water</td></tr>
<tr><td>Facilities operated/maintained:
3 Reservoirs, 2 Water Treatment Plants</td></tr>
<tr><td rowspan="5">Pacheco Pass Water District[3]</td><td rowspan="5">Special District</td><td rowspan="5">4,200 acres of San Benito County and 1,300 acres of Santa Clara County</td><td>Founded: 1931</td></tr>
<tr><td>Population served: Approximately 863[2]</td></tr>
<tr><td>Services: Provides water supply for natural groundwater recharge through reservoir capture, storage, and release.</td></tr>
<tr><td>Water Sources:
Local surface water from Pacheco Creek and from naturally occurring runoff</td></tr>
<tr><td>Facilities operated/maintained:
2 reservoirs/dams (Las Viboras Dam and North Fork Dam)</td></tr>
</table>

1. Valley Water website
2. San Benito County Water District 2020 Groundwater Annual Report
3. Santa Clara LAFCO. https://santaclaralafco.org/cities-and-special-districts/special-district-profiles/pacheco-pass-water-district