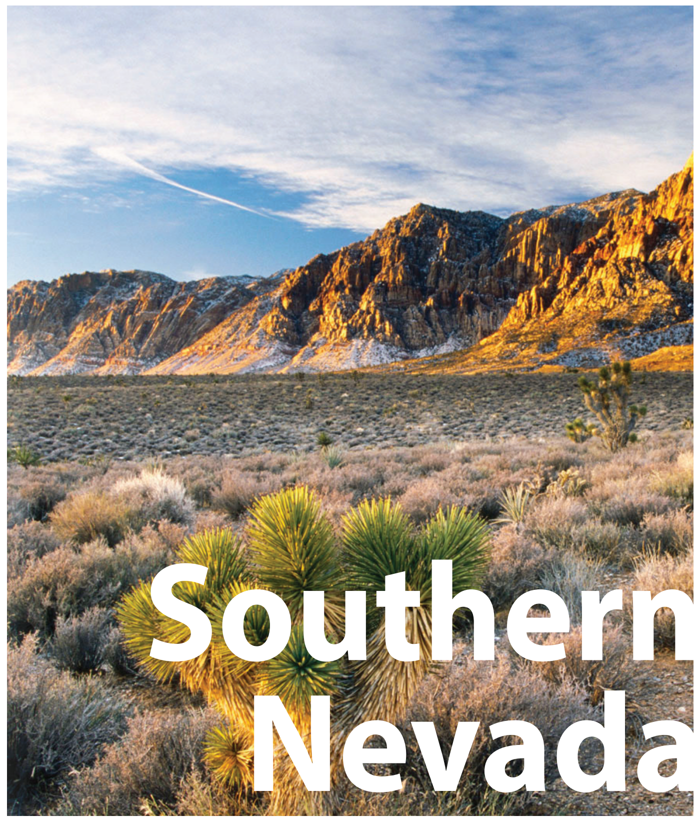


Southern Nevada Sustainable Systems Inventory

CONTENTS

INTRODUCTION

Las Vegas is world-renowned as an entertainment and tourist destination; more than 2 million people reside in Southern Nevada and 41 million people from around the world traveled to Southern Nevada in 2015. People often associate Las Vegas with iconic imagery of resorts, gaming, and entertainment. However, the term "sustainability" paired with "Las Vegas" is not synonymous. As the image of Las Vegas has been crafted over time, negative perceptions sometimes label Las Vegas as a place of excess that is wasteful, inefficient, and unlivable. Residents, visitors, and those who've never traveled to the City frame their perceptions on what they see in the media or what they experience. Perhaps because the City is located in the arid Mojave Desert with limited water resources, the impression of an urban oasis is given. Contrary to these opinions, Southern Nevada and its residents and businesses have done much to change that; these changes are reflected in individual dynamic systems that interact with each other that comprise a sustainable community and its surrounding environment: Water, Transportation, Energy, Food, Waste, and Pollution.

Why should a city or region inventory its sustainability systems? Sustainability is not just the environment; the social and economic impacts to all systems are equally important. Conside the 1,450 mile Colorado River. The Colorado River is a shared common resource that supports more than 30 million people across Arizona, California, Colorado, New Mexico, Nevada, Utah, Wyoming, and Mexico. Beginning in 2000 (and continuing today), Las Vegas and other booming metro areas including Phoenix, Los Angeles, San Diego, and others throughout the American West have been contending with an unprecedented drought. Since the early 20th Century, Nevada has only been allotted 2% of the share of Colorado River water. Because water is the lifeblood of the American West, not only for Southern Nevada, scarcity of water in the Colorado River Basin may increasingly stress agricultural and municipal users as well as put challenges on the natural environment and regional economies through a series of cascading impacts. According to the U.S. Bureau of Reclamation, preliminary assessments indicate increasing supply-demand imbalance over the next 50 years due to changing climates and population growth. This can affect both the quantity and quality of water resources available for drinking and municipal use, irrigation for agriculture and food production, hydropower generation, recreation, and the surrounding Mojave ecosystem. Long term scarcity could lead to transportation of food from even greater distances, even greater fuel consumption, decreased regional economic output, and greater strain on the resident population. An impact to one system could clearly have a ripple effect on many other systems.

Because our region's leaders recognized the challenges and threats presented by drought, Southern Nevada took the lead to become one of the nation's leaders in conservation. Southern Nevada Water Authority (SNWA) reached a number of major milestones over the last three years, including saving more than 40 billion gallons of water over the last decade while adding approximately 500,000 in population, constructing a third intake to draw high quality water deeper from within Lake Mead, and reducing water consumption by 33 percent, through a combination of incentives, education, tiered rates and restrictions that reduce per-person water consumption, and an extensive regional water reclamation effort that returns approximately 200,000 acre-feet to the Colorado River each year for return-flow credit and direct reuse.

While this is only one system, stories in other systems similarly exemplify the region's progress that have led to major accomplishments and improved community quality of life – environmentally, socially, and economically. The community has an increasing share of energy production from renewable sources, more options for alternative modes of transportation, an increasing recycling rate, and fewer greenhouse gas emissions. These have all contributed to increased livability, greater recognition, and a shift in perception on how Las Vegas (and other cities) can be sustainable. Not only does the community benefit from cleaner air and water, new transportation amenities and alternatives, responsible use of resources, but it also makes the region more livable and resilient for its residents, businesses, and visitors. Cities and regions that come together and work toward a common sustainability mission, with representation from local jurisdictions, major employers, utilities, academia, economic development organizations, and the non-profit community will be better suited to address community challenges as a whole, respond to gaps, create plans with buy-in from the beginning, and change perceptions. When faced with regional challenges, Southern Nevada made investments in clean energy, efficient buildings and public infrastructure, and waste minimization, even in the midst of a devastating economic recession. Some cities face drought, some face sea level rise or coastal erosion, some face extreme weather. Whatever the challenge, achieving consensus and working with diverse stakeholders to make changes and investments in programs and projects that increase efficiency and efficacy in order to create a cleaner, resilient, adaptable, and livable environment. This "Sustainability Atlas" shows individual sytems applied geographically to reveal relationships throughout the region as well as a guide on how the region can become more resilient and sustainable.

THE MOJAVE DESERT BIOREGION

Southern Nevada is situated within the Mojave Desert, a sensitive and unique region covering more than 50,000 square miles of Southern California, Southern Nevada, Northeastern Arizona, and Southwestern Utah. It is a rain shadow desert created by the Sierra Nevada and coastal mountain ranges of Southern California, bounded between the Great Basin Desert to the north and Sonoran Desert to the south. Prevailing Pacific coastal winds traveling inland are forced upwards by these mountains; those that do make it through have potential to release available precipitation, but only an average of five inches of rain fall annually, with most falling during winter months. The Mojave Desert also receives summer monsoonal moisture that is pushed into the region from the Gulf of California. Thunderstorms wash sediment from mountains into enormous alluvial fans onto the desert floor. Rainwater carries sediment that forms bajadas at the base of mountains. Further down, water collects in basins and playas, and evaporates quickly, leaving behind alkaline deposits.

During the Paleozoic era, the Mojave Desert was a shallow sea. Sedimentary, igneous, and metamorphic rocks reveal a landscape 2.7 billion years old. Today, the Mojave Desert, much like its northern Great Basin desert neighbor, consists of dry lakes, desert pavement, and dunes on valley floors, surrounded by mountains that contain diverse alpine environments – an ocean of sagebrush with mountain islands. Most elevations range between 3,000 and 6,000 feet, but dramatic elevation changes can be seen in Death Valley, in which the 11,049 foot Telescope Peak towers above Badwater Basin, the lowest point in the United States at 282 feet below sea level. Temperatures in these basins and ranges can be extreme and can fluctuate widely; summer heat can reach excesses of 120 degrees while winter temperatures can drop below freezing.

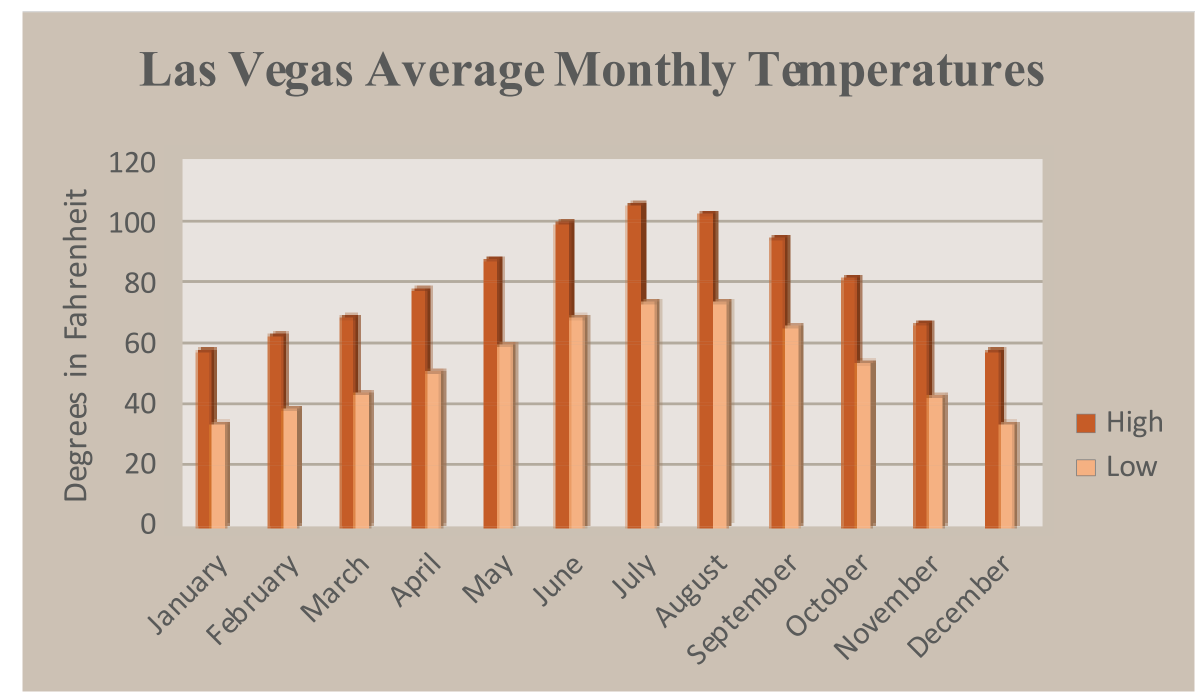
Widely spaced, low-lying shrubs compose most of the Mojave Desert flora. Dominant species, some of which are protected under the Endangered Species Act, include Joshua trees (Yucca brevifolia), creosote (Larrea tridentate), white bursage (Ambrosia dumosa), blackbrush (Coleogyne ramossissima), and Mojave yucca (Yucca schidigera). There are 250 ephemeral plants, approximately 80-90 of which are endemic. The Mojave is also home to a wide range of mammals (including bats, bobcats, cougars, coyotes, bighorn sheep, pronghorn, muledeer, jackrabbit, and kit fox), birds (including burrowing owls, hummingbirds, hawks, falcons, eagles, and a number of migratory birds) , reptiles (including the threatened Desert tortoise, a number of species of rattlesnakes and lizards, Gila monsters, and chuckwallas), fish (chubs and dace), amphibians (such as the Red-spotted toad), and insect and arachnid species.

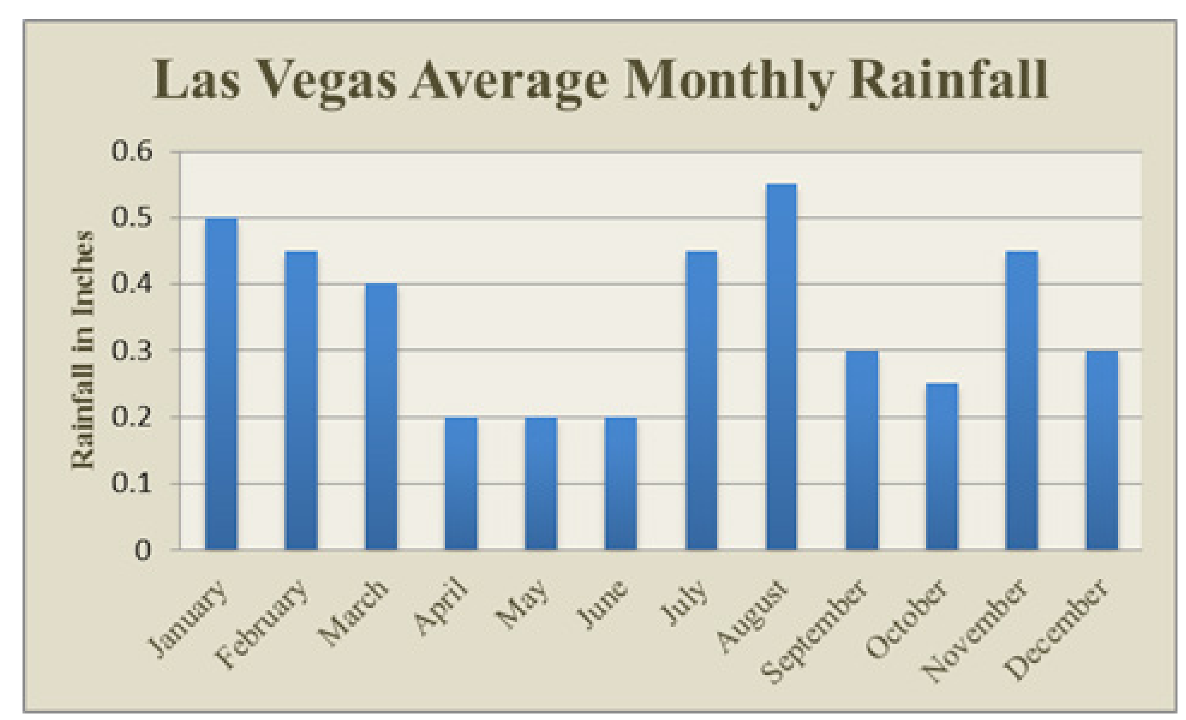
LESS THAN 5" OF RAIN

TEMPERATURES RANGE FROM 120 DEGREES F TO BELOW FREEZING

THE LAS VEGAS VALLEY

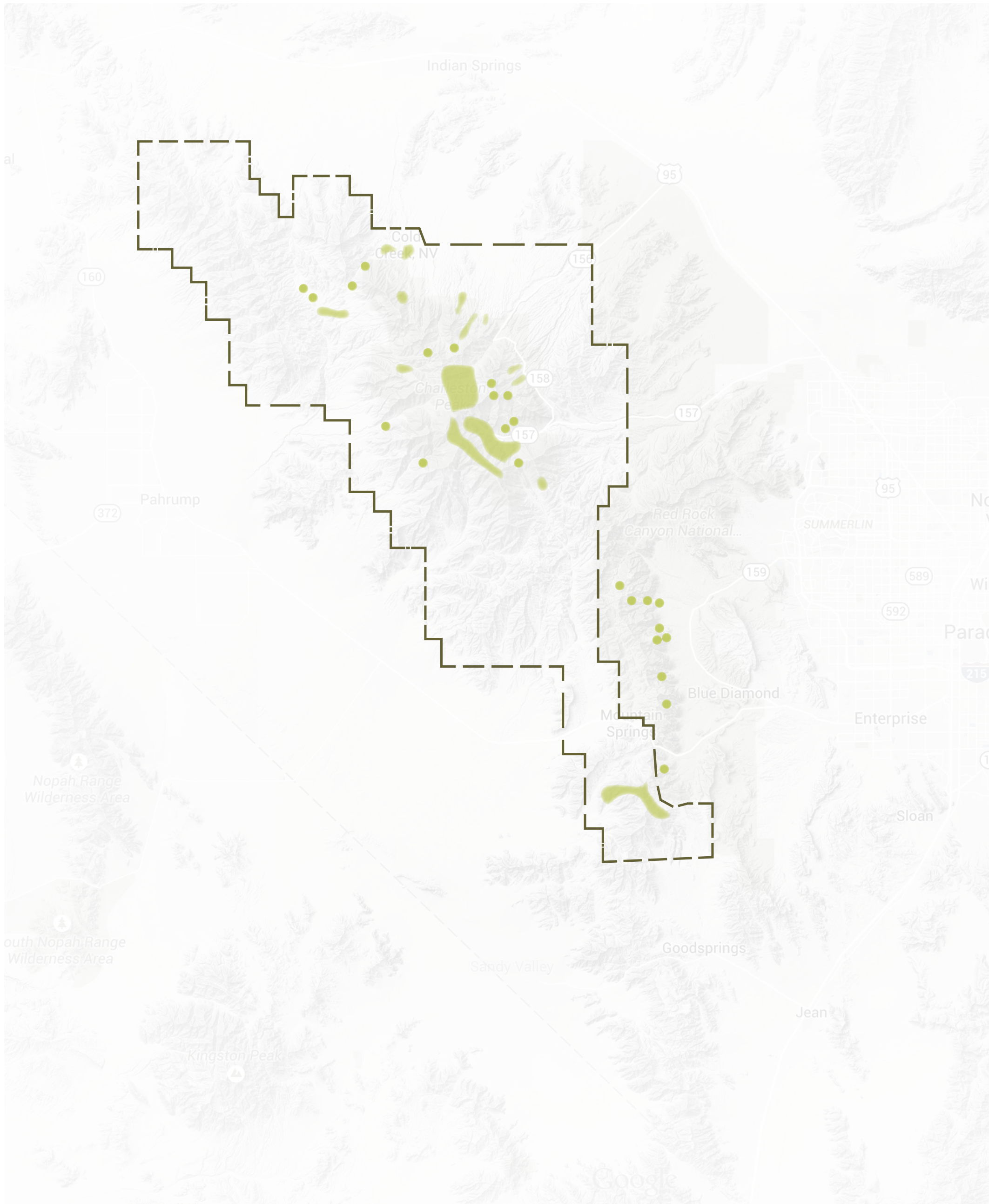
The Las Vegas Valley covers six hundred square miles and is bounded by the Sheep Range to the north, the Frenchman, Muddy, and River Mountains to the east, the McCullough Range to the south, and Spring Range to the west. The Spring Range extends 55 miles from north to south and includes Mount Potosi, Red Rock Canyon, La Madre Mountains, and its highest peak, Mount Charleston. The range peaks in elevation around 12,000 feet and contains alpine tundra and thick pine forests. The valley floor slopes from west to east, with the Las Vegas Wash, an ephemeral stream, and its tributaries carrying water and precipitation to the Colorado River. By 1955, the Las Vegas Wash flowed continuously, because of the increasing settlement and the new inhabitants' use of water that returns to Lake Mead. This new flow into the wash created ponds and wetlands throughout the year. The average precipitation in the Las Vegas Valley is four inches annually. Monsoonal rains occur during late July and August, scattering desert thunderstorms throughout the area. Rain and snow in the Spring Mountains infiltrates bedrock through faults and fractures and rests in aquifers. Temperatures vary from extremes of below freezing in the mountains in the winter to 120 degrees on the valley floor during the summer. Temperatures can consistently exceed one hundred degrees for summer highs. Winter months tend to be mild with average temperatures usually around sixty degrees.



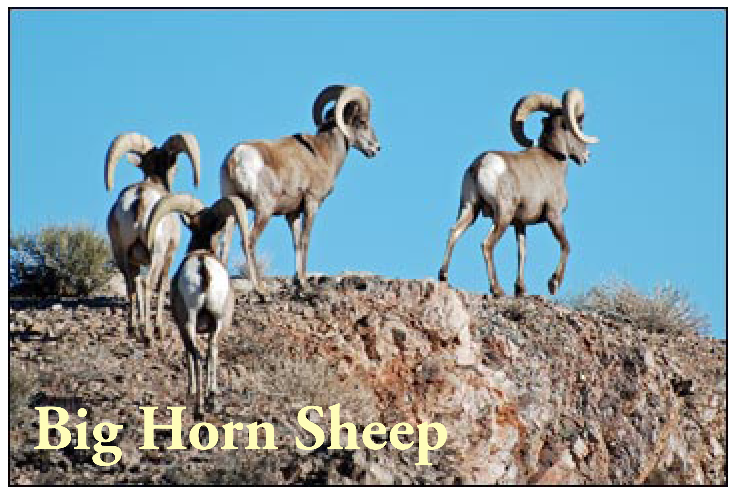


SPRING MOUNTAINS

The Spring Mountains are perhaps one of the most diverse ecosystems within Southern Nevada and are home to 25 endemic species more sensitive to disturbances coming from human activity, such as development and climate change. At mid-elevations (4,000-5,000 feet) desert scrub is prevalent; upper elevations (5,500-7,500 feet) have mixed conifer and juniper forest, while the highest elevations (over 7,500 feet) are home to Ponderosa and Bristlecone Pine. Numerous zones within each range contain evolutionary pockets with high species diversity, many endemic species, and rare plant communities. Ecotones, which are especially noticeable in the Spring Mountains, are areas of change between two plant communities. The transition of two ecological communities acts as a buffer zone, protecting adjacent ecosystems from environmental damage. Genetic diversity is critical to species' resilience in isolated areas because a richer gene pool leads to a stronger species, plant community and ecosystem over time. This protective buffer acts as bridges of gene flow creating elasticity in ecosystems. Areas with deep pockets of biodiversity shore up resilience by increasing fitness and breadth of genetic material for survival.



Species of Concern   Biodiversity hot spot area   NRA Boundary

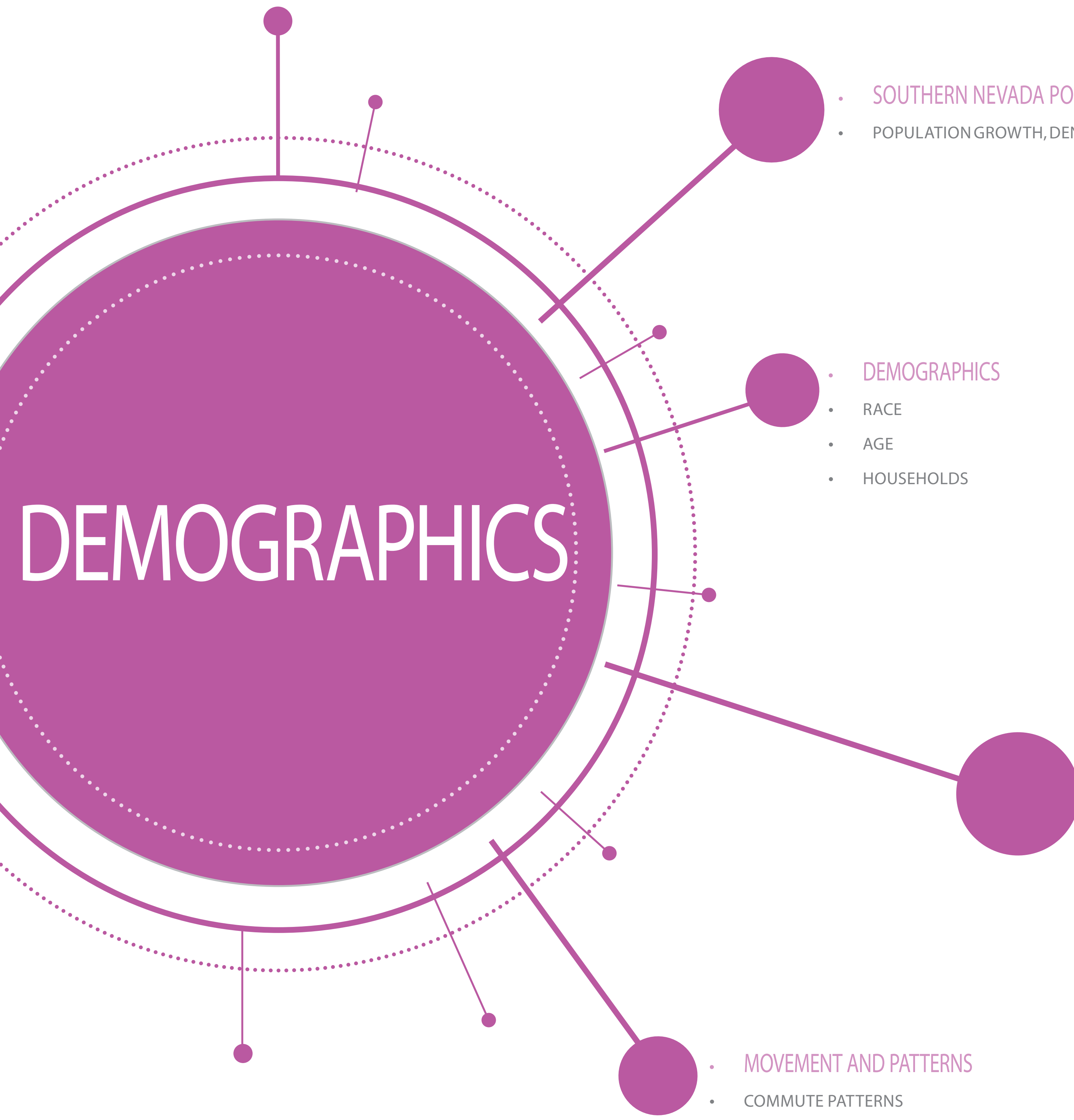


THREATS

The Mojave Desert is threatened by changing natural and anthropogenic climatic conditions, which contribute to extreme heat, wildfire, drought, extreme storm events, and associated plant and animal species loss. These ecological disturbances are necessary for the ecosystem to function. Some disturbances, such as fire, allow the ecosystem to renew itself. However, the capacity of the ecosystem to be resilient and ecologically stable without rapidly losing native flora and fauna during periods of change can be altered with increased rates or intensity of disturbance. Increased heat and less water from drought will mean less resources available to plant and animal communities. Temperatures in the mountains will move ecosystems up the slopes to the tops of the mountains. Endemic species will be forced to move to higher latitudes, ultimately bottlenecking species at higher and higher elevations. Historically, fire was infrequent in arid communities. Fires in lower elevation desert shrub communities have been increasing due to the emergence of invasive grasses such as red brome (Bromus rubens) and cheatgrass (Bromus tectorum). Nonnative grasses that have invaded the space between native perennials form new fuel for fires that can destroy native desert shrubs across the arid landscape. The increased fire frequency begins a new grass/fire cycle not before seen in this landscape. After fires, nonnative species out-compete the slower-to-establish native vegetation. Gradually, this may convert desert shrublands to grasslands filled with nonnative species.

One example of possible species loss by both natural and anthropogenic factors is the Mojave Desert Tortoise (Gopherus agassizii). The Desert Tortoise was listed by the Federal government as threatened in 1990. It is well-adapted to the harsh desert landscape, foraging on plants below 4,000 feet in elevation inside Joshua tree (Yucca brevifolia) and creosote bush (Larrea tridentata) habitats. However, off-road vehicles, low nutritional nonnative grasses, and increased fires have lead to increased tortoise habitat fragmentation. Urban development, transportation infrastructure, and other forms of human encroachment have also contributed to the fragmentation of the landscape occupied by the tortoise, making it difficult for the species to gain access to the resources it needs and to diversify its gene pool. Another example of a threatened Mojave species is the Mount Charleston Blue Butterfly (Plebejus Shasta). It confronts enormous anthropogenic pressures including degradation of habitat due to non-natural fire regimes, urban development, and increases in nonnative plants.

The Desert Tortoise, Blue Butterfly, and other species in the Mojave Desert ecosystem each face long-term anthropogenic pressures which may lead to further decline and could lead to permanent changes that will never return to original states, resulting in an ecosystem that bears little in the way of a state it once resembled not long ago.



DEMOGRAPHICS

- SOUTHERN NEVADA POPULATION
- POPULATION GROWTH, DENSITY, AND PATTERNS

- DEMOGRAPHICS
- RACE
- AGE
- HOUSEHOLDS

- ECONOMIC DEMOGRAPHICS
- EDUCATIONAL ATTAINMENT
- NEW POPULATION
- INCOME
- LABOR MARKET
- POVERTY
- HEALTH CARE COVERAGE

- MOVEMENT AND PATTERNS
- COMMUTE PATTERNS

Southern Nevada has grown 190% from 1990 to 2015 and was known as the fastest growing community in the United States from 1990 – 2010. While population growth slowed dramatically during the Great Recession, it has picked back up and is projected to continue at a rate of 1% in the next 35 years. At this rate, Southern Nevada is anticipated to reach a population of 3.1 million by 2050. With the added population, in addition to changing demographics and national trends in older and younger populations, race and ethnicity, and socioeconomics, Southern Nevada will be confronted with new challenges on energy, water supply, transportation, food, waste, pollution, and urban development that will impact the Mojave Desert ecosystem.

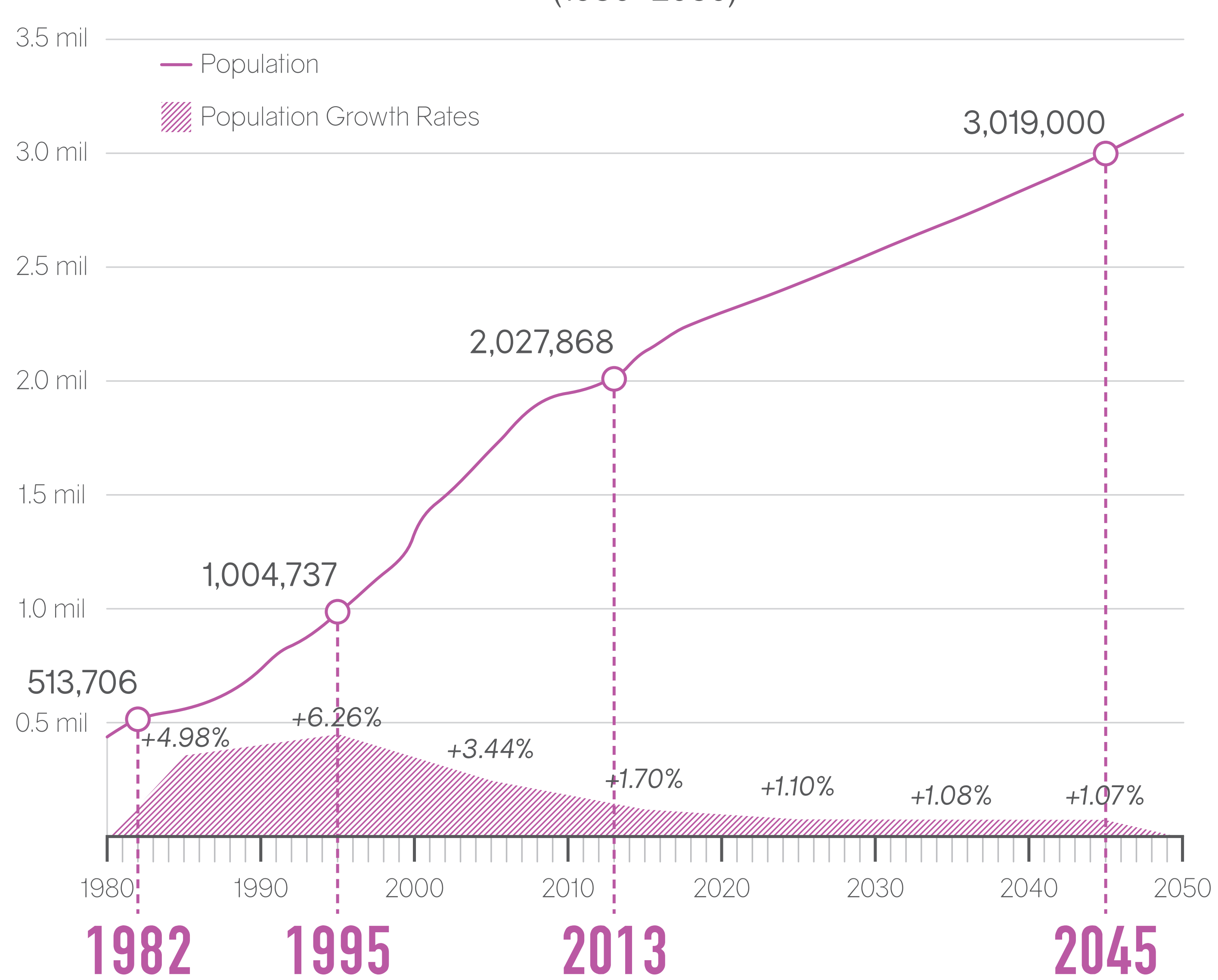
SOUTHERN NEVADA'S POPULATION

Throughout the twentieth century, the population growth rate in the Las Vegas Metropolitan Statistical Area had been one of the fastest among U.S. metros. Las Vegas hit half a million people in 1982; it took only 13 years to double that population to over a million by 1995. Beginning in 2006, the rate began to slow before the Great Recession (2008-2013); Southern Nevada still hit another milestone in this period when population increased to over two million within an 18-year period (1995–2013). Since 2012, population has increased at a rate of 1.5 percent. According to the 2014 Long-Term Population Forecast Report by UNLV's Center for Business and Economic Research (CBER), the Las Vegas Metropolitan Statistical Area's population in Clark County projects to grow at an average rate of 1.1% through 2050. Even with the region's recovery from the Great Recession that included a jump in the growth rate of two percent for 2012 and 2013, the rate is expected to stabilize to about one percent in the next decade. With this lower growth rate, it is expected to take more than 30 years to add another one million people to Southern Nevada's population. Southern Nevada will not only be bigger in 2050, but its makeup will be radically different as people live longer lives, as minority groups, especially the Latino population, comprises a greater share of the population, and as Baby Boomers (and later, Millennials) age and retire.

This inventory analyzes demographics using data from the U.S. Census Bureau's 2010 Census, the 2010-2012 American Community Survey analyzing 326 of Clark County's urbanized census tracts, UNLV's Center for Business and Economic Research, and the Nevada State Demographer.

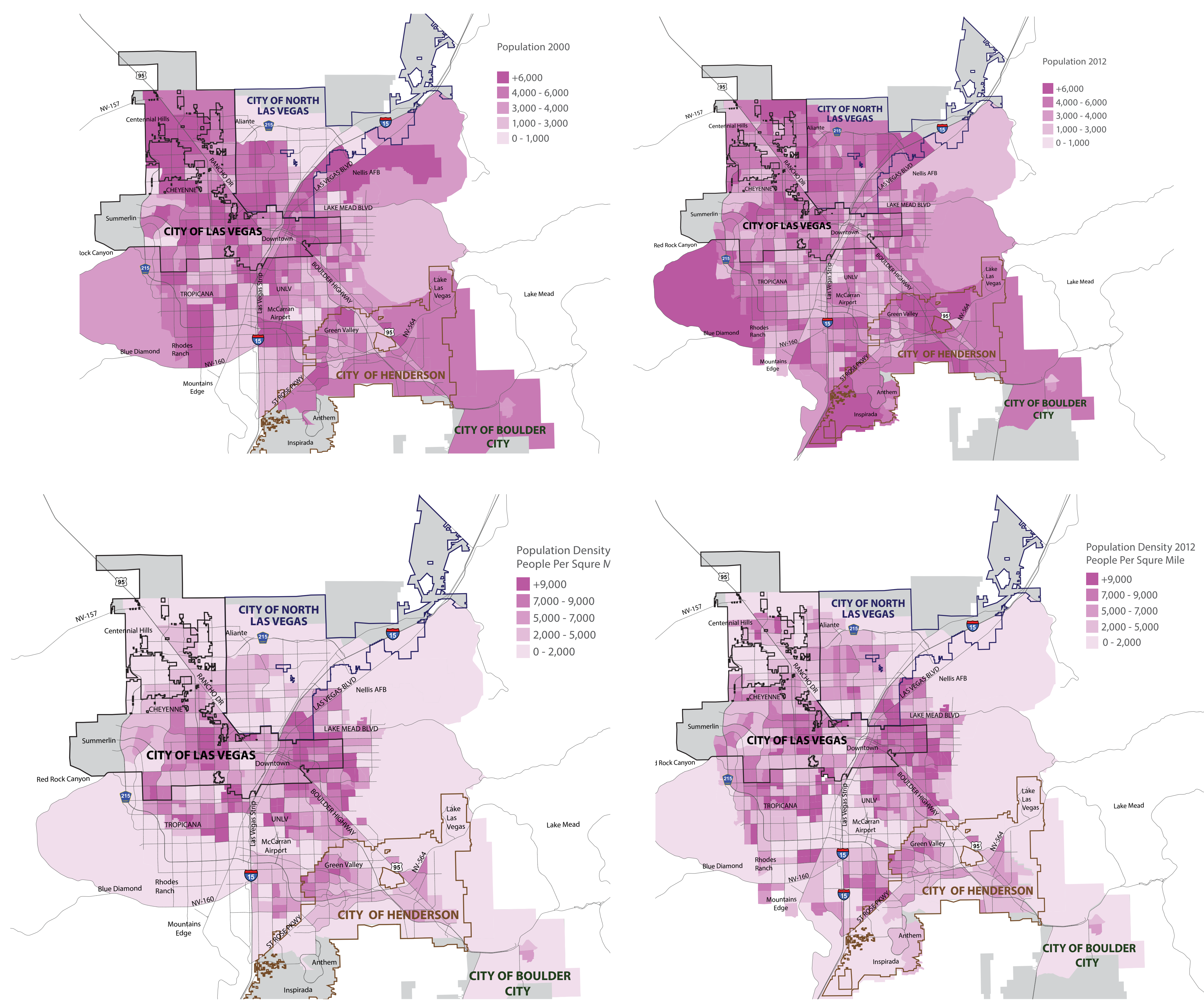
Clark County (TOTAL):	2,069,450
Las Vegas:	610,637
North Las Vegas:	230,491
Henderson:	280,928
Boulder City:	15,627
Mesquite:	18,262
Unincorporated county:	913,505

Clark County Total Population Estimation & Forecast (1980~2050)



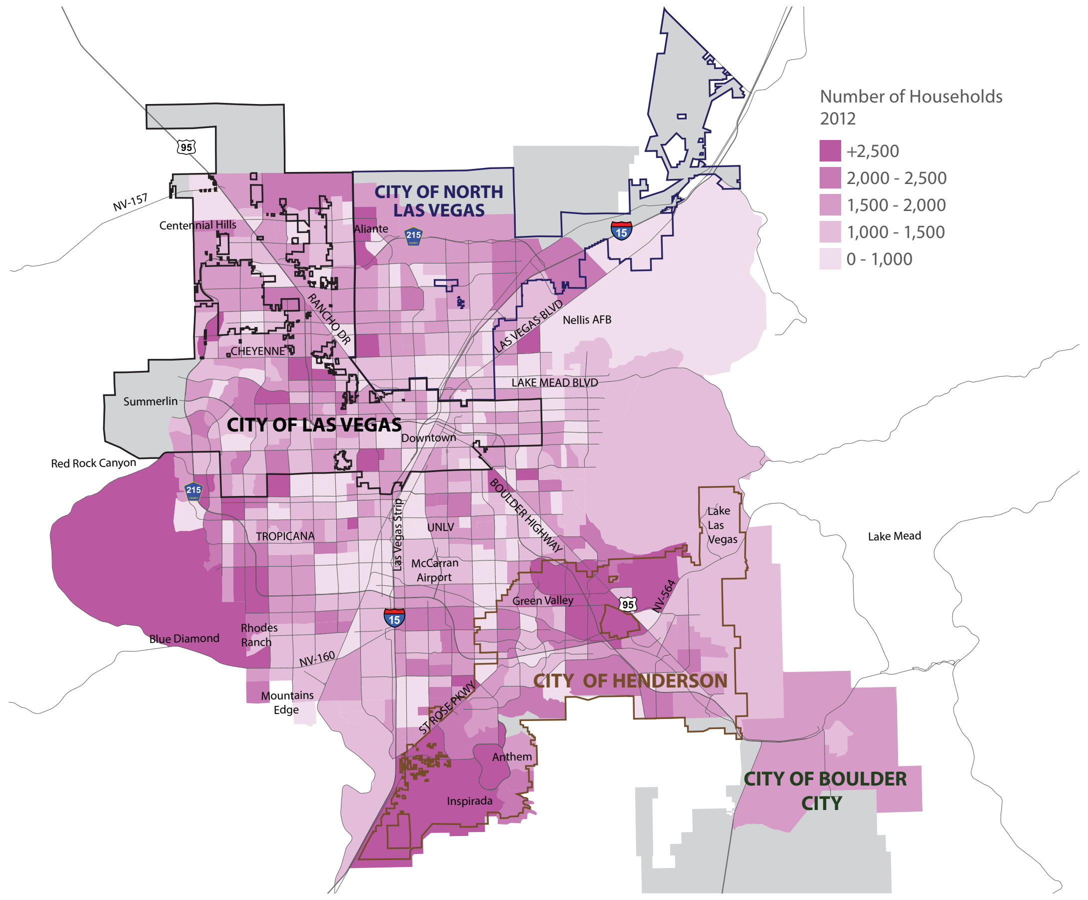
As Southern Nevada has grown in population, so has its urban footprint and density. While the City is surrounded by Federally owned public lands that somewhat contain growth, the overall shift has been to that of suburban sprawl. Initially, population was concentrated around Downtown Las Vegas and the Strip and around Downtown Henderson. Between 1970-1990, growth filled in the desert between Las Vegas and Henderson, especially with the development of the 7,100 acre Green Valley master planned community northwest of Downtown Henderson. Similarly, beginning in the 1980's to this day, the Howard Hughes Corporation led development of the Summerlin 22,500 acre master planned community in Western Las Vegas. Much of the rest of Southern Nevada grew during the 1990's and 2000's and has continued to grow throughout the past decade .

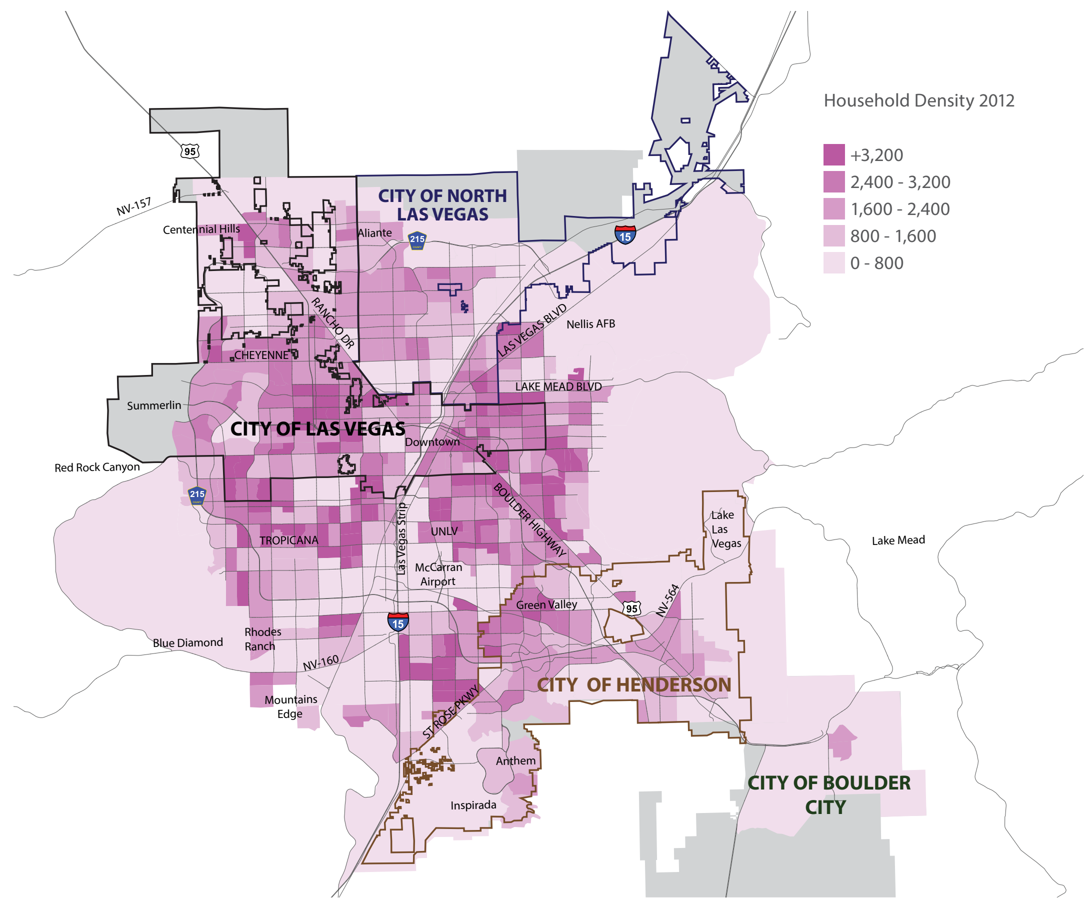
Desert land once controlled by the Bureau of Land Management was authorized to be sold under the 1998 Southern Nevada Public Lands Management Act, which enabled suburban growth and development of hundreds of neighborhoods in the south, southwest, northwest, and northern portions of the Las Vegas Valley. Major planned communities, including Anthem, Inspirada, Southern Highlands, Mountain's Edge, Rhodes Ranch, Cliff Shadows, Providence, Centennial Hills, and Anthem, have been added in the last two decades. While individual communities have been developed at comparatively lower densities, a comparison of the overall population density between 2000 and 2012 reveals an increase in density from 4,223 per square mile to 4,298 per square mile. Density in areas in the urban core and around Downtown Las Vegas and the Strip have historically been greater than 7,000 people per square mile; however, trends indicate suburban development contributing to overall increases in density. This could be explained by regional zoning regulation and market forces that have resulted in relatively smaller lot sizes and developers maximizing the number of units per development.

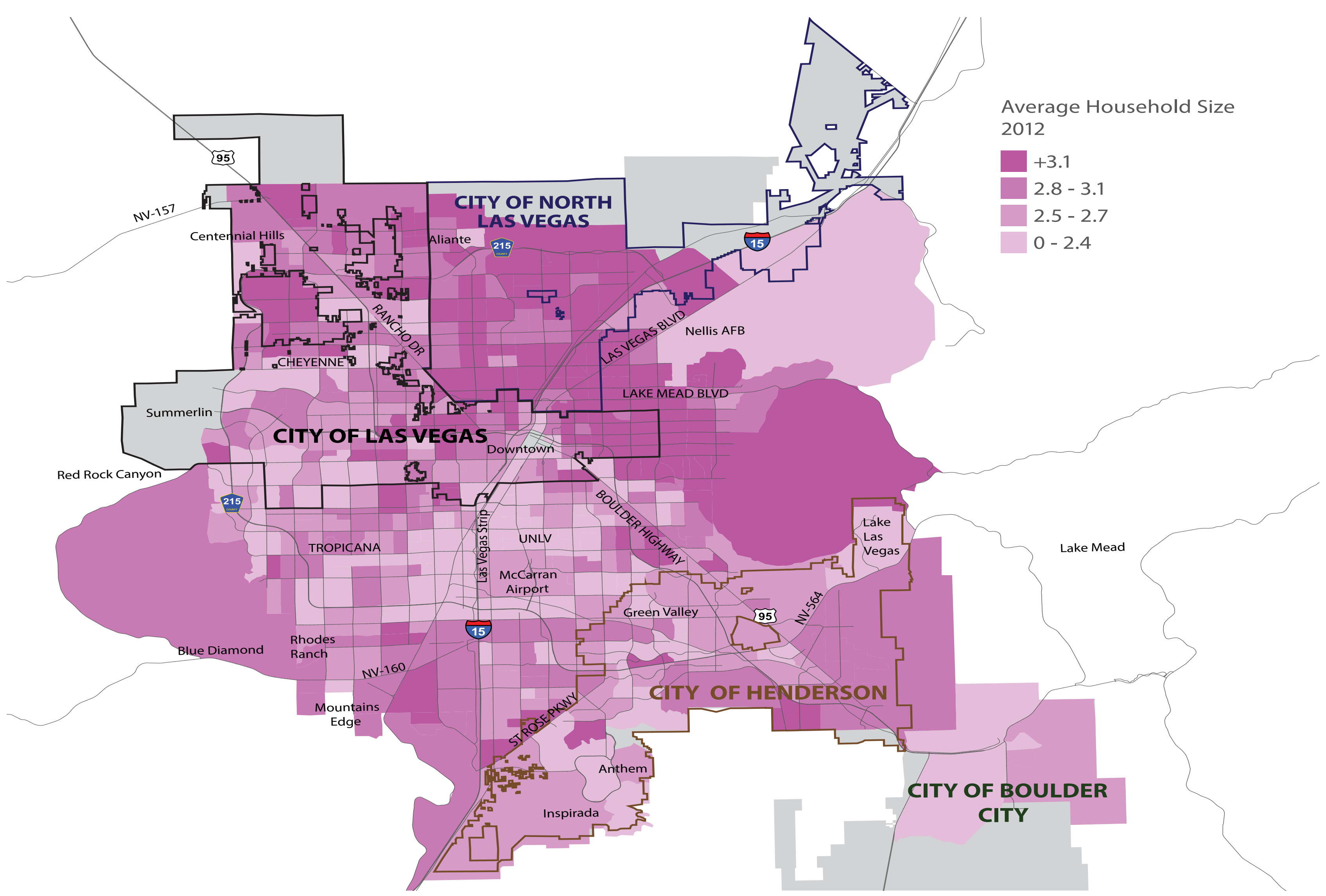


HOUSEHOLDS

The spatial distribution of the number of households and household density in 2012 indicates a similar pattern to population distribution and density. However, the pattern of average household size indicates a high concentration of Census tracts with households with more than three persons, many of which are in the northeastern part of the City and coincide with the same tracts that have higher relative concentrations of Latino and Hispanic populations.

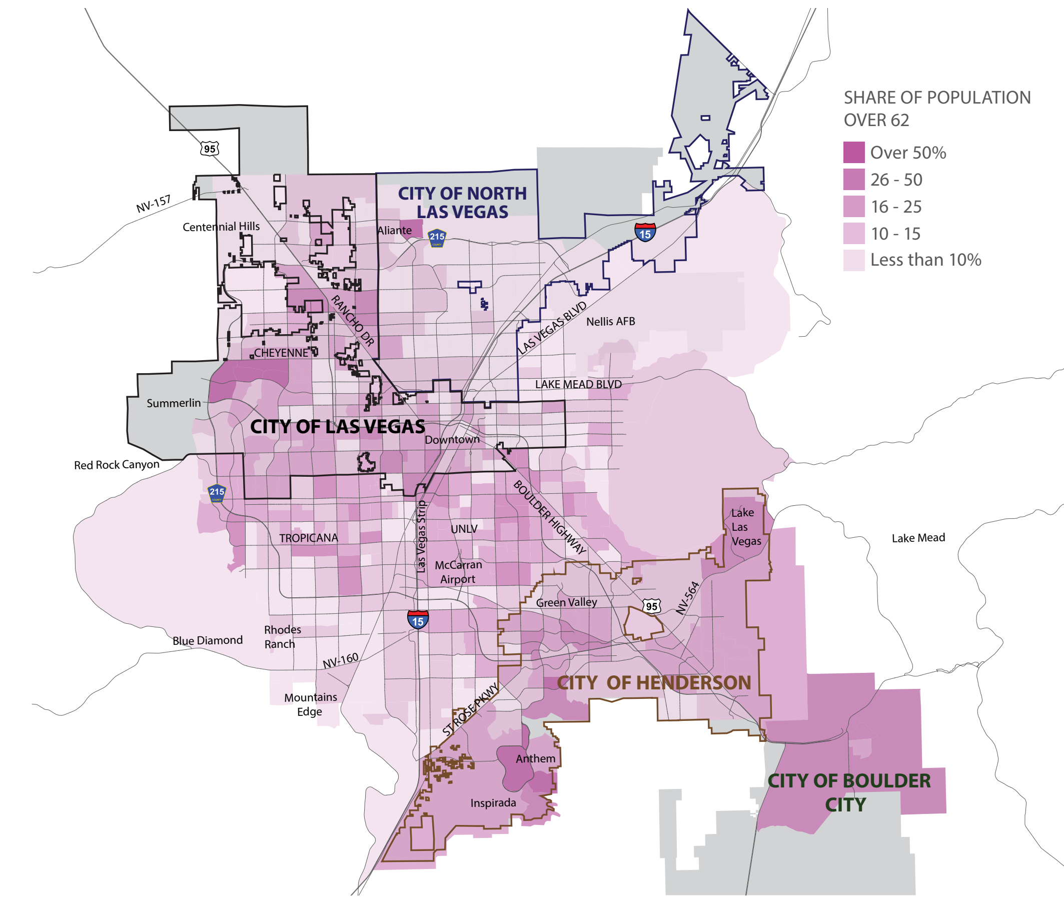


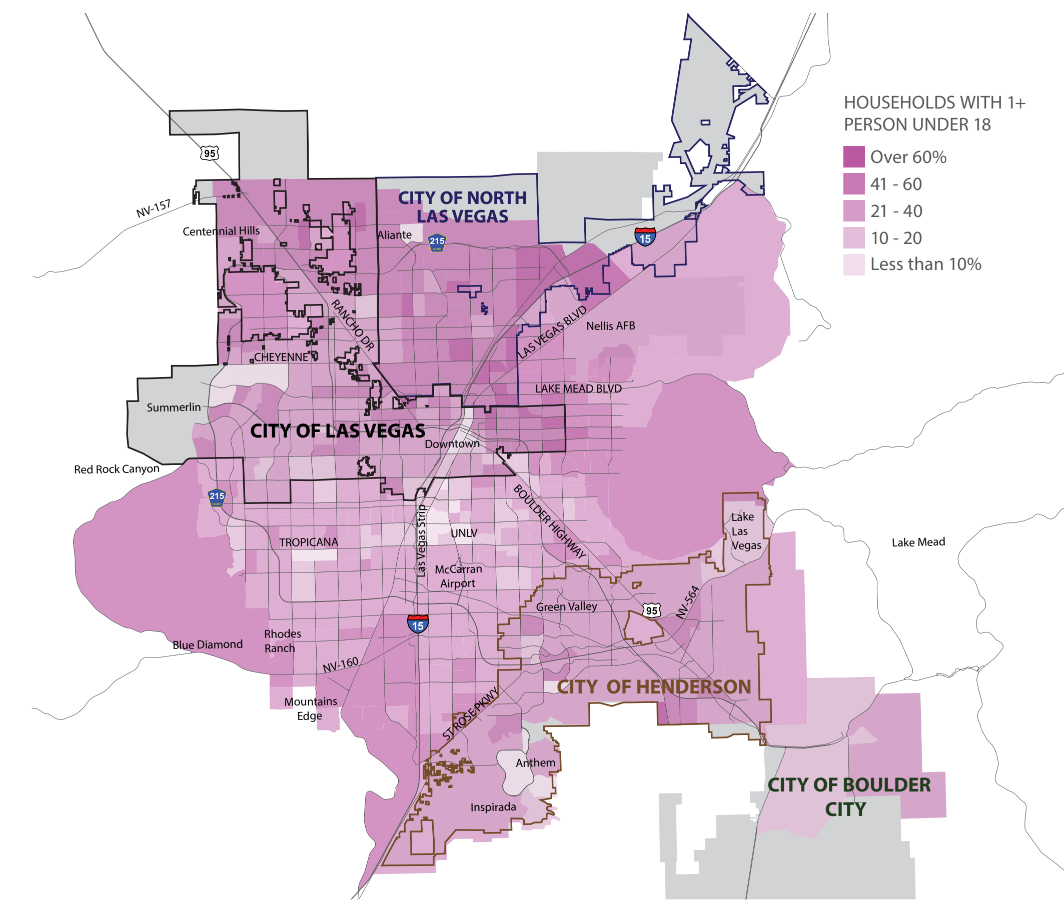


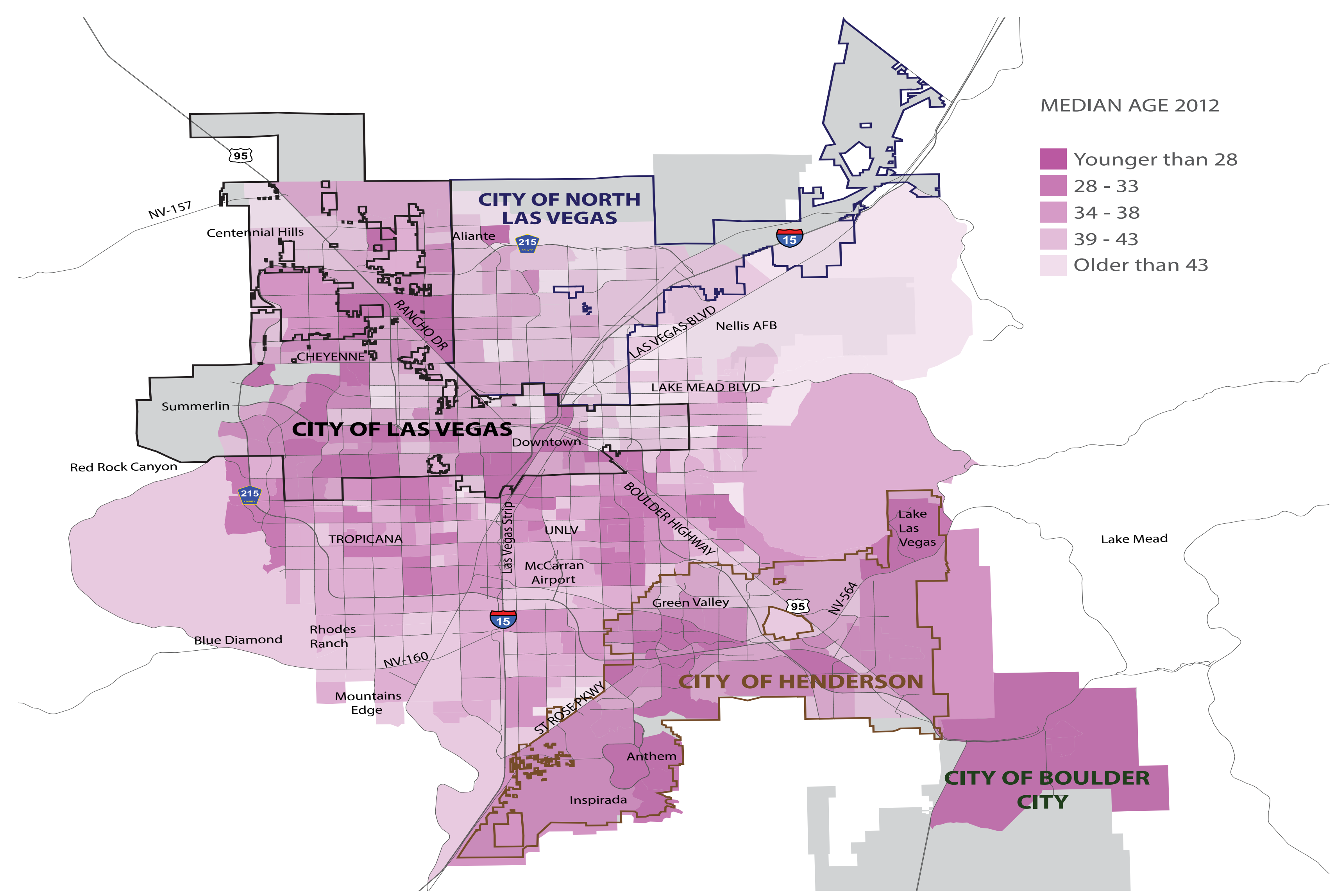


AGE

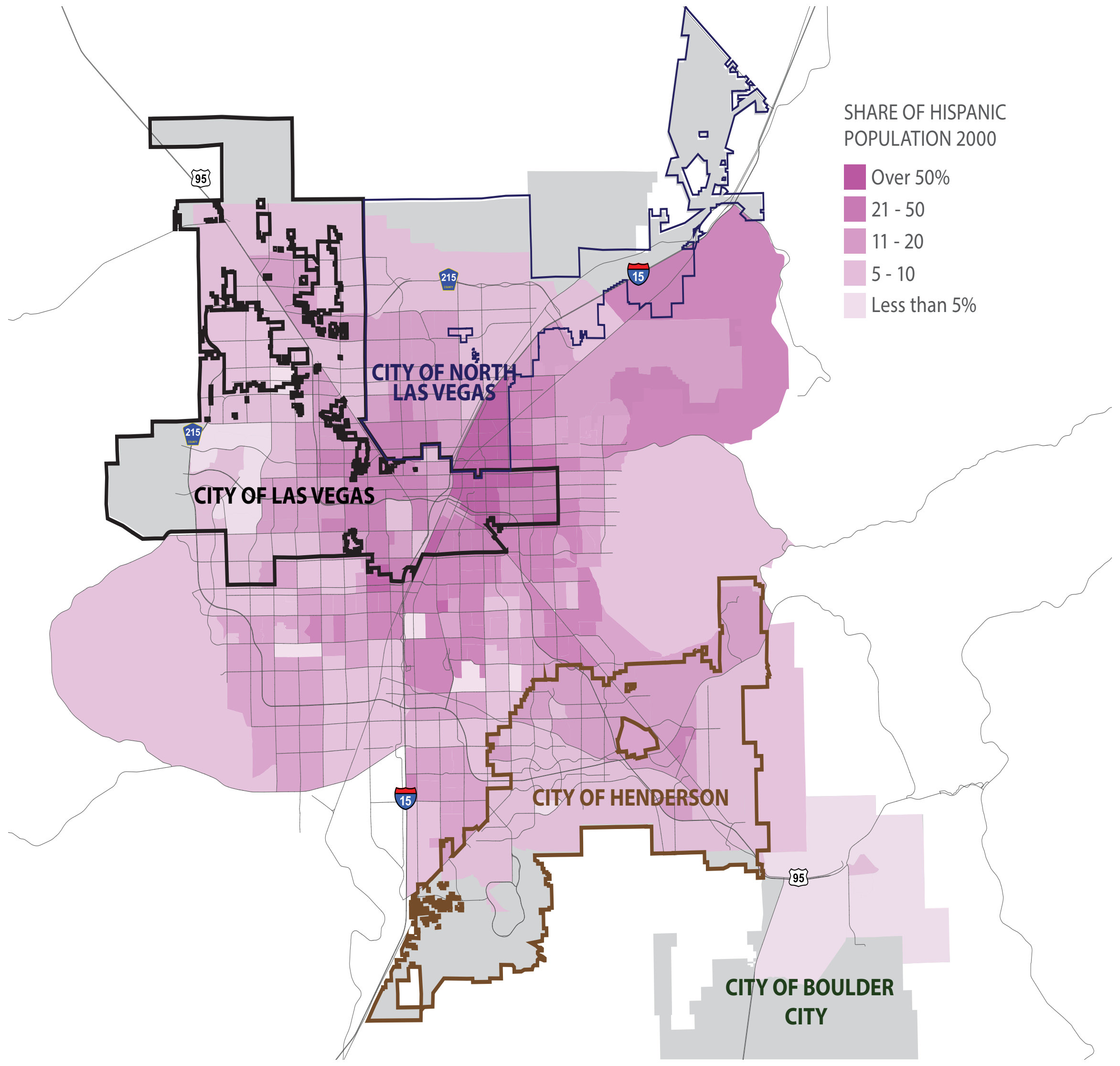
The median age distribution indicates a relatively younger group related to recent growth concentrated in the northeastern part of Clark County, while older populations are located in Boulder City and parts of Henderson and Summerlin. In 2000, tracts with a median age of older than 43 years were found in Boulder City and southeastern Las Vegas. By 2012, Henderson and Summerlin had large populations of aged 43 due to the presence of age restricted communities. A few tracts in Summerlin and Anthem have more than 50 percent of the total population in an age cohort older than 62. Between 25 to 50 percent of the total population in Boulder City was older than 62 years, while tracts with less than 10 percent of the population over 62 years old are concentrated in North Las Vegas and near Nellis Air Force Base. Census tracts with more than 60 percent of households having at least one person under age 18 are located around Downtown Las Vegas and North Las Vegas. In the northern and southwestern parts of the City, 50 percent of the households contain at least one person under the age of 18. Boulder City sits in contrast to other areas in the Las Vegas Valley with only 20 percent of households having someone under 18. An explanation of Boulder City's age characteristics may be related to Boulder City's growth management policies; more people have lived in the community a longer time, and new housing development is restricted and contained, allowing few new residents to move into the City.

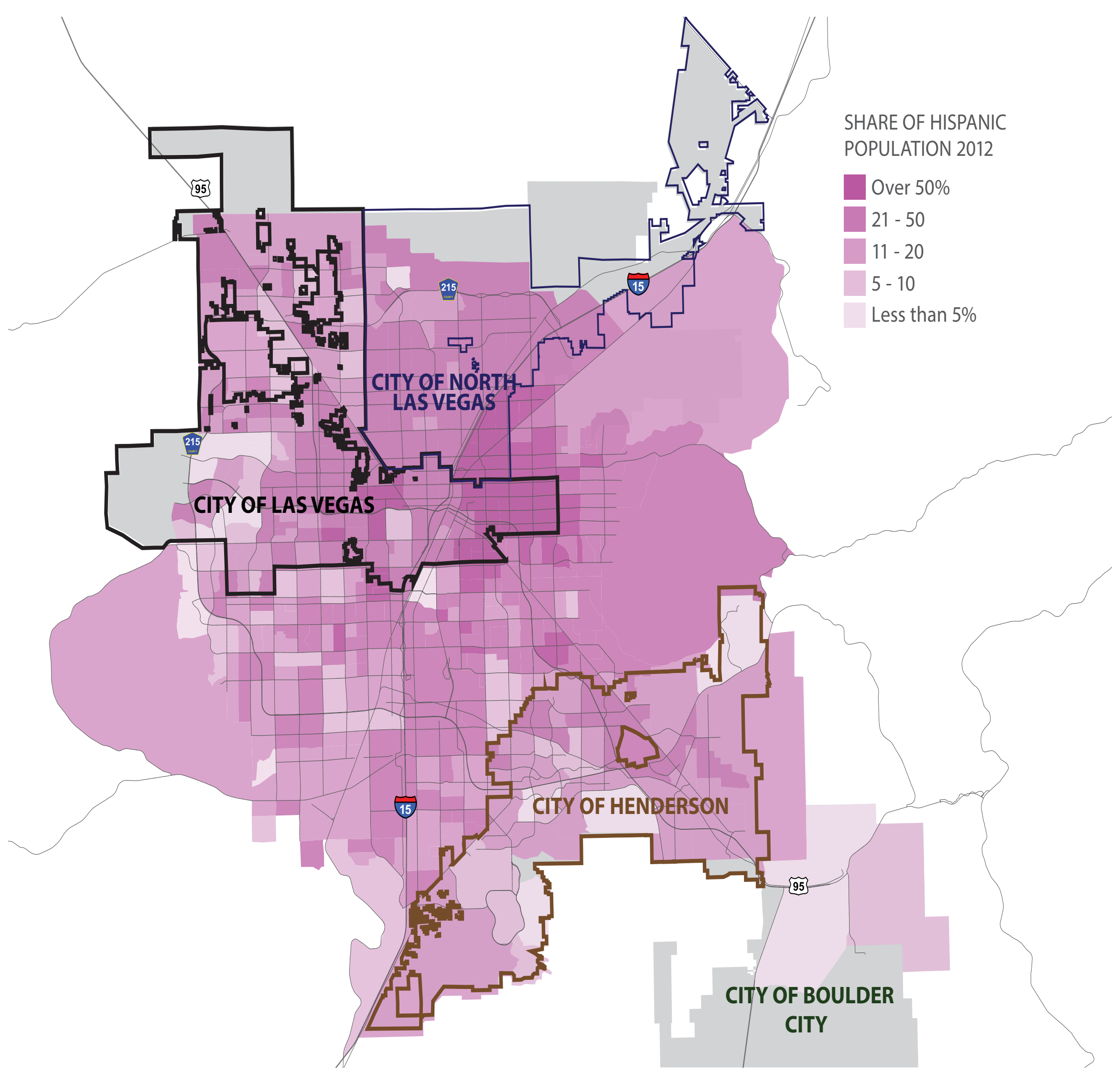






RACE





2000 Census

White:	71.6%
African American:	9.1%
American Indian/Alaskan:	0.8%
Asian:	5.3%
Hawaiian/Pacific Islander:	0.5%
Two or More Races:	4.2%
Hispanic or Latino:	22.0%

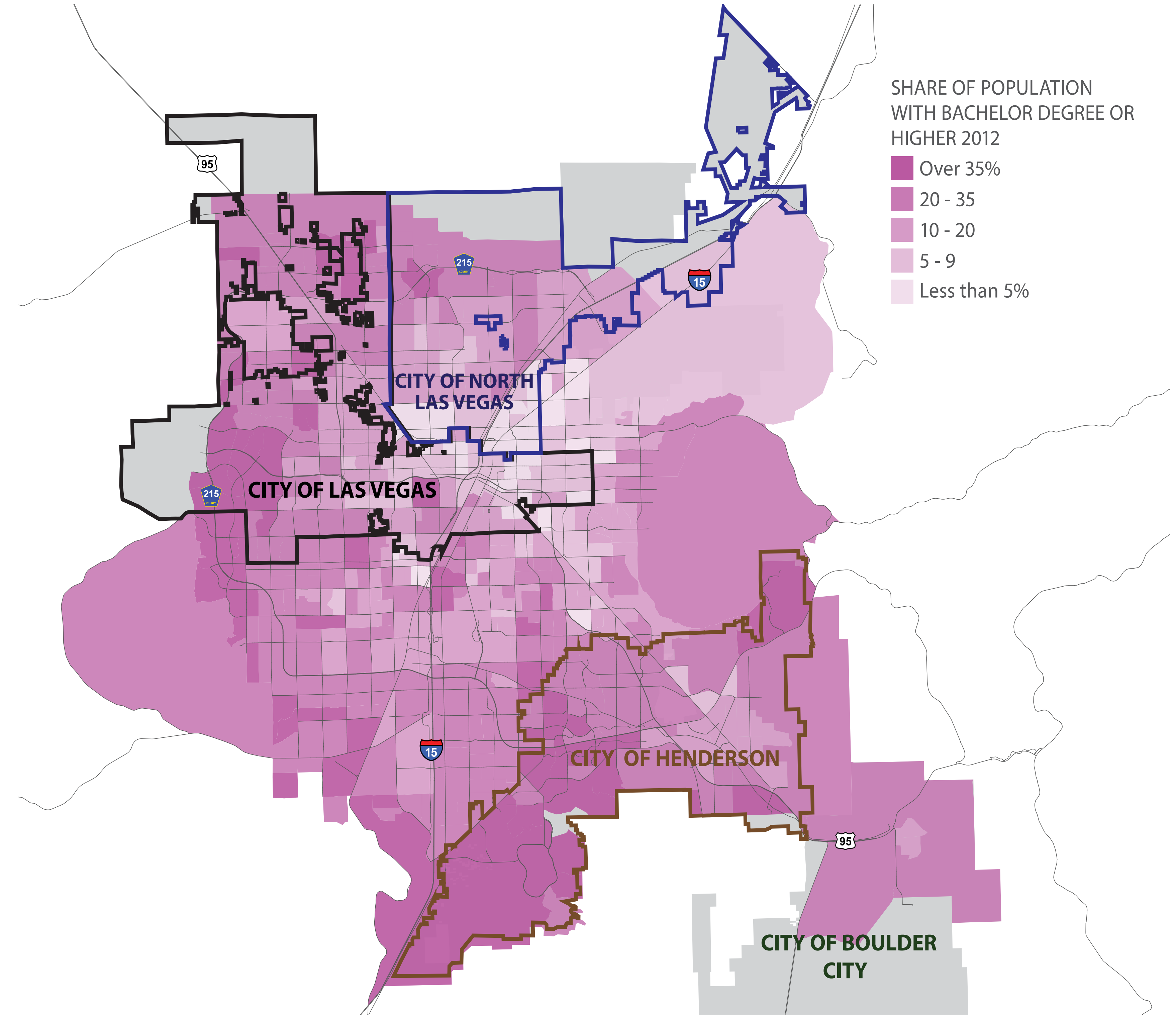
2010 Census

White:	60.9%
African American:	10.5%
American Indian/Alaskan:	0.7%
Asian:	8.7%
Hawaiian/Pacific Islander:	0.7%
Two or More Races:	5.1%
Hispanic or Latino:	29.1%

Southern Nevada has seen its racial composition diversify dramatically over time, most notably amongst the Hispanic-Latino populations. The share of Latinos of Mexican origin increased by around seven percent, up from almost 16 percent in 2000 to nearly 23 percent in 2012 . This is equivalent to a 42 percent increase over a 12-year period. Existing an new concentrations developed in certain neighborhoods, including those located in the northeastern part of the Valley east of Interstate 15. The average share of the population in these census tracts is now over 40 percent in these areas. Other racial groups grew as well, including those identifying as Asian alone. Between 2000 and 2010, the Asian population grew by almost 100,000, a rate of 133%.

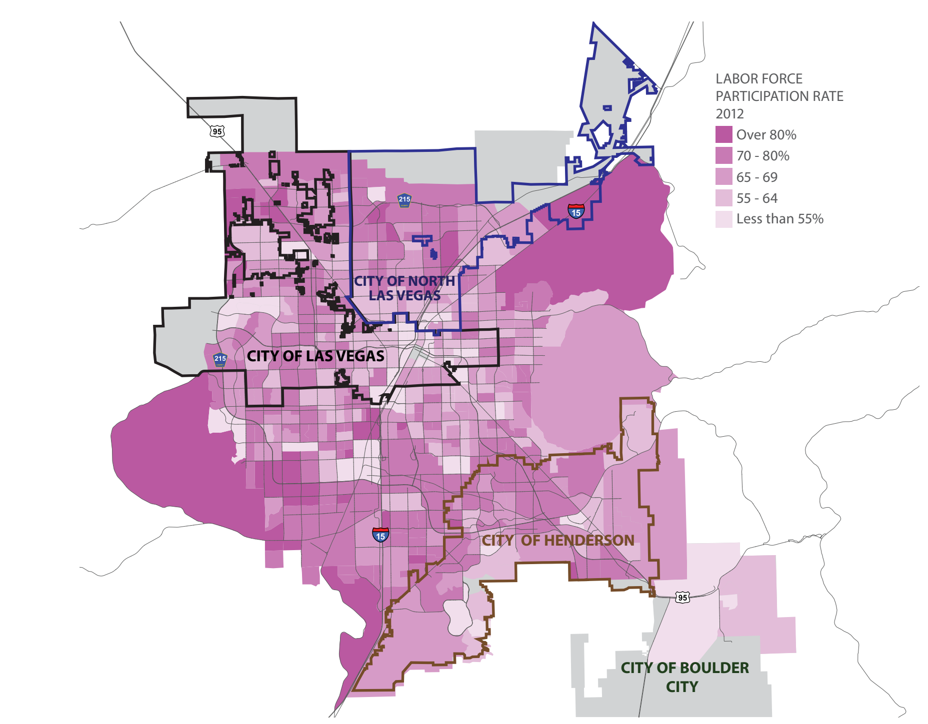
Today, Southern Nevada is already a "minority-majority" community; at current growth rates, Hispanics and Latinos are likely to equal Southern Nevada's non-Hispanic and Latino population by 2030.

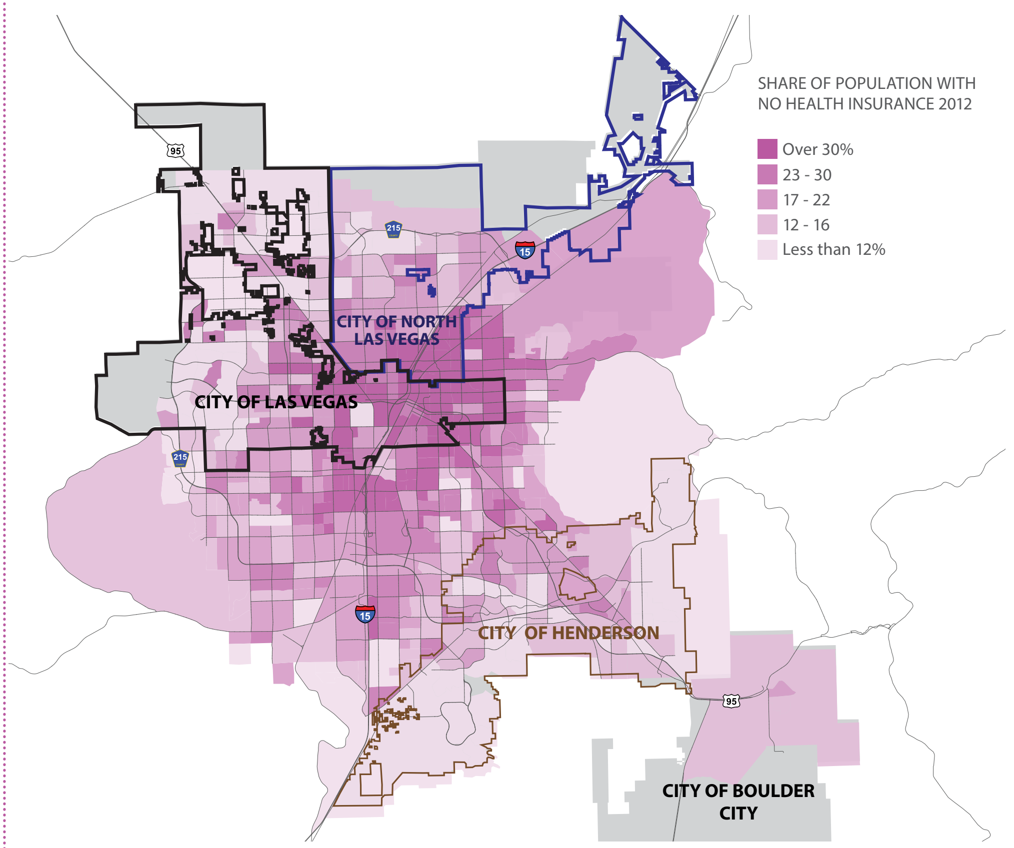
EDUCATIONAL ATTAINMENT

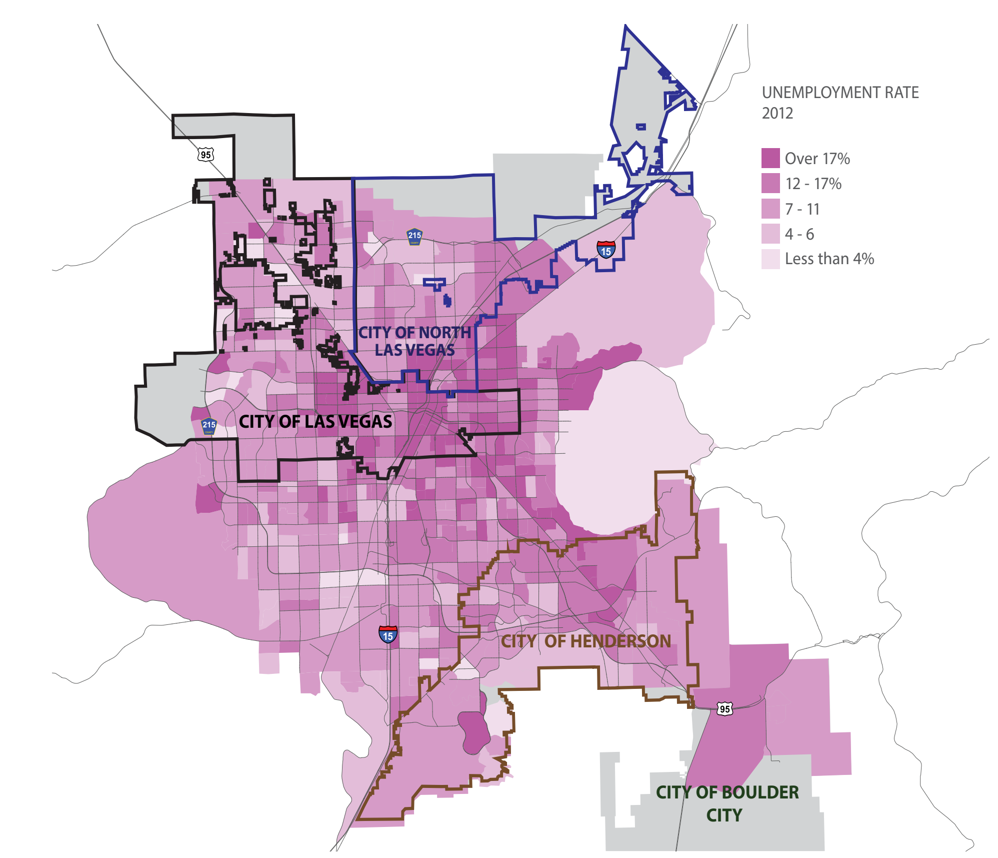


Educational attainment is an important socio-economic measure and speak to both the types of jobs offered in the community and the state of the region's primary, secondary, and post-secondary education systems. Higher rates of education can contribute to greater rates of employment and participation in the labor force. In Southern Nevada, only 22% have obtained a Bachelor's degree or higher, while 84% have obtained a high school diploma. A third of Southern Nevada's Census tracts with a population between 25 and 64 years old have attained a high school diploma. Another third do not complete high school, many of which are concentrated in locations with higher minority group populations. The highest percentages with people having at least a college degree are located in the suburban neighborhoods of Anthem, Green Valley in Henderson, and Summerlin.

ECONOMIC DEMOGRAPHICS





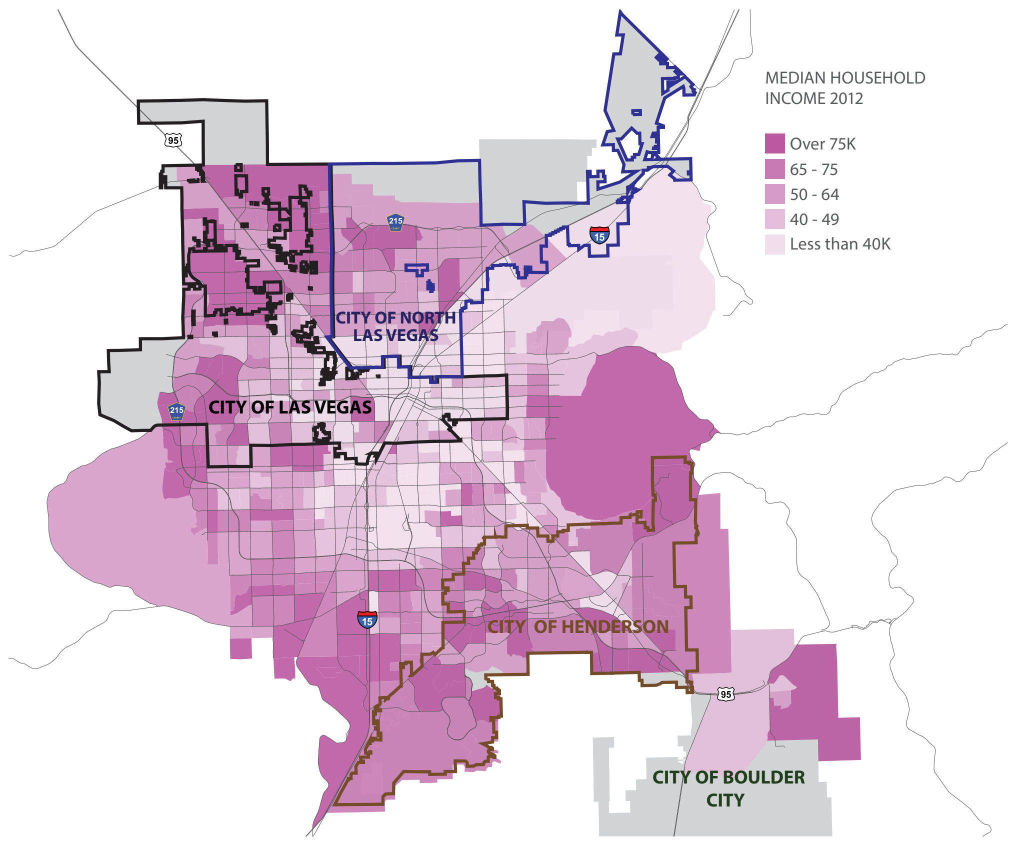


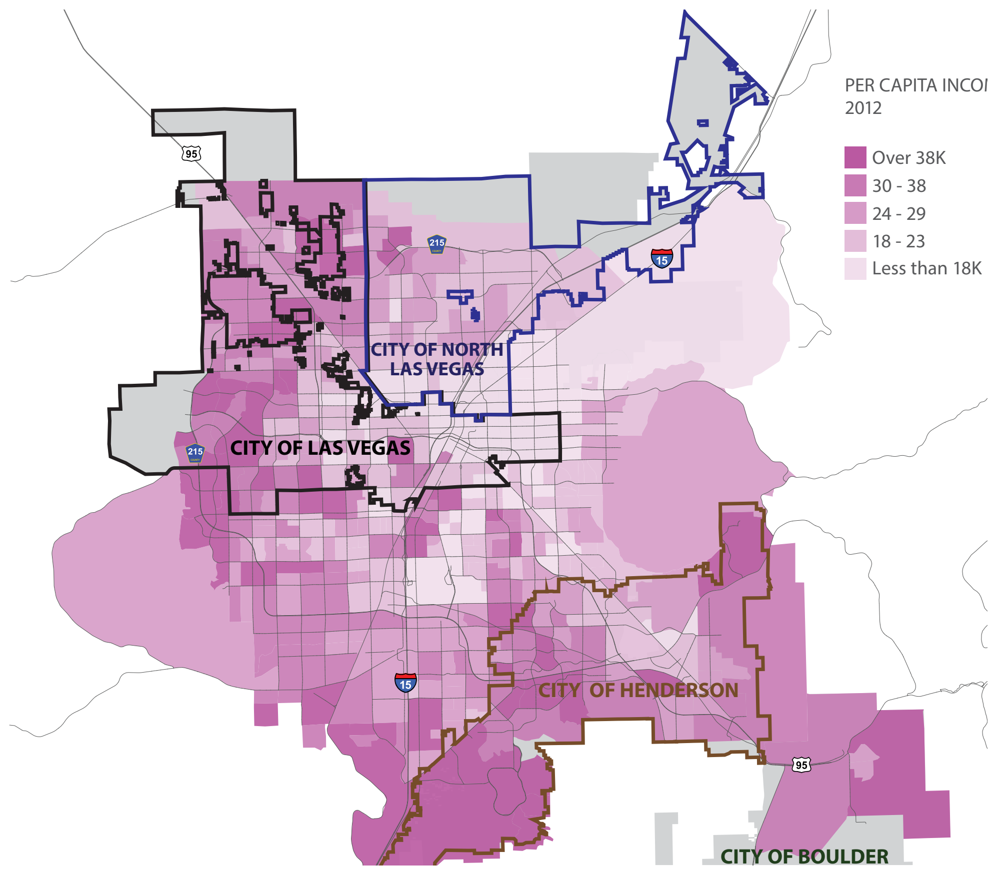
A number of factors and indices can be used to measure the economic sustainability of Southern Nevada's resident and special populations, including income, employment status, and rates of poverty. In general, the wealthiest Southern Nevadans are employed, live in suburban parts of Las Vegas, are white, have higher educational attainment, and are less likely to require public assistance or participate in social programs. The poorest Southern Nevadans tend to be the opposite: they tend to have higher rates of unemployment, live in central, northeastern or eastern neighborhoods, identify with a minority population, have lower levels of educational attainment, and are more likely to participate in public assistance or social programs. Median Household Income ($52,070 in Southern Nevada (2014)) and Per Capita Income patterns reveal that the wealthiest Southern Nevadans live in relatively new suburban neighborhoods along the Las Vegas Beltway, while the poorest live around Downtown Las Vegas, in North Las Vegas, central Las Vegas east of the Strip, and the northeast. A few pockets of high income areas are found in the central valley, including exclusive gated enclaves such as Las Vegas Country Club and Rancho Circle.

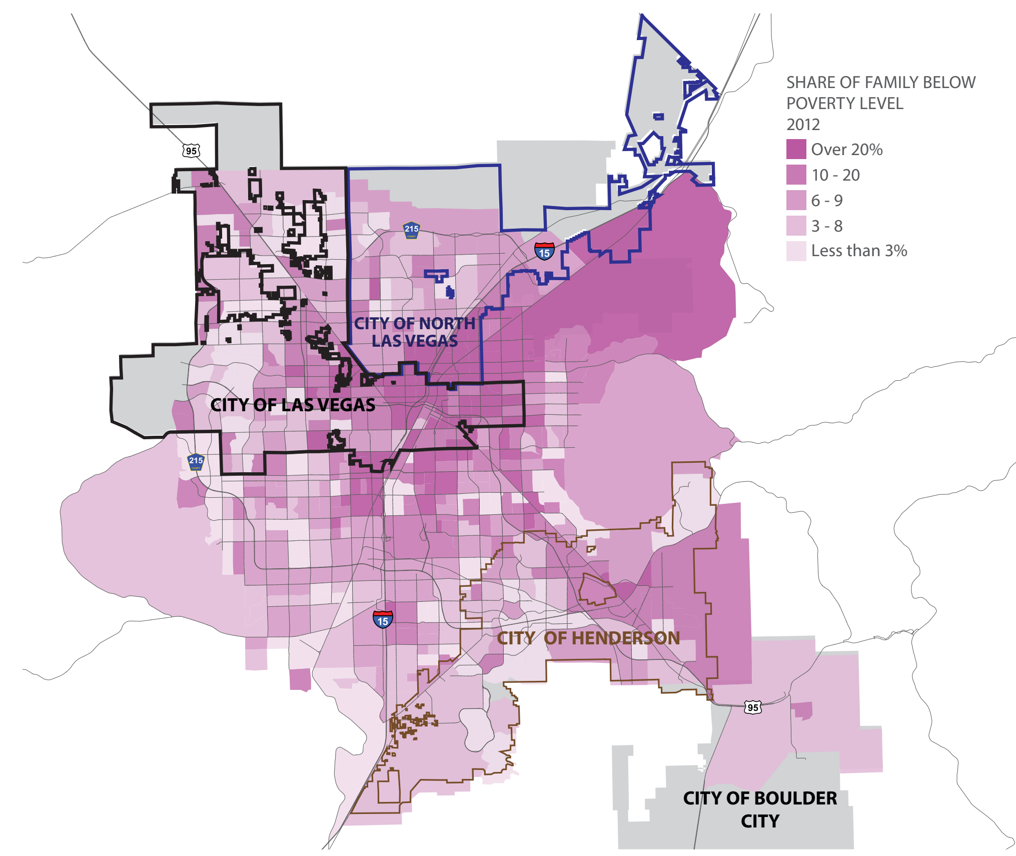
Since 2012, the unemployment rate in Southern Nevada has continued to recover after the Great Recession, with recent improvement in its unemployment rate of 6.2% in 2015 and its labor force participation rate of 65.4%. Still, higher unemployment rates and lower labor force participation rates persist in Downtown, North Las Vegas, and northeastern Las Vegas. A few areas that are exceptions include locations with age-restricted neighborhoods with retirees, including Sun City communities in Aliante, Summerlin, and Anthem.

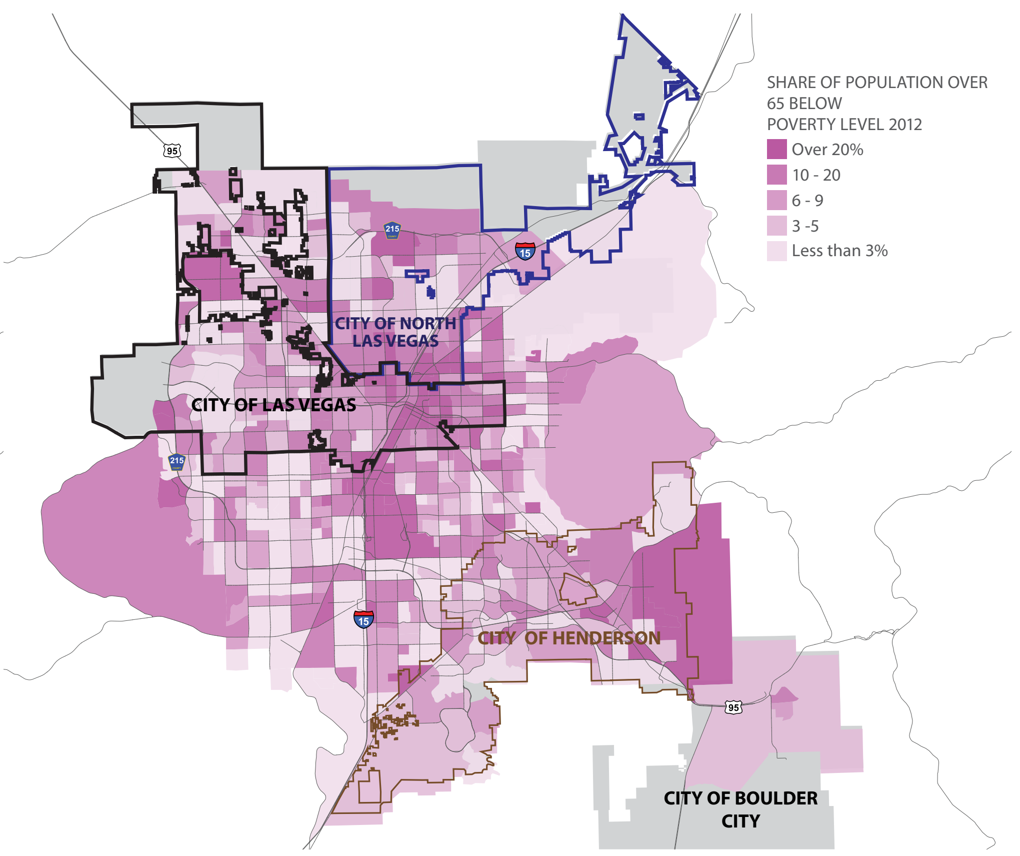
Lower incomes and unemployment are contributing factors of poor nutrition and poor health. Approximately 17 percent of Americans had no health care in 2012, and 22% of Southern Nevada residents had no coverage. While that number has dropped to 14% nationwide and 21% in Southern Nevada since the passage of the Affordable Care Act, the geographic concentrations of the uninsured in Southern Nevada continue to correlate with geographic concentrations of Latino and Hispanics, areas of high unemployment, low educational attainment, low income, and relatively high pollution in around Downtown Las Vegas, North Las Vegas, and the eastern portion of the valley.

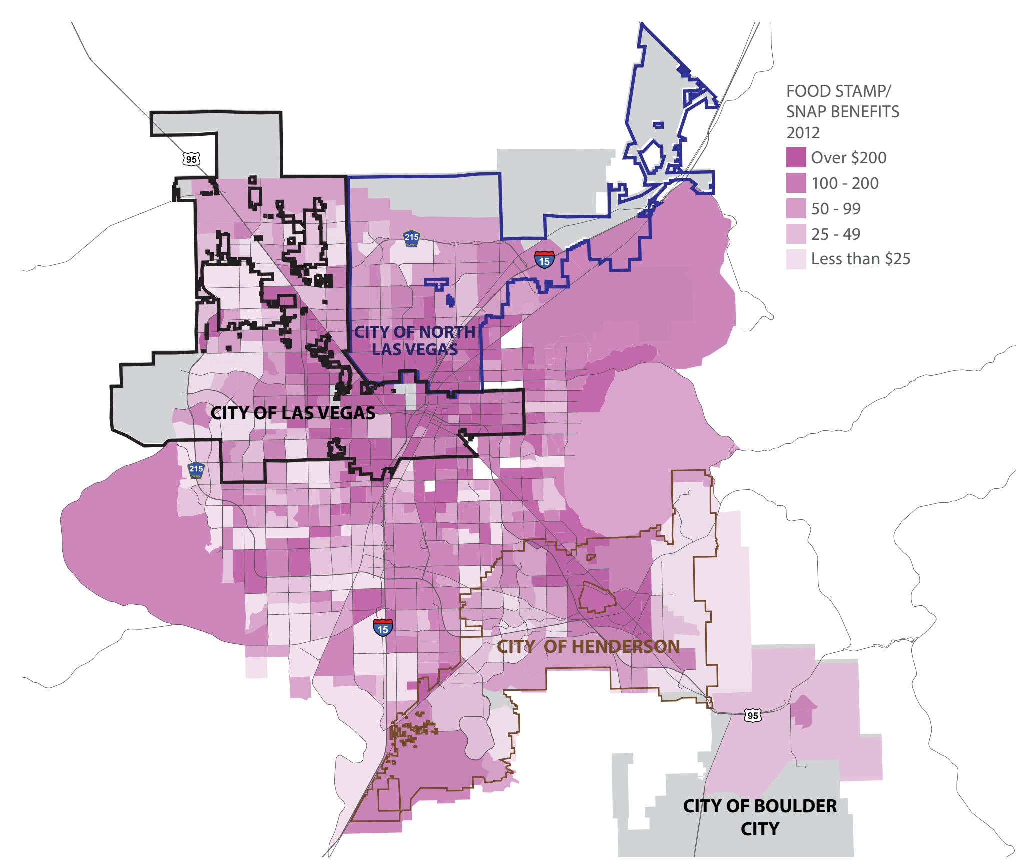
With the larger household sizes, lower levels of educational attainment, higher unemployment and lower labor force participation rates, income directly correlates with poverty indicators. People living in areas around Downtown, in North Las Vegas, Downtown Henderson and portions of the eastern and northeastern parts of the valley, especially those identifying as Latino/Hispanic or African American, are more likely to be susceptible to poverty. These areas also have higher concentrations of families and persons under 18 below US defined poverty levels and are also more likely to be participants in the (Supplemental Nutrition Assistant Program (food stamps)). While elderly populations falling below poverty levels are also found in concentrations in central Las Vegas, North Las Vegas, and east Henderson, some pockets are also found in suburban areas including Centennial Hills, Summerlin, and Aliante and could be explained by poverty definitions.

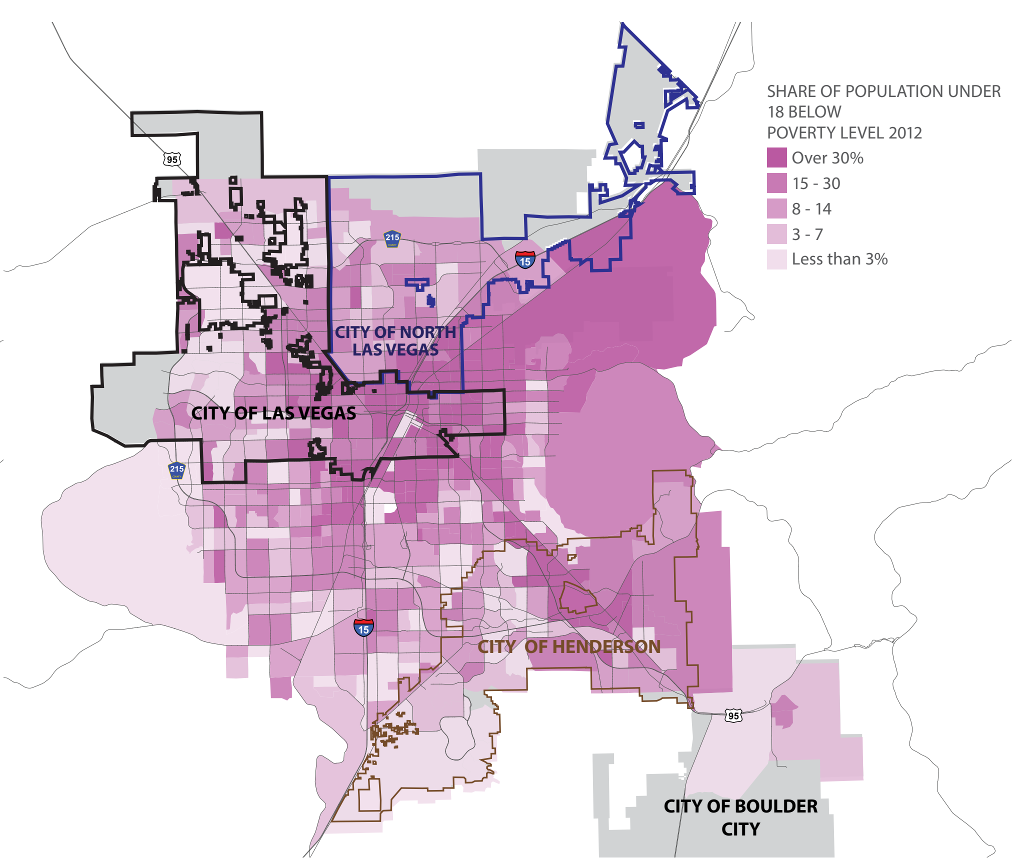




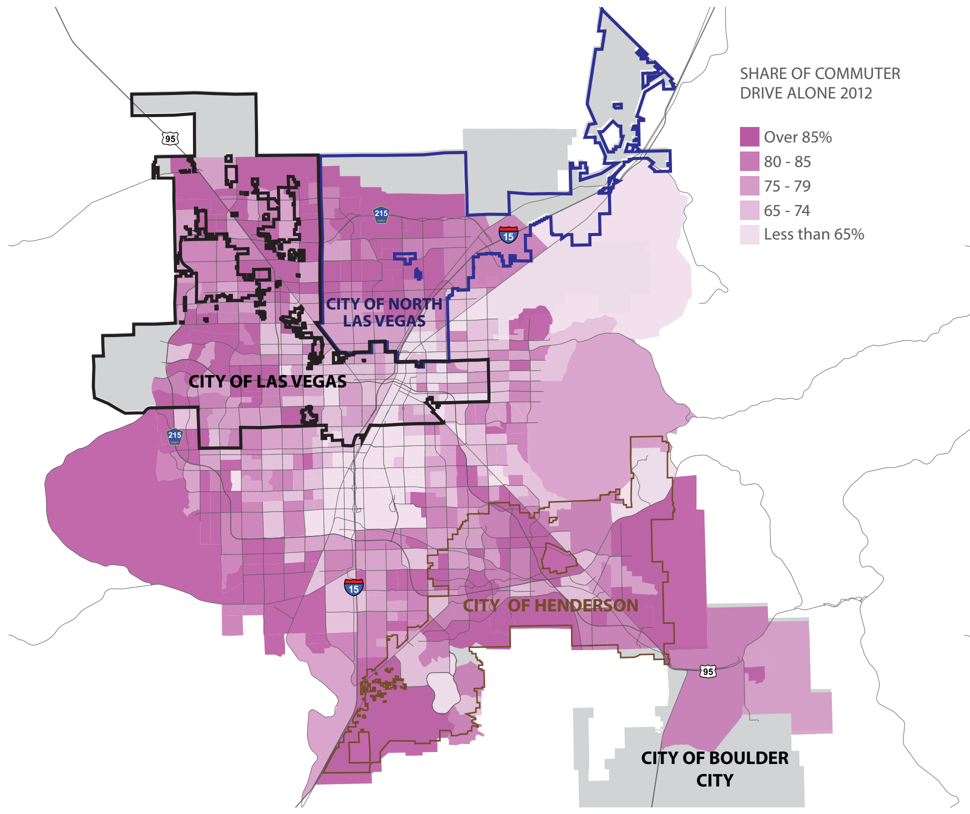


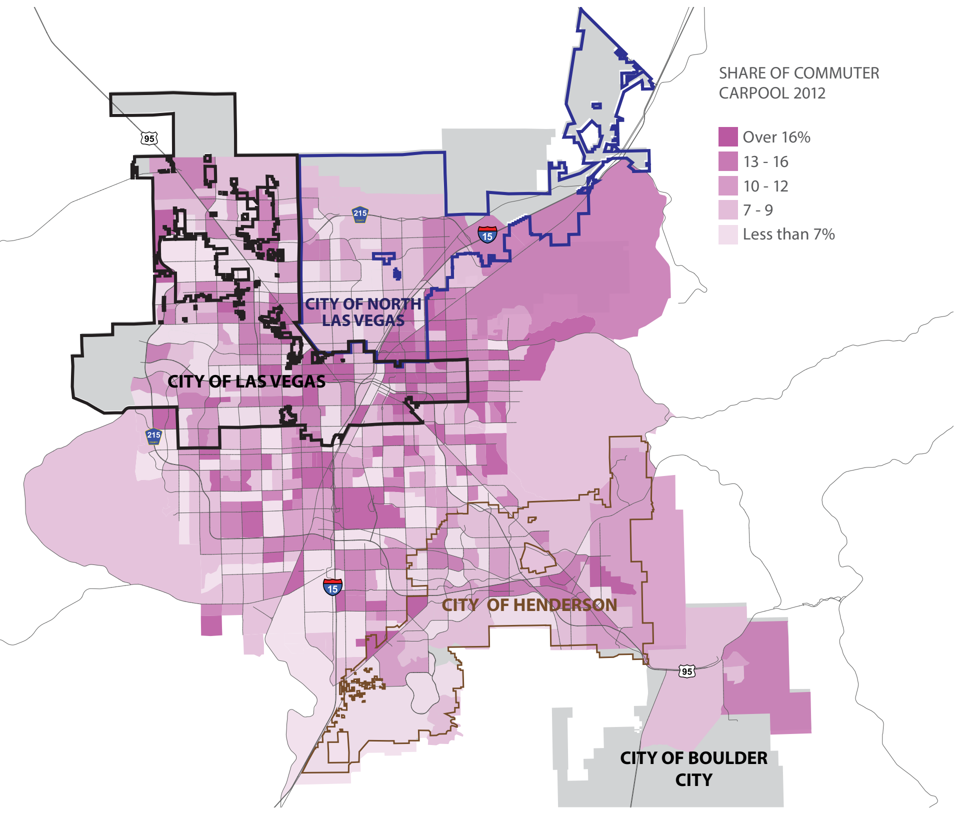


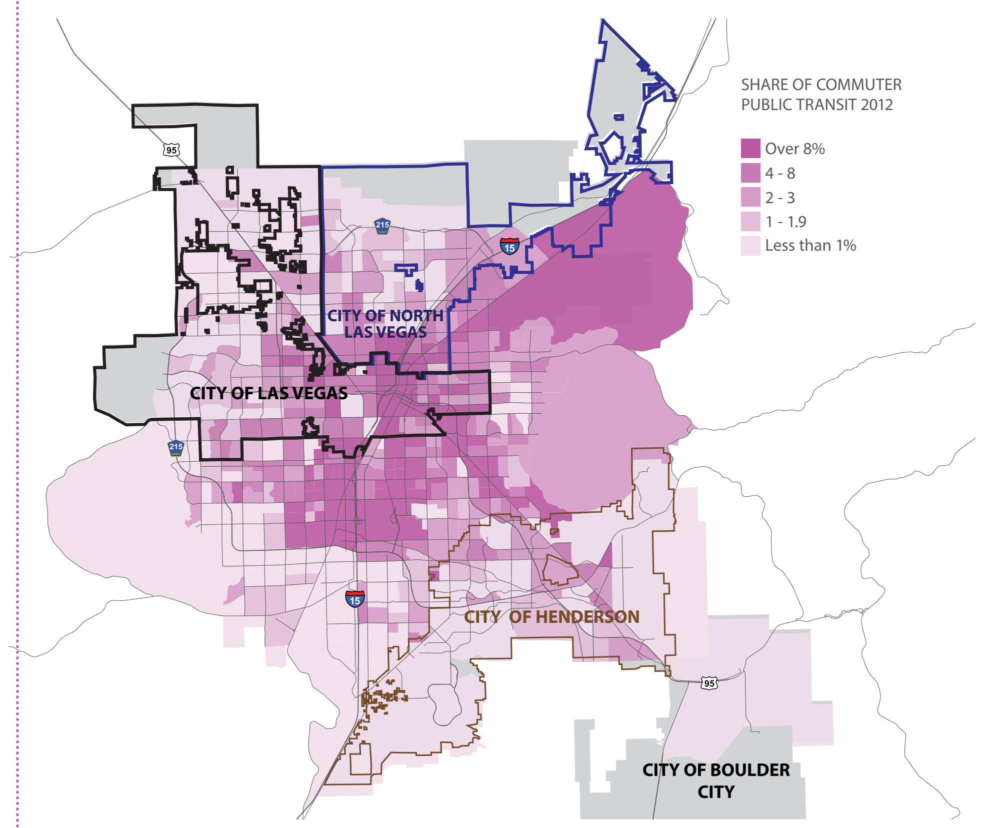


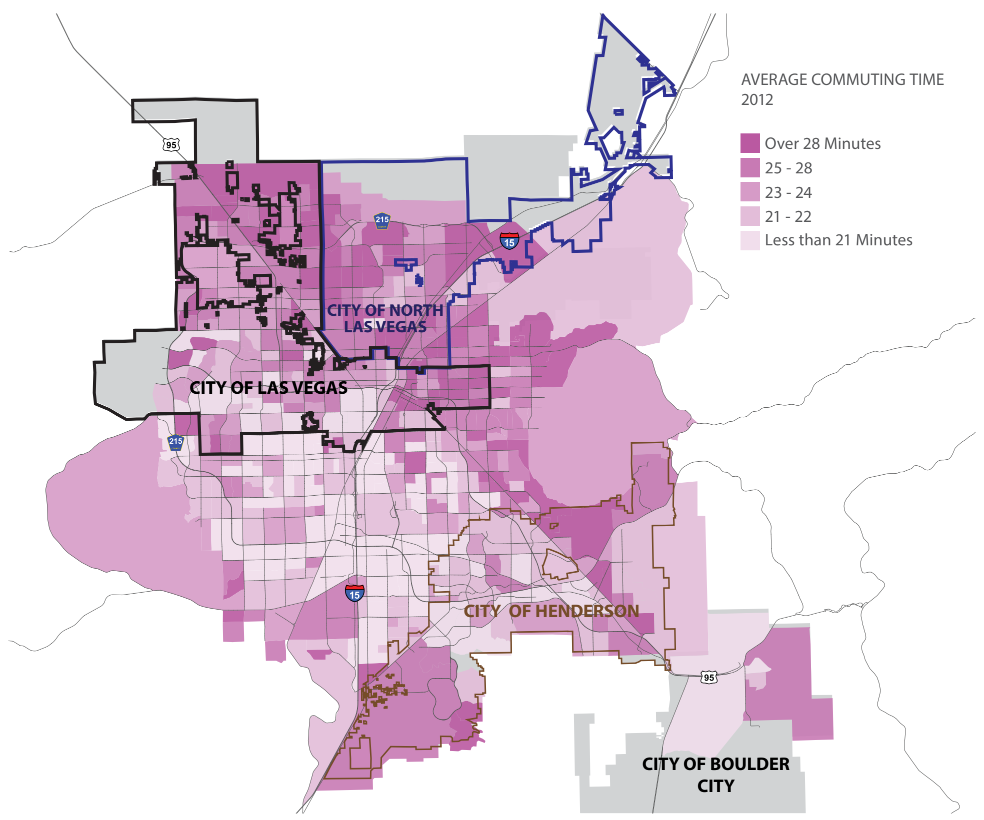


COMMUTING PATTERNS









Commuting behavior relates closely to the socioeconomic status of commuters and their chosen commuting routes. Because Las Vegas has concentrated employment in Downtown Las Vegas, the Las Vegas Strip, and around McCarran Airport, most commuters, regardless of mode, make a typical journey of work from the suburbs to the core of the city in the morning, and reverse in the evening. Solo drivers typically travel longer distances to work from their residences, with the longest travel times of approximately half an hour coming from Centennial Hills, Aliante, much of North Las Vegas, and Anthem. These suburban areas have higher incomes, enabling residents of these zones to have more options for choice of transportation.

Higher transit ridership rates show up in areas closer to job centers and employment, including Downtown and the Strip, McCarran Airport, and the northeast. Transit ridership rates also correspond with the socioeconomic characteristics of these commuters. Areas with higher Latino and Hispanic populations in the north, northeast and east also tend to have longer commute times, but are also areas with higher rates of transit reliance.

#

- SUPPLY
- HYDROLOGY
- LAKE MEAD SUPPLY
- DROUGHT

- USE
- USE SECTORS
- INDOOR AND OUTDOOR USE
- RECYCLING AT A METRO SCALE

- CONSERVATION
- EDUCATION
- INCENTIVES
- WATER PRICING
- REGULATION

- WATER AND THE ENVIRONMENT
- WATER QUALITY
- FLOOD CONTROL

Southern Nevada is located within one of the most arid regions in the nation, receiving about 4-inches of rain a year. With over 2 million residents, the region strives to use its local groundwater and imported Colorado River supplies efficiently and wisely. Local water and wastewater entities in 1991 formed the not-for-profit Southern Nevada Water Authority to help address Southern Nevada's unique water needs. The agency is comprised of seven local water and wastewater agencies that provide service to the Valley's residents and 40 million annual visitors.

Even with such a small amount of precipitation each year, local storm events cause flash flooding. Protecting the population from flash flooding and ensuring long term sustainable water supplies are two critical components to urban resilience. This chapter summarizes the Clark County Regional Flood Control District's (CCRFCD) efforts to reduce flooding risk and the Southern Nevada Water Authority's (SNWA) efforts to ensure reliable water supplies are available to meet the region's water needs for generations to come.

The SNWA publishes a water resource plan that outlines how demands and water supplies are planned to be utilized over a 50-year planning horizon, while the CCRFCD publishes a Ten-Year Construction Improvement Plan and maintains updated Master Plans for areas throughout Southern Nevada.

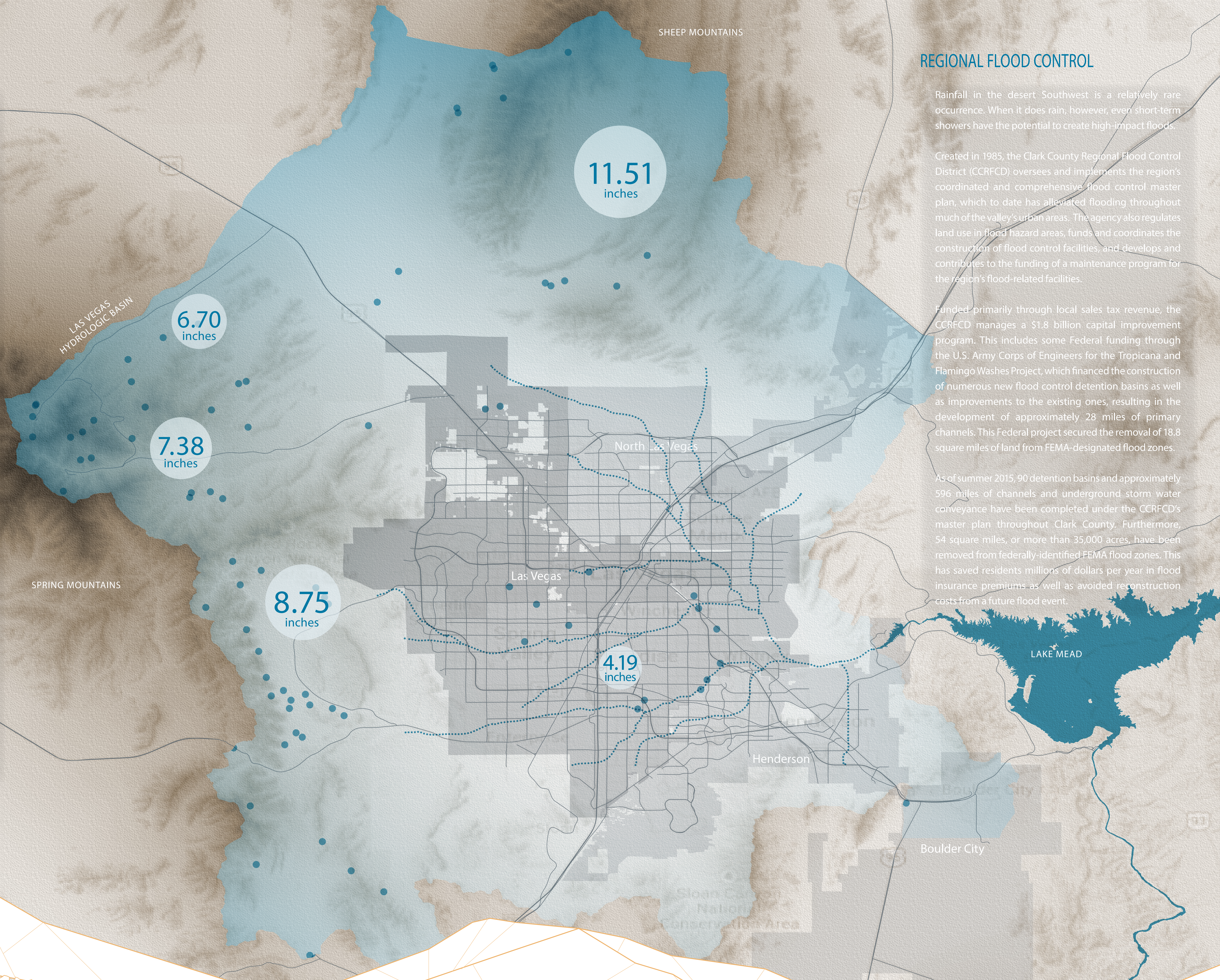
LAS VEGAS VALLEY HYDROLOGY

Early development in the Las Vegas Valley relied solely on artesian springs and groundwater resources to meet local water demands. The groundwater system is naturally recharged via snow and rainfall in the Spring and Sheep mountains that re located on the west and north sides of the Las Vegas Valley, respectively.

Since 1987, the Las Vegas Valley Water District and later the City of North Las Vegas have stored unused Colorado River water in the Las Vegas Valley Groundwater Basin. This "banked" water provides a water reserve to be used in the future; this is done by the process called Artificial Recharge, in which drinking water from the Colorado River is injected directly into the groundwater aquifer via wells.

The Southern Nevada Water Authority (SNWA) is in charge of developing and maintaining the regional water infrastructure and periodically updates water resource plans to ensure water demand throughout the region are met. SNWA provides water to seven out of every 10 Nevadans. Groundwater within the Las Vegas Hydrographic Basin makes up about 10 percent of the water supply in Southern Nevada, while Colorado River water provides 90 percent of the supply.

To reduce the negative impact of groundwater usage, the SNWA, at the direction of the Nevada Legislature, developed the Las Vegas Groundwater Management Program. Elements of this program include: permanent recharge to the aquifer, grants for conversions from private wells to municipal service, aquifer monitoring, well plugging and abandonment grants, and conservation education.



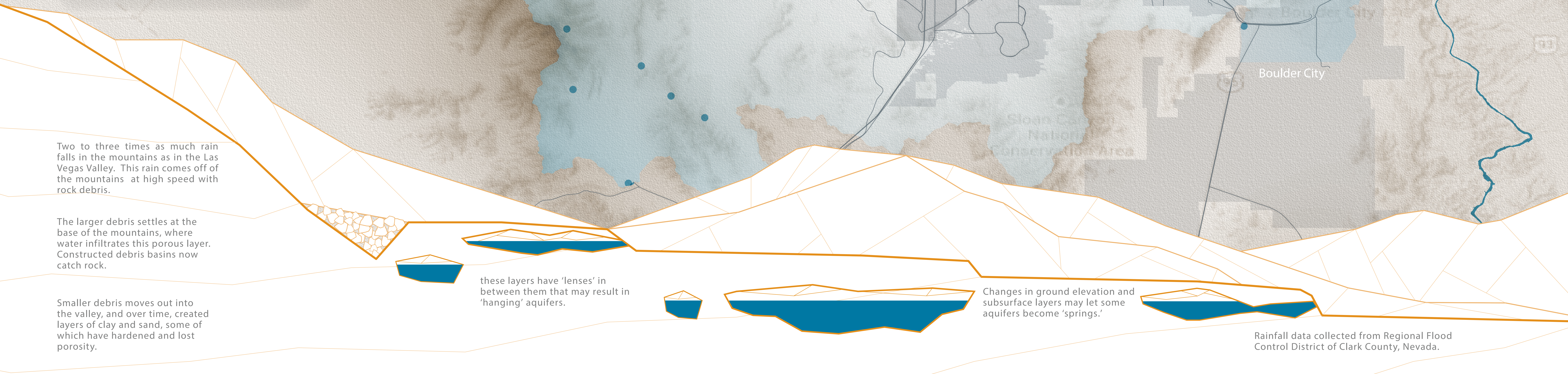
REGIONAL FLOOD CONTROL

Rainfall in the desert Southwest is a relatively rare occurrence. When it does rain, however, even short-term showers have the potential to create high-impact floods.

Created in 1985, the Clark County Regional Flood Control District (CCRFCD) oversees and implements the region's coordinated and comprehensive flood control master plan, which to date has alleviated flooding throughout much of the valley's urban areas. The agency also regulates land use in flood hazard areas, funds and coordinates the construction of flood control facilities, and develops and contributes to the funding of a maintenance program for the region's flood-related facilities.

Funded primarily through local sales tax revenue, the CCRFCD manages a $1.8 billion capital improvement program. This includes some Federal funding through the U.S. Army Corps of Engineers for the Tropicana and Flamingo Washes Project, which financed the construction of numerous new flood control detention basins as well as improvements to the existing ones, resulting in the development of approximately 28 miles of primary channels. This Federal project secured the removal of 18.8 square miles of land from FEMA-designated flood zones.

As of summer 2015, 90 detention basins and approximately 596 miles of channels and underground storm water conveyance have been completed under the CCRFCD's master plan throughout Clark County. Furthermore, 54 square miles, or more than 35,000 acres, have been removed from federally-identified FEMA flood zones. This has saved residents millions of dollars per year in flood insurance premiums as well as avoided reconstruction costs from a future flood event.



Rainfall data collected from Regional Flood Control District of Clark County, Nevada.

COLORADO RIVER SUPPLY AND USE

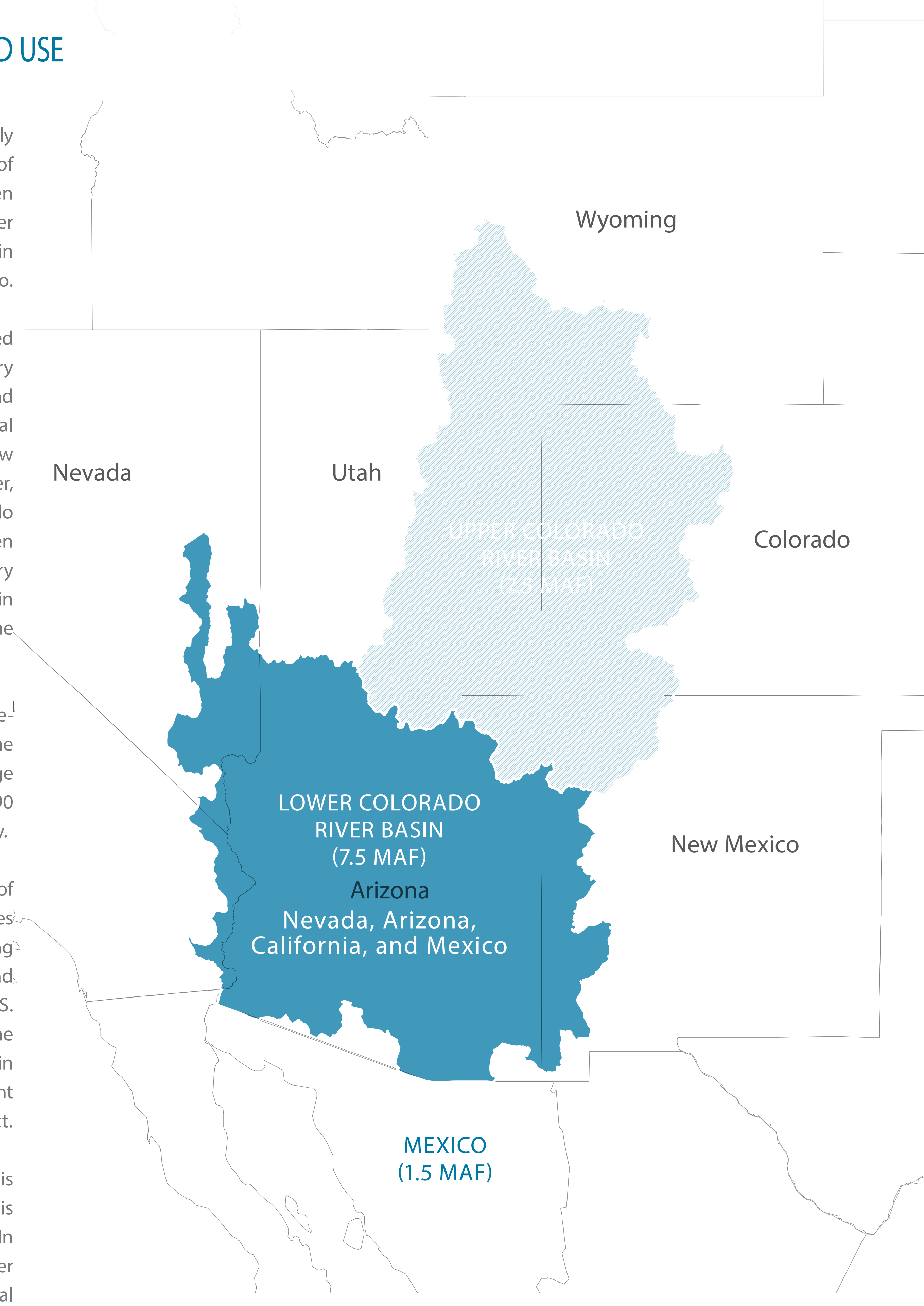
The Colorado River supplies water to nearly 40 million people and millions of acres of irrigated agricultural fields within seven states and the country of Mexico. The river is fed primarily from snowmelt originating in mountains of Wyoming, Utah and Colorado.

The Colorado River is managed and operated through a series of contracts, regulatory guidelines, federal laws, court decisions and decrees, compacts, and an international treaty that is collectively known as the Law of the River. Through the Law of the River, the waters flowing through the Colorado River are apportioned amongst the seven Colorado River Basin States and the country of Mexico. The entire Colorado River Basin consists of two distinct regions known as the Upper and Lower Basins.

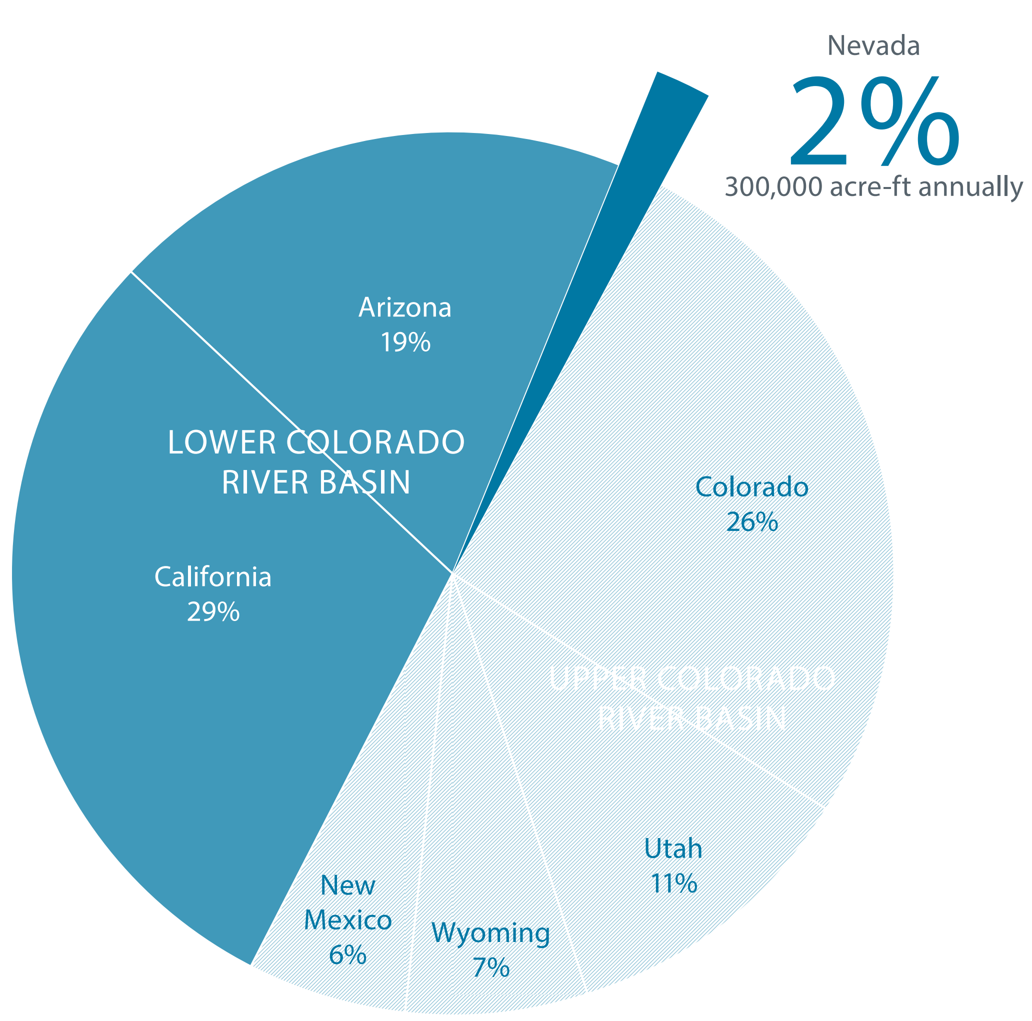
Although Nevada is allocated 300,000 acre-feet of water a year – the smallest share of the Basin States at roughly 2 percent of average Colorado River flows— this represents 90 percent of Southern Nevada's water supply.

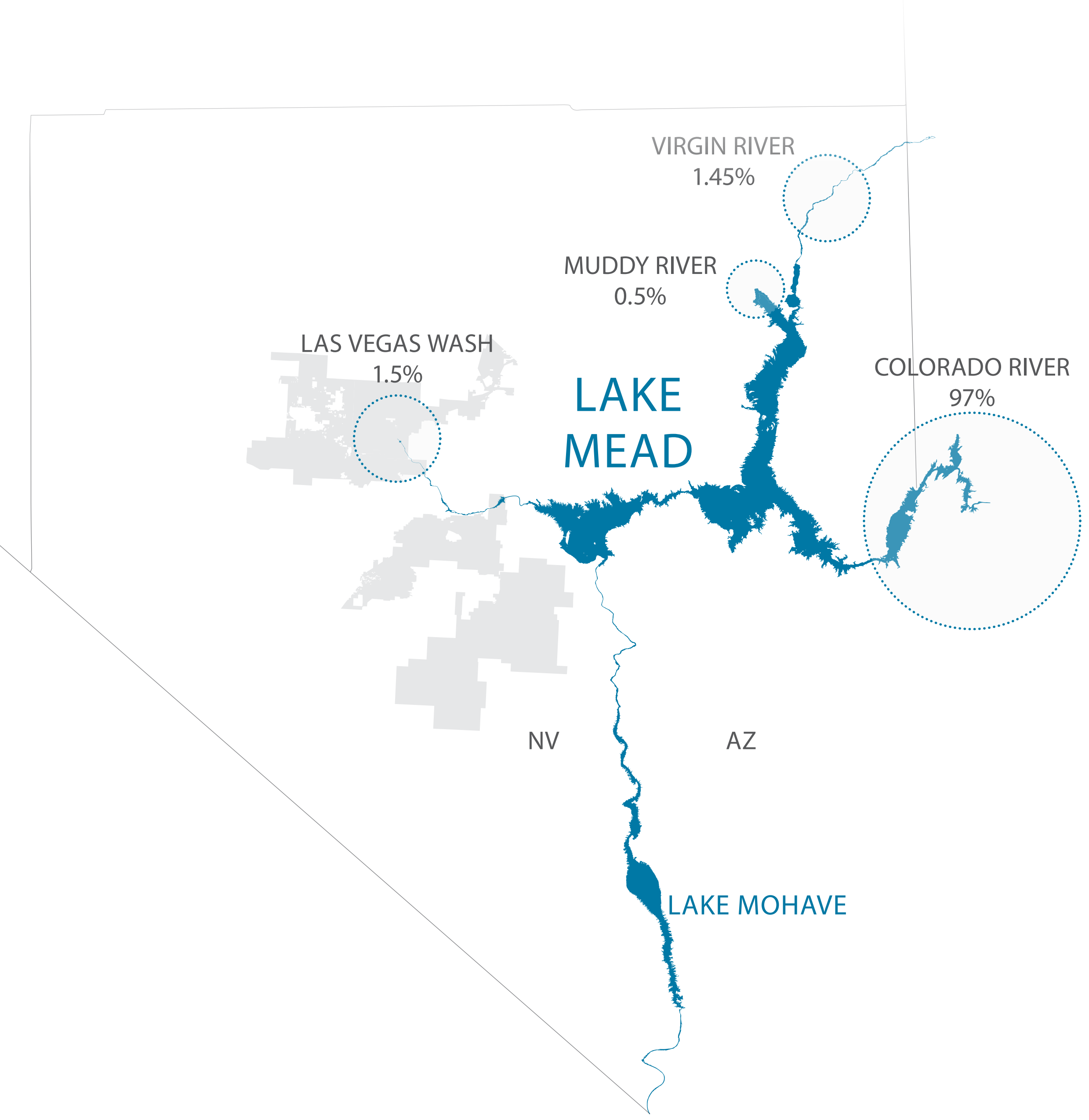
The Colorado River supports a wide array of municipal, industrial, and agricultural uses throughout the Basin States, contributing to diverse and robust local, regional and national economies. In 2014, the U.S. Bureau of Economic Analysis estimated the combined gross state product of the Basin States represents approximately 20 percent of the nation's total gross domestic product.

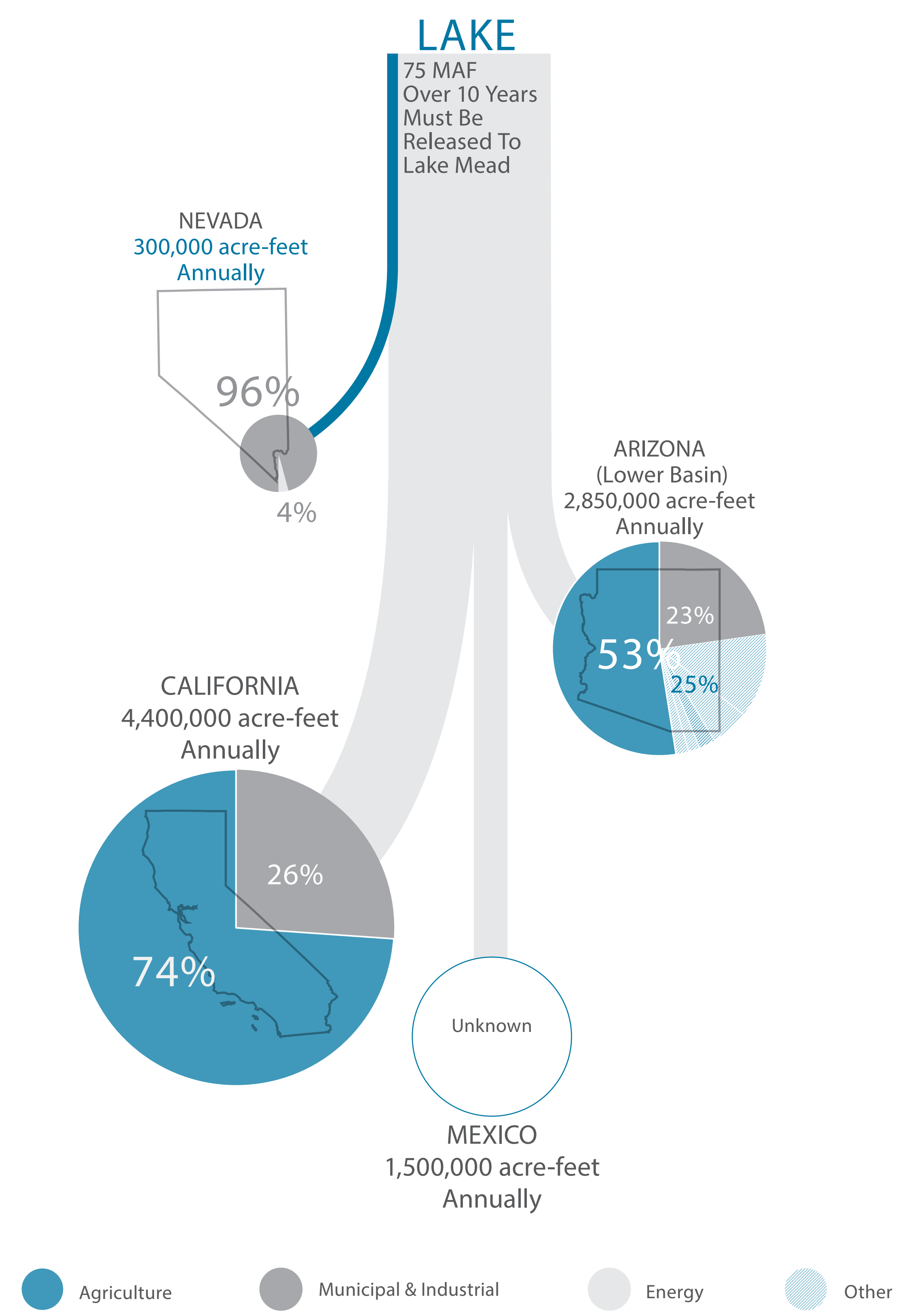
The largest use of Colorado River water is for agriculture, while roughly 20 percent is used for municipal and industrial uses. In contrast, Southern Nevada's Colorado River water is used almost entirely for municipal and industrial purposes. Residential water use makes up the largest percentage of the various municipal and industrial uses, accounting for 55-80 percent of water use throughout most major metropolitan areas. Colorado River water is also used to support other resources in the system, including hydroelectric power generation, recreational opportunities, and ecological systems.



Colorado River allocations out of 15 Million Acre Feet







COLORADO RIVER DROUGHT

Since 2002, the entire Colorado River Basin has experienced severe drought conditions that have reduced the average flows of the Colorado to well below the normal, long-term averages. This has impacted water levels in lakes Powell and Mead, the river system's two largest storage reservoirs. Despite being in a prolonged period of drought, however, water demands within the Lower Basin continue to be met, due in large part to Upper Basin States not fully developing use of their 7.5 MAF allocation, and because the reservoirs within the Colorado system have a combined storage capacity of approximately 60 million acre-feet. This volume is equivalent to nearly four years of the river's average flows, enabling the entire basin to be more resilient to multi-year droughts.

The potential impacts of climate change and greater natural climate variability create uncertainty about the future flows of the Colorado River. In 2012, the Bureau of Reclamation, in partnership with the Basin States, estimated a potential water supply and demand imbalance within the Colorado River system. Over a 10-year running average, the median imbalance is projected to be about 3.2 million AFY by 2060. Collaboratively the Basin States, Bureau of Reclamation, and other stakeholders are actively pursuing options and strategies to avoid these future imbalances. Findings from the first phase of this effort are reported in the Bureau of Reclamation's Moving Forward report, which focuses on clarifying uncertainties related to water efficiency, reuse, recreation, and environmental flows of the river.

For Southern Nevada, SNWA's water resource plans anticipate continued and worsening drought conditions. The SNWA Water Resource Plan, which is reviewed annually and updated as needed, demonstrates sufficient water supplies to meet projected demands throughout the next 50 years, even if drought conditions continue to persist in the Colorado River.

SOUTHERN NEVADA WATER USE

SNWA water is used solely for municipal and industrial purposes and is categorized into eight primary use sectors. A unique element to Southern Nevada's water use is high-volume tourism. Approximately 40 million people visit the Las Vegas Valley annually with an average visitor stay of four days. Even with such a large tourism population, the resort industry uses a small fraction—under 7.6 percent—of the total municipal water used in Southern Nevada. Furthermore, the majority of the water used by resorts is indoor water use, which is recycled. When recycling is accounted for, resorts are estimated to consume less than 3 percent of the region's total water resources.

Gallons Per Capita Per Day (GPCD) is a metric used by many communities to measure water consumption. It is also an effective tool to measure efficiency over time. GPCD varies across communities due to a number of factors, including differences in climate, demographics, water use accounting practices and economic conditions. For planning purposes and to monitor conservation progress, GPCD is weather-normalized to account for weather variations that differ from the region's 30-year average.

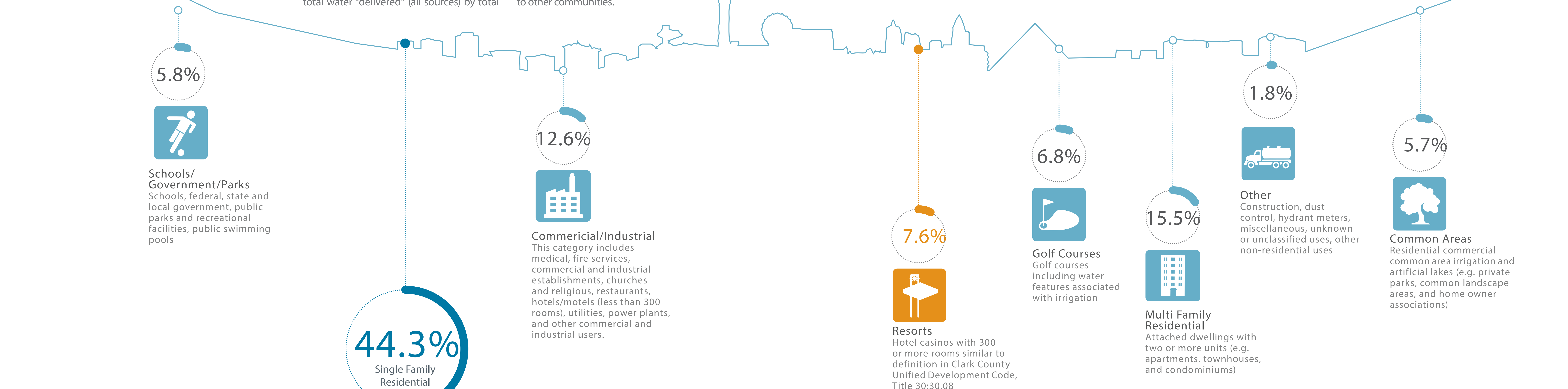
SNWA calculates two variants of GPCD: Total System GPCD and Net GPCD. Total System GPCD is calculated by dividing total water "delivered" (all sources) by total resident population served (water delivered/resident population/365 days = Total System GPCD). The SNWA uses Total System GPCD as a benchmark for setting conservation goals and measuring achievements. It also helps evaluate appropriate sizing for water treatment and delivery facilities, as well as facility-related energy demands.

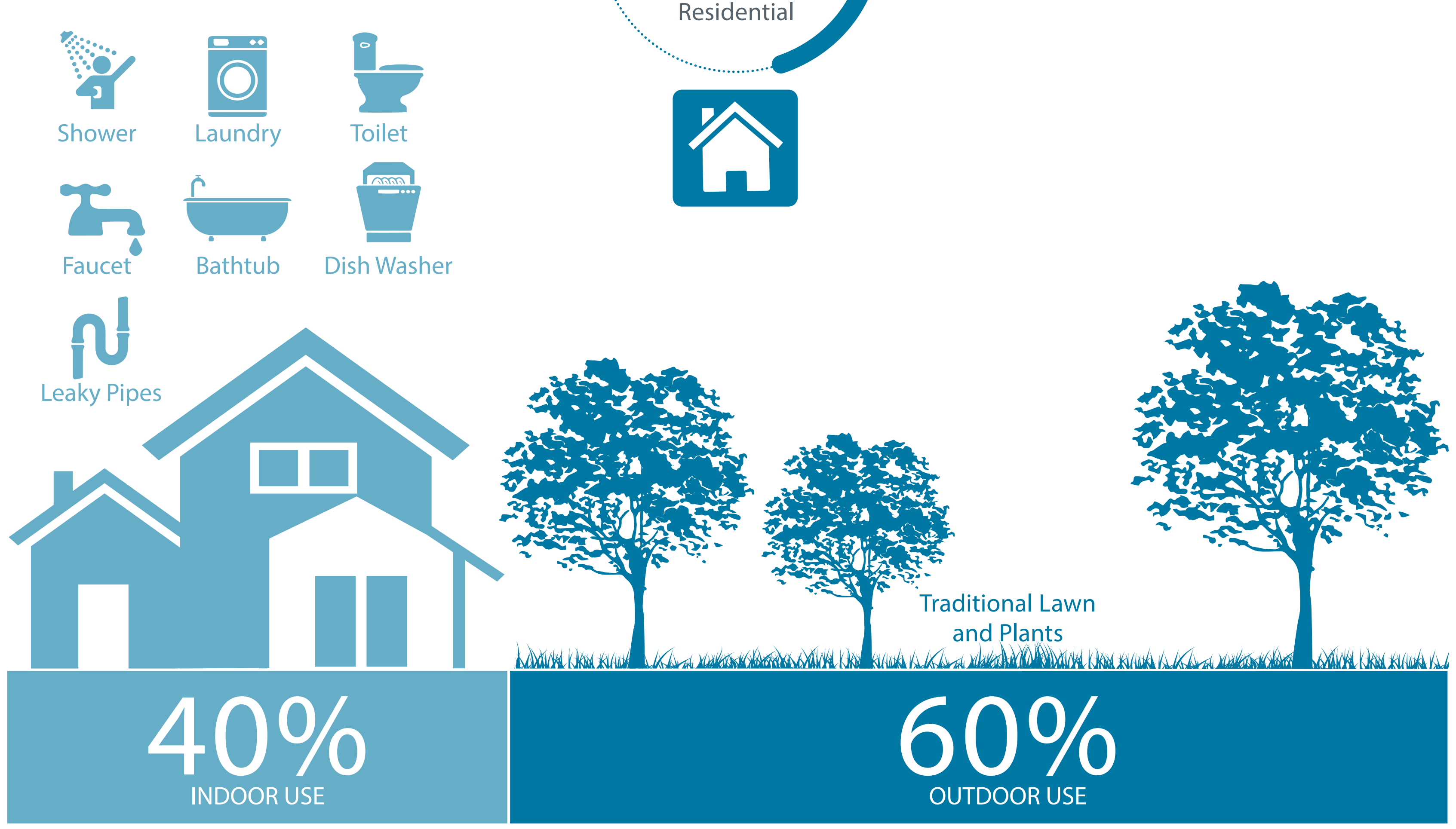
Net GPCD is calculated by dividing total water "consumed" (all sources) by total residential population served (water consumed/resident population/365 = Net GPCD). Net GPCD recognizes that not all delivered water is consumed; this is because SNWA recycles nearly all indoor water use, either through direct or indirect reuse. Net GPCD provides a more accurate comparison to other communities.

INDOOR AND OUTDOOR WATER USE

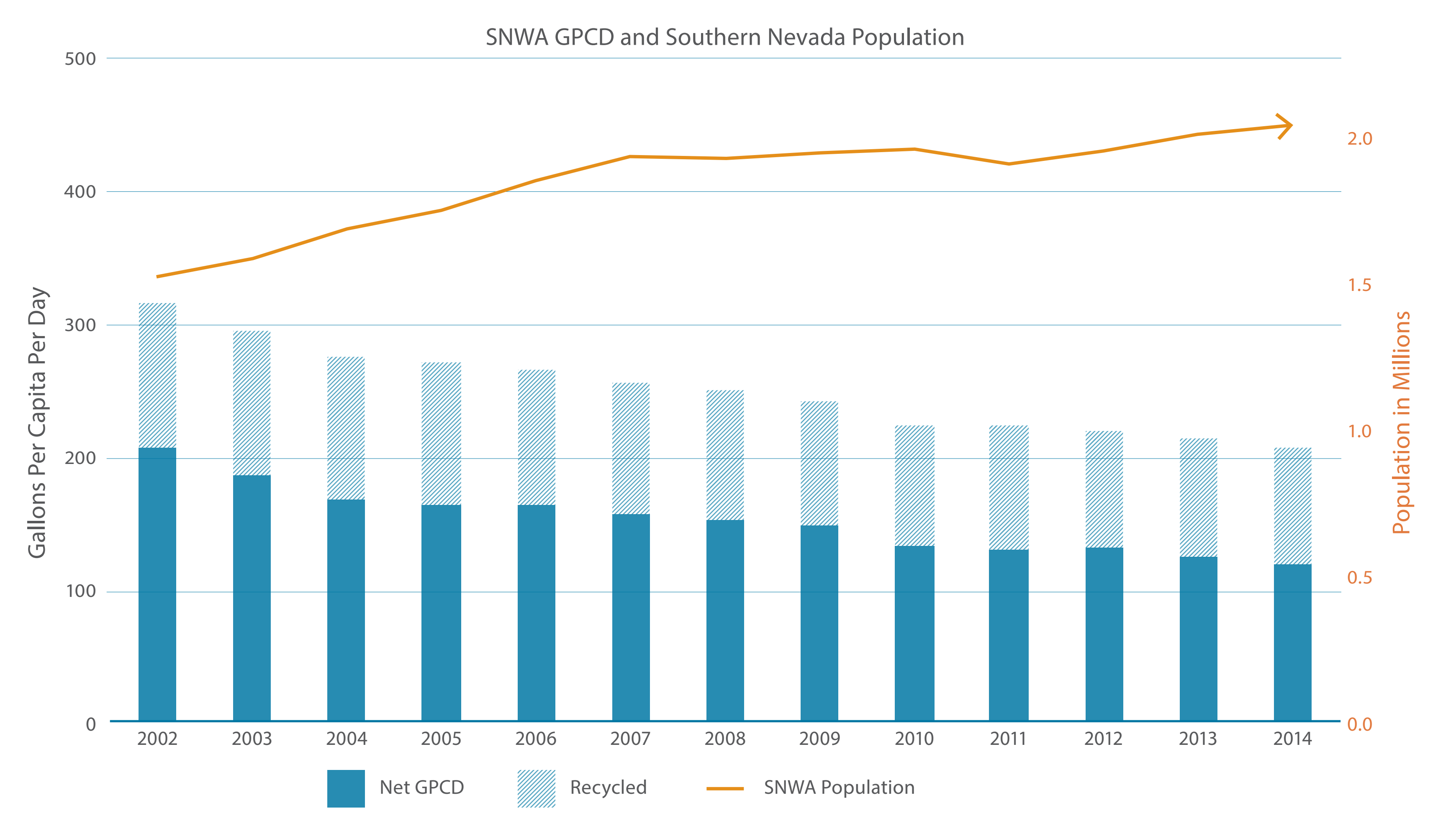
Indoor water use comprises about 40 percent of the water SNWA supplies, and 99 percent of this indoor use is recycled through direct and indirect recycling. The other 60 percent delivered by SNWA to its member agencies is used outdoors, much of which is applied to landscapes, particularly single- and multi-family residential customers. Because this water is not recycled through direct or indirect reuse, it is characterized as consumptive water use. This is why outdoor residential water-use provides the greatest opportunity for local gains in water efficiency.

Southern Nevada has made great strides towards water use efficiency. As a result of the community's progressive and comprehensive water conservation program, Southern Nevada's "Net" use of water per person (Gallons Per Capita Per Day) has declined by 43% between 2002 and 2014. This water savings also translates to using less energy to treat and deliver water and is the equivalent of removing approximately 7,026 cars a year from the roadways.





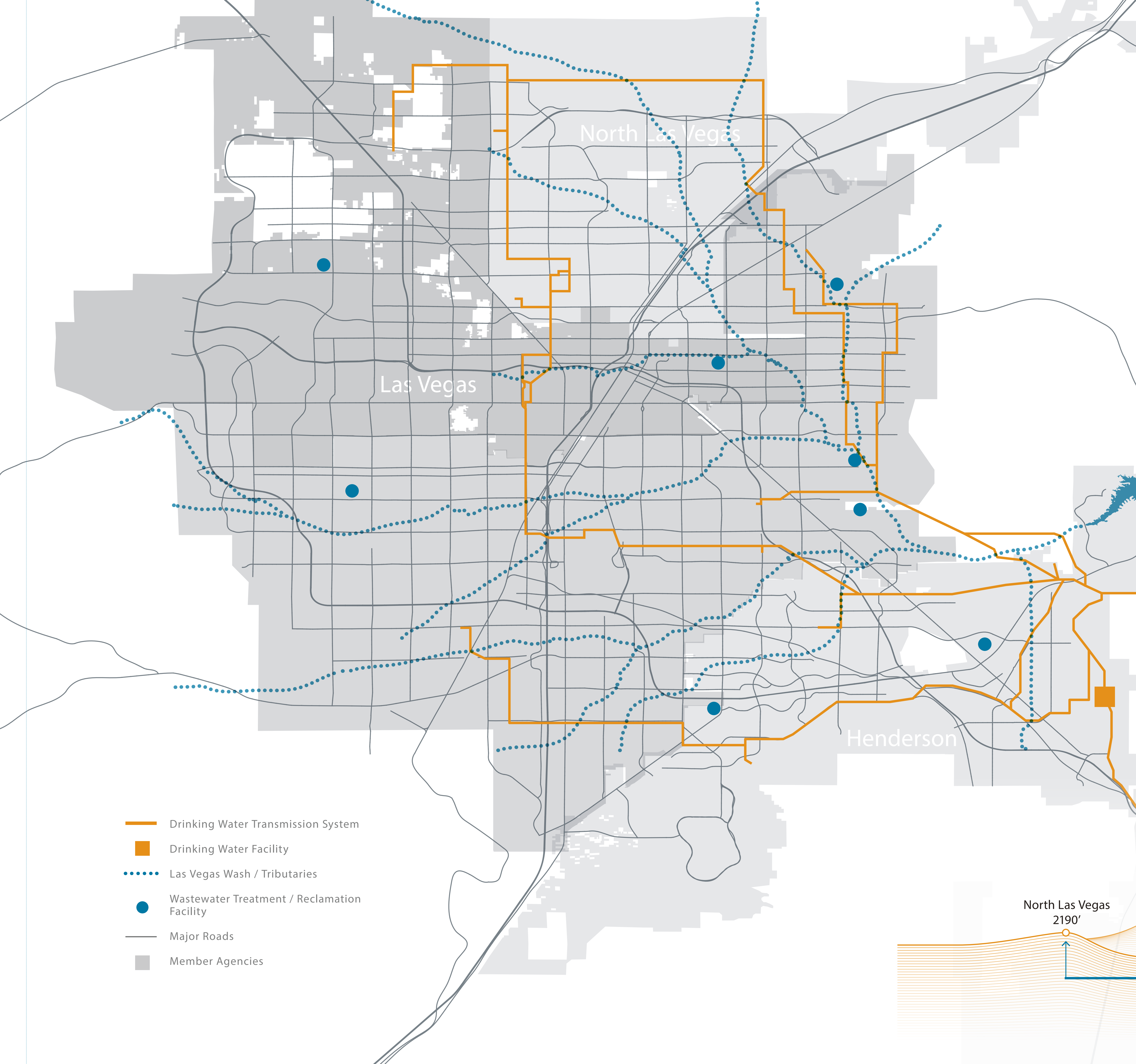
Single Family Residential Water Use

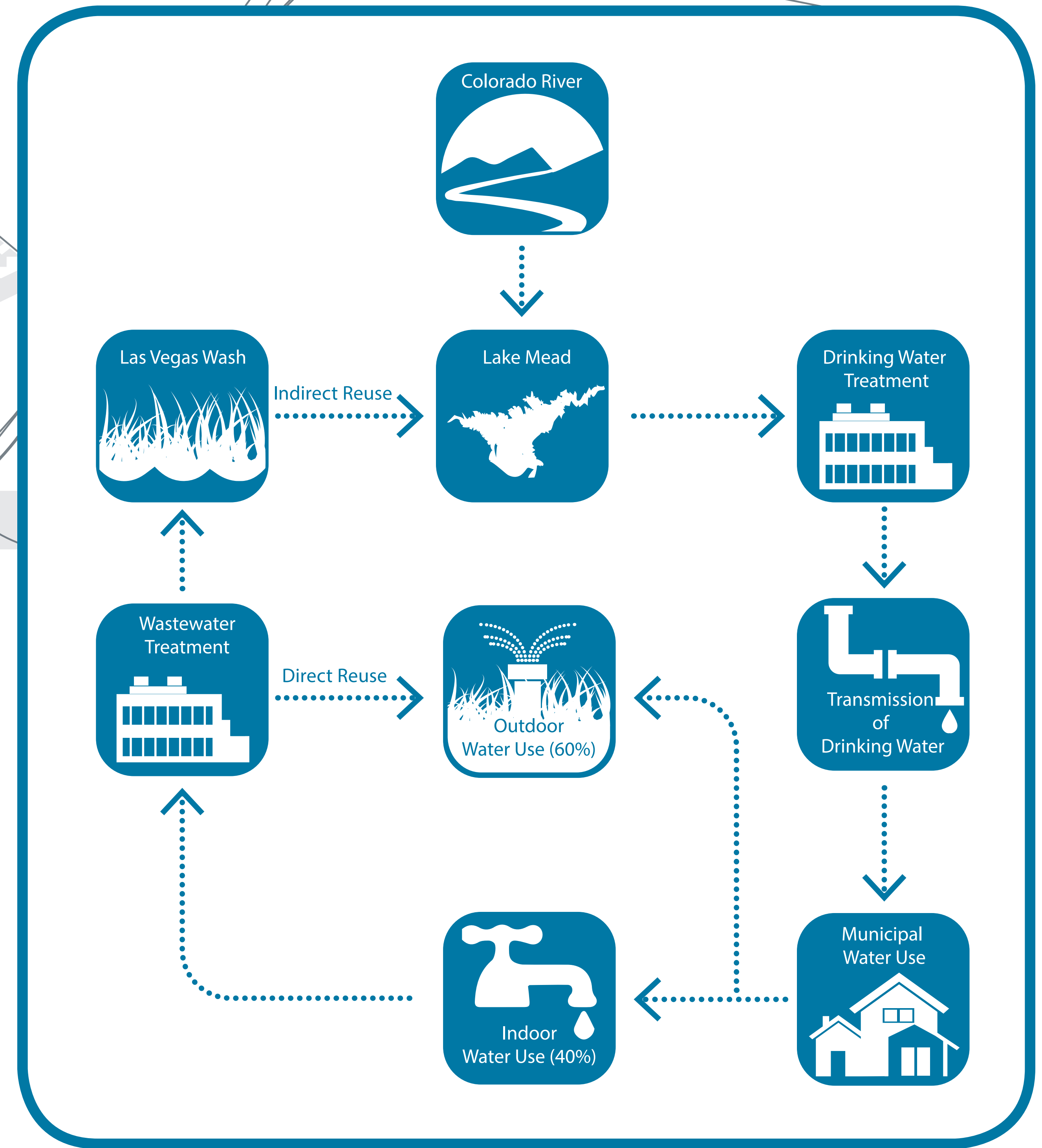


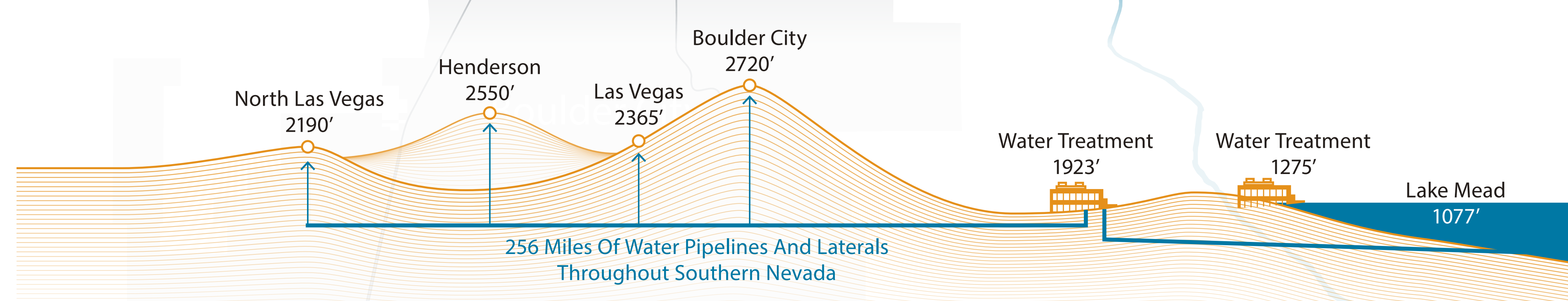
SOUTHERN NEVADA'S REGIONAL WATER SYSTEM

The SNWA and its member agencies – Big Bend Water District, City of Boulder City, City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Water Reclamation District, and Las Vegas Valley Water District – work together to manage existing and future water resources, maintain and build infrastructure, and promote water conservation.

Water is drawn from Lake Mead through three existing intake structures and pumped to one of two water treatment facilities before it is distributed throughout the community. The system is able to pump, treat and distribute approximately 900 million gallons per day, ensuring uninterrupted sustainable service to the growing community.







WATER RECYCLING AT A METROPOLITAN SCALE

The apportionment of all of the states' Colorado River water is consumptive use (net) allocations. This means that Southern Nevada can actually use more water than its 300,000 acre-feet per year allocation of Colorado River water, as long as it returns water back to the river system through return-flow credits. Because Southern Nevada recycles nearly all of its wastewater, either through direct or indirect reuse (i.e., through return-flow credits), the community extends and maximizes the use of its water resources.

Water used indoors (e.g. sinks, toilets, showers, dishwasher, etc.) by municipal water customers is collected and conveyed to centralized wastewater treatment facilities and treated to high-quality standards. The highly treated wastewater is then recycled by reusing it for non-potable uses such as golf course irrigation (known as direct reuse) or released back to Lake Mead via the Las Vegas Wash. For every gallon of highly-treated wastewater that the community returns to Lake Mead, another gallon can be taken out of the Colorado River system where it may be reused locally (known as indirect reuse). Through direct and indirect reuse, Southern Nevada recycles 99 percent of its highly treated wastewater.

Indirect reuse through Colorado River return flow credits constitute a significant portion of the region's permanent Colorado River resources, expanding the SNWA's basic consumptive use and other Colorado River resources allocation by approximately 75 percent.

In addition, through direct reuse, recycled water is put to beneficial use by golf courses, power plants, and some local parks. On the whole, recycled water accounts for roughly 40 percent of the water used in Southern Nevada, making it our second largest water resource and a critical piece of our water resource portfolio.

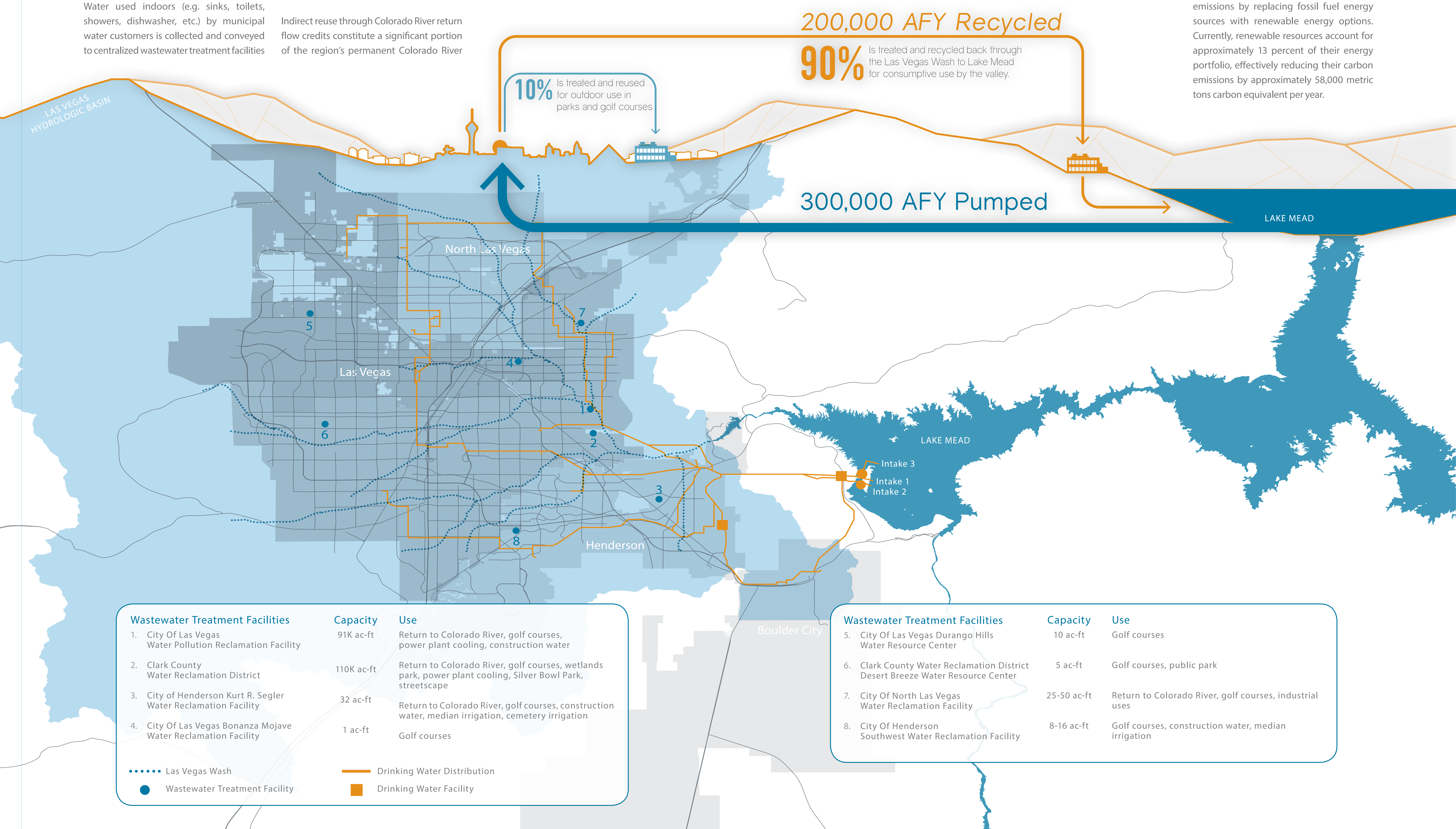
ENERGY TO DELIVER WATER

The treatment and delivery of drinking water requires a stable and secure energy supply. SNWA estimates that for every 1,000 gallons of water pumped, treated, and distributed, 7.6 kWh of energy is used, much of which is for lifting Colorado River water from Lake Mead to the Las Vegas Valley which low elevations to higher elevations. To mitigate its carbon footprint, SNWA employs a number of energy savings measures, outlined in SNWA's sustainability report.

These measures include:

- Optimizing energy efficiency by evaluating all Southern Nevada distribution system energy requirements to maximize pumping and scheduling capabilities,
- Installation of energy conservation measures at the Alfred Merritt Smith Water Treatment Facility made possible through a $2.2 million State Revolving Loan Fund,
- Refinement of computerized lighting and power settings at facilities
- Use of a life cycle cost evaluation standard process to consider a project's energy needs, costs and benefits before recommending implementation.
- Nearly 100 percent replacement of standard-fueled vehicles in SNWA's fleet with alternative fueled vehicles

The SNWA further reduces carbon emissions by replacing fossil fuel energy sources with renewable energy options. Currently, renewable resources account for approximately 13 percent of their energy portfolio, effectively reducing their carbon emissions by approximately 58,000 metric tons carbon equivalent per year.



Wastewater Treatment Facilities	Capacity	Use
1. City Of Las Vegas Water Pollution Reclamation Facility	91K ac-ft	Return to Colorado River, golf courses, power plant cooling, construction water
2. Clark County Water Reclamation District	110K ac-ft	Return to Colorado River, golf courses, wetlands park, power plant cooling, Silver Bowl Park, streetscape
3. City of Henderson Kurt R. Segler Water Reclamation Facility	32 ac-ft	Return to Colorado River, golf courses, construction water, median irrigation, cemetery irrigation
4. City Of Las Vegas Bonanza Mojave Water Reclamation Facility	1 ac-ft	Golf courses

Wastewater Treatment Facilities	Capacity	Use
5. City Of Las Vegas Durango Hills Water Resource Center	10 ac-ft	Golf courses
6. Clark County Water Reclamation District Desert Breeze Water Resource Center	5 ac-ft	Golf courses, public park
7. City Of North Las Vegas Water Reclamation Facility	25-50 ac-ft	Return to Colorado River, golf courses, industrial uses
8. City Of Henderson Southwest Water Reclamation Facility	8-16 ac-ft	Golf courses, construction water, median irrigation

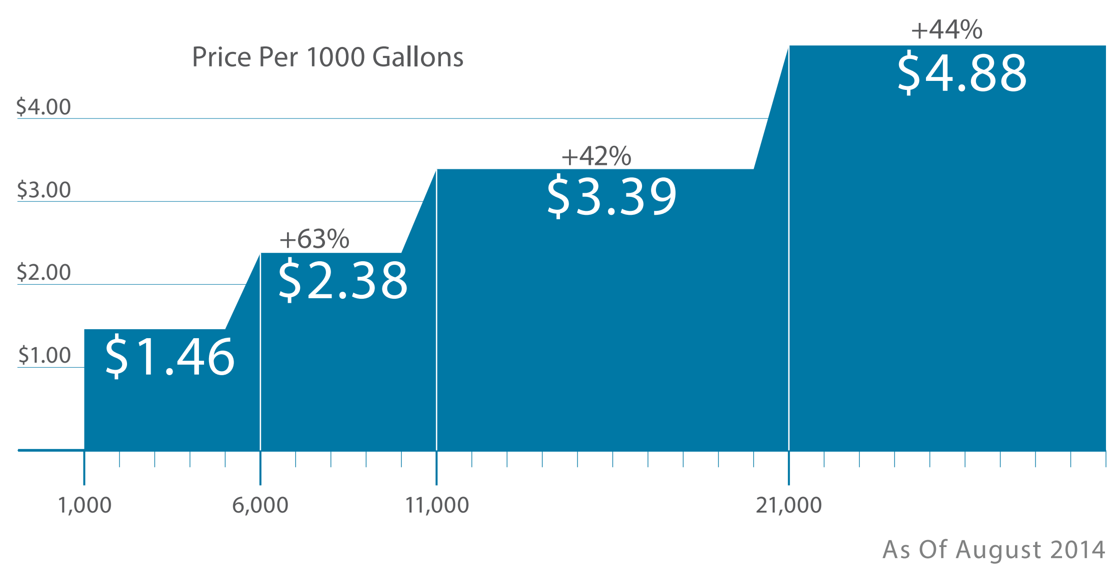
CONSERVATION

Conservation plays a critical role in water resource planning and management efforts; the ability to increase water use efficiency and reduce water waste has a direct impact on the amount of resources that will be needed in the future. Since 1991, SNWA has managed one of the most progressive and comprehensive water conservation programs

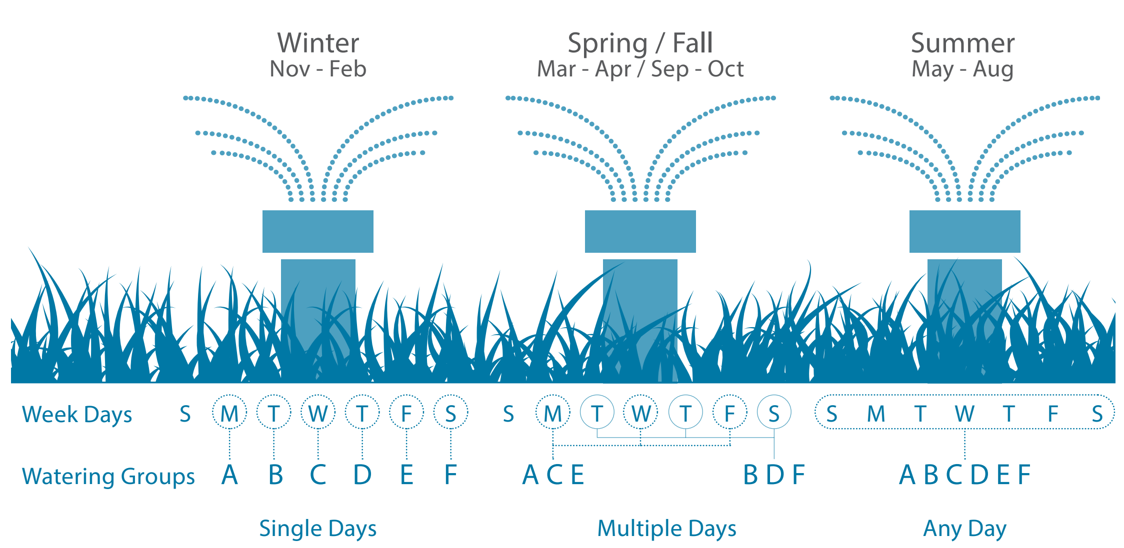
SNWA's Conservation Program relies on the four pillars of conservation: Water Pricing, Incentives, Regulation, and Education. The most effective element of the program is the Water Smart Landscape Rebate Program, which uses monetary incentives to entice residents to replace their water intensive lawns with water efficient desert landscapes.

Education
SNWA has a variety of public-education programs to engage the community and help residents understand efficient use of water in the desert.

Incentives
Programs allow the community to participate in conservation efforts. Examples include rebates for turf removal and implementation of pool covers.



Water Pricing: Four-tiered rate structure
The four-tiered rate structure charges higher rates as water use increases. This encourages residents to reduce water use or face increasing expenses for water.



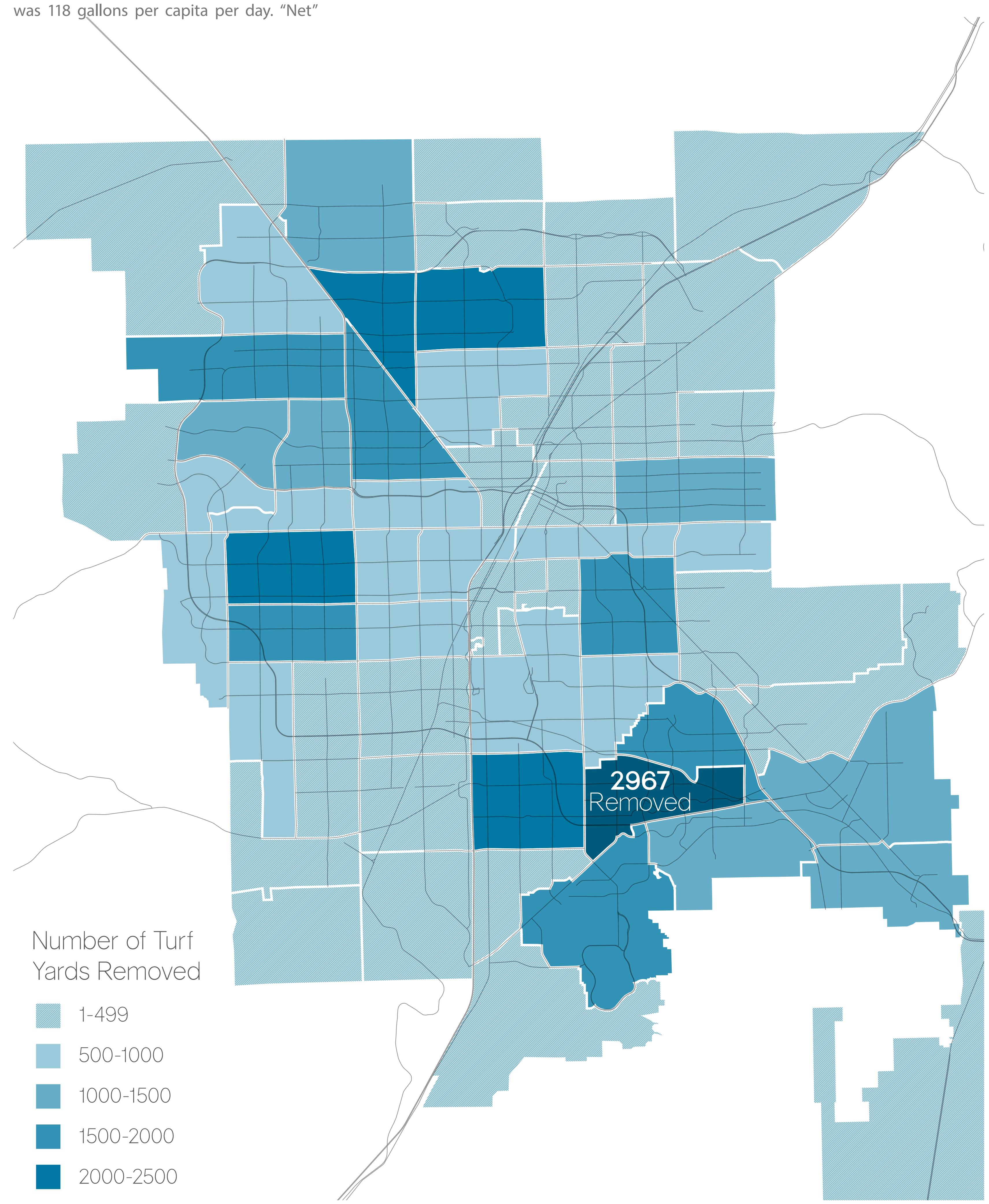
Regulation
City and county governments established land-use codes and water-use ordinances to eliminate and reduce excess water use.

The effectiveness of SNWA's conservation programs are illustrated by these successes:

- Between 2002 and 2014, Southern Nevada's consumption of Colorado River water decreased by 32 billion gallons—a 43% reduction in Net per capita water use—while adding 520,000 residents during the same period.
- The SNWA Board of Directors set conservation goals that the community has met or surpassed. In 2009, the board adopted a goal of 199 gallons per capita per day (Total System GPCD) to be achieved by 2035.
- The community lowered Total System GPCD to 205 in 2014, well on target to meeting the goal outlined in SNWA's Water Conservation Plan 2014-2018.
- In addition, "Net" water use in 2014 was 118 gallons per capita per day. "Net" refers to the portion of water Southern Nevada consumes, rendering it unavailable for recycling or water reuse. Net GPCD represents Southern Nevada's water footprint on Colorado River and is more comparable to the GPCD of other western cities.

Participation in the SNWA's rebate programs has realized record-breaking results:

- Water Smart Landscape Rebate Program: 172 million square feet of grass removed (Enough grass for a roll of sod to extend 87 percent of earth's circumference) and 78 billion gallons of water saved since the program began in 1999
- Pool Cover Instant Rebate Coupon Program: 33,000 coupons distributed and 420 million gallons of water saved annually
- Water Efficient Technologies Program: 1.25 billion gallons of annual water savings by businesses
- Water Smart Homes: More than 10,000 homes have been built via this program and 900 million gallons of water saved per year



WATER QUALITY

Water delivered by the SNWA meets all state and federal drinking water standards. Each year, SNWA scientists collect more than 30,000 water samples and conduct more than 300,000 analyses to ensure that Southern Nevada's drinking water meets or surpasses Safe Drinking Water Act standards. Furthermore, SNWA tests for 91 regulated contaminants and 50 additional unregulated contaminants to ensure Southern Nevada's drinking water is at the highest standards.

Under the Safe Drinking Water Act, which was passed by the United States Congress in 1974, public water entities are required to provide the Environmental Protection Agency and the public with a water quality report each year. The report describes where the water comes from and the constituents found in it. The report also provides an overview of how the water is treated and delivered to customers throughout the region.

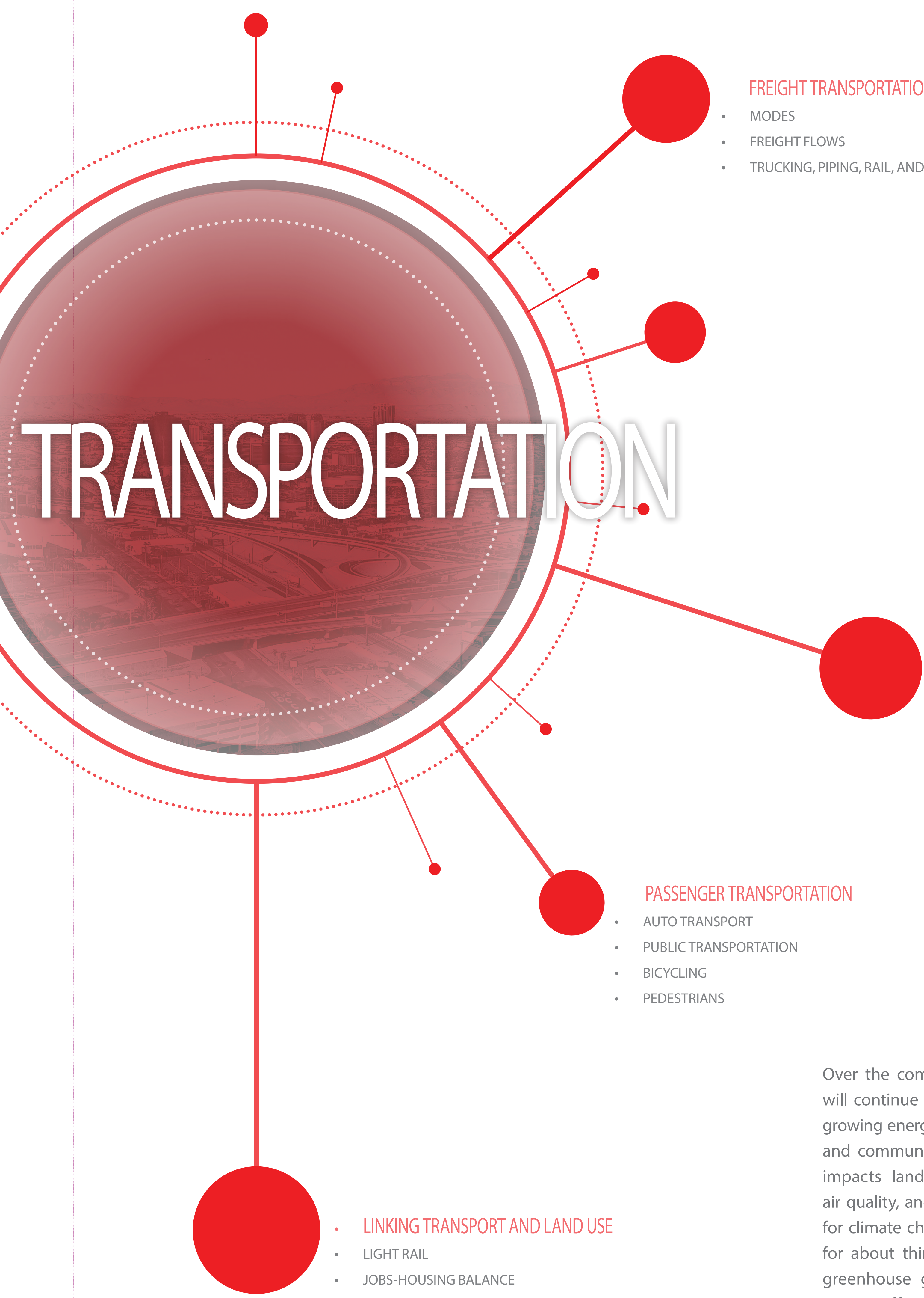
RECONSTRUCTING NATURE TO CLEAN WATER

The Las Vegas Wash is the final link in the Las Vegas Valley's water supply. It conveys highly treated wastewater and urban runoff from Clark County Regional Flood Control District storm drains and channels back to Lake Mead, a portion of which accounts for the Colorado River return flow credits SNWA receives (i.e., indirect reuse). The Las Vegas Wash supports acres of wetlands that provide additional cleansing of the flows by further filtering the water, improving its quality before it reaches Lake Mead.

Prior to 1998, the Las Vegas Wash experienced significant erosion, which scoured the banks forming an incised channel with degraded wetlands. To combat the changes in the Wash, the Las Vegas Wash Coordination Committee (LVWCC), a 29-member interagency group of Federal, state, and local agencies and private interests, was formed. In accordance with the Plan, the SNWA and LVWCC as of 2015 have spent over $150 million to:

- o Construct 18 of 21 erosion control structures
- o Install over 400 acres of revegetation
- o Remove over 500 acres of tamarisk and other invasive species
- o Reduce total suspended solids (regulated by the EPA) by over 60%
- o Successfully removed the Wash from Nevada Division of Environmental Protection's list of impaired waters

As a riparian corridor in an urban area, the Las Vegas Wash is also an important ecological resource. It now provides habitat to more than 1,000 fish and wildlife species and more than 200 species of upland, riparian and wetland plants.



FREIGHT TRANSPORTATION

- MODES
- FREIGHT FLOWS
- TRUCKING, PIPING, RAIL, AND AIR FREIGHT

PASSENGER TRANSPORTATION

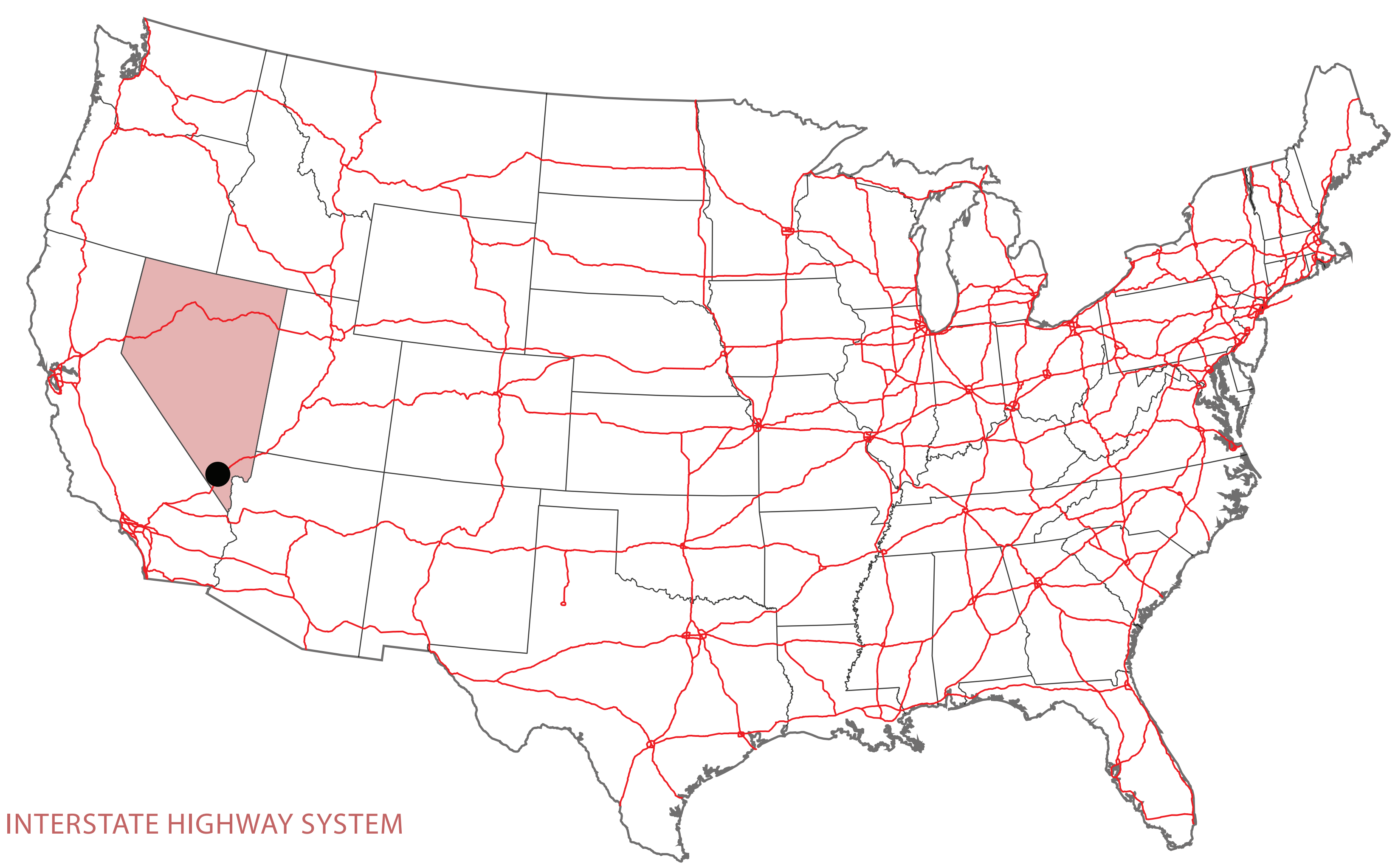
- AUTO TRANSPORT
- PUBLIC TRANSPORTATION
- BICYCLING
- PEDESTRIANS

LINKING TRANSPORT AND LAND USE

- LIGHT RAIL
- JOBS-HOUSING BALANCE
- MODAL SHARES

Over the coming decades, transportation will continue to be a driving force behind growing energy demand, urban economics, and community dynamics. Transportation impacts land use decisions, community air quality, and has significant implications for climate change as it currently accounts for about thirty percent of the total U.S. greenhouse gas emissions. A clean and energy-efficient transportation network can contribute to the sustainability of the environment and energy resources. American cities are confronting these challenges while meeting demands for adequate, efficient, equitable, and accessible transportation systems critical to metropolitan sustainability. This includes the movements of goods and commodities through and within the city, residents to employment, education, health care, and daily needs, and visitors to hotels, entertainment, and attractions.

OVERVIEW OF TRANSPORTATION IN SOUTHERN NEVADA



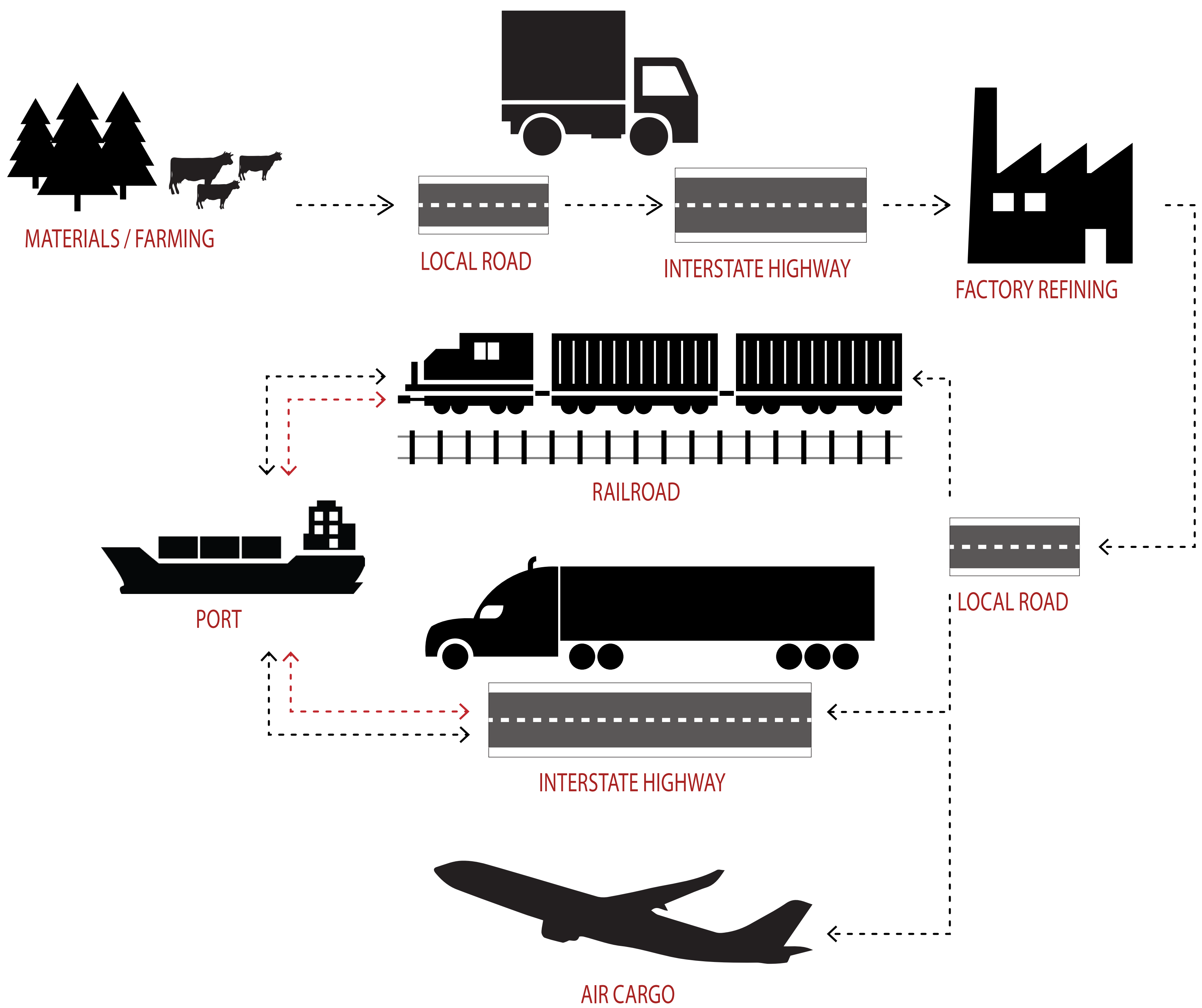
INTERSTATE HIGHWAY SYSTEM

Las Vegas developed as a stop along the San Pedro, Los Angeles, and Salt Lake Railroad in 1905. Over the 20th Century, Southern Nevada's transportation network quickly shifted away from to the automobile; during the era of road building in Nevada, promoters in Las Vegas advocated for and built an all-weather route between Los Angeles and Salt Lake City known as the Arrowhead Trail in 1915, which followed the Old Spanish Trail along the Virgin River through Valley of Fire and into Las Vegas. It would continue south to Searchlight and into San Bernardino. Both the U.S. Bureau of Public Roads and the State of Nevada urged the inclusion of the cutoff route into each state's highway systems and by 1924, the Arrowhead Trail became a part of what would eventually be known as US 91.

With nationwide construction of the Interstate Highway System, the Interstate 15 corridor became the lifeline for residents of the valley and helped fuel its growth by cementing its linkage to Southern California and to points further north and east. Because Southern Nevada lacks major agriculture and heavy industry, it relies upon product importation: ninety percent of goods are imported through a 'single-threaded' system. Most goods are shipped globally and delivered to support the region's two million residents and forty million annual visitors. Disruptions to I-15, either through traffic congestion, collisions, or natural disasters, such as wind or flooding, could interrupt or slow the supply chain.

Southern Nevada also lacks diversified transportation infrastructure. Approximately 92% of Las Vegas commuters drive to work alone, while less than 5% bike, walk, or take public transportation. With three work shifts in the resort industry, some commuters travel off of usual peak times during work days, but Southern Nevada still retains a heavy morning and afternoon peak rush hour. The costs of traffic congestion, including wasted time, fuel, and emissions will continue to take a toll on the community unless a multi-modal transportation network is developed.

FREIGHT TRANSPORTATION



Different modes of transport use different types of infrastructure to import, export, and deliver goods. These complex services link transport cargo ranging from raw materials to finished products from their source to the consumer. Some materials and products may need to travel only a short distance across a city, while others may travel long distances (or globally) and use multiple modes of transport.

The national Interstate Highway System and cross-country rail transportation routes connect ports on the Pacific Coast, including the intermodal Port of Los Angeles and Port of Long Beach with the interior of the country. Southern Nevada, linked by both I-15 and the Union Pacific Railroad, is approximately 300 miles from each port and is the recipient of goods shipped from locations across the Pacific Rim. Southern Nevada is well connected to Southern California, but is also connected to nearby population centers within the Intermountain West, including, Phoenix, Reno, and Salt Lake City by US Highways 93 and 95, in addition to Interstate 15.

Trucks move more than half of the freight tonnage in the United States. Trucks are primarily used for both short (less than 750 miles) and long haul (more than 2,000 miles) distances, while rail is used to move goods traveling intermediate distances between 750-2,000 miles. Rail moves less than 40 percent of freight tonnage, with mined coal consisting of nearly half of that amount. Due to heavy truck use on the nation's Interstate highways, road maintenance and repair are frequently needed. Trucking is also a heavy contributor to air quality issues, with almost eighty percent of greenhouse gas emissions coming from trucks, and only eight percent from rail.

FREIGHT BY MODE

TRUCKING

Trucking is the dominant freight transportation mode in the United States. It is the most common shipping method to and from the Southern Nevada. In 2012, trucks handled 87 percent of the area's freight. Strong interstate connections and an efficient warehouse distribution system ease the access for trucks serving the metro area. However, due to congestion and increased emissions, trucking has the most critical environmental impact of any shipping mode. Cleaner and alternative fuels, as well as truck stop electrification, could reduce this impact.

FREIGHT RAIL

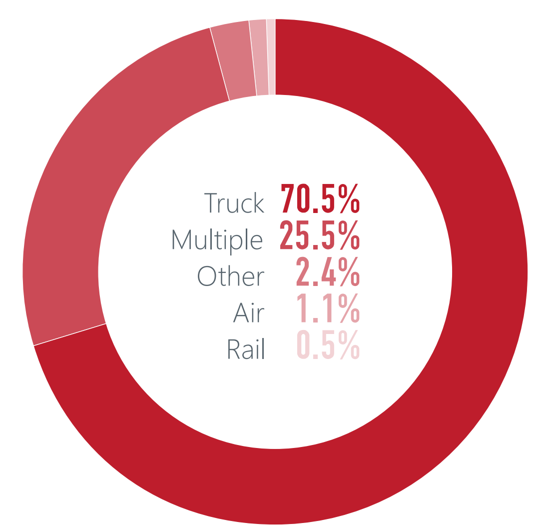
Nevada is a thoroughfare for rail freight moving to and from ports in Southern California. The Union Pacific Railroad's South Central Route is the only Class I railway through the Las Vegas Valley, connecting to Salt Lake City and Los Angeles, paralleling Interstate 15. Freight by rail is an efficient mode for long-distance transport and can evolve to be a more environmentally sustainable alternative to trucking along certain routes.

AIR CARGO

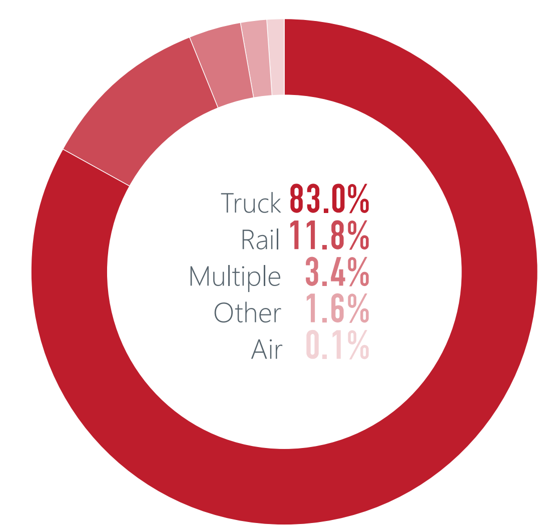
Five civilian airports operate in Southern Nevada. McCarran International Airport is the largest and only airport with a freight system at the Marnell Air Cargo Center. This makes McCarran the thirty-sixth busiest freight airport in the world. The use of air freight shipments among industries in Southern Nevada is low compared to other modes of freight transportation.

REGIONAL FREIGHT FLOWS

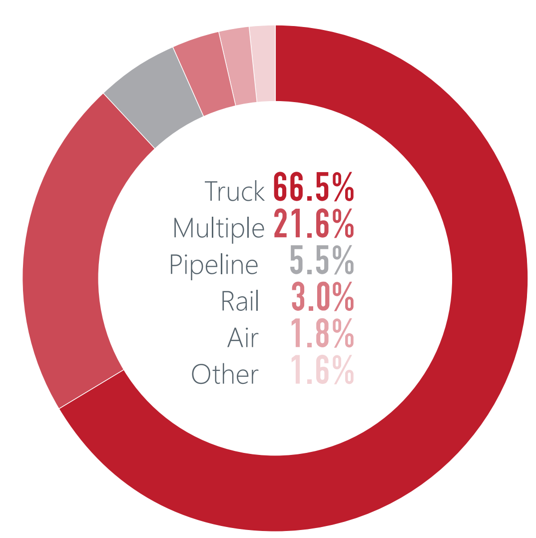
OUTBOUND & EXPORTS BY MODE AND PERCENT OF VALUE FHWA FAF 2011



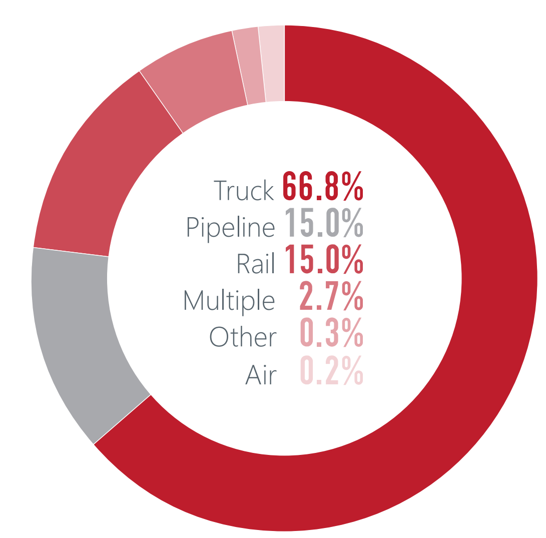
OUTBOUND & EXPORTS BY MODE AND PERCENT OF TONNAGE FHWA FAF 2011



INBOUND & IMPORTS BY MODE AND PERCENT OF VALUE FHWA FAF 2011



INBOUND & IMPORTS BY MODE AND PERCENT OF TONNAGE FHWA FAF 2011



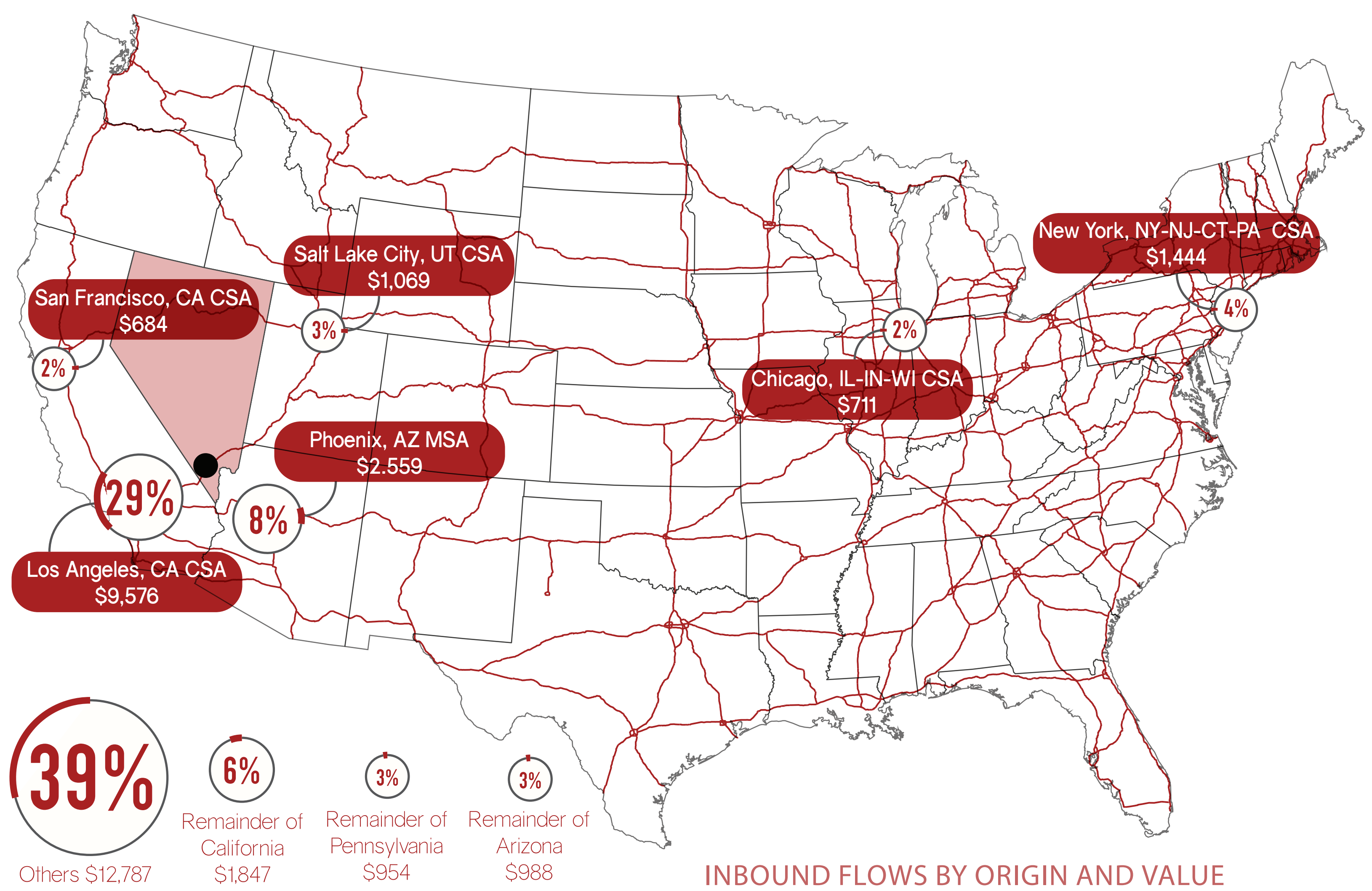
FREIGHT TRANSPORTATION TO SOUTHERN NEVADA

California, Nevada, and Utah are highly dependent upon Interstate 15 as the primary route for freight and goods movement. I-15 also connects the region to the rest of the United States. Goods traveling to the Midwest, Great Lakes, and Northeast states travel north along I-15 and connect east via I-70 in Central Utah or I-80 in Salt Lake City. Seventy million tons of goods traveled along I-15 at a value of $68 billion in 2007. These values are projected to increase to 129 million tons worth $168 billion by 2040. Interstate 15 is also part of the CANAMEX transportation corridor connecting Mexican, Canadian, and American trade. As a vital trade route, the U.S. Department of Transportation designated US 93 in Arizona (slated to be upgraded to interstate standards as I-11) and I-15 through California, Nevada, Utah, and Arizona as a 'Corridor of the Future' designed to carry 200,000 vehicles per day. Comparatively, parts of I-405 through Los Angeles, known as one of the busiest routes in the United States, reaches an average of 374,000 vehicles per day. I-15 currently has over 270,000 vehicles daily in central Las Vegas. With almost 24 million people living in the counties along the I-15 corridor and sixteen percent of the continental United States' population living within these four states, I-15 proves its vitality.

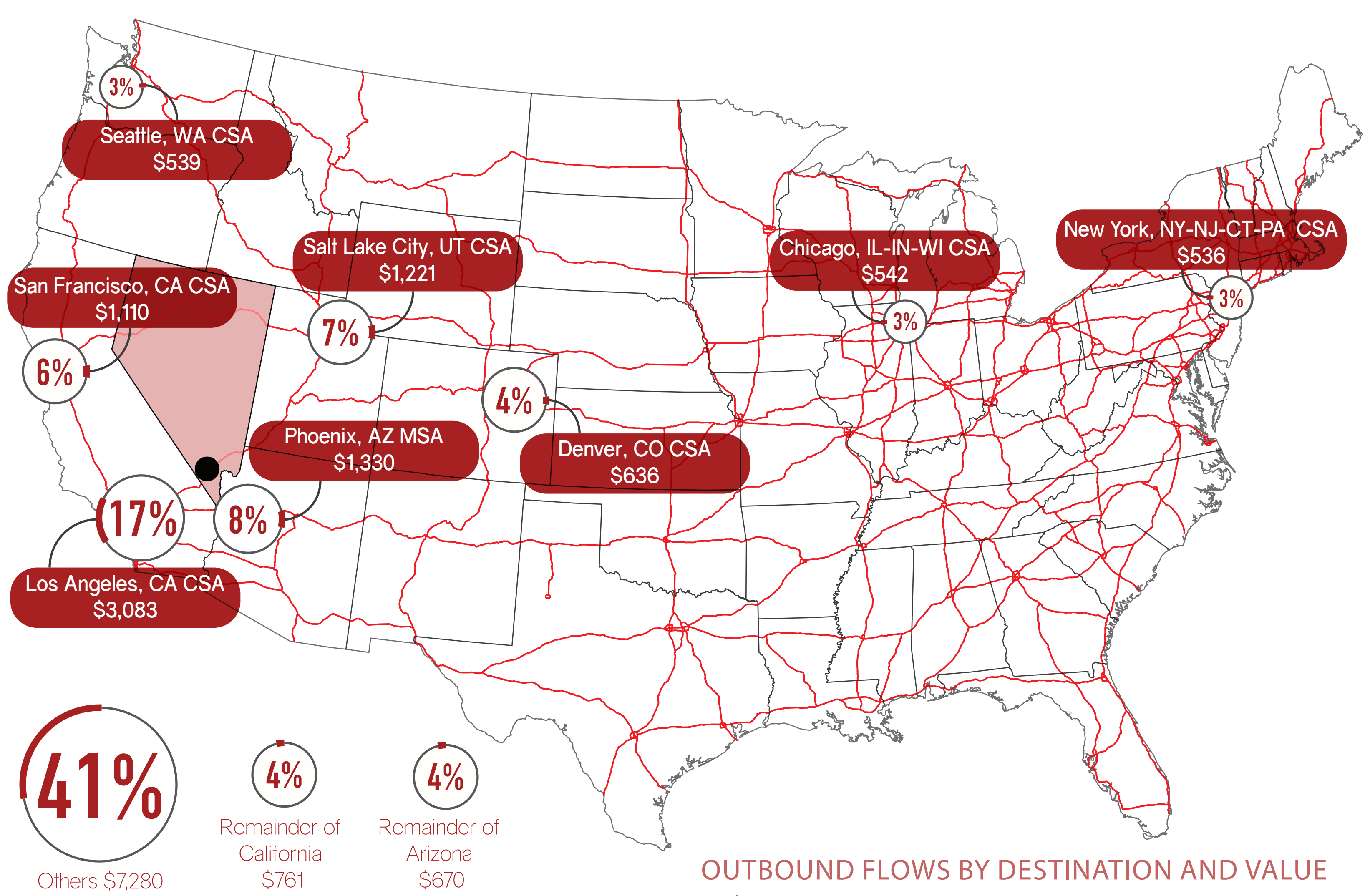
Southern Nevada is well situated geographically to have rapid access to major domestic and international markets with the presence of relatively new highway, rail, and airport infrastructure.

As a state, Nevada produces a lot of raw materials through mining, but not enough manufactured goods to create a diversified output economy; in Southern Nevada, the small manufacturing and agricultural outputs are limited, and tourism serves as the primary economic base. National and regional freight networks therefore import around ninety percent of Las Vegas's goods and food. According to the Freight Analysis Framework (FAF) database, all freight modes moved over seventy million tons of freight into, out of, or within Southern Nevada in 2010, much of which originates or terminates in California. When considering shipments by tonnage, pipeline (15 percent) and rail transportation (also 15 percent) are the second and third most used modes of transportation for inbound and import shipments measured by volume, with trucking accounting for 66.8 percent. By value, shipments into Nevada have a mix of modal usage with a significant reliance on trucks (66.5 percent) and multi-modal rail-truck (21.6 percent); 5.5 percent of goods, such as oil and natural gas, are transported by pipeline. Goods exported from Las Vegas are mostly distributed regionally around the Southwest; Trucks haul 83.0 percent of this volume. Within Southern Nevada, 87 percent (61.3 million tons) of the tonnage moved was handled by trucks in 2010.

This amount of importation requires warehousing, logistics, and distribution centers to store goods before further shipment to retailers or customers. Because more than 50 million people live within one day's drive of Las Vegas and due to Nevada's inexpensive operational costs and favorable tax climate, shipping through the region can be attractive for national business.



INBOUND FLOWS BY ORIGIN AND VALUE
(in $USD millions)

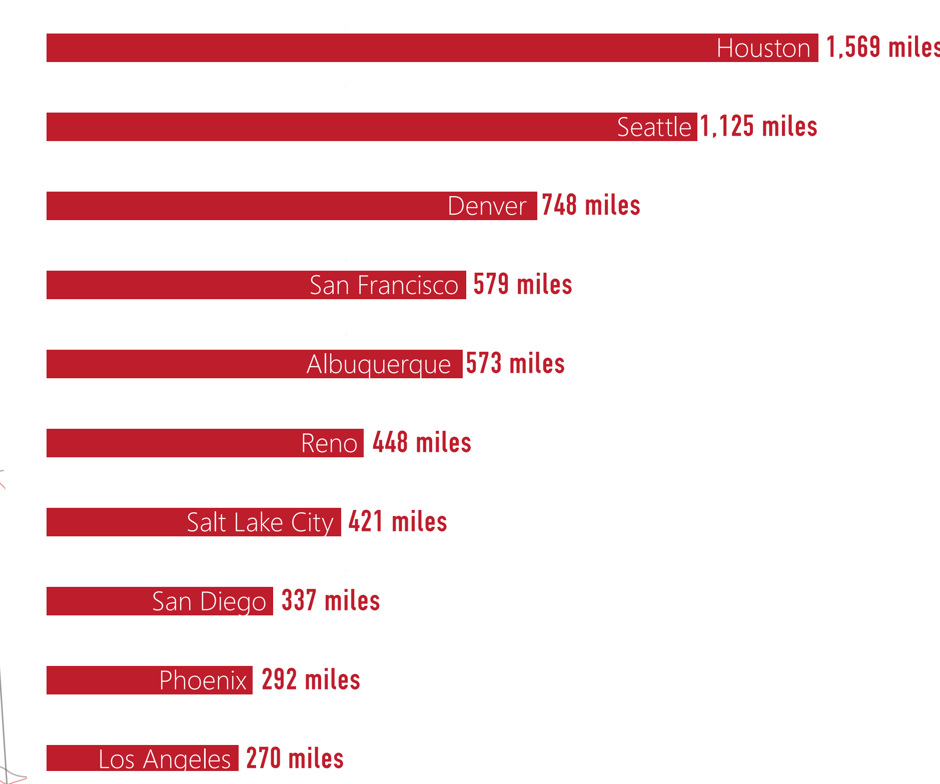


OUTBOUND FLOWS BY DESTINATION AND VALUE
(in $USD millions)

MAJOR TRUCKING ROUTES 2010

MAJOR TRUCKING ROUTES 2040

JOURNEY DISTANCE TO FREIGHT METROS RELATED TO LAS VEGAS

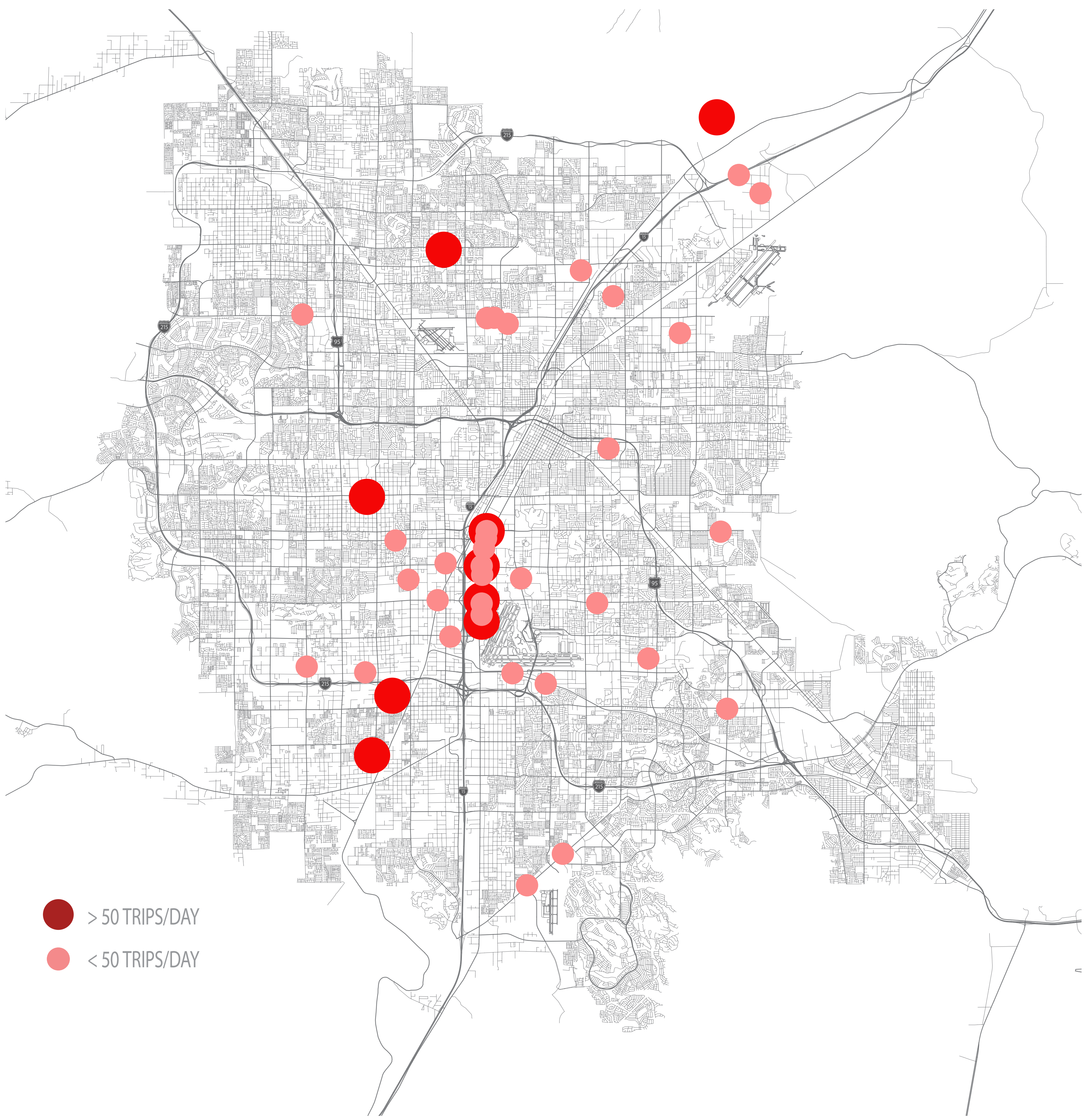


TRUCKING FLOWS AND MAJOR GENERATORS IN SOUTHERN NEVADA

A study of freight movement prepared for the Regional Transportation Commission of Southern Nevada (RTC) in 2013 reveals truck travel flows in Southern Nevada. The study used an employment-based method to determine the number of truck trips per day. This method categorized major industries using trucks, created an employment database, and calculated the number of truck trips by multiplying trips by employment in designated freight zones. Trucks took about 60,000 trips per day in the Valley. Internal trips inside the metro area were about two-thirds of the total, while the rest were external or pass-through trips.

The I-15 corridor is the major freight route and is the trunk of activity in the Valley. Freight storage, major commercial or "big box" stores and logistics hubs occur along corridor branches from the interstate.

Note that the major activity generators for trucking include the Las Vegas Strip and industrial zoned areas close to airports and rail distribution centers along the edges of the Valley.



While clustering of industries is beneficial to share common infrastructure and for efficient land use, there are logistical challenges and environmental impacts from trucks congregating in and moving frequently through the same area, including increased air and noise pollution for residents in adjacent areas, and wear and tear on roadway infrastructure to and from the cluster.

REGIONAL TRANSPORTATION COMMISSION'S 2013 REGIONAL FREIGHT STUDY FINDINGS

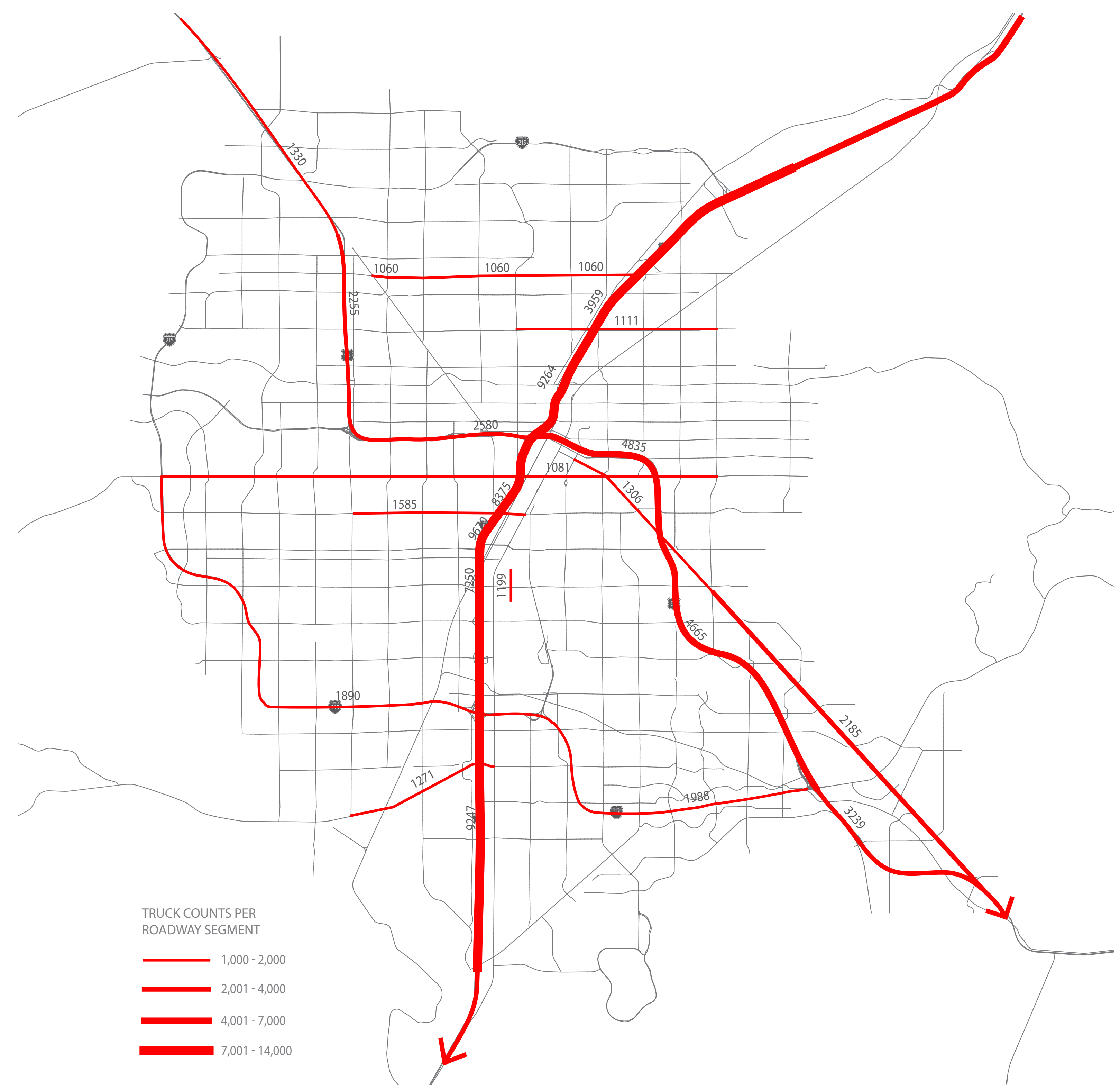
A concentration of manufacturing, industry, and warehousing facilities in zip codes 89118, 89115, and 89030 result in heavy truck traffic.

Truck drivers use freeways as much as possible. Most tankers run on the freeways, because most gas stations are near freeway exits.

Overwhelmingly, the most important factor in route selection is free-flow movement (low congestion, fewer and well-timed traffic signals, no school zones, etc.).

Casinos are a major generator of freight traffic. The collector roads behind and around the casinos include Koval Lane, Audrie Street, Harmon Avenue, Joe W. Brown Drive, Frank Sinatra Drive, and Dean Martin Drive. The trucking industry favors these roads for deliveries and convention services Casino docks open early and typically close by mid-afternoon. Tuesdays and Fridays are the busiest days for delivering food and beverages.

A large trade show can generate 1,200 truck trips over a two-week period. A single truck will make multiple trips between a marshalling yard and convention center over that time.

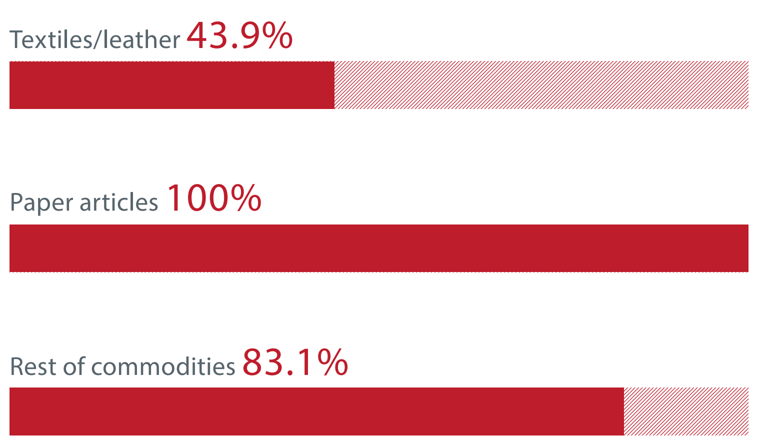


GOODS AND COMMODITIES IMPORTED BY TRUCK

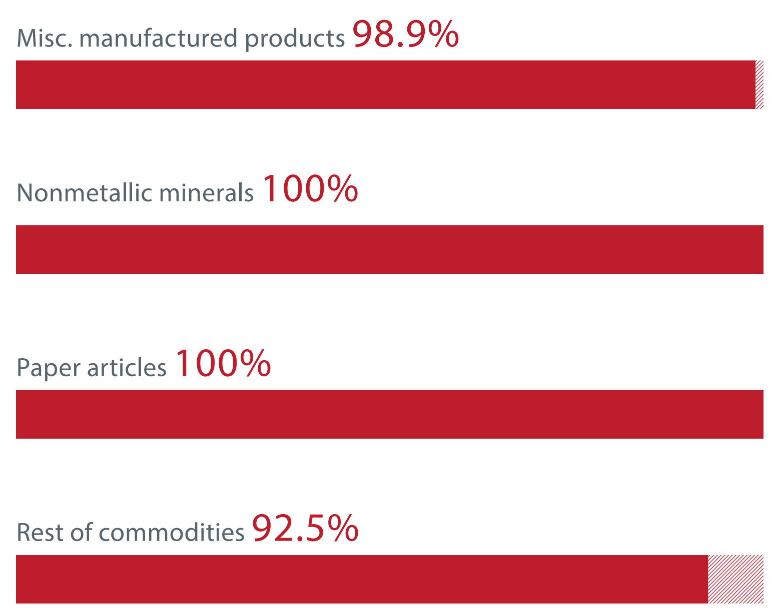
Inbound freight for food services, mining, and construction lead in truck freight value, ranging between $783 million and $2.7 billion. Food services and manufacturing have around a ninety percent import reliance. This reveals the magnitude of how food systems may be vulnerable due to truck freight issues.

Industry Description	Percent Reliance	Output (Sales)	Value Added
Mining & quarrying	78%	$2,731	$1,979
Construction	72%	$1,979	$1,150
Food services	87%	$1,869	$1,142
Accommodations	70%	$996	$619
Food manufacturing	92%	$783	$123
Manufacturing	82%	$593	$335
Healthcare	82%	$578	$397
Utilities	62%	$572	$271

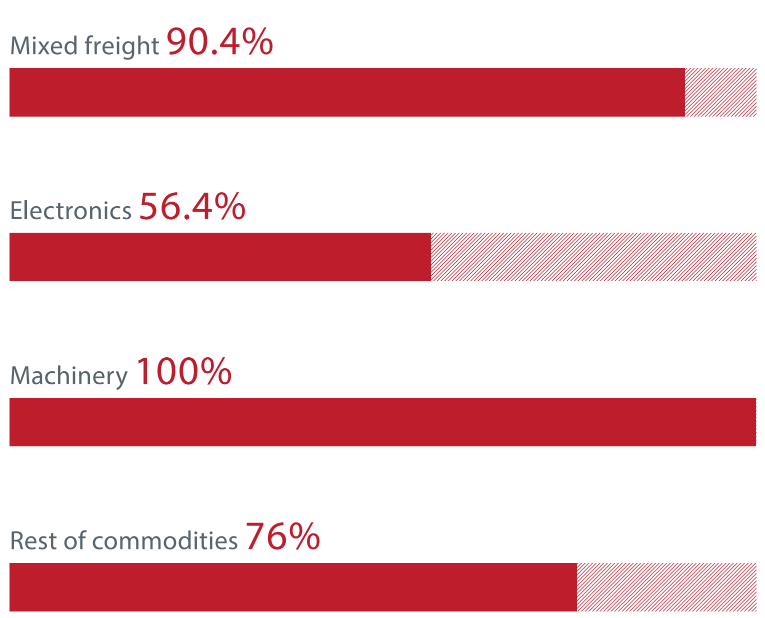
Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*



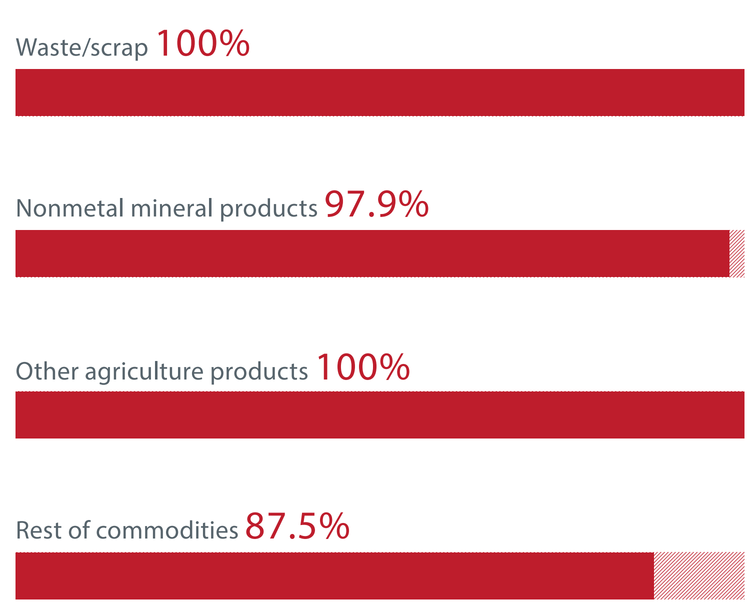
Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*



Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*



Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*



Commodity percentages are based on value (in $USD millions) or weight (thousands of tons) relative to other modes. Some commodities are only carried by trucking (e.g., 100%). Source: FHWA FAF 2011

POTENTIAL IMPACTS OF FUEL TO TRUCKING AND TRANSPORTATION

At 30 percent of all road transportation fuel, freight transportation by trucking is the second-largest energy user of all transportation modes after light-duty vehicles and is the fastest-growing energy user of all transportation modes. Growth in freight trucking is projected to rise by 150 percent by 2050, the largest growth level of all transportation modes.

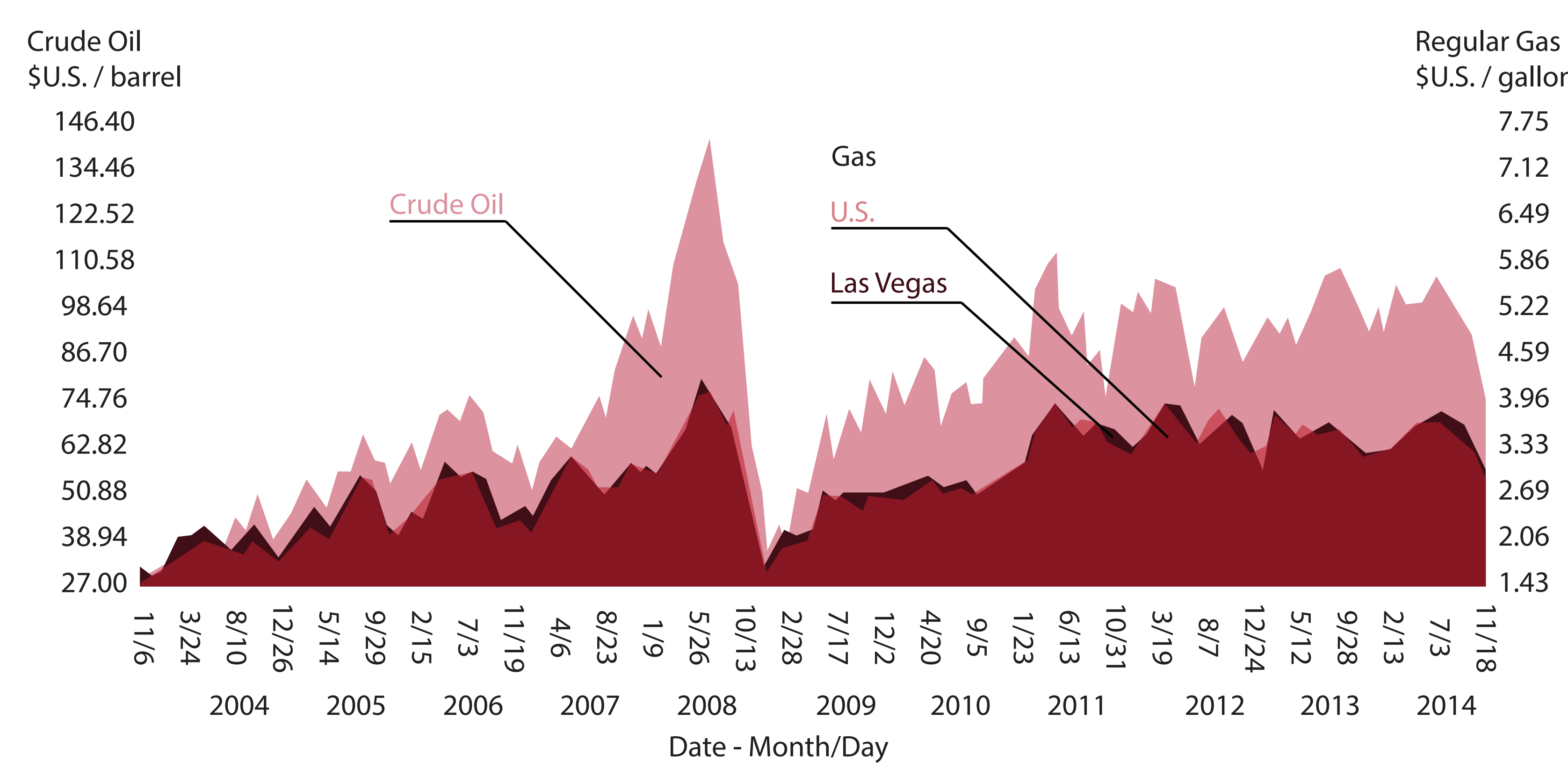
Gasoline and diesel fuels comprise over 90 percent of road transportation fuel usage in North America. The U.S. Energy Information Administration (EIA) expected the Brent crude oil spot price, an index of light sweet crude oil refined in Western Europe, to drop to $100 per barrel in 2014, down from an average of $108 per barrel in 2013. After averaging $94 per barrel in 2012 and increasing to $105 per barrel in July 2013, the West Texas Intermediate crude oil spot price averaged $93 per barrel in 2014. Similarly, retail gasoline prices rose to an average of $3.59/ gallon in the third quarter of 2013. By mid-2014, average gasoline prices rose another ten cents $3.70/gallon. The U.S. Department of Energy and EIA's Short-Term Energy Outlook states that diesel fuel, which was $3.97/gallon in 2012, was projected to average $3.92/gallon in 2013 and $3.76/gallon in 2014. By July 2014, average diesel prices were actually $3.92/gallon.

With several interstate pipeline projects crossing the Great Plains to Gulf Coast refining centers completed in 2014, the cost of transporting crude oil to refiners declined, and many states around the country saw gas prices drop to around $3.00/gallon in 2014. At the retail level, diesel fuel prices were impacted by higher biodiesel blending yields. According to EIA reports, gasoline prices fall as crude oil prices fall following summer driving seasons. The cyclical increases and decreases in fuel prices exemplify the unpredictability of the fuel markets.

As an import-reliant and tourism dependent destination, rising gasoline and diesel fuel prices have a direct impact on Southern Nevada's economy and have long been a concern as many visitors drive from California and other neighboring states. With average daily auto traffic at the California/Nevada border on I-15 at 42,318 in 2014, approximately one-third of Las Vegas' visitors drive in California.

Because Southern Nevada's economy relies heavily upon trucking for necessary imports and its tourism, potential union strikes, damage to highway infrastructure changes, and fuel price volatility, each could have the potential of leaving Las Vegas vulnerable. Of these, the cost of fuel could have the most impactful effect on the cost of goods; these costs can disproportionately effect tourism, lower-income residents, and other special populations.

CRUDE OIL AND UNITED STATES AND LAS VEGAS VALLEY GAS PRICES 2004-2014



FREIGHT RAIL

FREIGHT FACILITIES

Intermodal facilities transfer containers and trailers between trains and trucks. The Las Vegas Intermodal Facility, located in North Las Vegas near I-15 and the Northern Beltway, is owned and operated by Union Pacific Railroad and is equipped with four tracks for sixteen railcars each, two each for automatic loading and intermodal. Storage capacity is sufficient for 80 trailers and containers. Rail traffic at the Las Vegas Intermodal facility declined between 2000 and 2010 as a result of shifting of traffic from the South Central Route through Southern Nevada to the Sunset Route through Arizona, which has corresponded with increased truck traffic in Nevada.

In the southern valley, Arden serves as Union Pacific primary railroad yard after being relocated from Downtown Las Vegas in the early 1990's; another branch extending southeast toward Henderson (and formerly serving Hoover Dam during its construction in the 1930's), is a secondary corridor that serves the Basic Magnesium complex.

RAILROADS AND FREIGHT IN SOUTHERN NEVADA

Rail traffic is an efficient means of moving large quantities of goods long distances. In 2009, U.S. freight railroads operated over 1,363,000 freight cars on 169,000 miles of track.

Nevada is a thoroughfare for rail traffic that connects large coastal ports with the major cities to the east. 96 percent mainline freight rail traffic consists of shipments traveling to and from California ports. In 2009, almost 200 million net tons of freight moved across Nevada. Around three percent of rail freight containing coal, clay, concrete, and chemicals originated outside Nevada with an in-state destination. Less than one percent originated in Nevada and moved chemicals, sand and gravel, allied products and non-metallic minerals out of state.

Burlington Northern-Santa Fe and Union Pacific are the region's two primary Class-I (large, line haul, multi-state) railroads. Union Pacific operates along both northern and southern east-west rail corridors of Nevada. The northern corridor connects San Francisco and Sacramento with Reno, Salt Lake City, Denver, and points to the east.

In Southern Nevada, Union Pacific tracks parallel I-15. Known as the South Central Route, it is predominantly a single-track mainline and connects the Port of Long Beach and Los Angeles, Las Vegas, Salt Lake City, and points to the east. All trains, including both those bound toward Las Vegas and those toward Northern Arizona, must wind their way slowly up and over the busy Cajon Pass between San Bernardino and Victorville, California, climbing more than 3,000 feet in 25 miles.

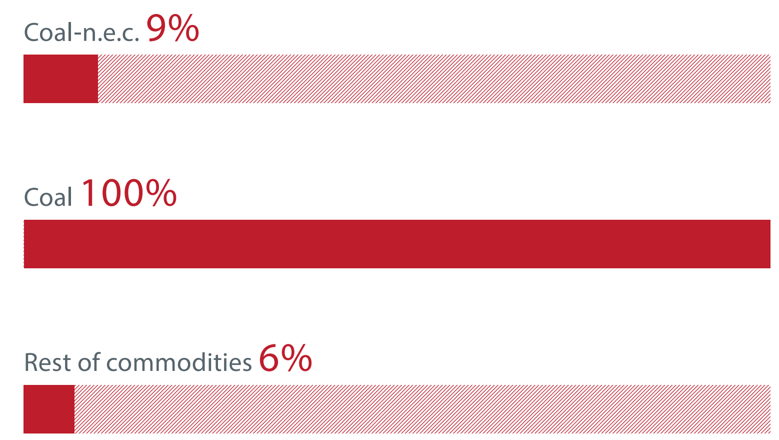
GOODS AND COMMODITIES IMPORTED BY RAIL

Over $2.2 billion of industry sales are dependent on freight transported by rail into Nevada. Though it doesn't have the highest value output, the utilities industry is the most reliant on inbound rail freight at 27% of its output. Compared to other major modes, reliance on imported freight by rail totals 10% of all industry output.

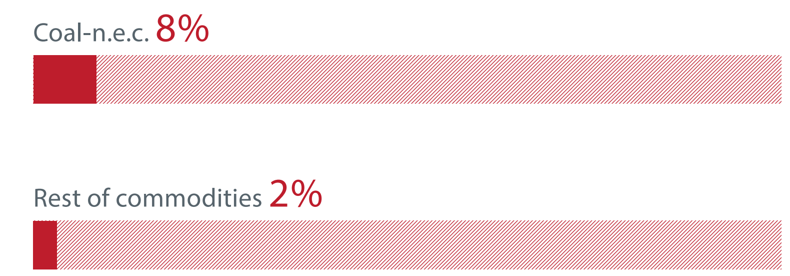
(Source: FHWA FAF and US Dept. of Commerce Bureau of Economic Analysis via TREDIS); Source: FHWA FAF 2011

Industry Description	Percent Reliance	Output (Sales)	Value Added
Mining & quarrying	18%	$631	$462
Utilities	27%	$248	$151
Construction	4%	$104	$61
Metal manufacturing	19%	$97	$17
General manufacturing	12%	$85	$48
Plastics and rubber	16%	$83	$23
Food services	3%	$74	$45
Chemical manufacturing	13%	$63	$15
Real estate	19%	$50	$33
Personal services	3%	$49	$30

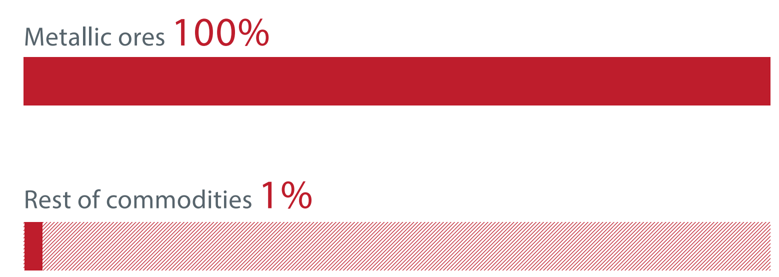
Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*



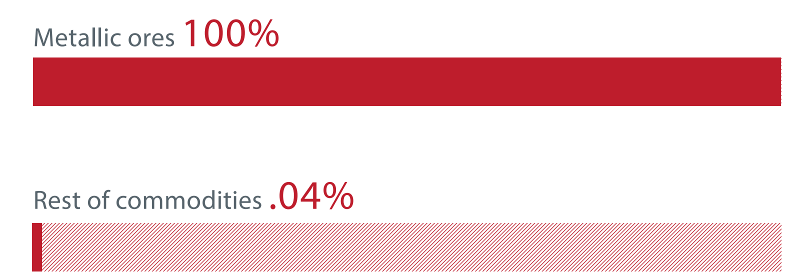
Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*



Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*

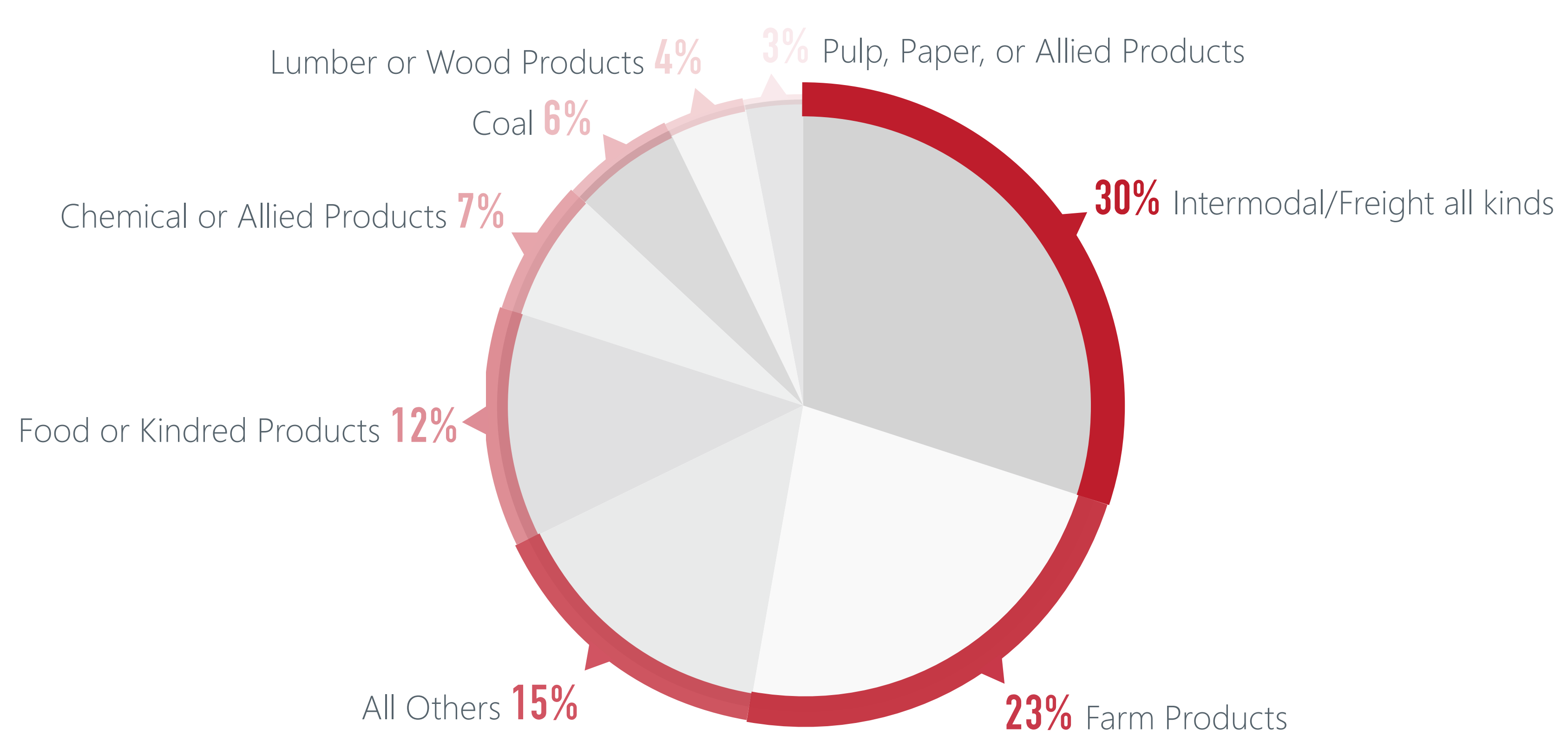


Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*



*Top-ranked commodities carried by rail by value and weight. Commodity percentages are based on the value (in $USD millions) or weight (thousands of tons) relative to other modes. Some commodities are only carried by this one mode (i.e. 100%) Source: FHWA FAF 2011

GOODS AND COMMODITIES IMPORTED BY RAIL



In 2013, railroads moved a ton of freight an average of 473 miles on a single gallon of fuel. According to an independent study produced for the Federal Railroad Administration, railroads have a low carbon footprint and are on average four times more fuel efficient than trucks. Railroad fuel efficiency has increased more than 100 percent since 1980 and moving freight by rail could reduce emissions by seventy-five percent. Even if only ten percent of long-distance freight moving by highway switched to rail, national fuel savings would approach one billion gallons a year. In addition, because freight trains can carry the loads of several hundred trucks, rail can reduce pressure on constructing new roads and cut the cost of maintaining existing ones.

However, according to Freight Analysis Framework (FAF) data, there has been a significant decrease in rail traffic on Union Pacific tracks passing through Southern Nevada. This has been a result of a re-routing of trains with Midwestern and Eastern destinations, but does not represent a decrease in demand for services to, from, or through Las Vegas. Extending track sidings, replacing rails and ties, and upgrading railyard facilities at freight origins and destinations could increase the routing potential along this rail corridor and could present an opportunity to re-route freight onto rails and off of trucks on I-15.

PIPELINE TRANSPORTATION AND ALTERNATIVE FUELS

Two petroleum (CALNEV and UNEV) and one natural gas pipeline (Kern River) serve Southern Nevada. CALNEV is a 500-mile pipeline transporting gasoline, diesel and jet fuel from Los Angeles and delivers over 60,000 barrels a day to Las Vegas. It is the primary source of fuel for McCarran International Airport, Nellis Air Force Base, and for commercial gasoline and diesel fuel. An additional 16-inch pipeline is planned to be constructed alongside the existing lines and would increase production capacity to between 200,000 and 300,000 barrels per day. UNEV is a 400-mile pipeline between Salt Lake City and Las Vegas, terminating at Apex Industrial Park. UNEV has a capacity between 62,000 and 118,000 barrels per day. Kern River Pipeline is a 1,700-mile natural gas pipeline line extending from southwestern Wyoming to Bakersfield, CA. The pipeline supplies local gas distribution companies, power plants, and heavy industrial users in Utah, Nevada, and California. The pipeline provides 80 percent of the natural gas supply to Southern Nevada.

NATURAL GAS

Natural gas comes as fuel in the form of compressed natural gas (CNG), liquid natural gas (LNG), and liquefied petroleum gas (LPG), and comprises about four percent of North American transportation fuel usage. It is derived from natural gas liquids including shale and tight gas, supplied to Nevada through the Kern River Pipeline from Colorado and Wyoming. While there is increasing public attention to the production practices involved in high-volume fracking, once it is in use, natural gas is 20-30 percent less carbon intensive than conventional gasoline and diesel and 50-60 percent less intensive than coal. Natural gas is rising as a transportation fuel source. According to the EIA, consumption will jump 1.3 percent from 2013 and another 0.3 percent in 2015.

BIOFUELS

Biofuels are plant- and feedstock-based composite fuels, including ethanol, methanol, and butanol, derived from carbohydrates and biodiesel-derived lipids. Biofuels may also be drop-in liquid fuels that can work in gasoline or diesel engines without major modifications. These are also derived from the same feedstocks, but can also be derived from sources such as algae.

The U.S. Environmental Protection Agency required that 2.75 billion gallons of biofuel be blended into the fuel supply by the end of 2013. This mandate has led to an increased use of biofuels nationwide. Biodiesel of Las Vegas, Inc. is the first and only certified large-scale biofuel production facility in Nevada. Located adjacent to the Union Pacific Railroad in North Las Vegas, it is close to bulk fuel distributors, and can produce around 40 million gallons annually. This facility serves the Clark County School District bus system, Nellis Air Force Base, and other entities. There are two commercial biodiesel filling stations located in Southern Nevada, as well as a station at Bentley Biofuels in Minden

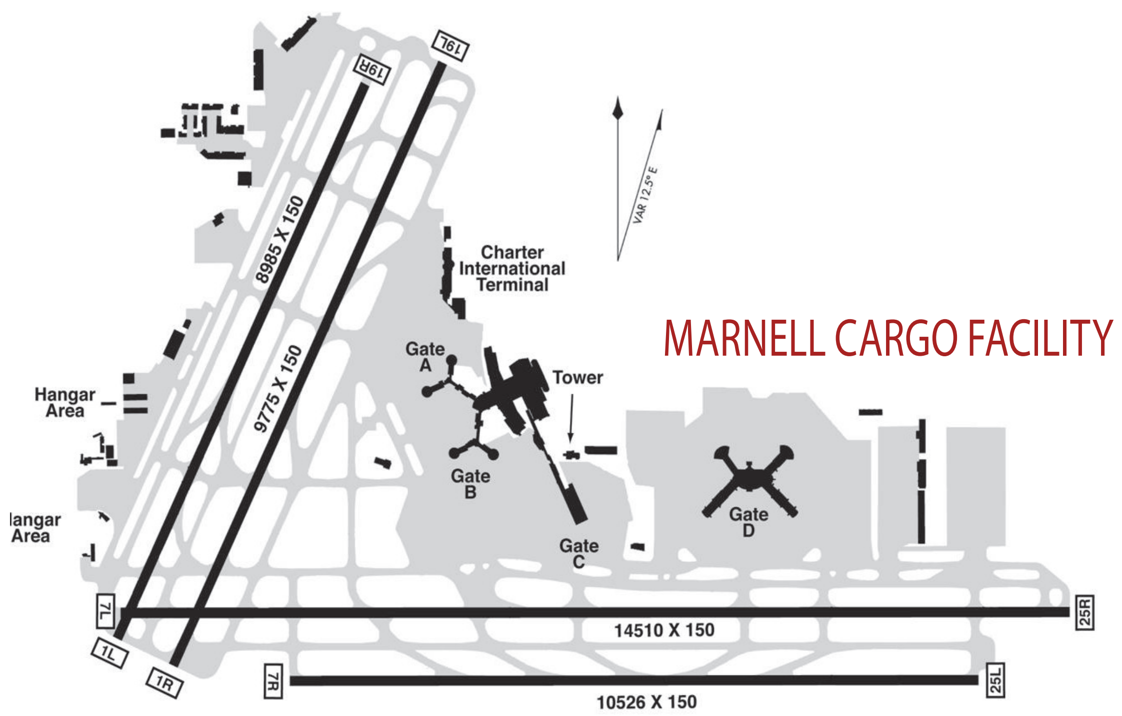
With world energy consumption projected to rise 40 percent by 2040, the sources and structures of our transportation fuel systems must change to meet these challenging demands. Mitigation and adaptation strategies must include the adoption of alternative fuel types, changes in consumer behaviors, and a heavier reliance on other modes of goods deliveries.

AIR FREIGHT IN SOUTHERN NEVADA

The Clark County Department of Aviation operates five civilian airports for general commercial aviation and passenger traffic: McCarran International Airport, North Las Vegas Airport, Henderson Executive Airport, Jean Airport and Overton-Perkins Field. Boulder City operates a municipal airport for commercial uses as well. Two air force bases, Nellis and Creech, are the region's military installations. A proposed commercial reliever airport was under consideration south of Las Vegas in the Ivanpah Valley near I-15 and the Nevada-California state line, but has been delayed indefinitely.

McCarran is the 36th busiest cargo airport in the world with more than 370 million tons of freight passing through. The Marnell Air Cargo Center, built in 2010, contains a 200,000 square foot freight and distribution facility, is within less than a mile of Interstate 15 and the Union Pacific railroad, and is within an 80-acre designated foreign trade zone. The Air Cargo Center houses large cargo haulers including United Parcel Service, US Airways, Airport Terminal Services, Allegiant, Worldwide Flight Services, Southwest Airlines and Federal Express.

$25 million in fuel farm upgrades at McCarran were completed in October 2011, which added a 65,000-barrel storage tank, two additional 1,200-gpm variable-drive pumps, an improved foam fire protection system, a new oil/water separator and lift station, and dike containment walls. A second phase will be completed in the future, which will add three additional 65,000-gallon tanks and increase storage capacity to 23.5 million gallons, or a two week supply.



http://www.faa.gov/nextgen/media/maps/arpt/LAS.jpg

36th BUSIEST AIRPORT for FREIGHT IN THE WORLD

GOODS AND COMMODITIES IMPORTED BY AIR

Over $357 million of industry sales are dependent on freight transported by air (which includes the truck portion of the trip) into Nevada. Only an estimated 1% of industries that are dependent on inbound transported freight rely on air though McCarran Airport's 40,000 square foot Marnell Cargo Center, which is designed to handle future air cargo demand

(Source: FHWA FAF and US Dept. of Commerce Bureau of Economic Analysis via TREDIS)

Industry Description	Percent Reliance	Output (Sales)	Value Added
Construction	1%	$39	$23
Food services	2%	$32	$20
Health care	4%	$28	$19
Sightseeing transportation	8%	$20	$15
Transportation equip.	7%	$18	$5
Hospitals	3%	$15	$9
Accomodations	1%	$14	$8
Sceince and tech.	2%	$13	$9
General manufacturing	2%	$12	$7
Air Transportation	2%	$12	$6

Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*

Non-metal mineral products 2%

Machinery 100%

Rest of commodities .1%

Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*

Transport equipment 100%

Rest of commodities 2%

Percentage of Total Commodity by Type for Outbound Shipments and Exports by Weight*

Misc. manufactured products 9%

Rest of commodities .06%

Percentage of Total Commodity by Type for Inbound Shipments and Imports by Value*

Misc. manufactured products 16%

Electronics 100%

Rest of commodities 3%

*Top-ranked commodities carried by air by value and weight. Commodity percentages are based on the value (in $USD millions) or weight (thousands of tons) relative to other modes. Some commodities are only carried by this one mode (i.e. 100%) Source: FHWA FAF 2011

PASSENGER AND COMMUTER MOBILITY IN SOUTHERN NEVADA

Southern Nevada's resident population is more than two million and averages around 40 million visitors annually, which share roadways, buses, bike lanes, the airport, and sidewalks. Despite increasing efficiency in fuel consumption, passenger vehicles – especially single occupant vehicles – are the greatest consumers of energy, are the largest share of mobile emissions, and contribute the greatest burdens to overall costs in time, fuel consumption, road maintenance and construction, and motorist fees for operation. While the Las Vegas Valley is relatively compact due to its growth boundaries, it is also one of the densest cities in the United States. More than 90% of residents and visitors use automobiles for travel.

The Regional Transportation Commission of Southern Nevada (RTC) is the region's transit authority, manages funding for streets and highways, operates transportation system and demand management programs, and is the metropolitan planning organization. The RTC identifies transportation challenges, explores and implements both short and long-term solutions while simultaneously promoting sustainability, air quality improvement, and enhanced mobility in the region. The fixed route transit system, which has been continuously improving to provide expanded and enhanced transit service, still only accounts for less than 5% of daily travel.

MODES OF TRANSPORT

AUTOMOBILE

Nearly half of Southern Nevada households have at least two vehicles. The automobile is the primary commuting mode in Southern Nevada, with more than ninety percent of the population commuting to work alone. Close to half experience a commute time of 20 minutes, while a third average commutes of over 30 minutes. The "Spaghetti Bowl" interchange of I-15/US 95 is the busiest interchange in the state with more than 300,000 vehicles passing through each day.

BUS

RTC Transit is the fixed-route bus system consisting of 38 routes with nearly 4000 stops. At peak, more than 300 fixed route buses serve around 180,000 passengers per weekday. The system includes 31 local routes, 3 limited stop BRT routes, and 4 express routes. 24-hour service on 12 routes to accommodate the city's three-shift employment model. In 2013, RTC transit carried nearly 60 million passengers and provided mobility to 4,000 passengers per day through its paratransit service.

MONORAIL / RAIL

The Las Vegas Monorail Company operates a four-mile monorail along the east side of the Las Vegas Strip. The system carries an average of 67,000 passengers during convention on its electric, zero emission trains. Extensions to the monorail have been proposed to Downtown, Mandalay Bay, and to the airport. Planning for light rail transit service have also occurred since the 2000's. Two routes are currently proposed: one serving the Las Vegas Strip and the other along Maryland Parkway, connecting the airport, UNLV, Downtown, and the Medical District. There is no regional rail service for the Valley. Amtrak's Desert Wind service, which connected Los Angeles to Chicago by way of Las Vegas, Salt Lake City, and Denver, was discontinued in 1997 due to budget cuts, competition from airlines the highway system, and frequent delays caused by Union Pacific freight trains. With trips between Las Vegas and Southern California taking seven hours by rail, the service was replaced by Greyhound bus service. Since 1997, multiple plans have surfaced for high speed rail passenger rail service between Las Vegas and Los Angeles, which would connect to California's high speed rail network.

AIR

Located a short distance from the Las Vegas Strip, McCarran International Airport is the world's 24th busiest airport and the nation's 9th busiest for passenger traffic, carrying over 41 million passengers and half a million takeoffs and landings annually. McCarran is the principal hub for Southwest and Allegiant Airlines and was expanded in 2012 to include a new international terminal. Other passenger airports within the immediate Las Vegas Valley area include North Las Vegas Airport and Henderson Executive Airport. A second commercial airport has been proposed in the Ivanpah Valley near Primm, but there are no current plans for construction.

BICYCLE

Many of Southern Nevada's local governments and the RTC have worked to increase the amount and connectivity of bicycle facilities. There are now 474 miles of bicycle lanes and routes, and 403 miles of shared-use trails throughout Southern Nevada. While bike commuting only represents a small share of the overall modal split and safety continues to be a concern, increased investment has lead to recognition; the cities of Las Vegas, Henderson, and Mesquite were recognized as Bicycle Friendly Communities from the League of American Bicyclists in 2014.

PEDESTRIAN WALKING

Las Vegas' highest volumes of pedestrian traffic are along the Las Vegas Strip and in Downtown Las Vegas. The City's conversion of Fremont Street into a pedestrian mall in the 1990s and the recent resurgence of Downtown has brought more pedestrians to the area. Street improvements in Downtown, as well as the construction of pedestrian bridges and facilities along the Las Vegas Strip have made both areas among the most walkable in the City. However, walking can be challenging due to extreme heat in the summer, as well as the physical design in suburban parts of the city. Low density, auto-oriented residential development surrounded by walls create barriers to walking, lowers connectivity, and creates long distances between neighborhoods and services.

AUTOMOBILE TRANSPORT

Southern Nevada's rapid population, employment, and visitor growth has led to higher travel demand and traffic congestion, with approximately 100 new cars added to roadways each day. Approximately 16 billion miles were driven in 2013 by automobile, accounting for approximately 90% of all trips made.

As roads were built during the early 20th century, many paralleled existing transportation corridors, including the Union Pacific Railroad (US 91 and US 93, also known as Las Vegas Boulevard), the Las Vegas and Tonopah Railroad (US 95, or Rancho Dr), and Boulder Highway. The Arrowhead Trail was the transcontinental route, built in 1915 following the Old Spanish Trail along the Virgin River from Utah to St. Thomas, through Valley of Fire, into Las Vegas. It would continue south to Searchlight and into San Bernardino, California. Both the U.S. Bureau of Public Roads and the State of Nevada urged the inclusion of the cutoff route into each state's highway systems. By 1924, the Arrowhead Trail became a part of what would eventually be known as US 91 and eventually tied into US 66 when the US Highway System was launched in 1926 and would be the primary road link to Southern California over the next fifty years. When constructed in the desert at the Southern end of the Las Vegas Strip in 1959, US 91 drivers would pass the Welcome to Fabulous Las Vegas sign heading to or from Los Angeles. The passage of the Interstate Highway Act in 1956 would lead to the construction of Interstate 15 between Southern California, Southern Nevada, and Salt Lake City. US 91 would be upgraded to a high speed, grade separated, limited access freeway. The initial segments were completed in the 1960's, in addition to a new "Las Vegas Expressway," a new US-95 freeway that connected to Downtown Las Vegas that intersected with I-15 at the "Spaghetti Bowl" interchange.

Throughout the 1980's, development crept south and west into open desert thanks to the development of master planned communities like Hank Greenspun's Green Valley in Henderson and the Howard Hughes corporation's Summerlin. As Southern Nevada grew, its arterial roadway network followed the north-south and east-west grid system that follows the township and range lines of the Public Land Survey System. Las Vegas and Henderson were soon joined by urban development and were served by a new freeway, Interstate 515 (shared by US 95 and US 93), that would be extended through the east valley. With Green Valley's build out, Henderson became Nevada's second most-populated city, passing Reno, with Green Valley itself home to more than 100,000 people. Soon after, discussion began of a beltway ringing the city, which would be routed at the southern and western edges of the development and eventually along the northwestern and northern fringe. The addition of the Interstate 215 Beltway would enable development of new Summerlin villages along the foothills of the western valley. Summerlin is now currently home to more than 150 neighborhood and village parks, more than 150 miles of trails, nine golf courses, shopping centers. Development continues today in Summerlin South and Summerlin West and upon full build-out, will be home to more than 250,000. The development of these master planned communities, as well as many other new neighborhoods filling in spaces between Downtown, the Las Vegas Strip, and other developments increased the city's footprint outward. New communities would emerge, including the exclusive Lake Las Vegas, Spanish Trail, Rhodes Ranch, Anthem, and Centennial Hills and Aliante along the northern section of the beltway.

As with so many American cities with a focus on street and roadway development, constant and rapid construction has occurred, especially during the 1990's, 2000's, and 2010's; at the same time, heavy congestion has also occurred on Southern Nevada's arterials and freeway network. The Spaghetti Bowl was upgraded once in 2000; a widening of US 95 to the northwest was initiated, as well as an expansion from 6 lanes to 10 lanes; Clark County fastracked construction of the Las Vegas Beltway with interim facilities with the full I-215 freeway slowly opening, mile by mile. With continued emphasis and reliance on road construction and driving, and with new projects such as Project NEON, widening I-515, construction of the new Interstate 11, it will be difficult to shift commuters to other modes of transportation
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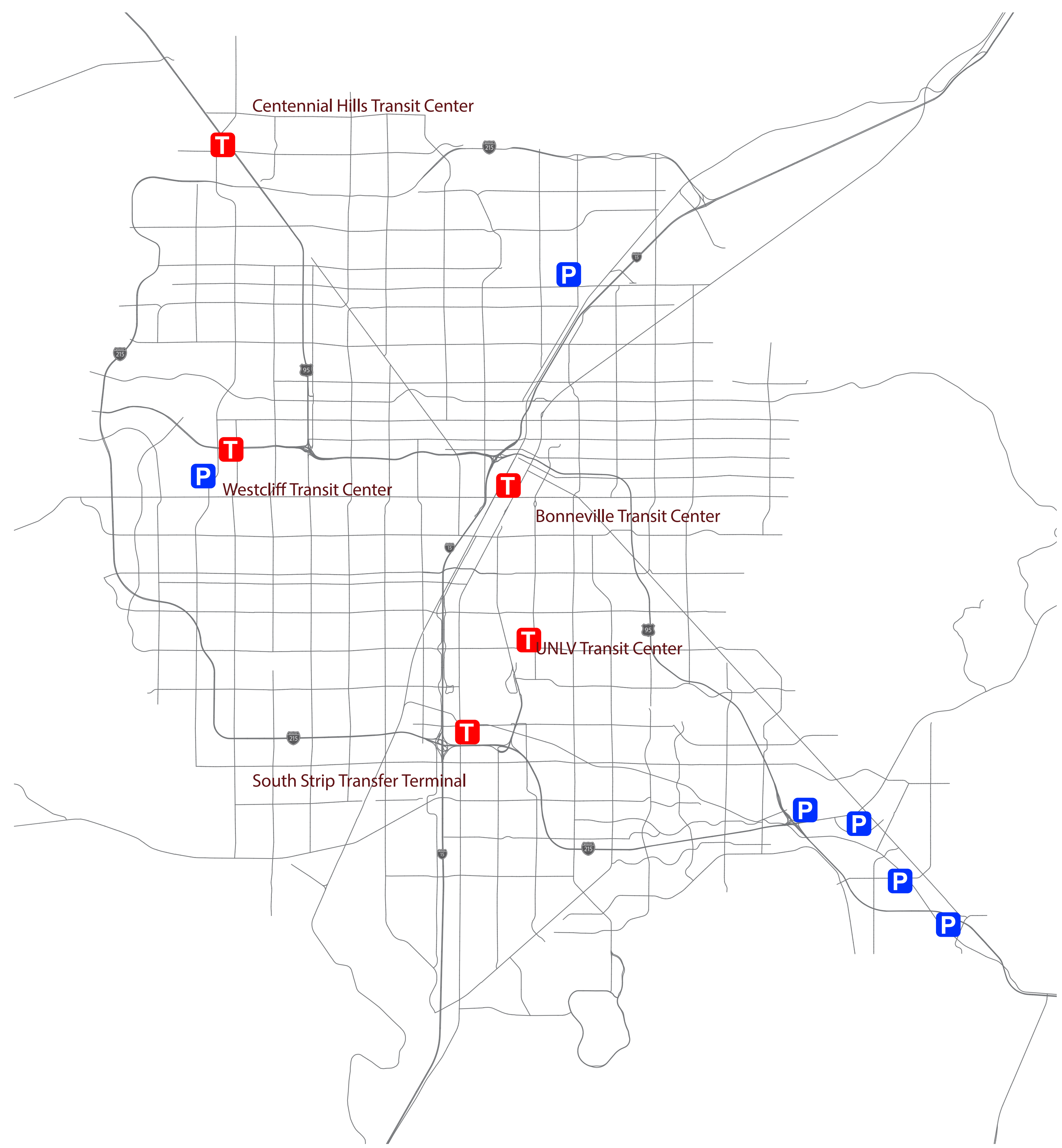


TRANSPORTATION DEMAND MANAGEMENT

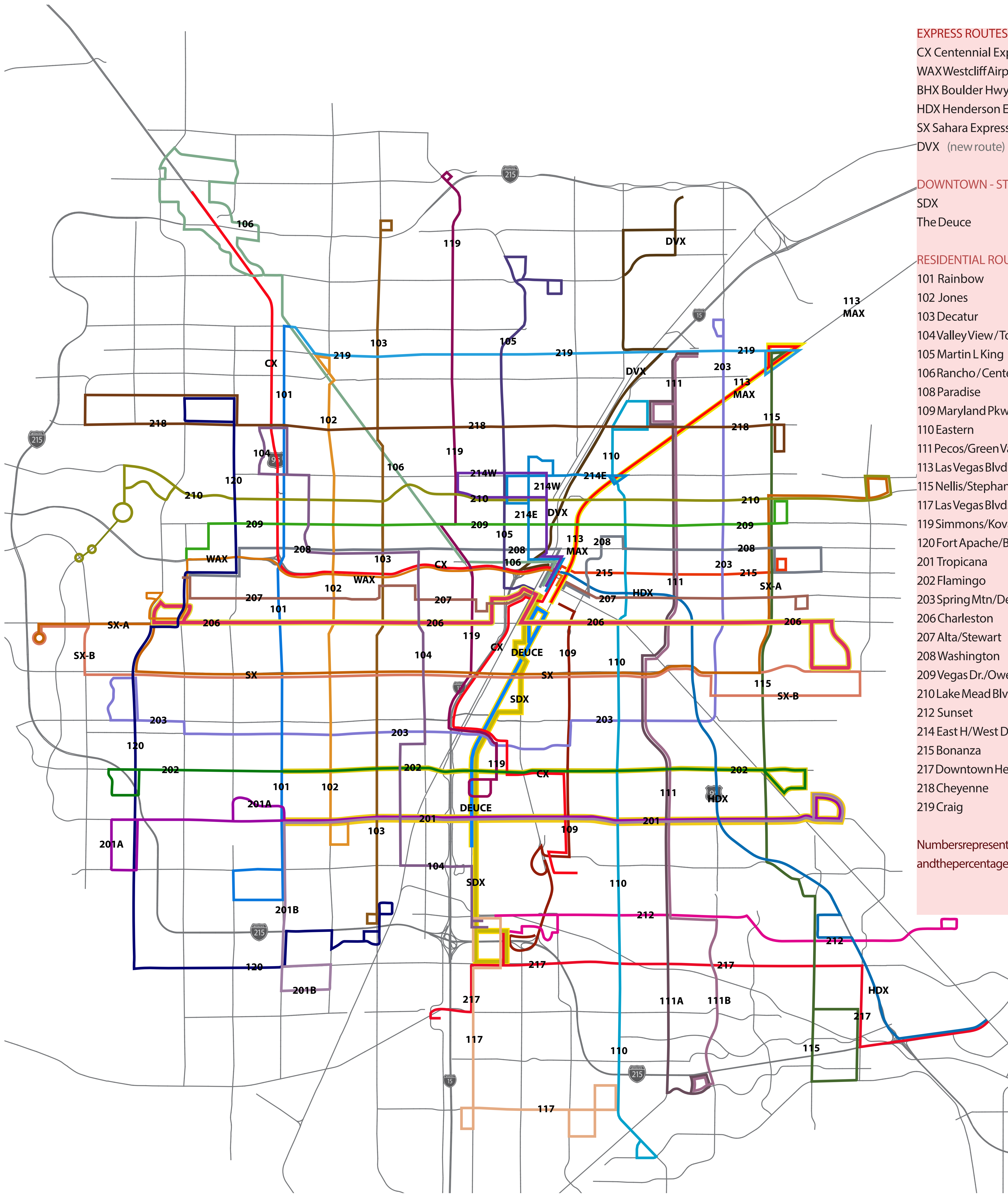
Carpooling and other transportation demand management techniques, facilitated by having dedicated managed facilities that reserve exclusive space and capacity for their proper functioning is a necessary tool for communities to effectively manage traffic congestion, make modal shifts, and increase public transportation ridership.

RTC offers the Club Ride program, a free trip-reduction program designed to improve air quality. It encourages the use of alternative modes of transportation for commuting, including carpooling, public transportation, walking, bicycling, motorcycles, and telecommuting. Club Ride works with employers and commuters throughout Southern Nevada and offers incentives and rewards to save time and money while reducing congestion and climate impacts.

Southern Nevada has also developed a network of dedicated lanes exclusively for public transportation, carpooling, or high-occupancy vehicles (HOV). An HOV lane or bus lane provides dedicated space for high occupancy vehicles and can carry more vehicles than an adjacent general purpose lane that is congested. A freeway or surface street lane operating at capacity will handle approximately 2,000 vehicles per hour. However, when demand exceeds that capacity and heavy congestion ensues, a lane handles as few as 900 vehicles per hour. These special lanes limit the number of vehicles in the lane so that demand is kept below capacity so congestion is avoided while also providing the benefit of faster travel times for public transportation, lower fuel consumption and vehicle emissions, and lower operating costs for all users. The greater number of people in each vehicle in an exclusive managed lane simply moves more people.

Since 2005, the Nevada Department of Transportation and RTC have invested in a combination of HOV lanes and bus-only lanes as a part of new BRT projects. Southern Nevada now has 11 miles of HOV lanes along US 95 and Summerlin Parkway within the City of Las Vegas and 23 miles of exclusive bus-only lanes for RTC's BRT routes along major arterials, many of which were constructed by converting parking or unused break-down lanes into a dedicated lane; this reserved space may also later be repurposed for light rail transit in some corridors. Construction of these lanes has provided dedicated space for transit and has corresponded to increased ridership along these new routes. The implementation of dedicated bus lanes will increase to at least four other major crosstown arterials and will add another 25 miles. Similarly, HOV lanes will be expanded to complete a major network along other freeways in Southern Nevada, including 11 new miles on I-15, HOV direct connection bridges as well as along the Las Vegas Beltway and I-515; these lanes not only facilitate carpooling, but also the use and deployment of freeway express transit routes that connect RTC's suburban park and rides and transit centers to major employment centers in Downtown Las Vegas, the Las Vegas Strip, UNLV, and McCarran Airport.

RTC TRANSIT



EXPRESS ROUTES / BUS RAPID TRANSIT		
CX Centennial Express	287,587	-5.3%
WAX Westcliff Airport Express	303,091	+7.8%
BHX Boulder Hwy Express	3,454,640	+6.7%
HDX Henderson Express	748,046	-27.8%
SX Sahara Express	3,329,843	+57.4%
DVX (new route)	213,021	+266.1%
DOWNTOWN - STRIP EXPRESS ROUTES		
SDX	5,192,835	-1.5%
The Deuce	8,908,631	+1.1%
RESIDENTIAL ROUTES		
101 Rainbow	1,037,842	+.06%
102 Jones	639,147	-3.7%
103 Decatur	1,657,735	-6.1%
104 Valley View/Torrey Pines	802,271	+3.4%
105 Martin L King	821,981	-2.3%
106 Rancho/Centennial Hills	972,930	+0.5%
108 Paradise	773,759	-5.2%
109 Maryland Pkwy.	2,925,998	-2.4%
110 Eastern	2,223,404	-6.0%
111 Pecos/Green Valley Pkwy.	1,173,363	-3.7%
113 Las Vegas Blvd North	1,639,370	-3.8%
115 Nellis/Stephanie	1,682,880	-3.8%
117 Las Vegas Blvd. South	569,695	-4.2%
119 Simmons/Koval	525,605	-5.4%
120 Fort Apache/Buffalo		N/A (new route)
201 Tropicana	2,985,348	-1.8%
202 Flamingo	3,988,998	-7.6%
203 Spring Mtn/Desert Inn	2,169,896	+5.9%
206 Charleston	3,174,235	-2.7%
207 Alta/Stewart	286,576	-15.2%
208 Washington	840,632	-2.2%
209 Vegas Dr./Owens	298,075	-11.7%
210 Lake Mead Blvd.	1,859,309	-1.0%
212 Sunset	335,055	+21.5%
214 East H/West D	296,301	+8.0%
215 Bonanza	600,609	-3.7%
217 Downtown Henderson	453,204	-2.6%
218 Cheyenne	642,557	+1.2%
219 Craig	589,925	+1.6%

Numbers represent route ridership totals from 2013 and the percentage change from the previous year.

Public transportation is a sustainable alternative to driving, as it helps reduce congestion, avoid emissions, and helps reduce individual commuting costs. RTC Transit is Southern Nevada's fixed-route public transportation system, consisting of 38 routes served by more than 400 buses. Originally beginning as Citizen's Area Transit in 1992, replacing an organized private transit system that was woefully underserving, plagued with problems, and unreliable, RTC rapidly modernized bus transit for Southern Nevada and has made it one of the most efficient transit systems in the country. Beginning in 2004, RTC began investing in Bus Rapid Transit (BRT) to provide enhanced transit service on highly used corridors, including the Las Vegas Strip, Boulder Highway, and Sahara Avenue. Most BRT service uses dedicated bus-only lanes and improved stops, however, some amenities once offered, including proof-of-payment riding, transit service priority at traffic signals, and queue jumps of intersections are no longer used.

The system's local bus routes primarily operates on major arterial streets following Las Vegas' grid system, with most stops placed every eighth of a mile and at major intersections and transfer points. Most routes typically operate on 30 minute headways during the week; commuter express routes and routes 207 and 209 operate hourly, while "Frequent Service" routes (Strip and BRT routes, routes 109, 201, 202, and 206) operate every 15 minutes or better. Because of the 24-hour nature of the City, service on busy routes is offered overnight. RTC is also required, by the Americans with Disabilities Act to operate paratransit services for mobility-impaired passengers, which provides door-to-door trips by appointment. While this service is much more expensive to operate, it must serve any destination located within three-quarters of a mile from the fixed route system; whenever RTC considers an expansion of the fixed-route system, it must also account for the cost of providing paratransit service to newly served areas. While more than 60 million passengers use RTC Transit annually (14 million of which are used by passengers on the two routes that serve Downtown and the Las Vegas Strip), and 60% of residents live within 2 blocks of transit stops, only 4% of Southern Nevadans commute using public transportation. Several factors may contribute to this:

- Coverage: While the majority of residents live near transit services, service is absent in low-density, suburban parts of the City, including Mountain's Edge, Summerlin, Anthem, Southern Highlands, and parts of Centennial Hills. While it would not be cost-effective to provide service to these areas until ridership potential is present, residents of those areas do not have another modal choice.
- Frequency and Reliability: Unreliable service can hinder public transit use; commuters may not choose to ride a bus because of bus schedules and frequency because most routes operate in mixed-flow traffic with automobiles, they are subject to the same delays and congestion.
- Time and Speed: Because most of RTC's routes, including its BRT routes, have so many stops, it is not competitive with speeds of the automobile. The inconvenience of transferring between routes can also pose a challenge.
- Perception: Nationwide, bus service still suffers negative perceptions, often related to the poor or homeless. Trains, however, do not have the same issues of perception. Despite the challenges, RTC is committed to proving low cost, efficient public transportation and will continue looking for opportunities to expand and improve its service, including the possibility of offering rail-based transit, which could spur new mixed-used transit oriented development.

419 TOTAL BUSES

318 BUSES PEAK

180,000 FIXED ROUTE RIDERS

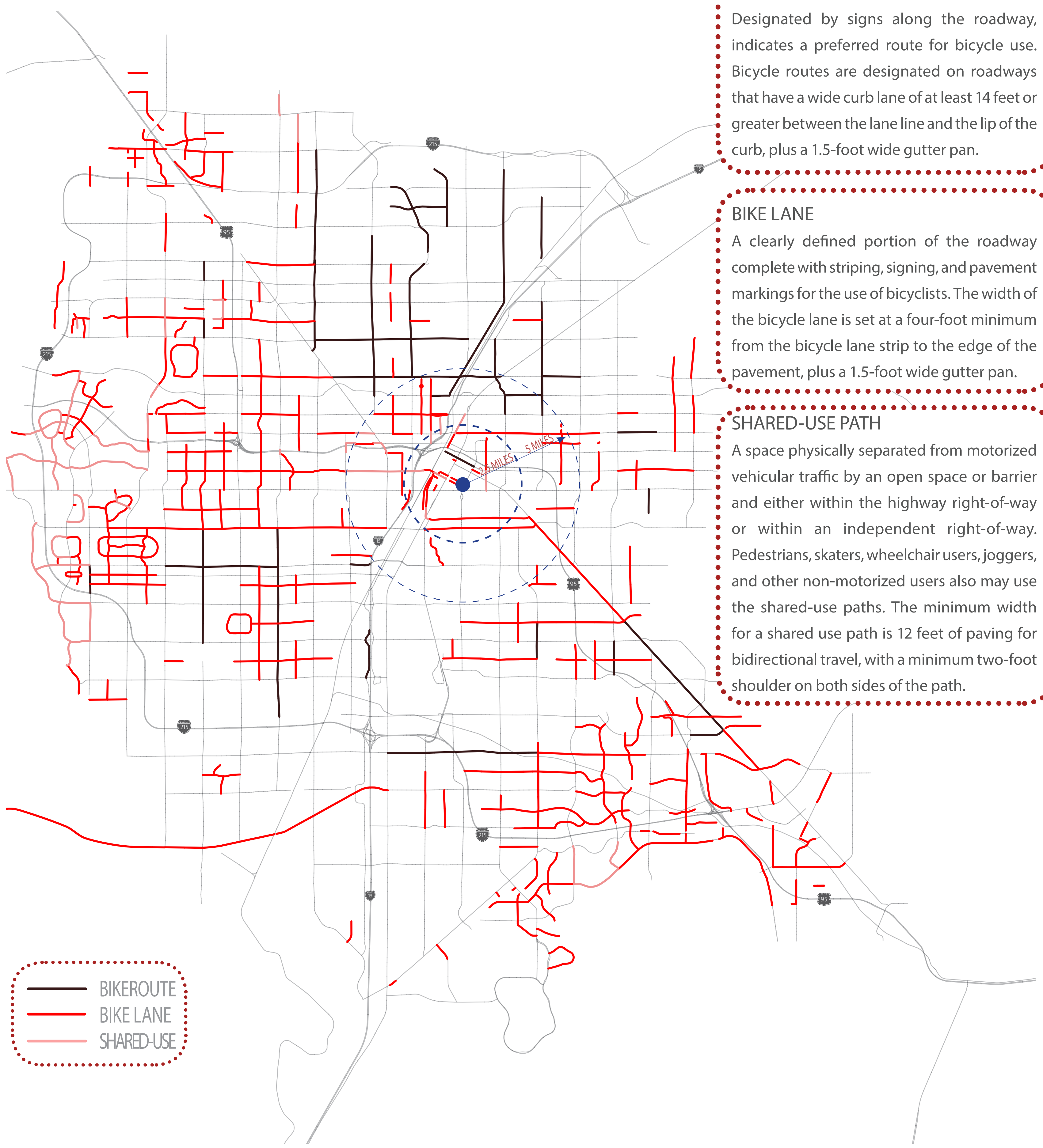
4,000 PARATRANSIT RIDERS

PER DAY

108°

If temperatures exceed 108 degrees, buses have difficulty running and may break down. In the summer months, extreme heat is common and there have been reports of this occurrence. Given increased ridership, a system-wide shutdown of city buses would greatly impact transport choices and the RTC's ability to serve residents and visitors if temperatures rise above this level.

BICYCLING IN SOUTHERN NEVADA



BIKE ROUTE

Designated by signs along the roadway, indicates a preferred route for bicycle use. Bicycle routes are designated on roadways that have a wide curb lane of at least 14 feet or greater between the lane line and the lip of the curb, plus a 1.5-foot wide gutter pan.

BIKE LANE

A clearly defined portion of the roadway complete with striping, signing, and pavement markings for the use of bicyclists. The width of the bicycle lane is set at a four-foot minimum from the bicycle lane strip to the edge of the pavement, plus a 1.5-foot wide gutter pan.

SHARED-USE PATH

A space physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way. Pedestrians, skaters, wheelchair users, joggers, and other non-motorized users also may use the shared-use paths. The minimum width for a shared use path is 12 feet of paving for bidirectional travel, with a minimum two-foot shoulder on both sides of the path.

Biking is a low-cost, healthy, and environmentally friendly alternative mode of transportation. In addition, Southern Nevada's favorable climate (with the exception of hot summer months and brief colder temperatures during the winter), low rainfall and humidity make it an ideal environment for cyclists. Historically, however, biking represents 0.4% of trips to work taken in Southern Nevada. The low numbers may be explained by the obstacles to biking in the Southern Nevada are road safety, bike facilities, and their connectivity. Between 2005 and 2013, there were 15 bike fatalities in Southern Nevada per 10,000 bike commuters, above the national average for the fifty most populous cities. In 2008 there were 82 miles of bike routes, 192 miles of bike lanes and 107 miles of shared use paths throughout Southern Nevada; this number has grown to 85 miles of bike routes, 389 miles of bike lanes, and 403 miles of shared use paths.

RTC and local governments have worked hard to improve conditions for cyclists to encourage biking. One of the primary ways has been through engagement with the League of American Bicyclists, a nonprofit organization that works to create bicycle-friendly communities by advocating and promoting best practices. These are centered upon five core areas (the 5 E's):

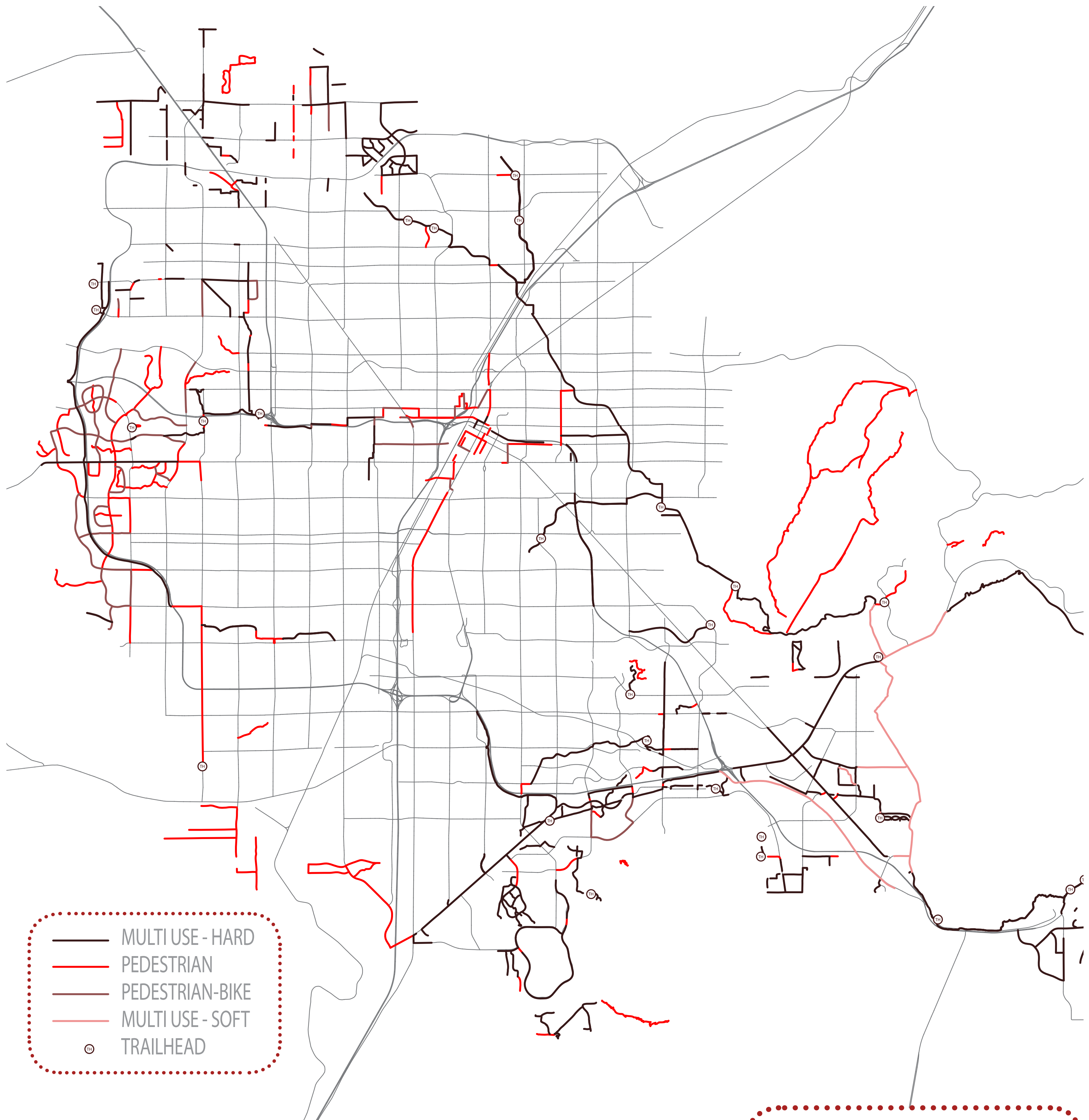
- Engineering: Creating safe and convenient places to ride
- Education: Giving people of all ages and abilities the skills and confidence to ride
- Encouragement: Creating a strong bike culture that welcomes and celebrates bicycling
- Enforcement: Ensuing safe roads for all users
- Evaluation and Planning: Planning for bicycling as a safe and viable transportation option.

The League's Bicycle Friendly Community program provides communities a roadmap to improve conditions for bicycling around the 5 E's, as well as a tiered rating system. In Southern Nevada, the Cities of Las Vegas and Mesquite attained a Bronze Bicycle Friendly Community rating, while the City of Henderson attained a Silver Bicycle Friendly Community rating. The ratings were a result of the expansion of the bike network through the use of different types of bike lanes (especially green bike lanes, like those present in Downtown Las Vegas), development of advocacy organizations like Southern Nevada Bicycle Coalition and Outside Las Vegas Foundation, and advisory boards like the Henderson Bicycle Advisory Committee, events and rides including the Las Vegas Century Ride and the Henderson Stroll and Roll, the RTC's introduction of a bike share program, b-Cycle, in Downtown Las Vegas in 2016, and the efforts of enforcement agencies like the Las Vegas Metropolitan Police Department, Henderson Police Department, and Nevada Highway Patrol to promote bike safety and the "Three Foot" car-bike distance separation law.

The League recommended a number of additional steps Southern Nevada entities can be taken to increase safety, to encourage a greater share of Southern Nevadans to bicycle.

- Continue to expand the bike network and increase connectivity, especially in areas around the Las Vegas Strip, where there are few bike facilities.
- Develop a design manual that meets current nationally recognized street and bicycle facility standards.
- Encourage more business to apply to be certified as Bicycle Friendly Businesses – as of 2015, there are only seven organizations, including the City of Las Vegas, SNWA, RTC, Cashman Equipment, the Bike Shop, Molasky Corporate Center, and Las Vegas Cyclery.
- Ensure smooth transitions for bicyclists between the local and regional trail network, and the street network.
- Make it a priority to collaborate with large employers (gaming/resort properties) in providing additional safe, accessible routes and facilities for the large population of service workers who often rely on a bike for their commute to work. On-street improvements coupled with the expansion of the off-street system will encourage more people to cycle and will improve safety.
- Make the Southern Nevada more of a destination for bicycle event organizers by reducing the costs of organizing events and streamlining the permit process.
- Work to make both motorists and cyclists aware of their rights and responsibilities on the road. Continue to expand your public education campaign promoting the share the road message.
- Further promote cycling throughout the year by offering or supporting more family-oriented community and charity rides, free bike valet parking at events, and additional bicycle-themed festivals, parades or shows.
- Ensure that police officers are initially and repeatedly educated on traffic law as it applies to bicyclists and motorists.
- Encourage local institutions of higher education to promote cycling to students, staff, and faculty and to seek recognition through the Bicycle Friendly University program.

PEDESTRIANS AND WALKABILITY IN SOUTHERN NEVADA



Walkable communities are designed around the pedestrian which helps improve resource use, safety, and physical fitness. Walkability as a mode, however, has been in decline; in 1977, 9.3 % of all trips in the U.S. were made by walking and by 1995, this number had declined to 5.5% of all trips. Streets in Southern Nevada have proven to be hazardous to pedestrians, given the dramatic increase of pedestrian fatalities (35 bike/ped fatalities in 2010, rising to 53 in 2013), and uncomfortable and disconnected built environment that creates a deterrent to the use of roadways for anything other than auto travel.

A walkable community allows residents to socialize and access community amenities needed to conduct daily activities within a 10-minute walking distance. Southern Nevada has worked to create communities that are conducive to walking which has resulted in the expansion of pedestrian facilities spread throughout Southern Nevada consisting of hundreds of miles of new paths, trails, and pedestrian oriented areas. Notable examples include the Las Vegas Wash Trail from North Las Vegas to Clark County Wetlands and Lake Las Vegas, Henderson's Amargosa and McCullough Hills Trails, Summerlin's trail network, and the 34 mile River Mountain Loop Trail linking Henderson, Boulder City, and Lake Mead.

WALKABILITY INDICATORS

Connectivity: How easily residents can walk within their neighborhood to community assets. The amount of accessible paths available for all ages and abilities determines the level of connectivity.

Safety: The provision of a route between walking points is safe to avoid the risk of physical harm. The amount of separation between pedestrians and vehicular traffic determines safety.

Comfort: Physical and aesthetic accommodations make walking an enjoyable experience. The amount of trees and shade are key components in creating comfortable walkways.

39 - LAS VEGAS WALK SCORE

Walking has many benefits for how we live our lives and for the sustainability of the environment around us. Several factors change the way we perceive walking and how easy it might be for us to change our behavior. Some of these include:

HEALTH:
The average resident of a walkable neighborhood weighs 6-10 pounds less than someone who lives in a sprawling neighborhood.

ENVIRONMENT:
82% of carbon emissions are from burning fossil fuels; walking generates no emissions.

FINANCES:
Cars are the second largest household expense in United States. One point of a walk score is worth up to $3,000 of value for your property.

COMMUNITIES:
Studies show that for every 10 minutes a person spends in a daily car commute, time spent on community activities falls by 10%.

Source: Walkable Neighborhoods - www.walkscore.com

COMPLETE STREETS

Complete Streets are roadways designed to maximize public right-of-ways to accommodate all users and modes of transportation including pedestrians, public transportation, bicycles, and automobiles. The integration of an attractive pedestrian environment, bicycle lanes and a connected transportation network help to make Complete Streets an integral part of any truly walkable community. RTC and local jurisdictions have studied and adopted Complete Street standards and are funding more to make them safer for all users.

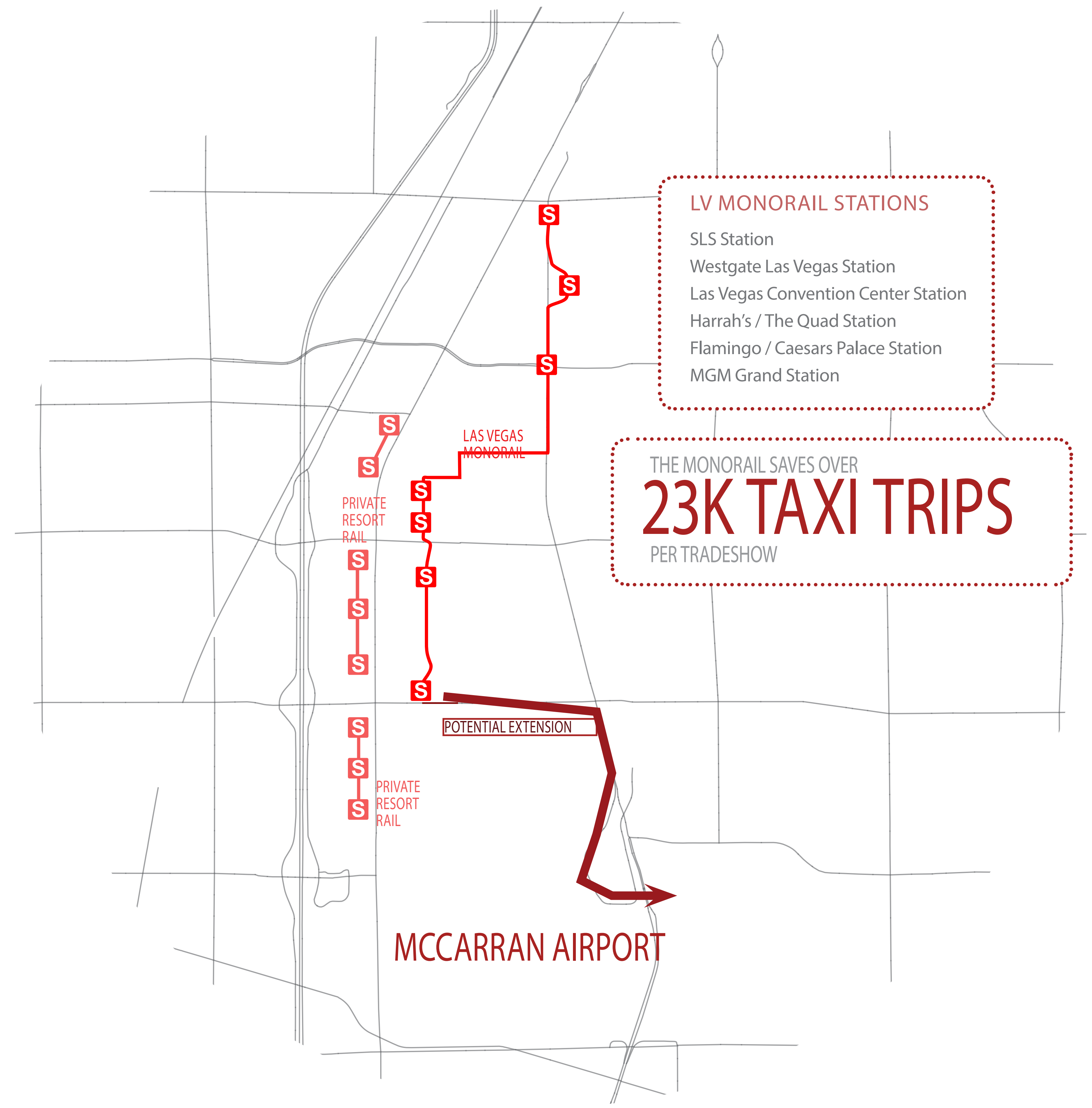
LIGHT RAIL AND MONORAIL

Rail based public transportation, such as streetcars, light rail, and monorail, has been frequently studied and contemplated by Southern Nevada officials. Several light rail proposals, including one along US 95, another along North 5th Street, Frank Sinatra Drive, and Henderson's Union Pacific rail corridor did not garner public support, let alone consideration of public funding for a high cost investment. Lower cost Bus Rapid Transit, which operates in mixed flows with vehicles, has been implemented, but the project has not yet generated significant transit oriented development despite providing additional capacity. The privately owned Las Vegas monorail was constructed in 2004, but its low impact on the overall local mobility put into question other rail proposals.

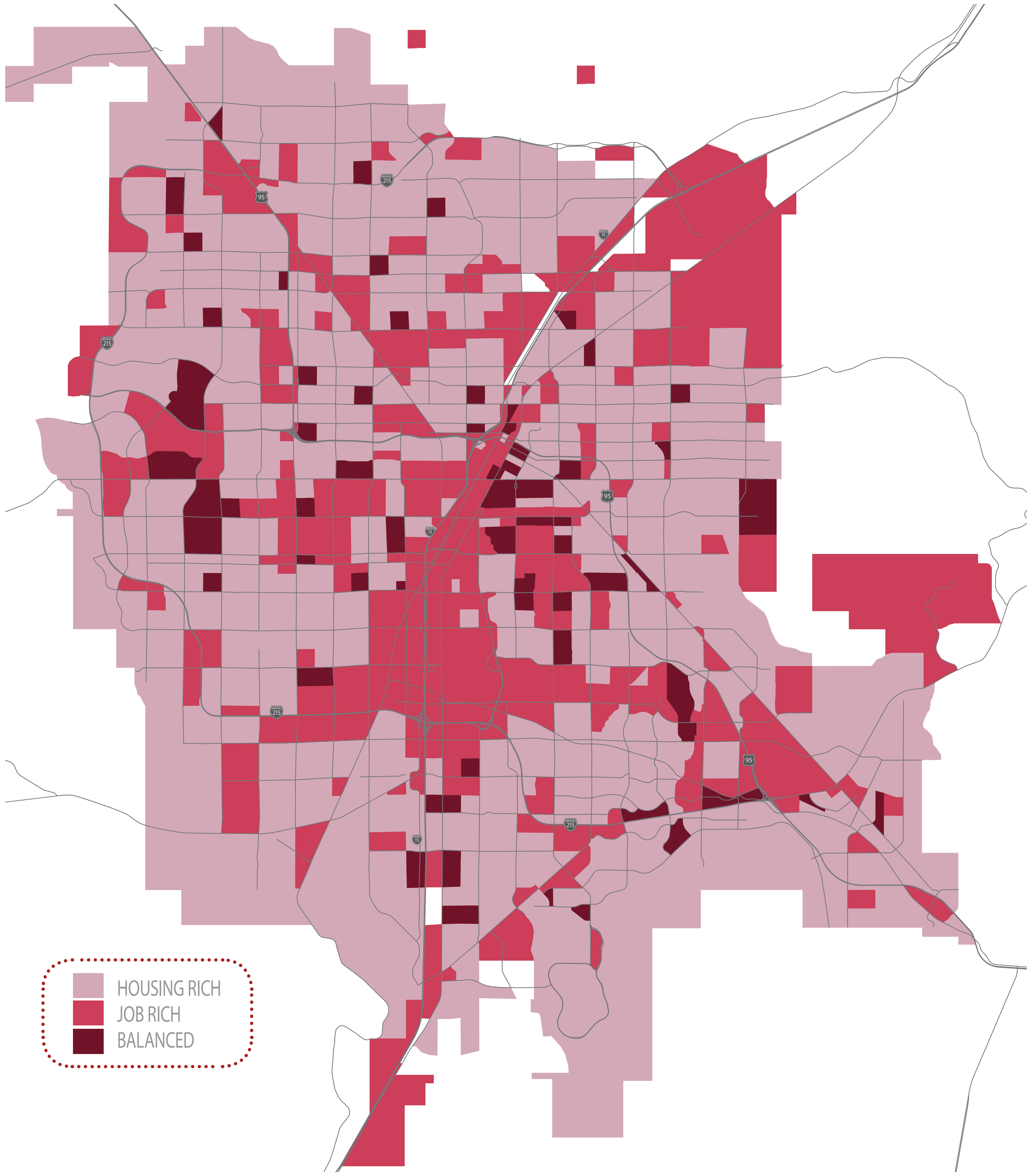
The four mile Las Vegas Monorail, extending from the MGM Grand to the SLS Hotel and Casino along the east side of the Las Vegas Strip, includes 7 stations and serves 8 major resorts, linking more than 25,000 hotel rooms and approximately 4.4 million square feet of meeting and convention space, including the Las Vegas Convention Center and operates every 5 minutes during peak hours. Since its opening, the Las Vegas Monorail has carried over 60 million riders, roughly averaging 32,000 riders per day. The monorail carries an average of 67,000 passengers during conventions, equivalent to 22,300 taxi trips or 1,200 bus trips per show. In 2013, the monorail aided in the annual removal of an estimated 1.9 million vehicle miles from roadways around the Resort Corridor. The monorail's electric trains reduce emissions by more than 24 tons of carbon monoxide, volatile organic compounds and nitrogen oxides annually. Its location, east of the Strip, was chosen to avoid negative impact on the Las Vegas skyline. However, the corridor choice makes it very challenging for passengers to access.

Despite questions of profitability, cost of fare, location, and opposition from city taxi companies and unions, discussion of monorail expansion has frequently arisen during its decade of operation. An initial two mile extension to Downtown Las Vegas was planned to begin construction in 2005, with service to beginning in 2008 with stations at the Stratosphere Hotel, Arts District, a Downtown Intermodal Terminal, and at Fremont Street Experience. System malfunctions and low revenue prompted the Federal government to withdraw support for a publicly funded option. Other extensions have been proposed, including one along the west side of the Strip, a circuitous extension along Harmon Avenue to UNLV, and an extension McCarran airport. This extension has received the most support and is still under consideration because of the proposal's linkage to move passengers from the airport to hotels and the convention center. A new proposal made within the RTC's 2015 Transportation Investment Business Plan would extend the monorail south from the MGM and link the Mandalay Bay Convention Center. With a station at the Sands Expo Center, the monorail could potentially link more than 7 million square feet of convention space.

The Transportation Investment Business Plan also proposes light rail along the Las Vegas Strip and Maryland Parkway with connections to McCarran International Airport, Downtown Las Vegas, Cashman Center, UNLV, and the Las Vegas Medical District.. These systems have been constructed and operate successfully in many cities across the west, including Los Angeles, Portland, Seattle, Sacramento, San Diego, Phoenix, Denver, and Salt Lake City. Light rail has proven to successfully address roadway capacity constraints in these cities, and can attract more riders than bus transit and can generate additional investment through transit oriented development. Light rail can be operated on the street, be elevated, or put underground and can handle frequency, capacity, and demand for both corridors and provides both residents and visitors additional modal choices. Light rail is a long-term investment with a cost that could require several billion dollars and coordination and support of multiple stakeholders for its planning, design, construction, and operations. Investing in light rail and the monorail will become increasingly important as Las Vegas continues to evolve as new visitors come and new residents move to Southern Nevada in the coming decades.



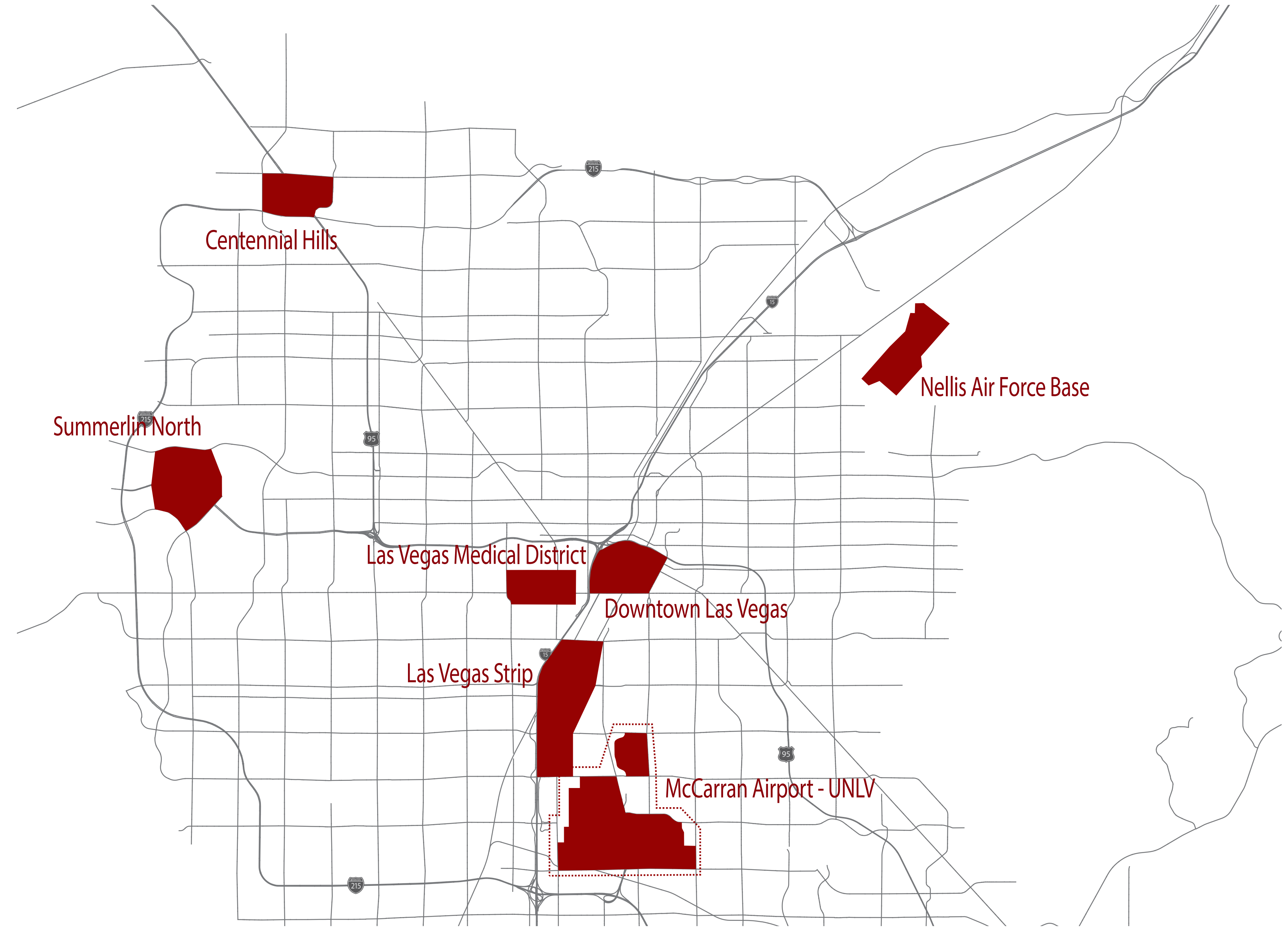
LINKING LAND USE WITH TRANSPORTATION: JOBS AND HOUSING IN SOUTHERN NEVADA



Southern Nevada's development pattern has occurred due to traditional auto-oriented Euclidean zoning codes in place by the County and cities, and transportation investments made over time. Because Las Vegas is a relatively new city, its historic urban footprint – Downtown Las Vegas, with a walkable grid system – is relatively small. The automobile was the only mode of transportation that influenced development patterns outside of Downtown throughout the latter half of the 20th century. Construction of Interstates 15 and 515, US 95 in the 1970's-1990's, and the Interstate 215 Beltway in the 2000's heavily influenced auto-oriented development, explains the relative lack of mixed-use development, and has been a large determinant of job and housing locations and work and home choice today.

The relationship between jobs and housing is critical to city planning and sustainability because it influences, where people choose to live, where businesses locate, and how people travel. A ratio known as the "jobs-housing balance" is an indicator for where people live relative to work, measuring the number of jobs per resident employee and is key when considering movement, land use, and environmental impact. A low value indicates a housing-rich area while a high value indicates a job-rich area. Ideally, if there is an adequate number of homes near employment centers, more people will choose to live close to where they work, thus minimizing personal transportation costs, congestion, time, and the environment. The jobs-housing balance can also be affected by the cost of housing, making it difficult for some people to live close to work and similarly impact and influence commuting patterns.

Southern Nevada has relatively few concentrated areas with a jobs-housing balance; most parts are either jobs rich, such as the Las Vegas Strip, Nellis Air Force Base, and around McCarran Airport and UNLV, or housing rich, such as the suburbs surrounding the core.

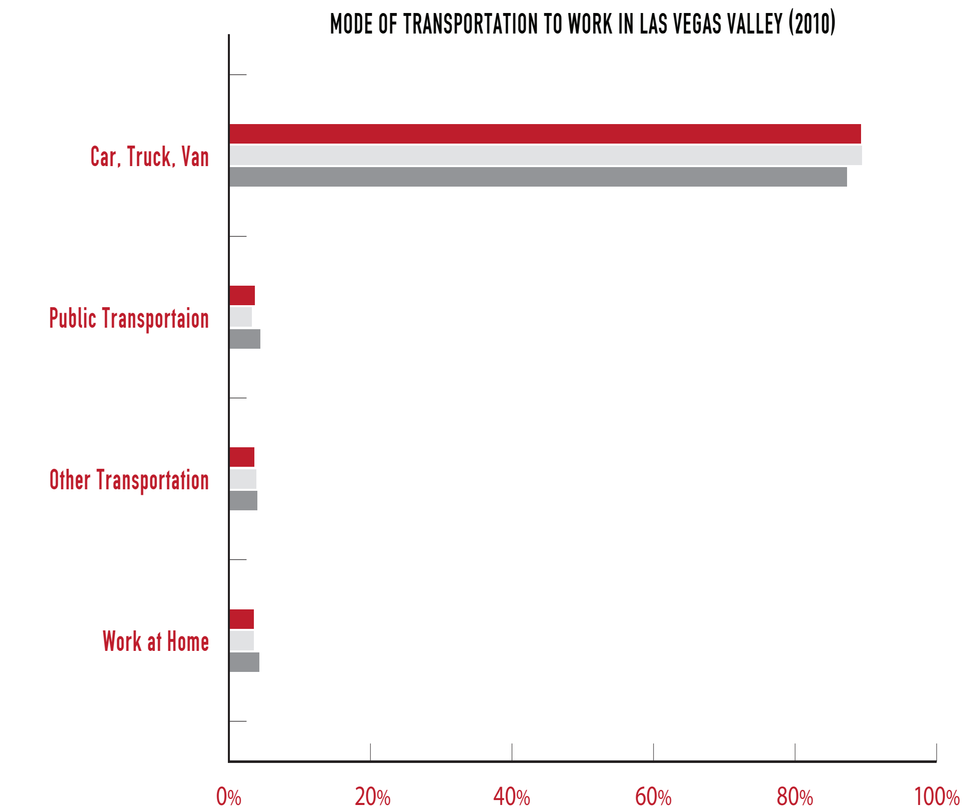


LARGEST EMPLOYERS IN LAS VEGAS VALLEY

Clark County School District	30,000+
Nellis Air Force Base	10,000+
Clark County Government	9,000+
Bellagio Hotel & Casino	8,000+
MGM Grand Hotel & Casino	7,000+
Mandalay Bay Resort & Casino	7,000+
Mirage Hotel & Casino	5,000+
State of Nevada	5,000+
Caesars Palace Hotel & Casino	4,000+
Las Vegas Metropolitan Police	4,000+
University of Nevada, Las Vegas	4,000+

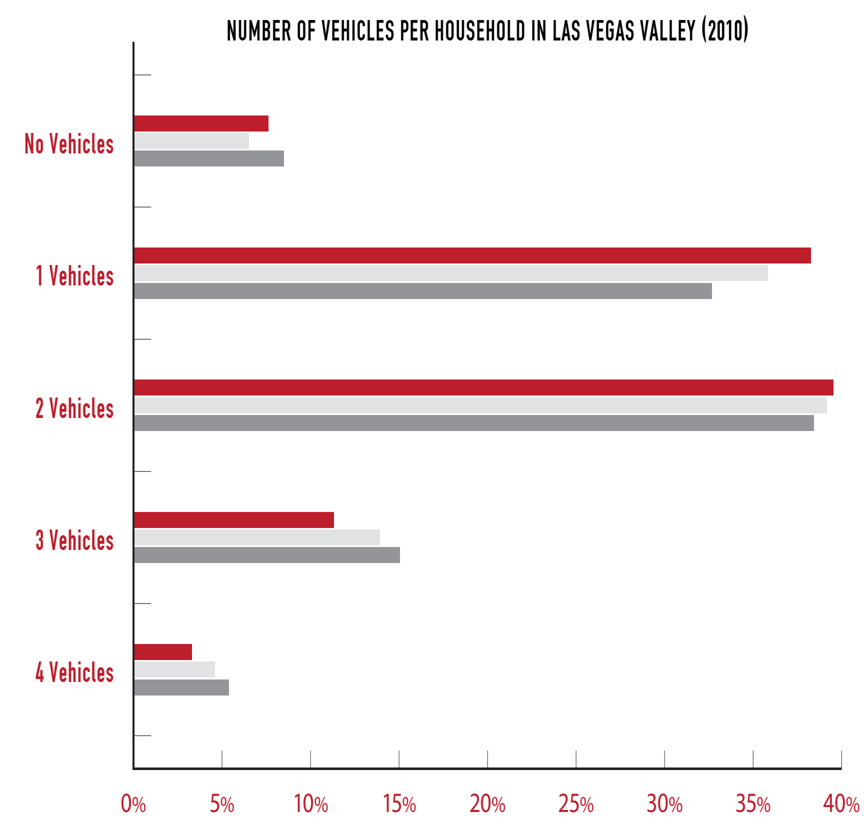
- Gaming, tourism, and the service industry have historically been the principal drivers of employment and account for half of the total Las Vegas Metropolitan Statistical Area employment. 57% of Southern Nevada's economy consists of hotel/gaming and recreation services with more than more than 26% of the workforce employed in this sector, most of which are concentrated along the Strip and in Downtown Las Vegas.
- The construction industry, has grown alongside the gaming industry and saw employment gains of 85% from 1990-2000. Despite a dip in activity during the recession, the construction industry still makes up 10% of the total workforce. While major construction of gaming properties occurs on the Strip, housing and strip-retail construction is dispersed and located around the core in suburban areas such as Summerlin and Centennial Hills.
- Another historic influence has been the military and Federal, State, and local government. Nellis Air Force Base (as well as Creech Air Force Base northwest of Las Vegas in Indian Springs) and the Department of Defense have been consistent employers throughout the history of Las Vegas; employment is concentrated in the northeast part of the Valley. Government employees, such as State, County, police, and university employees tend to be concentrated in Downtown Las Vegas or at UNLV, whereas Clark County School District teachers are dispersed throughout the community.
- As the city has grown, Southern Nevada has worked to diversify its economy. Focused incentives and government backed development strategies, in addition to location, climatic, labor force, economic, and tax conditions, have lead to growth in light manufacturing, information technologies, renewable energy, health care, and logistics. Employment in the manufacturing sector continues to grow and doubled in the last decade of the 20th century, compared with zero to negative growth nationally. Manufacturing and industrial areas south of the Strip, near McCarran Airport, and along the I-215 Beltway have grown in footprint over the last two decades. Similarly, a new UNLV medical school located in the Medical District near University Medical Center will continue to fuel employment in this area.

SOUTHERN NEVADA MODAL SHARE



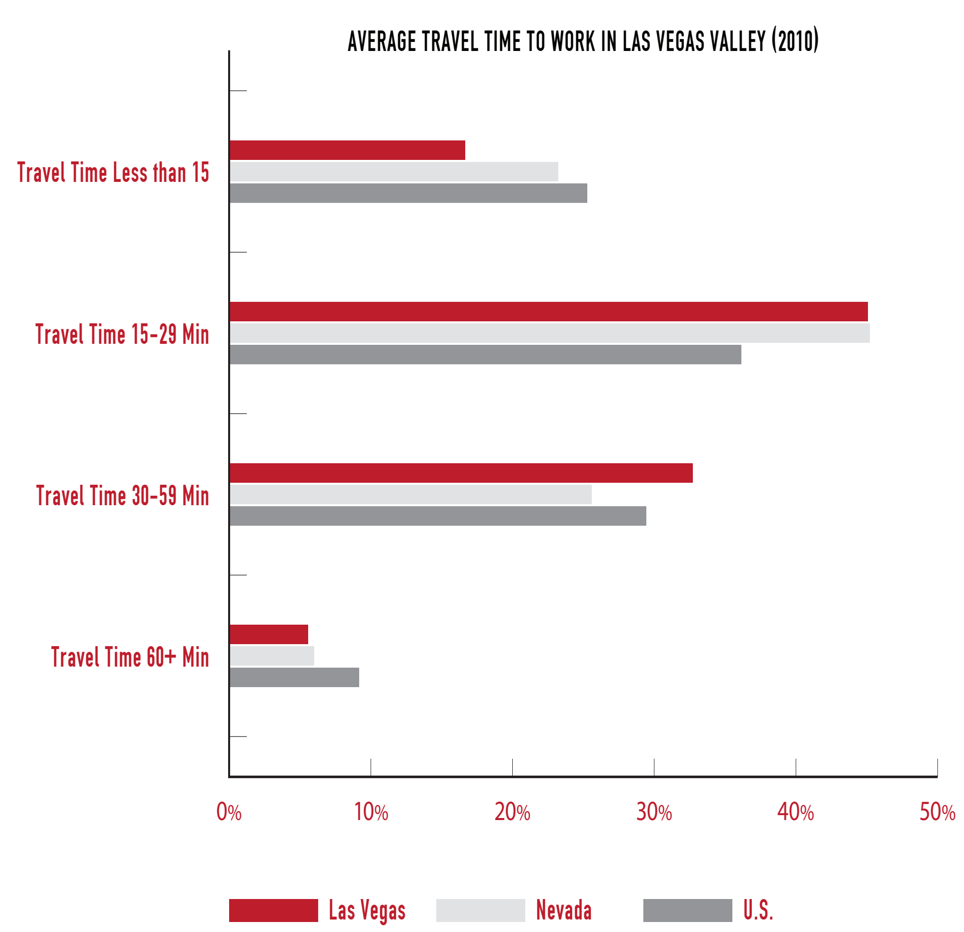
MODE OF TRANSPORT TO WORK

Like most cities in the United States, Southern Nevada residents use personal vehicles as the primary mode of choice to commute to work. Nearly 90% of people drive a car or truck compared to 87.3% nationally – 78.1% drive alone, while 11.4% carpool. Approximately 4.0% take public transportation compared to 4.5% across the United States. Lower income residents (that are less likely to own a vehicle) and those living within the urban core are more likely to take public transportation. For example, in the Downtown zip code 89101, 16.8% of people take public transportation and 12.2% use it in West Las Vegas. Transit use is also higher along the Strip at 12.6%. Approximately 2% of commuters bike or walk.



VEHICLES PER HOUSEHOLD

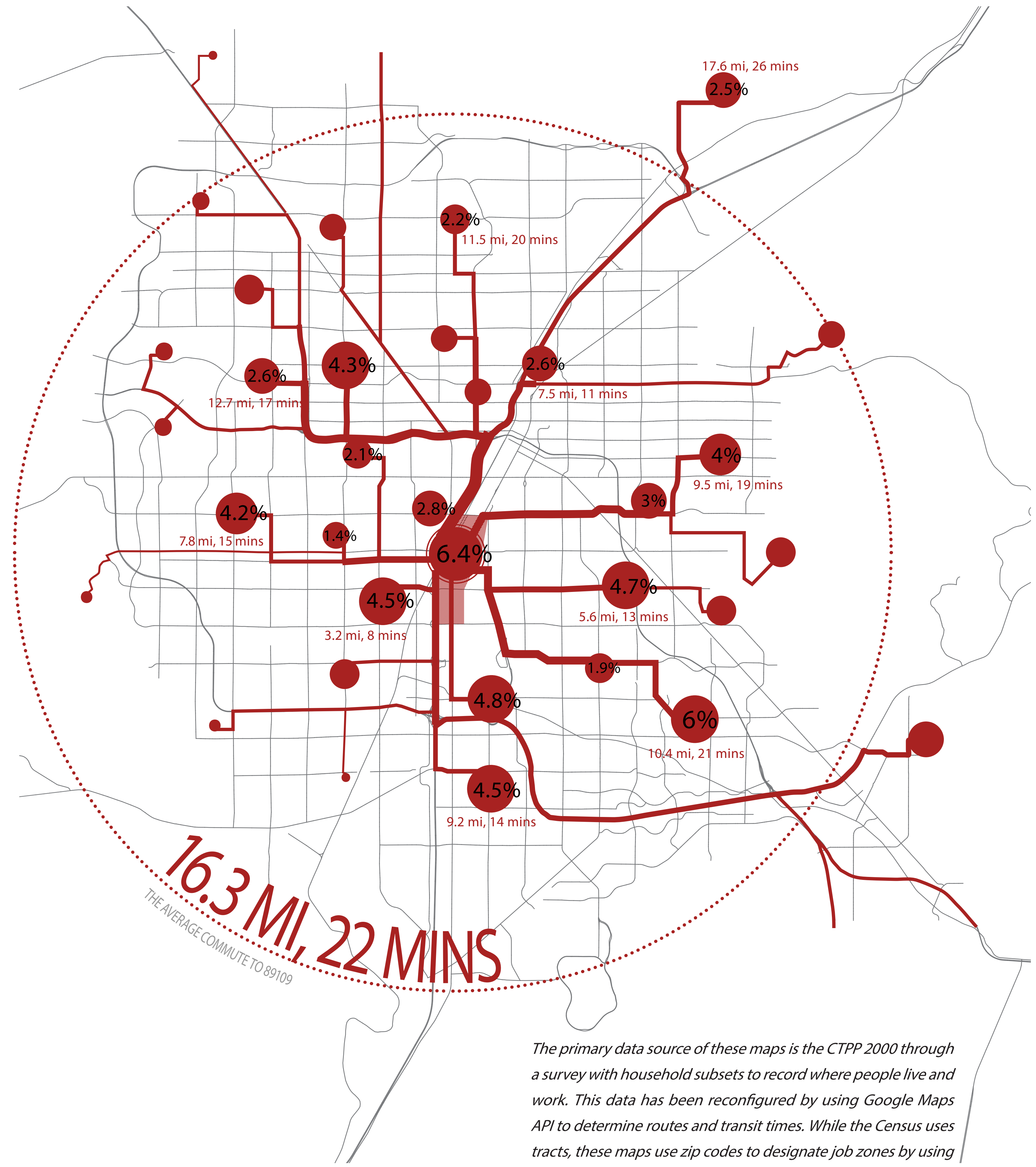
Vehicle ownership data helps explain how people travel and whether or not they have sufficient public transportation options should they not have access to a vehicle. Nationally, people own 2.28 vehicles per household. Southern Nevada has lower vehicle ownership rates, owning approximately 2 per household. The number of Southern Nevada households with 1 vehicle is nearly 39% compared to 32% nationally. Owning no vehicles in Southern Nevada is similar with State and national trends, however, the number of households (7.6%, or 18,509 households) is actually slightly lower than the national average of 8.5%.



TRAVEL TIMES TO WORK

Southern Nevada does have higher residential densities and is a well connected city in terms of roadway infrastructure than other cities in the American West. While only 16% of people live within 15 minute travel time range of their place of employment (compared to 25% nationally), nearly half of the city's residents live within a 30-minute travel window, compared to only 36% of people nationwide. These numbers are relative to the strength of the city's jobs-housing balance. 86% of residents live within 3/4 mile of transit stops compared to a national average of 69%., while 98% of low-income residents live nearby. A greater modal share may not exist given Southern Nevada's reliance on cars, the relative lack of rail options, commuter express bus routes, and travel time performance of bus-based public transit.

LAS VEGAS STRIP

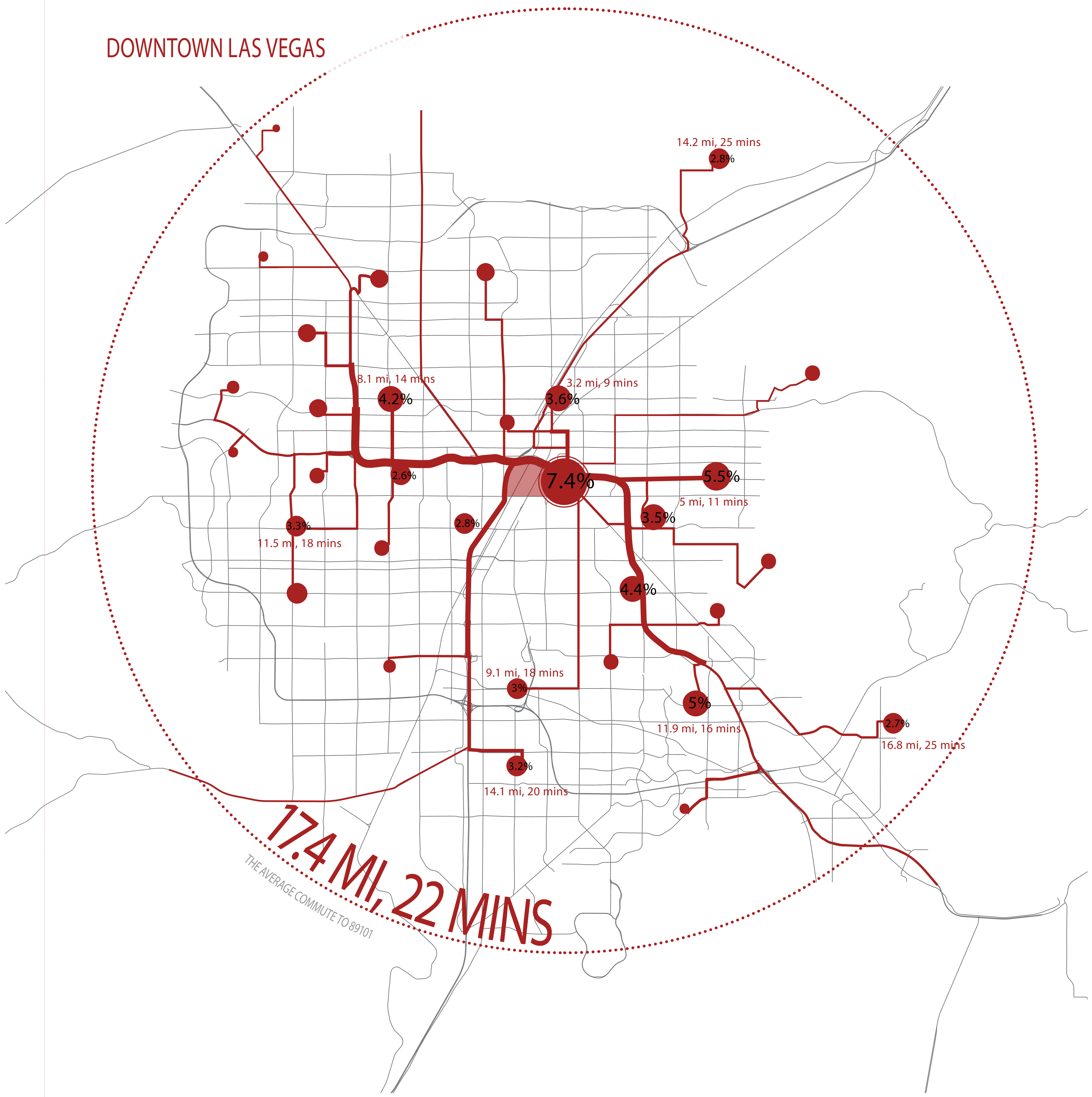


The primary data source of these maps is the CTPP 2000 through a survey with household subsets to record where people live and work. This data has been reconfigured by using Google Maps API to determine routes and transit times. While the Census uses tracts, these maps use zip codes to designate job zones by using Census Zip Code Tabulation Areas (ZCTAs) to determine the tracts that fall within each zip code.

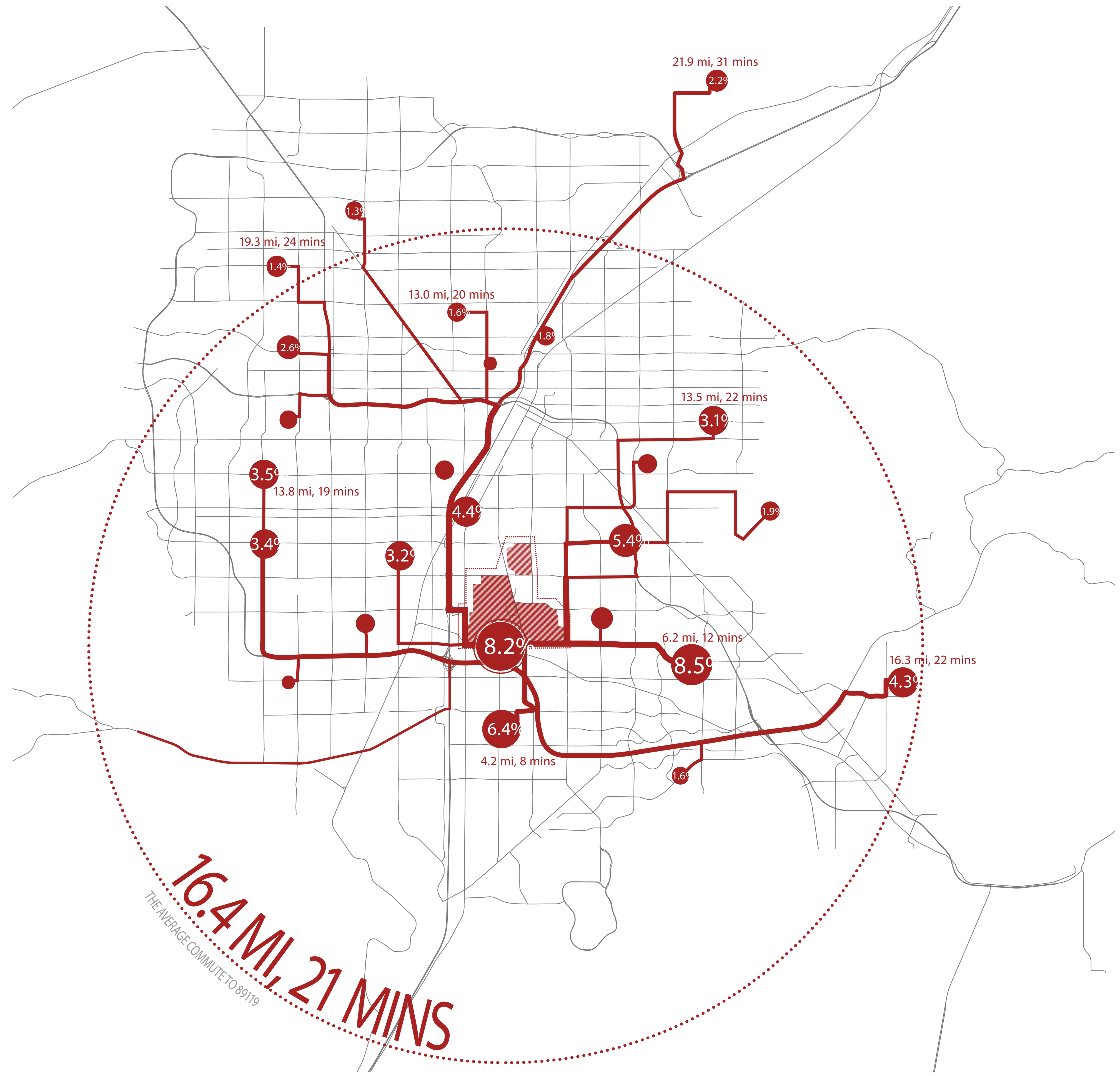
COMMUTING TO 89109

26% of the Las Vegas workforce is employed in the hotel gaming and recreation sector, the majority of which is located along or immediately around the Las Vegas Strip. Only 7% of the people who work within the Strip zip code also live in this area; however, the majority of workers that commute to 89109 for work can do so within 20 minutes, which is less than the average commute time for all workers in Southern Nevada (between 22-30 minutes when adjusted for peak travel). When combined with other local commutes and visitor traffic makes access can be challenging. The city's road infrastructure allows multiple points of automobile access and is a convergence point for both crosstown local bus routes, Bus Rapid Transit routes, and commuter express routes from Centennial Hills and Summerlin.. Because there is no dedicated bicycle facilities near the Strip or approaching it, commuting by bike is not a convenient (or safe) option.

DOWNTOWN LAS VEGAS



MCCARRAN AIRPORT



COMMUTE TO 89101

Downtown Las Vegas, with its casinos, entertainment, and presence of government facilities, has always been the historic job hub. While only 8% of people who work in Downtown also live in or near Downtown, its redevelopment and the addition of more housing options, have contributed to increase employment and residential growth. For those that commute to Downtown, its central location and proximity to the interstates and major secondary roadways permit people to make relatively quick commutes to the Downtown zip code 89101. It is also the central hub of RTC Transit, serving most local routes, bus rapid transit, and express routes. A network of bike lanes have been developed by the City of Las Vegas and Downtown's dense street grid make it one of prime locations for biking and walking, offering both commuters and residents alternative options to get to work.

COMMUTE TO 89119 & 89154

McCarran Airport and UNLV's zip codes (89119 and 89154) were combined given their geographical proximity and shared access points. Only 8% of people that work at these locations live near them. Like other job zones, commuters that work at the airport, work at or attend the University, or work in nearby industrial complexes arrive by car, often making use of the Airport Connector tunnel, Las Vegas Beltway, and Interstate 15. While both UNLV and RTC area served by RTC express routes, and the area is served by the South Strip Transfer Terminal and park and ride, no express routes directly connect to either location from Henderson. Both are difficult to reach by bicycle or on foot.

ENERGY

- THE ELECTRICAL GRID
- GENERATION
- TRANSMISSION
- INFRASTRUCTURE

- SOURCES
- PORTFOLIO

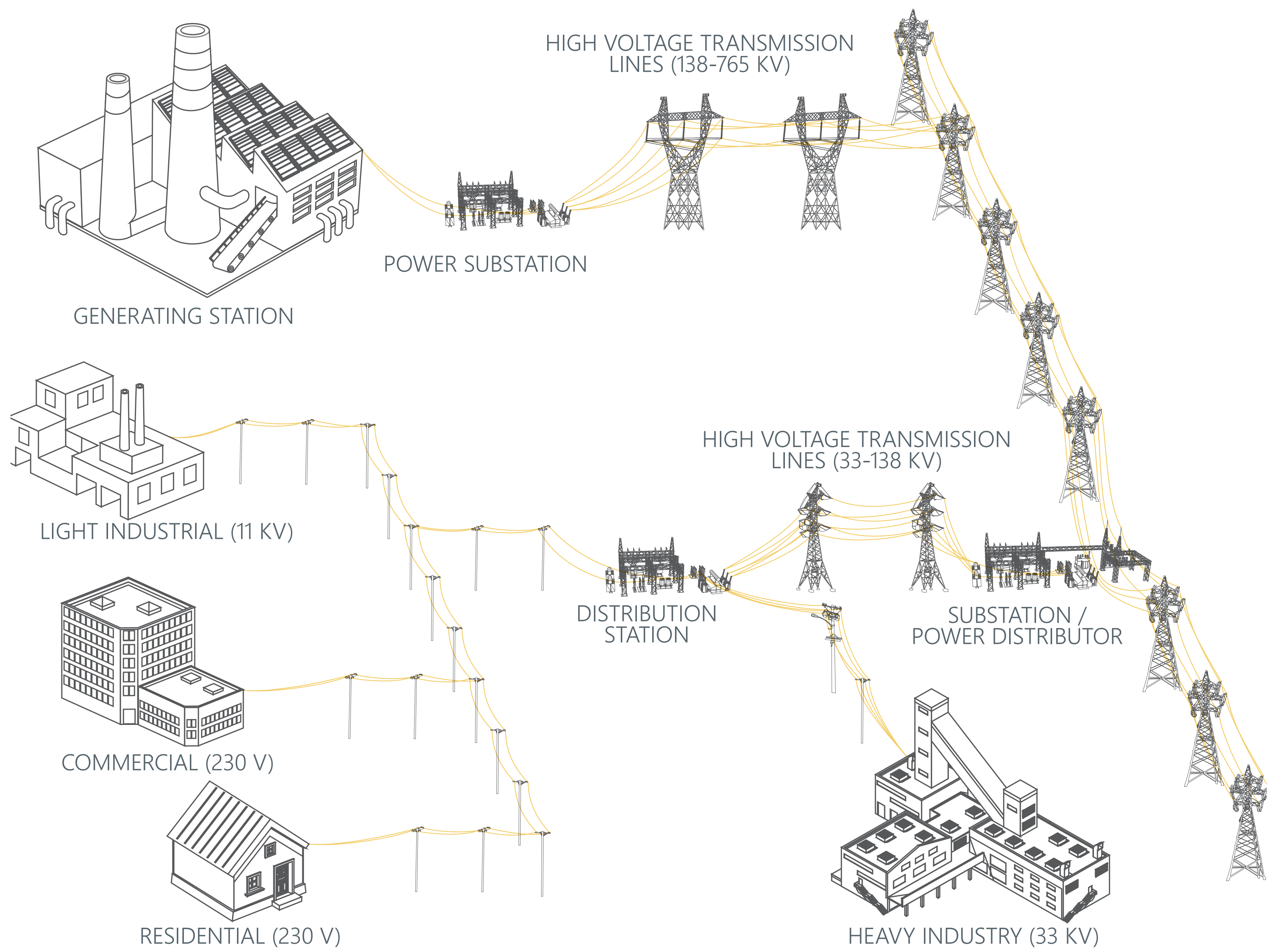
- DEMAND
- USE SECTORS

Nationwide, a substantial amount of energy is used for buildings and electrical devices within them. The same is true in Southern Nevada. The region's buildings, however, also pose a significantly heavy load on the electrical system due to the need for cooling during the summer months

Ideally, an electrical grid will be balanced where the system size and capacity are optimized, along with a balance of 'flow' between supply and demand. Chronic and/or sharp changes in this balance and size can cause problems in grid operations. In climate change scenarios with temperature increases, the Western Grid could have operational issues during times of high demand.

The energy landscape is dynamic; policy shifts are moving the United States away from coal and natural gas toward cleaner and more renewable resources. These resources will alter changes in climate, population, and energy demand. This chapter provides a snapshot of trends in energy and their impact on Southern Nevada.

THE ELECTRICAL GRID



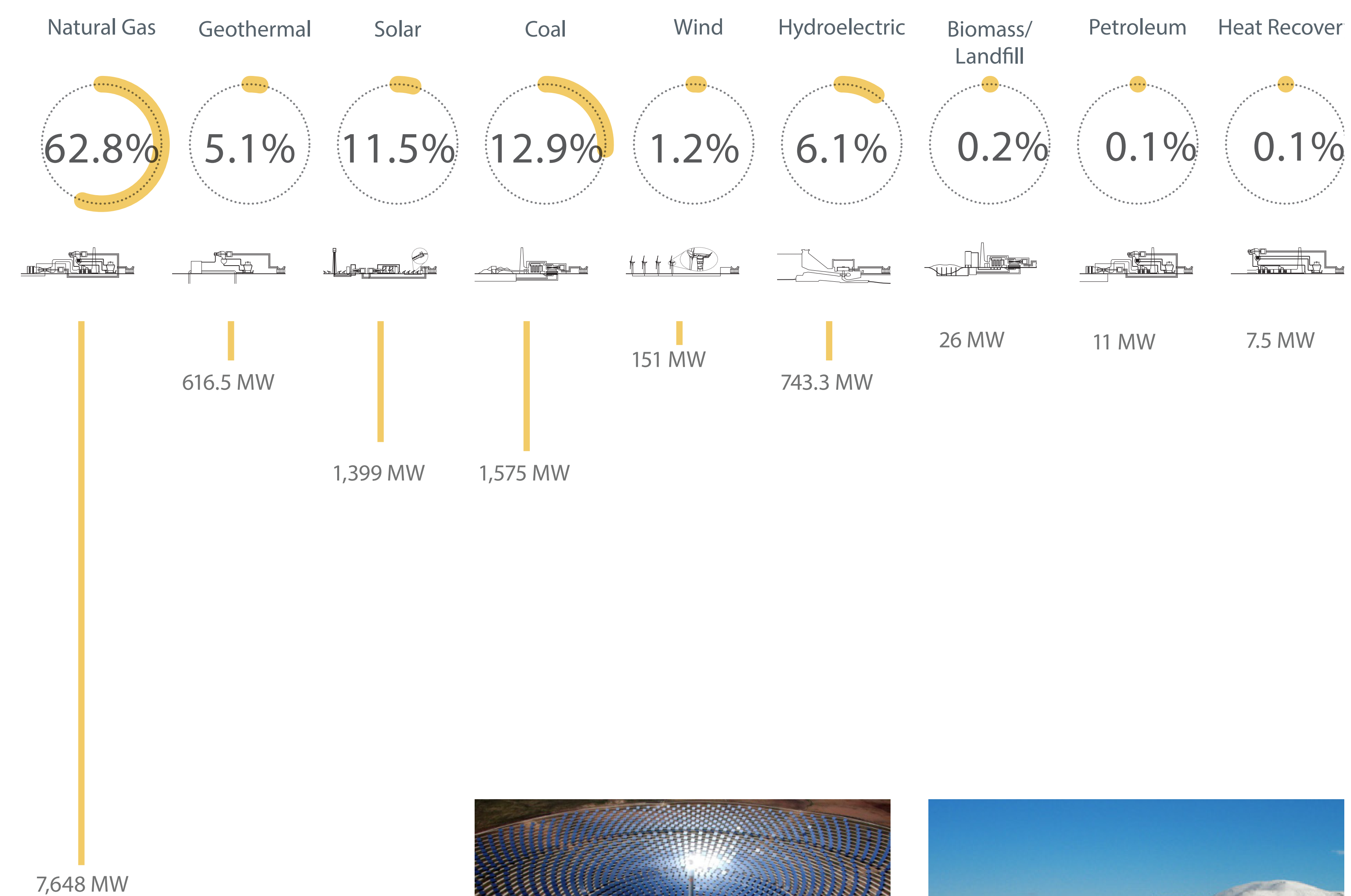
Southern Nevada is laregly served by the state's two primary investor owned utilities: NV Energy for electricity and Southwest Gas for heating. Much of NV Energy's electricity is generated at company owned power plants across the state or purchased from other generators and transmitted from the to the consumer. Natural gas, coal, hydroelectric, geothermal, solar heat concentrators, wind, biomass, petroleum and heat energy recovery are the primary resources used in power plants to make electricity. Heat or steam (created from using the fuels above) is driven through turbines to create force that turns a shaft; the generator produces a current using magnet and coils. The only exception to turbine electricity generation is photovoltaic panels. In these panels, sunlight is directly converted to electricity.

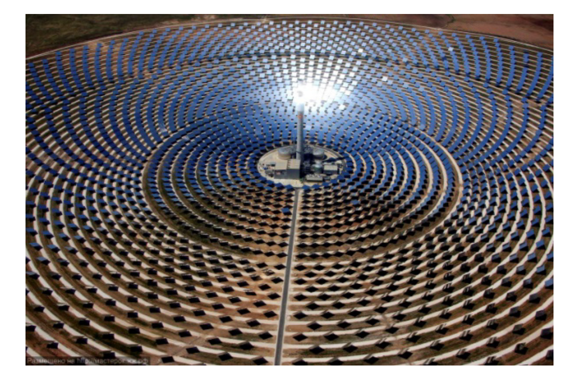
Transmission lines carry electricity from each power plant where it is produced. The grid of linked generating facilities and transmission lines must accommodate fluctuations in the daily use of electricity to ensure there is enough electricity to power everything connected to it. The flow of electricity cannot be controlled like a liquid or gas by opening or closing valves or switched like calls over a telephone line; electricity flows freely along all available paths from generators to loads and divides among all connected flow paths in the network to users that demand it.

Managers of the electric grid must balance power generation and demand continuously. A failure to match generation to demand causes the frequency of an alternating current (AC) power system (60 cycles per second or 60 Hertz) to increase when generation exceeds demand or decrease when generation is less than demand. The grid must be a stable system, operated so that it remains reliable even if an incident occurs, such as the loss of a key generator or transmission facility. Therefore, managers must monitor flows over transmission lines and prepare for contingencies to ensure that the grid's limits are not exceeded.

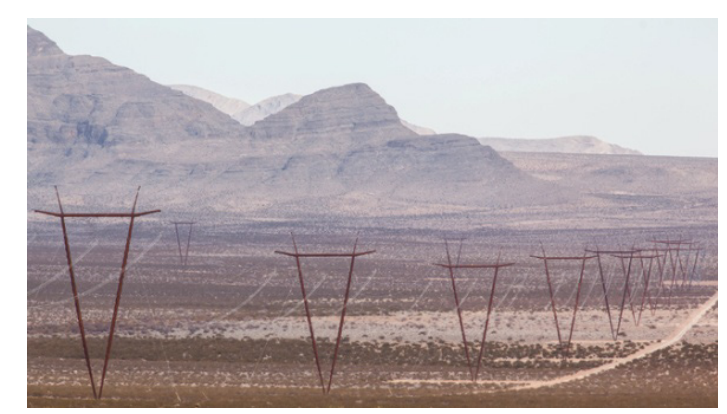
Should unplanned events impact grid performance and reliability, such as brownouts or blackouts, regulations are in place that require electricity providers to have actions to mitigate the impacts of a contingency.

NEVADA'S ENERGY SOURCES





There are more than 12 gigawatts of installed renewable and non-renewable energy sources in Nevada's portfolio. Nearly all (9,223 megawatts) comes from coal or natrual gas fired power plants. Nevada's installed capacity the majority serves users in Southern Nevada.



Energy moves across the grid so there is not a rigorously defined boundary as there are in other systems. As a result, energy sources can be located greater distances from urban areas. Many of Southern Nevada's non-renewable generation facilities are located outside of the metropolitan area in Apex, Moapa, or Primm.

Similarly, non-renewable energy sources can be transmitted across long distances; with certain exceptions, most must be located within close proximity to existing transmission and distribution facilities and be near the resource.

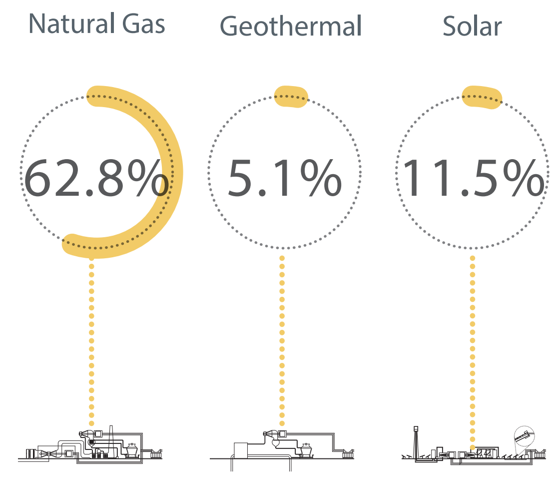
NATURAL GAS

Natural gas is the dominant resource for Nevada used for power generation and heating. Almost two-thirds of the supply of natural gas for the State of Nevada goes to electricity generation, while the residential sector consumes about a seventh of the supply of natural gas. Almost two in three Nevada homes use natural gas as their primary heating fuel.

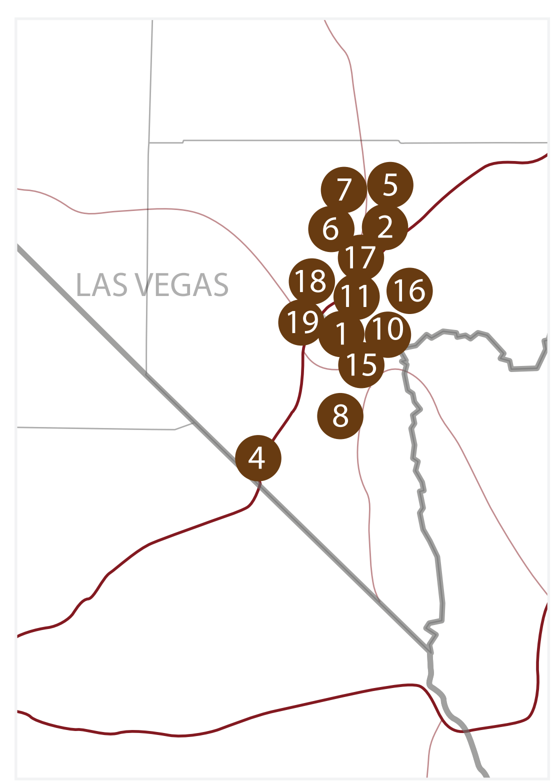
Natural gas production in the state of Nevada is relatively small; as a result, Southern Nevada relies on out of state supply. Unlike electricity, natural gas is relatively efficient to transport by pipeline, with about eighty percent of the total transmitted supply becoming useful energy. Much of this natural gas is piped from resource areas through Utah from the Green River Basin and Opal trading hub in Wyoming. About half of the natural gas flowing through this pipelines is supply for the state of California. Other supplies come to the Las Vegas Valley from the Permian Basin in Texas and the San Juan Basin in New Mexico by way of a pipeline traversing Arizona. California's San Joaquin Basin, and Utah's Uinta-Piceance Basin provide reserves. The Malin trading hub in Oregon and interstate pipelines in Idaho supply Reno and Northern Nevada for power generation.

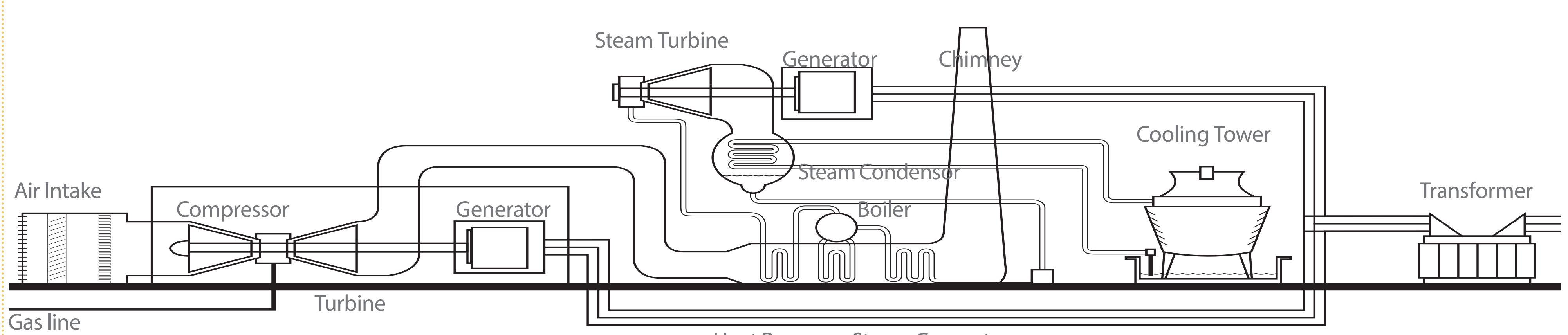
There are nineteen gas-fired power plants across the state of Nevada that provide electricity for use in the region. Natural gas is typically used as a "peaking" fuel at power plants that support power during "peak" load conditions. There are two high periods for natural gas in Southern Nevada per year: the summer period where the largest consumer is NV Energy for electricity production for cooling loads and the winter period for residential sector heating.

Generators for natural gas plants have a typical useful life of twenty-five years and are relatively easy to start and stop, making them better for peak load electric generation. With routine maintenance, a gas combustion turbine generator may have a life of up to sixty years. While several larger gas-fired plants in Nevada have aging generators that will likely be replaced or upgraded, use of natural gas and gas-fired generation will continue to grow as other resources, such as coal, are phased out of the portfolio in favor of this cleaner burning and accessible fuel source.

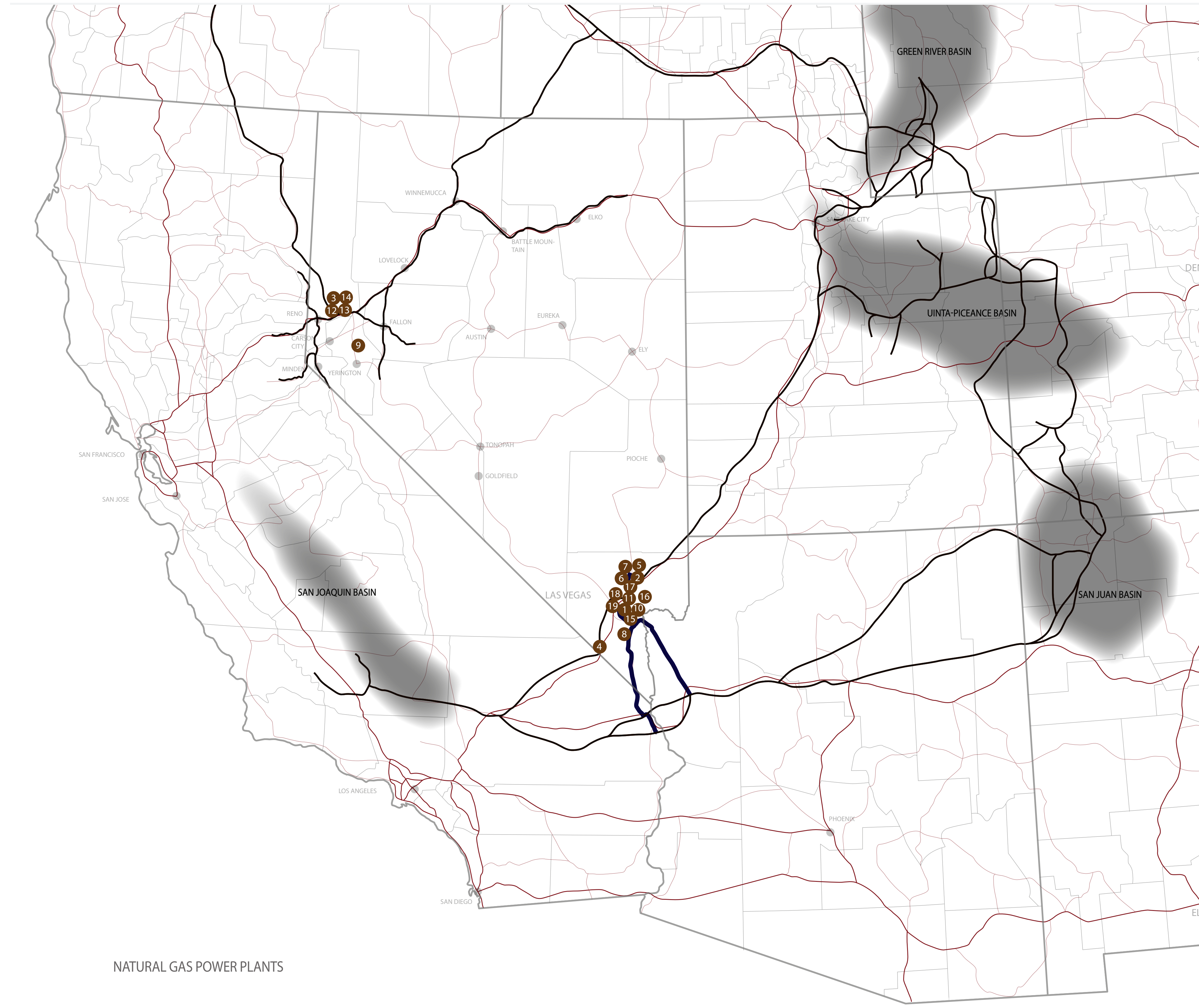


Southern Nevada Natrual Gas Plants





NEVADA NATURAL GAS GENERATION, TRANSMISSION, AND SUPPLY



NATURAL GAS POWER PLANTS

NATURAL GAS GENERATION UNITS AND CAPACITY

	NAMEPLATE CAPACITY	AGE (YEARS)
1. EDWARD W. CLARK	1,103 MW	60, 41 and 6
2. CHUCK LENZIE	1,102 MW	8
3a. FRANK A. TRACY	889 MW	51, 20 and 6
3b. TRACY COMBINED CYCLE PLANT	514 MW	6
4. HARRY ALLEN	628 MW	19
5. WALTER M. HIGGINS	530 MW	10
6. SILVERHAWK	390 MW	10
7. APEX	484 MW	3
8. DESERT STAR	490 MW	14
9. FORT CHURCHILL	226 MW	46 and 43
10. SUN PEAK	222 MW	14
11. LAS VEGAS COGENERATION II	230 MW	11
12.TRI CENTER NANIWA ENERGY	252 MW	13
13. CLARK MOUNTAIN	132 MW	20
14. WESTERN 102	118 MW	9
15. SAGUARO POWER	105 MW	23
16. PABCO GYPSUM BLACK MOUNTAIN	85 MW	22
17. GEORGIA PACIFIC GARNET VALLEY	89 MW	22
18. LAS VEGAS COGENERATION I	50 MW	20
19. CITYCENTER CENTRAL PLANT	8.5 MW	5

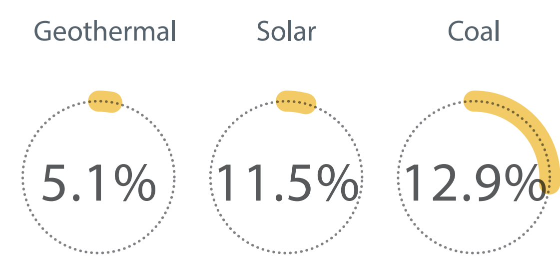
COAL

Nationwide, coal is the most common energy source for power. Coal-fired plants are typically 'base load' plants, meaning that they power our 'base load' or the common load condition throughout the day and night.

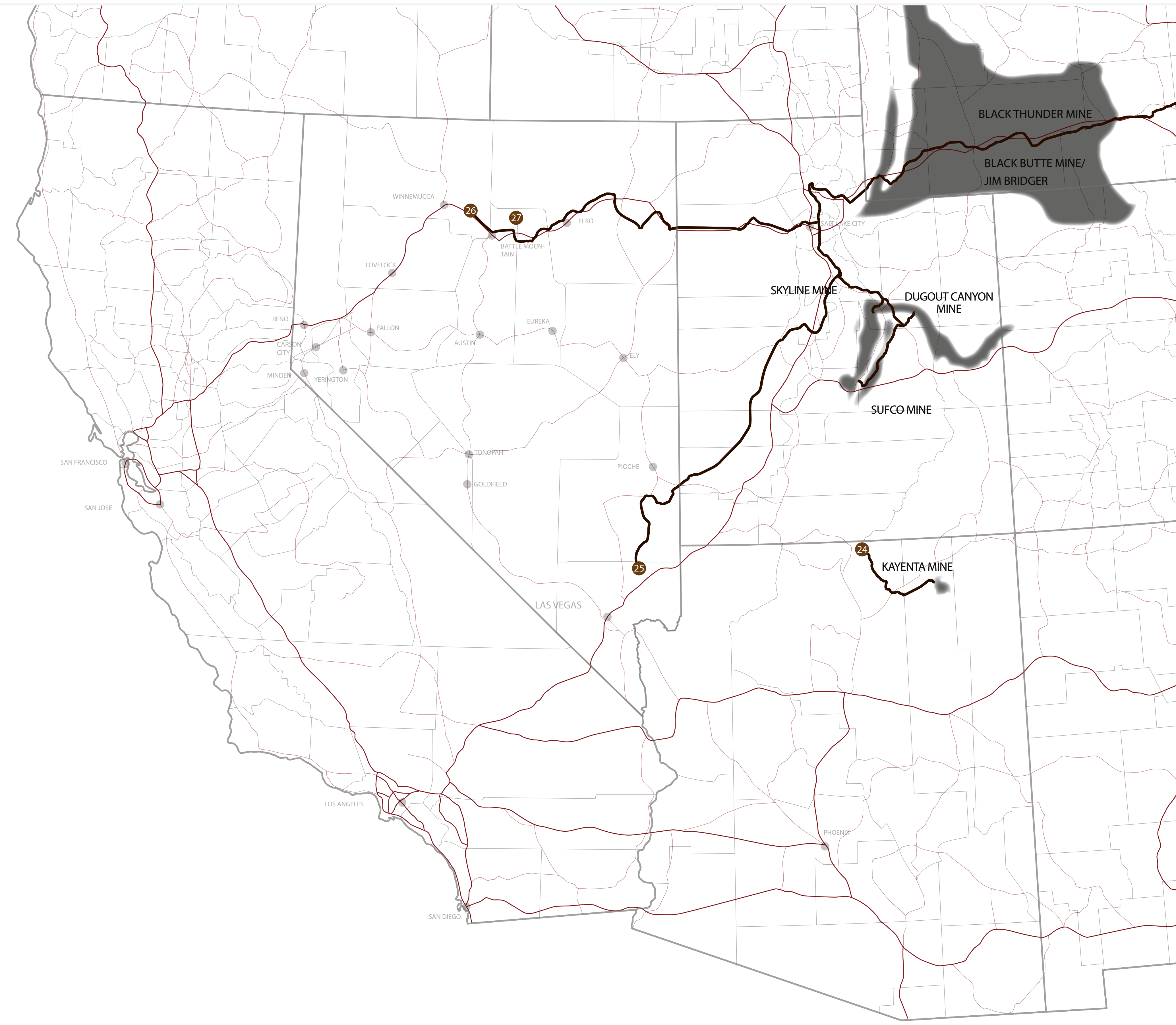
Nevada does not have any active coal mining and coal-fired electricity is anticipated to be completely phased out by 2025 in accordance with Senate Bill 123 of the 2013 Legislative Session, which required the reduction of 800 MW of coal-generated electricity in Nevada. There are three coal-fired generators in Nevada and one in Arizona that supply electricity to Nevada. A fourth plant in Laughlin was shut down in 2005 and demolished in 2011. Each plant is directly connected by rail that brings coal from mines in Wyoming, Colorado and Utah to Reid Gardner in Southern Nevada and North Valmy, and T.S. Power stations in Northern Nevada.

Reid Gardner began operations in 1965, making it the oldest plant in the state. At the end of 2014, NV Energy shut down three of the four coal-generating units at Reid Gardner The remaining unit will be retired by 2017. North Valmy will continue to provide power until its units are retired in 2025. The T.S. Power Plant in Dunphy is used for nearby gold mining operations and also supplies the grid with electricity. Finally, NV Energy purchases power from Navajo Generating Station near Page, Arizona. Nevada currently receives just over ten percent of the power generated at Navajo, but NV Energy will eliminate its ownership interest in 2019.

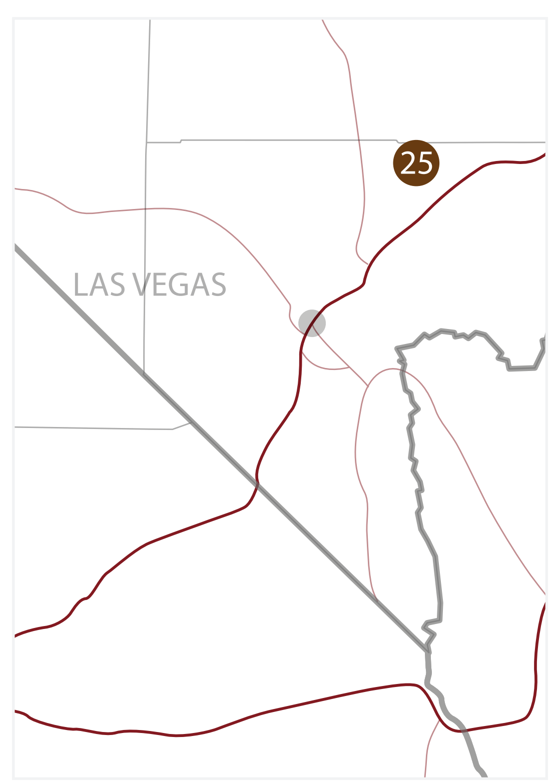
Plans to build several new coal-fired plants (Ely Energy Center, Gerlach Plant, White Pine) in Northern Nevada were canceled between 2006-2009 and no new coal-fired plants are scheduled to be built. Interest has instead shifted to alternative energy sources.



NEVADA COAL GENERATION AND SUPPLY



Southern Nevada Coal Plants

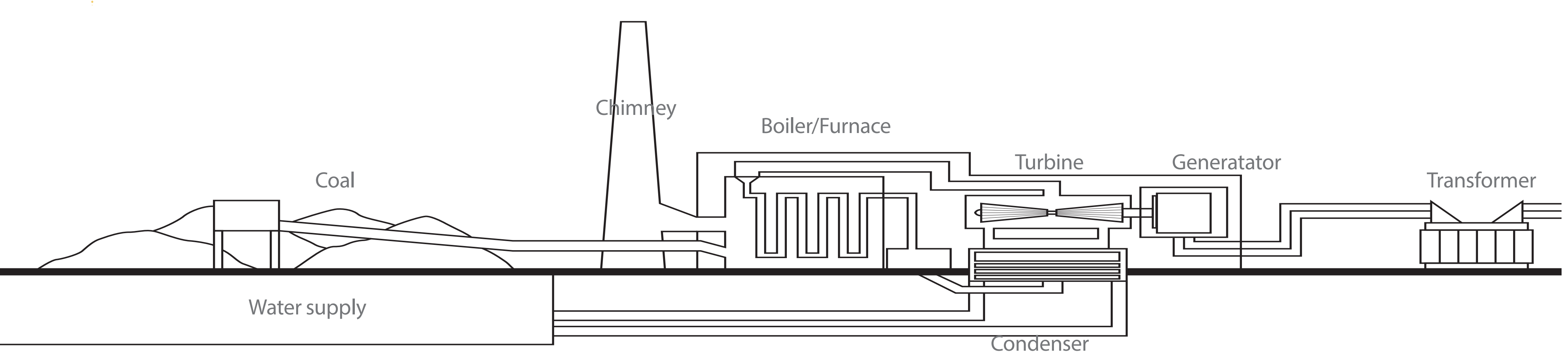


COAL GENERATION UNITS AND CAPACITY

	NAMEPLATE CAPACITY	AGE (YEARS)
24. NAVAJO GENERATING STATION*	254 MW	40
25. REID GARDNER^	557 MW	49 and 31
26. NORTH VALMY	522 MW	33 and 29
27. T.S. POWER	242 MW	6

*Navajo Generating Station has a 2,250 MW capacity, but NV Energy receives only 11.3% of station's total energy; is eliminating ownership interest in 2019.

^Reid Gardner Generating Station retired three of four boilers in 2014, and will close completely by 2017.



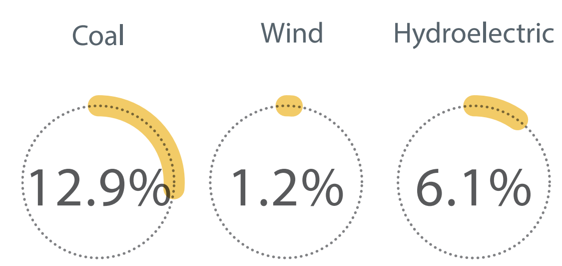
HYDROPOWER

Conventional hydropower is Nevada's largest renewable resource, with the benefit of providing a reliable source of energy because output can be predicted based on the water source. Reservoirs also provide a stable source of drinking water, create areas for wildlife and recreation, and provide cooling. While hydropower is a clean source of energy and is mostly reliable, low water flow caused by drought scenarios could threaten power production. In addition, dams and their reservoirs block river flow, which have lead to other negative environmental consequences. In Southern Nevada, the impoundment of the Colorado River by Hoover Dam and Davis Dam creates Lake Mead and Lake Mohave, respectively.

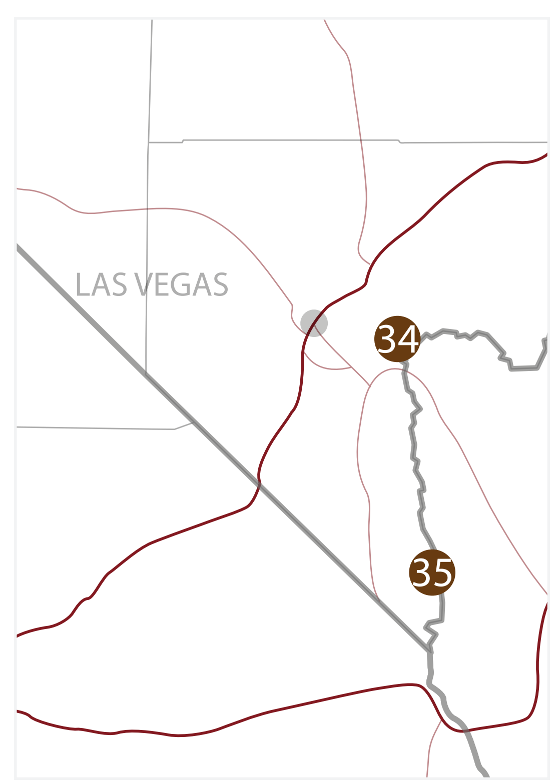
Hydroelectric plants provide energy quickly in times of peak demand, which is an advantage over other fossil-fuel based plants. By using "pumped storage," water is held above the plant when demand is low; the plant can then direct the stored water through the turbines during times of peak energy usage in order to match supply and demand.

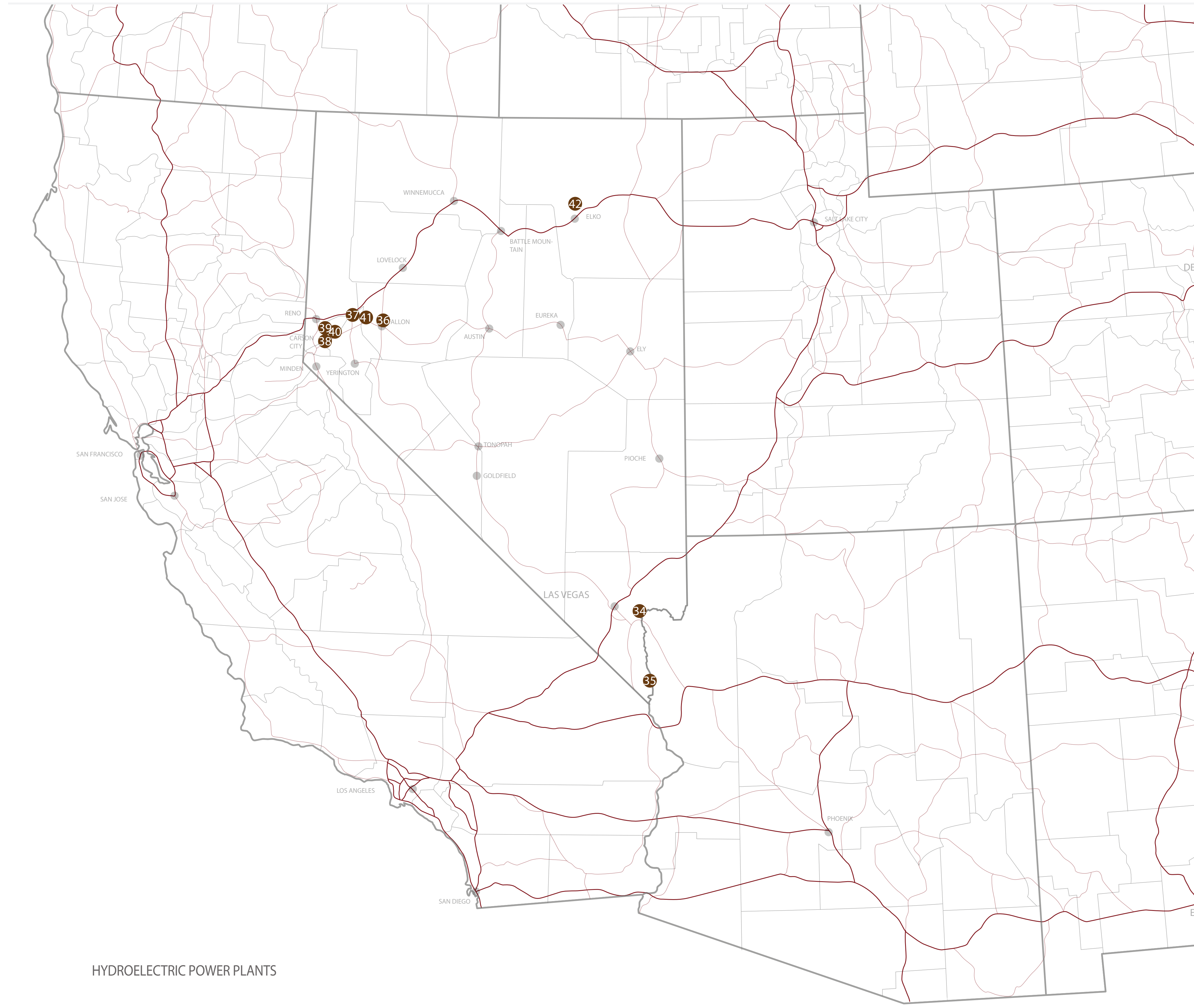
In 1922, the Bureau of Reclamation presented a report calling for the development of the dam for downstream flood control and power generation in what would be known as the "Boulder Canyon Project." President Coolidge signed the Boulder Canyon Project Act into law six years later. The Act appropriated $165 million for dam construction, including for the Art-Deco styled "Boulder Dam." Led by the Six Companies joint venture, construction began on the massive project in 1932; placement of more than 4 million cubic yards of concrete began in 1933 and finished in 1935. The Federal government formally accepted the dam as completed on March 1, 1936. Later that year, water levels were high enough to permit power generation and the first three Francis turbine-generators began operating. Water from Lake Mead enters two intake towers that lead to four penstocks that funnel the water down to 17 generators. Additional generators came online over the next three years as the reservoir filled. Power is generated as water is released from Lake Mead based on downstream water demands for municipal and irrigation uses in Arizona and California. Electricity from the dam's power plant was originally sold according to a fifty-year contract authorized by Congress that expired in 1987. A new contract set power allocations from the dam from 1987 to 2017 and in 2011, another contract was authorized to 2067. More than half of the power goes to the state of California and Southern California cities; about a quarter goes to Arizona; the remainder goes to Nevada, but only a small amount for customers in Las Vegas.

Smaller dams and hydopower systems generate electricity for the grid in other parts of the state, including generators along the Truckee River in Reno and as a part of the Truckee-Carson Irrigation District.



Southern Nevada Dams



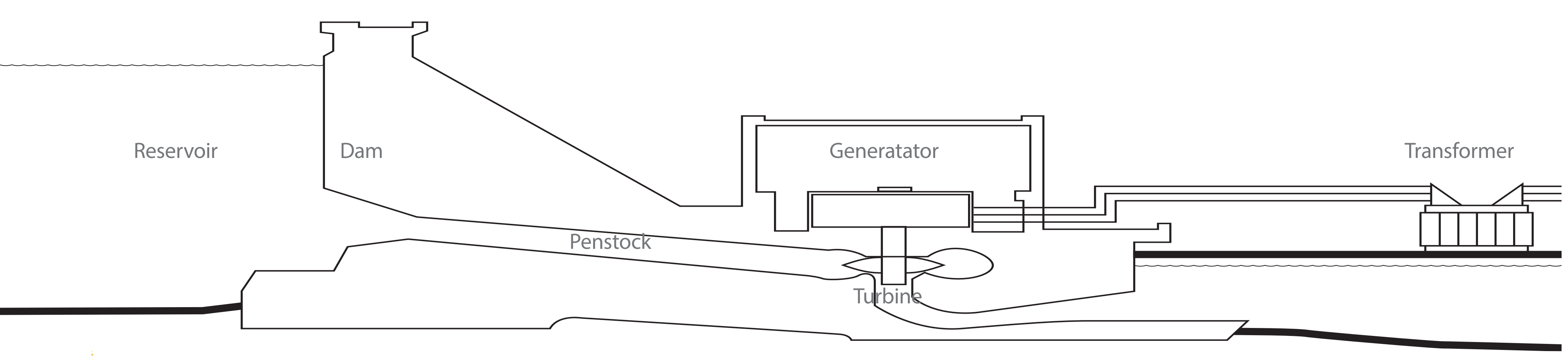


HYDROELECTRIC POWER PLANTS

HYDRO PLANTS AND CAPACITY

	NAMEPLATE CAPACITY	AGE (YEARS)
34. HOOVER DAM*	478 MW	75
35. DAVIS DAM	251 MW	63
36. V-LINE CANAL - 26' DROP	1 MW	60
37. LAHONTAN DAM	2 MW	10
38. FLEISH HYDRO POWER PLANT	2.25 MW	6
39. VERDI HYDRO POWER PLANT	2.15 MW	5
40. WASHOE HYDRO POWER PLANT	2.15 MW	5
41. LAHONTAN DAM - NEW	4 MW	26
42. FRANK HOOPER HYDRO POWER PLANT	0.75 MW	28

*Hoover Dam generates 2,080 MW, and Nevada receives 23.3% of this total.

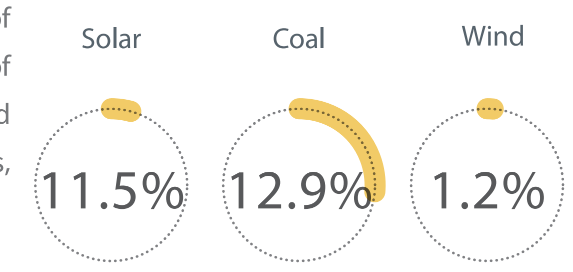


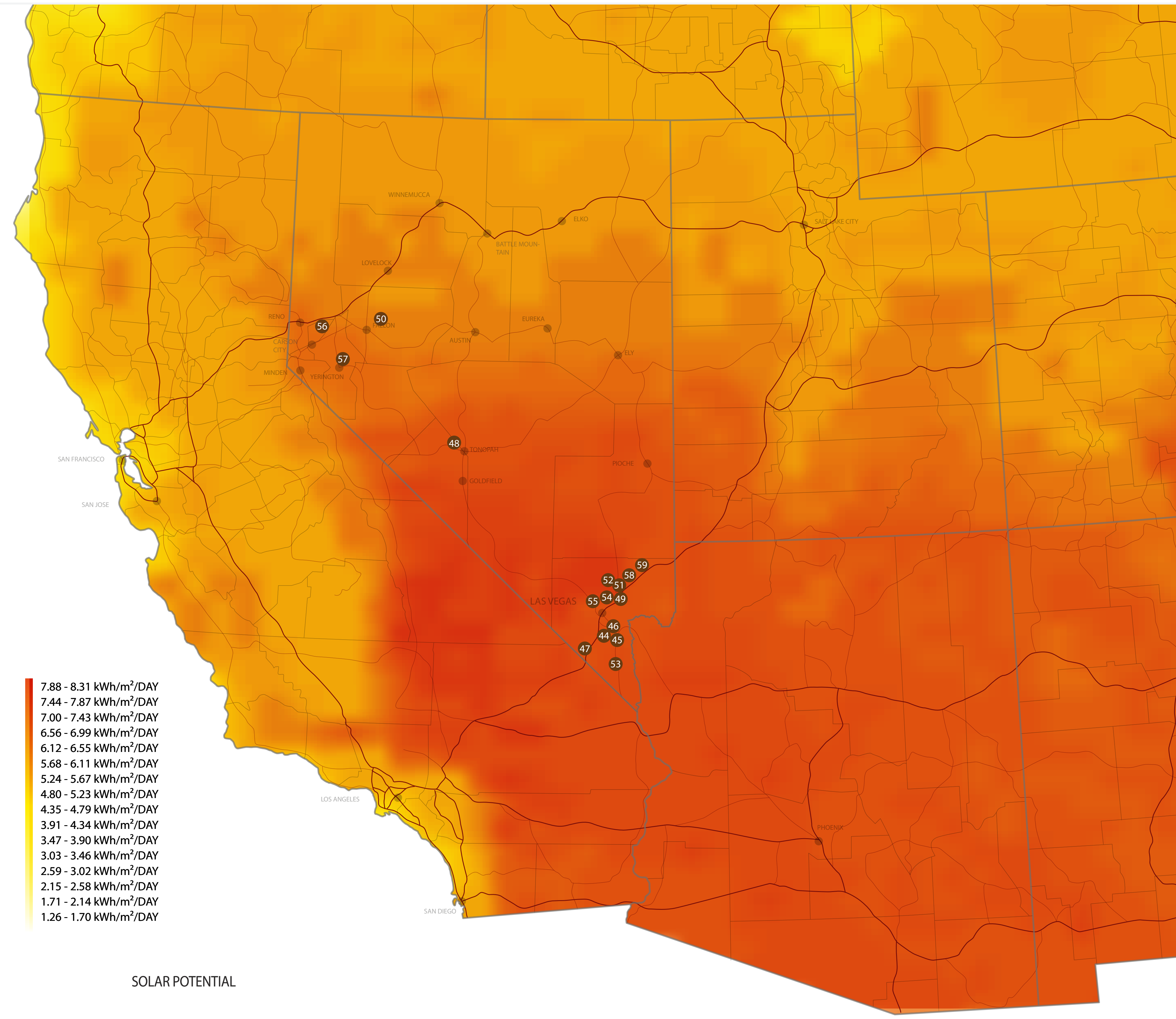
SOLAR ENERGY

Solar energy is renewable, clean, and abundant throughout Nevada - Southern Nevada in particular has some of the highest solar potential in the country. Energy from the sun can be generated using several different technologies: solar photovoltaic (PV) panels, solar thermal power plants, solar cooling, or solar thermal collectors. Solar power is often used by utilities during peak demand hours due to its intermittancy. Utilities combine it with base load non-renewable sources to provide a balance of energy generation and energy demand.

The amount of solar energy produced in Nevada has continued to increase due to Nevada's Renewable Portfolio Standard, which requires that at least five percent of the RPS be generated by solar facilities (six percent beginning in 2016). Large-scale solar PV and concentrated solar thermal projects, such as Crescent Dunes near Tonopah and Nevada Solar One near Boulder City, are among the largest in the world in terms of capacity and footprints. While utility-scale solar energy has increased, construction of these plants have required large acreages of open desert for installation, which has raised concerns of habitat destruction for birds, desert tortoise, and other sensitive species.

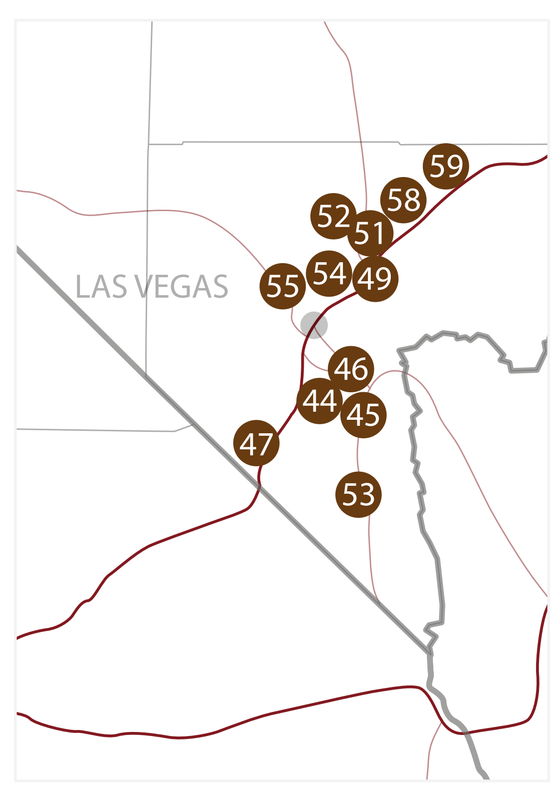
An alternative to large-scale plants has been distributed generation through rooftop solar installations. NV Energy's SolarGenerations rebate program and net-energy metering policies that credit solar system owners for energy generated have resulted in approximately 11,000 rooftop systems being installed in Southern Nevada, with more than 100 megawatts installed statewide. Although the cost of solar is still high across all technologies, widespread adoption has lead to dramatic reductions in overall costs, making both utility-scale plants and rooftop solar affordable for businesses and homeowners.





SOLAR POTENTIAL

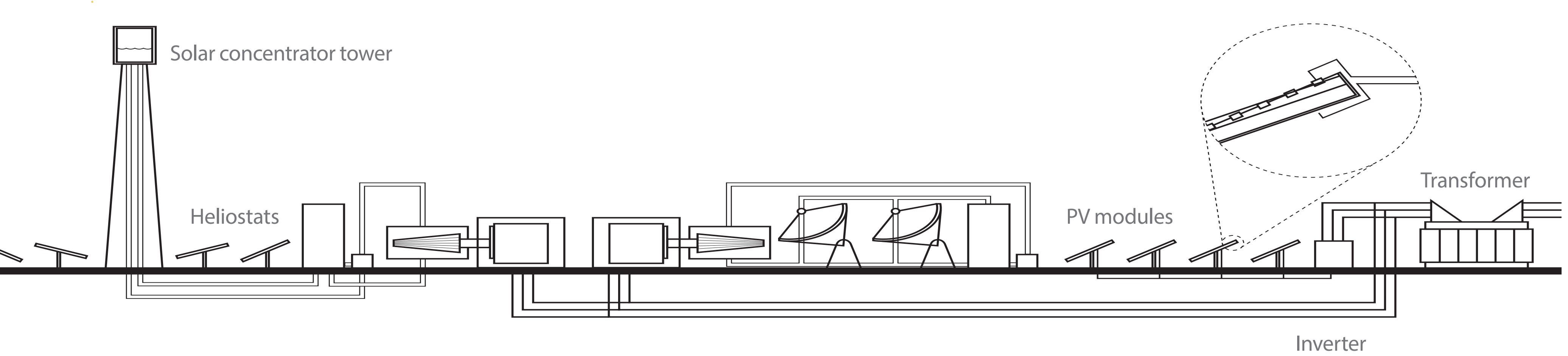
Southern Nevada Solar Plants



SOLAR PLANTS AND CAPACITY

	NAMEPLATE CAPACITY	AGE (YEARS)
SOLARGENERATIONS*	100 MW	< 1
44. COPPER MOUNTAN SOLAR I, II, III	450 MW	5 / 4 / 1
45. NEVADA SOLAR ONE	75 MW	7
46. BOULDER SOLAR	100 MW	IN DEVELOPMENT
47. SILVER STATE SOLAR	52 MW	2
48. CRESCENT DUNES	110 MW	ONGOING
49. SPECTRUM NEVADA SOLAR	30 MW	1
50. STILLWATER II	22 MW	2
51. MOUNTAIN VIEW SOLAR	20 MW	< 1
52. APEX NEVADA SOLAR	20 MW	2
53. SEARCHLIGHT I	17.5 MW	< 1
54. NELLIS AFB SOLAR	28 MW	7
55. LAS VEGAS VALLEY WATER DISTRICT	3 MW	8
56. BARRICK SOLAR FARM	1 MW	6
57. FORT CHURCHILL SOLAR	20 MW	< 1
58. SWITCH STATION	100 MW	IN DEVELOPMENT
59. MOAPA SOLAR	250 MW	IN DEVELOPMENT

*SolarGenerations is a program available to Nevada residents through NV Energy; installation incentives are offered to customers who install solar panels. More than 10,000 solar projects have been installed through this program

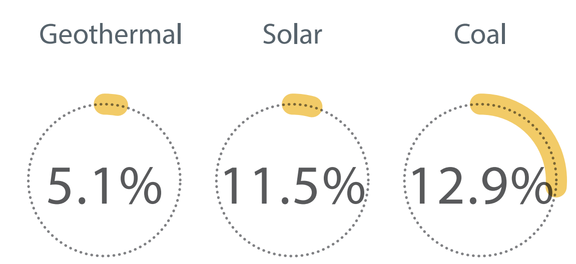


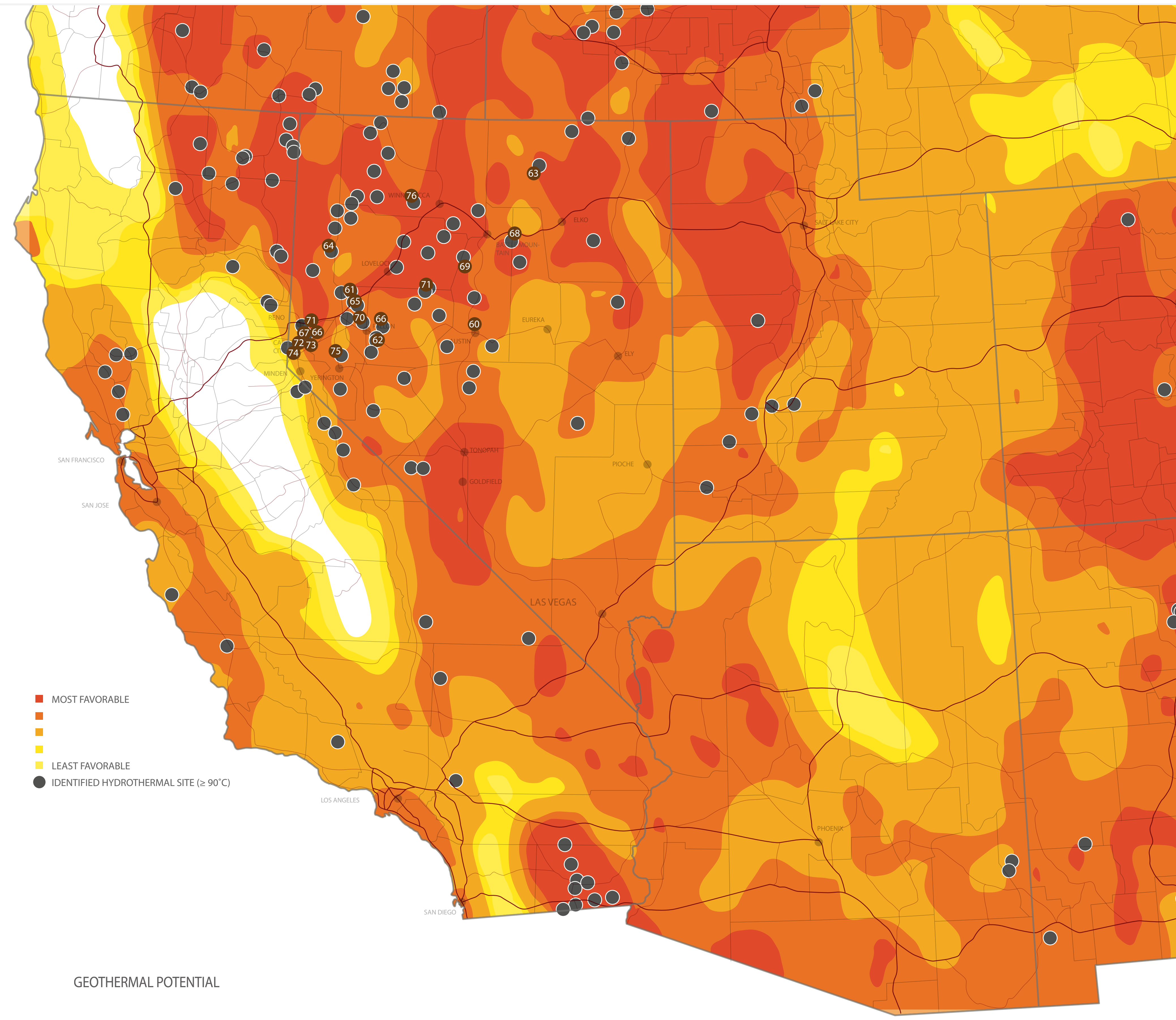
GEOTHERMAL

Geothermal energy is heat generated below the Earth's surface harvested for use as a source of heat and electricity. Naturally occurring hydrothermal reservoirs, such as hot springs or geysers, can be accessed either by direct use or by drilling geothermal production wells that bring heated water to the surface to spin turbines in power plants that create electricity. Geothermal energy is also a base load, non-intermittent energy source.

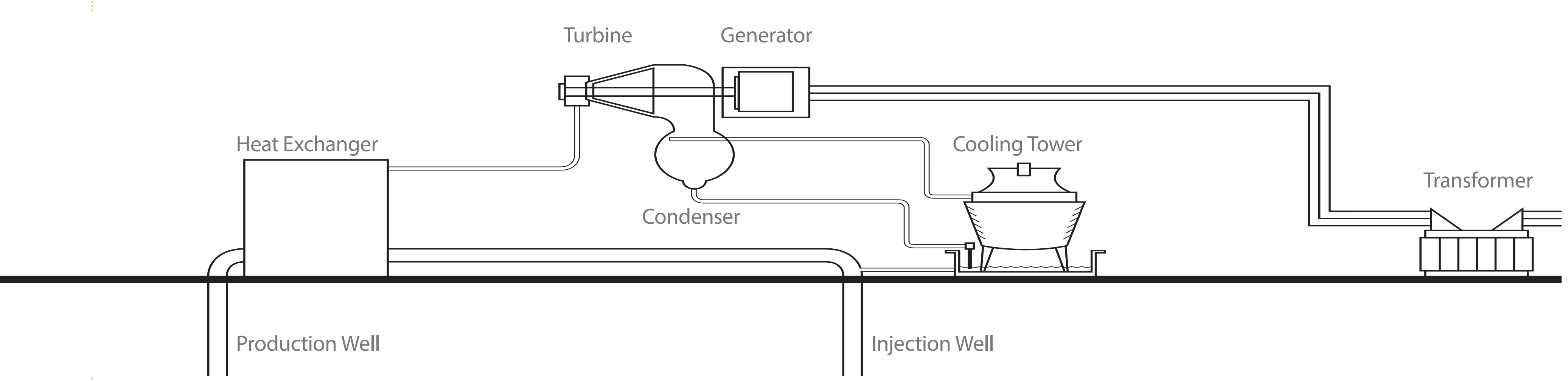
While California leads the nation in geothermal energy production, Nevada is the second leading producer, with approximately seventy percent of the State's RPS coming from nineteen geothermal power plants located in Northern and Central Nevada. An estimated sixty percent of Nevada's geothermal potential remains untapped. NV Energy's geothermal power purchase agreements first began in the early 1980s; about half of the power plants are older than twenty years, and half are less than ten years. With proper maintenance, geothermal power plants may have operating capacities of forty-five years. New geothermal energy exploration, however, contains higher risks due to drilling production wells in optimal locations, often on Federal lands in area without habitat or environmental constraints, that are also feasible for power plant construction and access to transmission lines. As a result of these uncertainties, it can be difficult for geothermal companies to get financing for projects.

Although geothermal energy produces a smaller share of energy comparable to other sources, it has helped Nevada reach its RPS goals by generating clean non-intermittent base-load power.





GEOTHERMAL POTENTIAL



GEOTHERMAL PLANTS AND CAPACITY

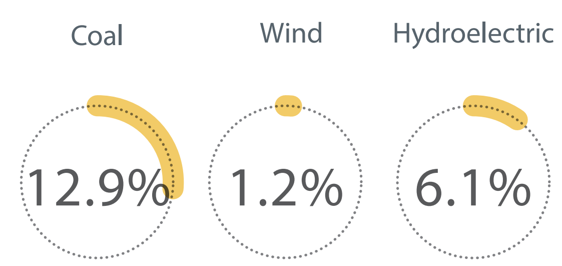
	NAMEPLATE CAPACITY	AGE (YEARS)
60. MCGINNIS HILLS	96 MW	< 1
61. BRADY	24 MW	22
62. SALT WELLS	23.6 MW	5
63. TUSCARORA	32 MW	2
64. SAN EMIDIO	11.8 MW	27
65. DESERT PEAK	25 MW	7
66. STILLWATER II	47.2 MW	5
67. RICHARD BURDETTE	26 MW	8
68. BEOWAWE	18 MW	8
69. JERSEY VALLEY	22.5 MW	2
70. SODA LAKE I & II	23 MW	23 / 27
71. DIXIE MEADOWS	129 MW	< 1
72. GALENA II & III	39.5 MW	7 / 6
73. STEAMBOAT I, II, & II	28.8 MW	26 / 26 / 22
74. STEAMBOAT HILLS	15 MW	26
75. HOMESTRETCH	5.6 MW	28
76. FAULKNER I	49.5 MW	5

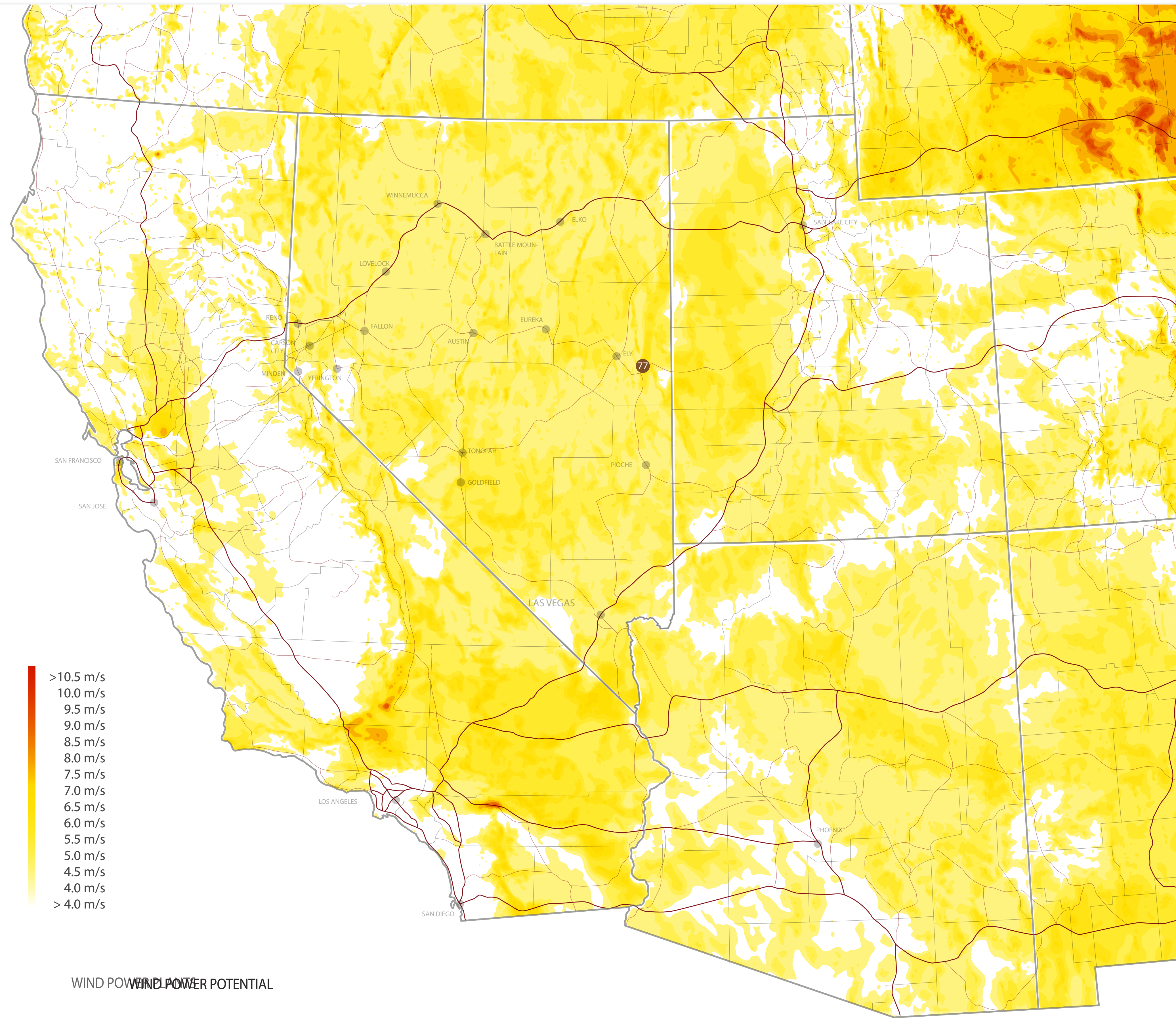
WIND

Wind power can supply large amounts of renewable energy in areas considered to have "Outstanding" resource potential, where sustained annual average wind speeds are greater than 8 meters per second (approximately 18 miles per hour) at a height of 50 meters (164 feet). American wind farms have been most successful in areas where there are open plains, rounded hills, or mountain passes that funnel wind flow. The top three states with the largest wind-generated electricity in 2013 were Texas, Iowa, and California. While wind is somewhat predictable in these areas, like solar, it suffers from intermittency issues. Such variability does not make it a base load source of energy. Wind turbines themselves also pose a threat to birds and bats and can create visual aesthetic issues.

While Nevada has many mountain ranges and valleys that are good wind resource locations, there is only one utility-scale wind farm in the state, just west of Great Basin National Park in Spring Valley, near Ely. This area has Outstanding resource potential and is in close proximity of transmission lines. NV Energy's WindGenerations program also offers incentives to residents and businesses for the installation of small wind systems that credit owners for energy generated. Approximately 160 wind systems have been installed, nearly all of which are in Northern Nevada, especially in areas around Reno and Carson City where wind potential is high.

The wind resource power potential throughout most of Southern Nevada, however, is considered Marginal to Fair, with the best areas for wind generation along mountain ridges and in valleys south of Las Vegas and near Laughlin. The lack of good areas to build (especially in Southern Nevada), along with the constraints of land ownership, proximity to power infrastructure, and environmental concerns pose major limits to additional development of wind resources in the future.



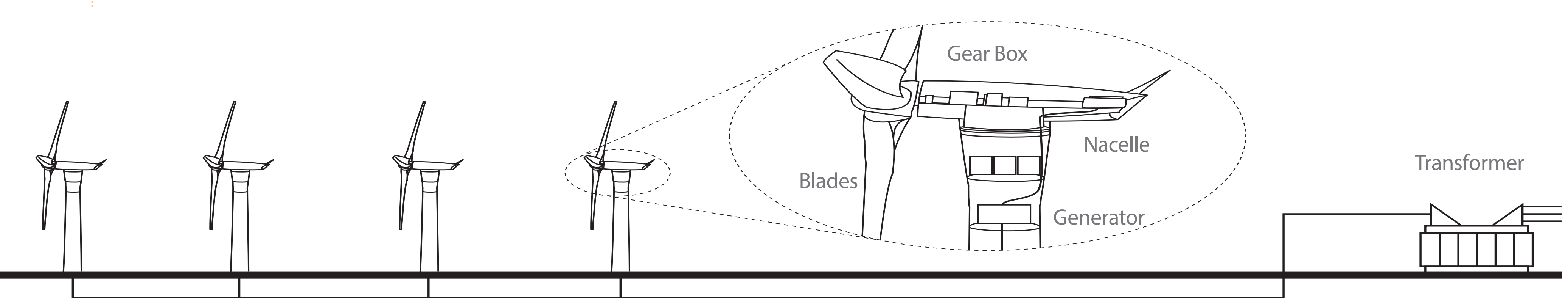


WIND POWER POTENTIAL

WIND FARMS AND CAPACITY

	NAMEPLATE CAPACITY	AGE (YEARS)
WINDGENERATIONS*	N/A	ONGOING
77. SPRING VALLEY WIND PROJECT	151 MW	2

*WindGenerations is a program available to Nevada residents through NV Energy; installation incentives are offered to customers who install wind-generating systems. Approximately 160 wind projects have been installed through this program.

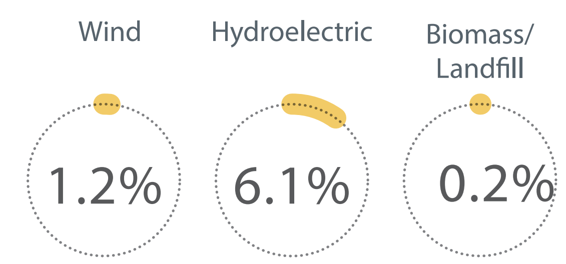


BIOMASS | LANDFILL

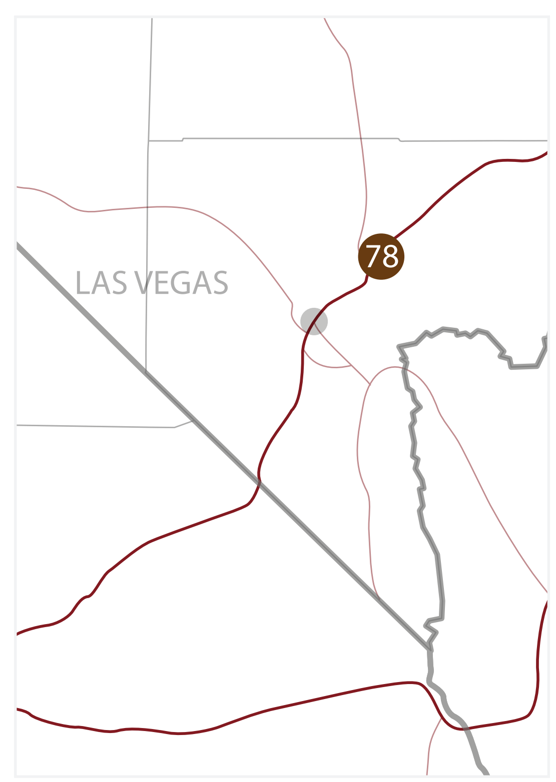
Biomass, consisting of food, plant and wood waste, and animal organic material are the most common feedstocks for energy. They can be used to create heat, converted it to electricity, or processed to create biofuel. Similarly, organic materials that decompose in landfills or solid waste from wastewater treatment plants produce methane gas that can be captured and burned for electricity production. Corn and sugar based biomass products can be converted into liquid biofuels (ethanol and biodiesel) when fermented. As part of the carbon cycle, biomass processes are carbon neutral.

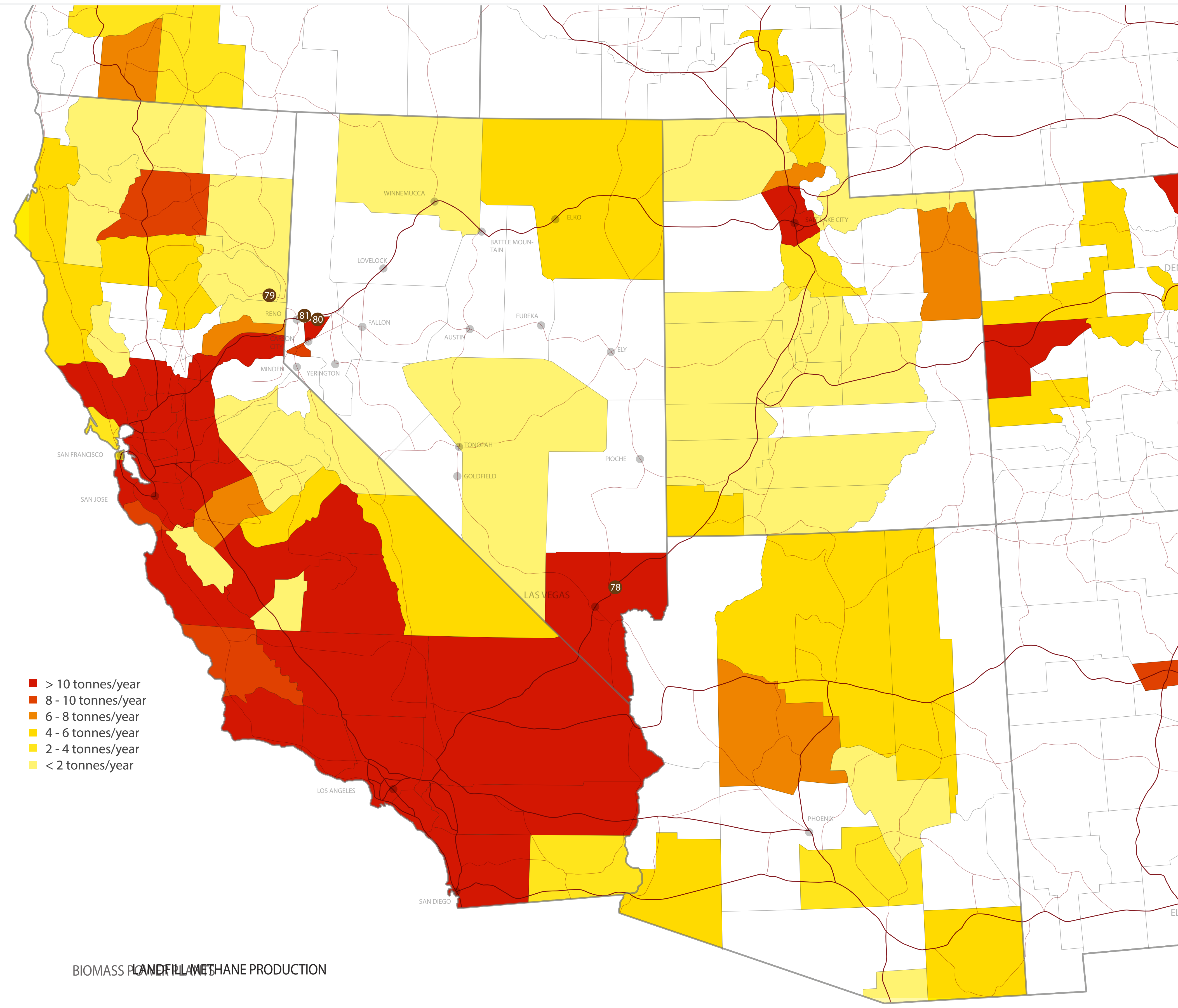
Nevada has four biomass/landfill gas projects. There are two gas-to-energy landfill facilities; one at Apex Regional Landfill north of Las Vegas and one at Lockwood Landfill east of Reno. The Sierra Pacific woodchip biomass project near Susanville, CA, also provides energy to Nevada through a cogeneration unit. The Truckee Meadows Water Reclamation Facility, the primary wastewater treatment plant in the Reno-Sparks region, treats wastewater that generates methane to power a small generator.

Several companies across the state produce biodiesel from supplied feedstock. Biodiesel of Las Vegas researches, produces, and sells biofuels created from various feedstocks such as vegetable oil, used cooking grease and animal fats, and cellulosic and algae oils. The company provides biodiesel to retail fueling stations, local vehicle fleets, and to Nellis Air Force Base.



Southern Nevada Landfill Plants

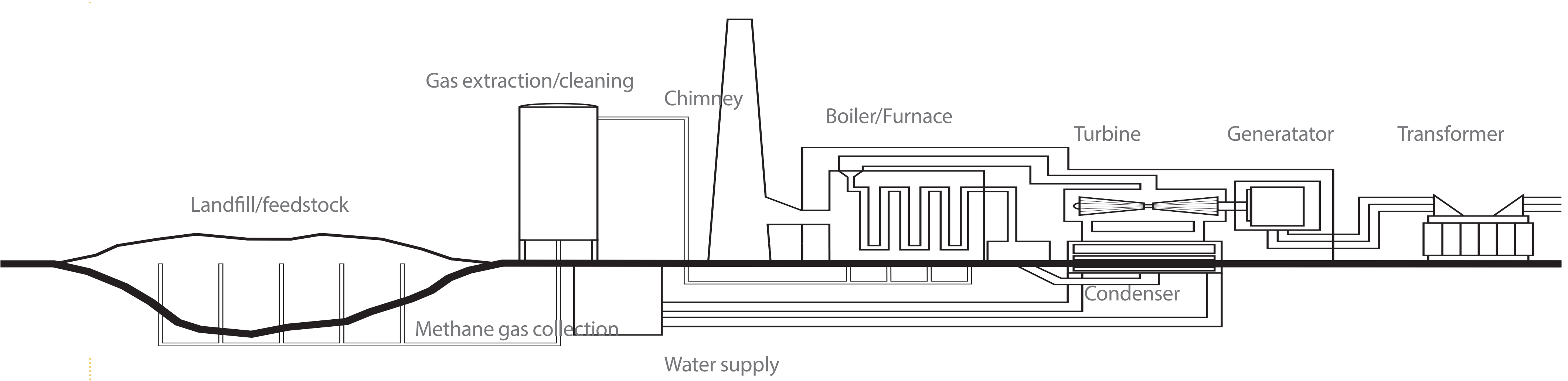




BIOMASS PLANT LANDFILL METHANE PRODUCTION

GENERATED AMOUNT

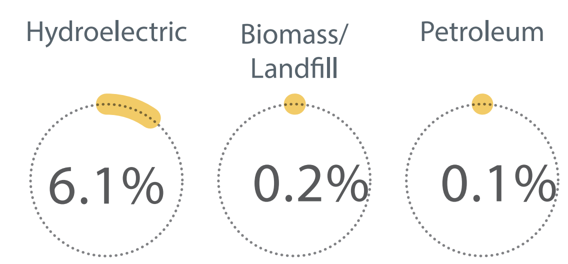
	MEGAWATTS	AGE (YEARS)
78. APEX/CC LANDFILL ENERGY	12 MW	2
79. SIERRA PACIFIC INDUSTRIES	10 MW	25
80. LOCKWOOD RENEWABLE ENERGY	3.2 MW	2
81. TMWRF	0.8 MW	< 1

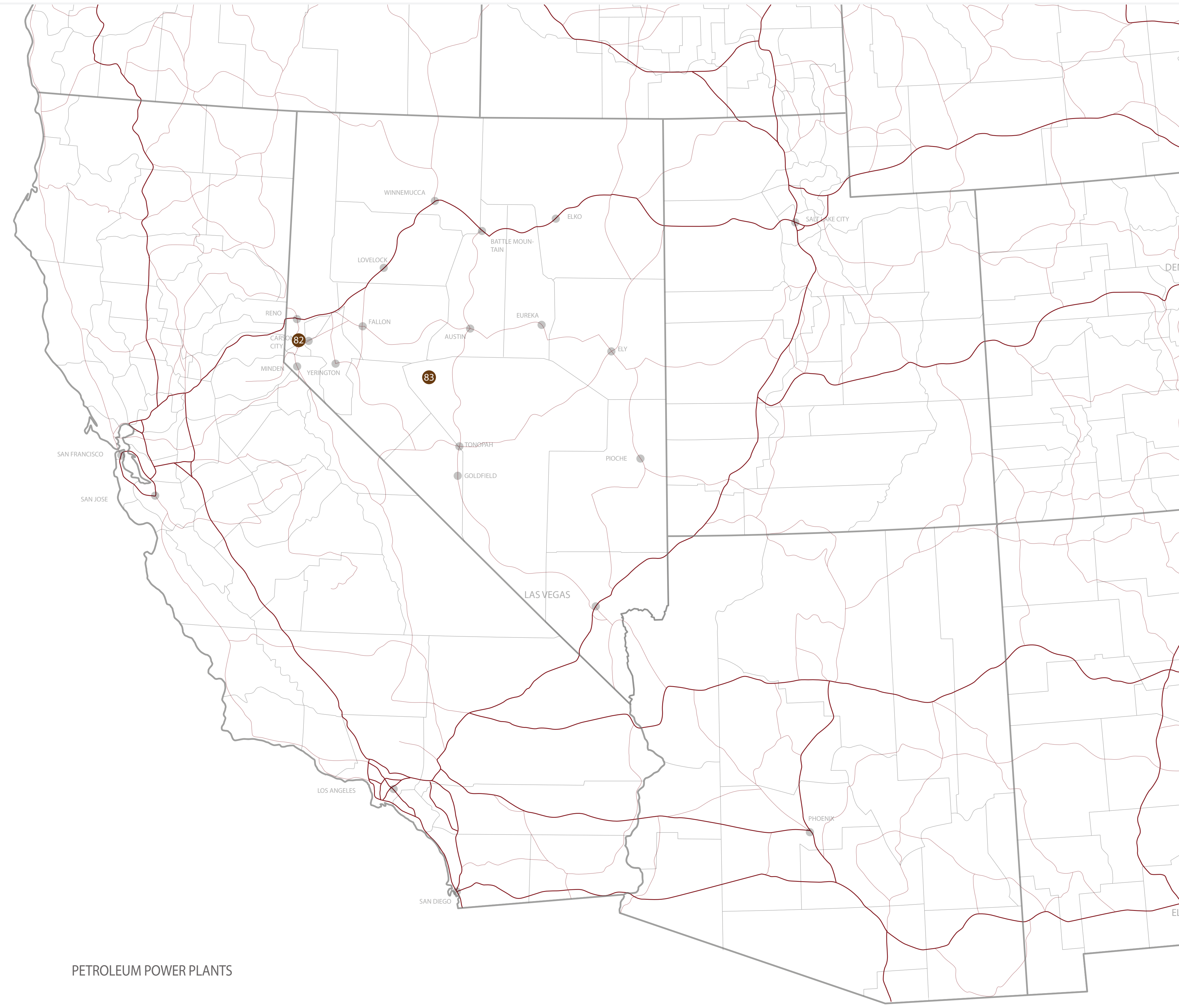


PETROLEUM (OIL)

Petroleum is a fossil fuel that consists of the remains of crude oil found in underground reservoirs that is drilled and extracted to the surface and factory refined can be used as gasoline, diesel, jet fuel, propane, and other petroleum products. In 2013, five states produced sixty-four percent of the crude oil in the U.S.: Texas, North Dakota, California, Alaska and Oklahoma. Parts of Eastern Nevada may have some oil and natural gas reserves but exploration has been limited.

Nevada has two small petroleum plants for power production near Carson City and Gabbs, both of which have passed their expected retirement dates. These plants produce only a small amount of petroleum and fuel for them is supplied from outside of the state. The state's overall use of major petroleum products used primarily for transportation; fuel oil is not typically used for heating as it is in other parts of the country but can be found in older some older homes and buildings in Northern Nevada.





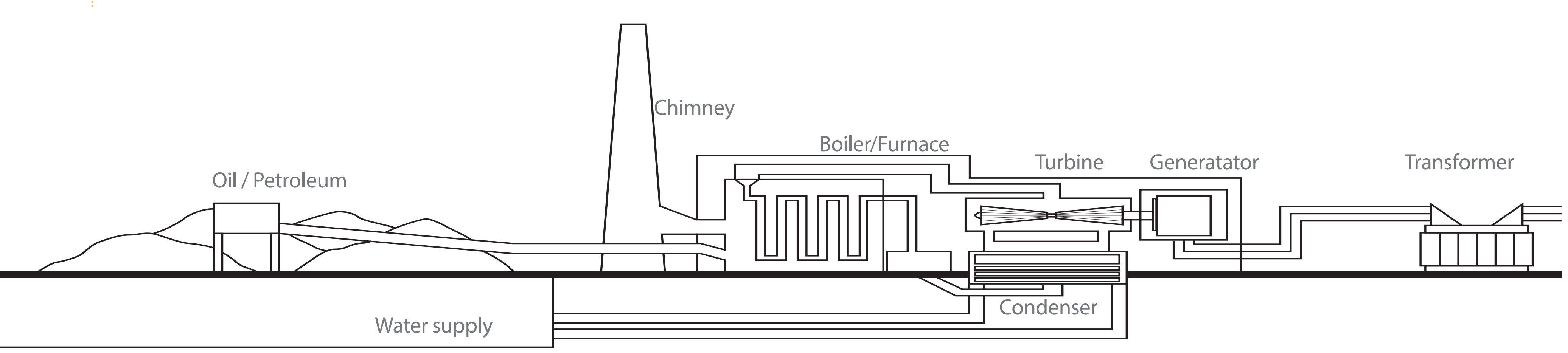
PETROLEUM POWER PLANTS

GENERATED AMOUNT

	MEGAWATTS	AGE (YEARS)
82. BRUNSWICK*	6 MW	54
83. GABBS^	5.4 MW	45

*Expected retirement date passed in 1990.

^Expected retirement date passed in 1999.



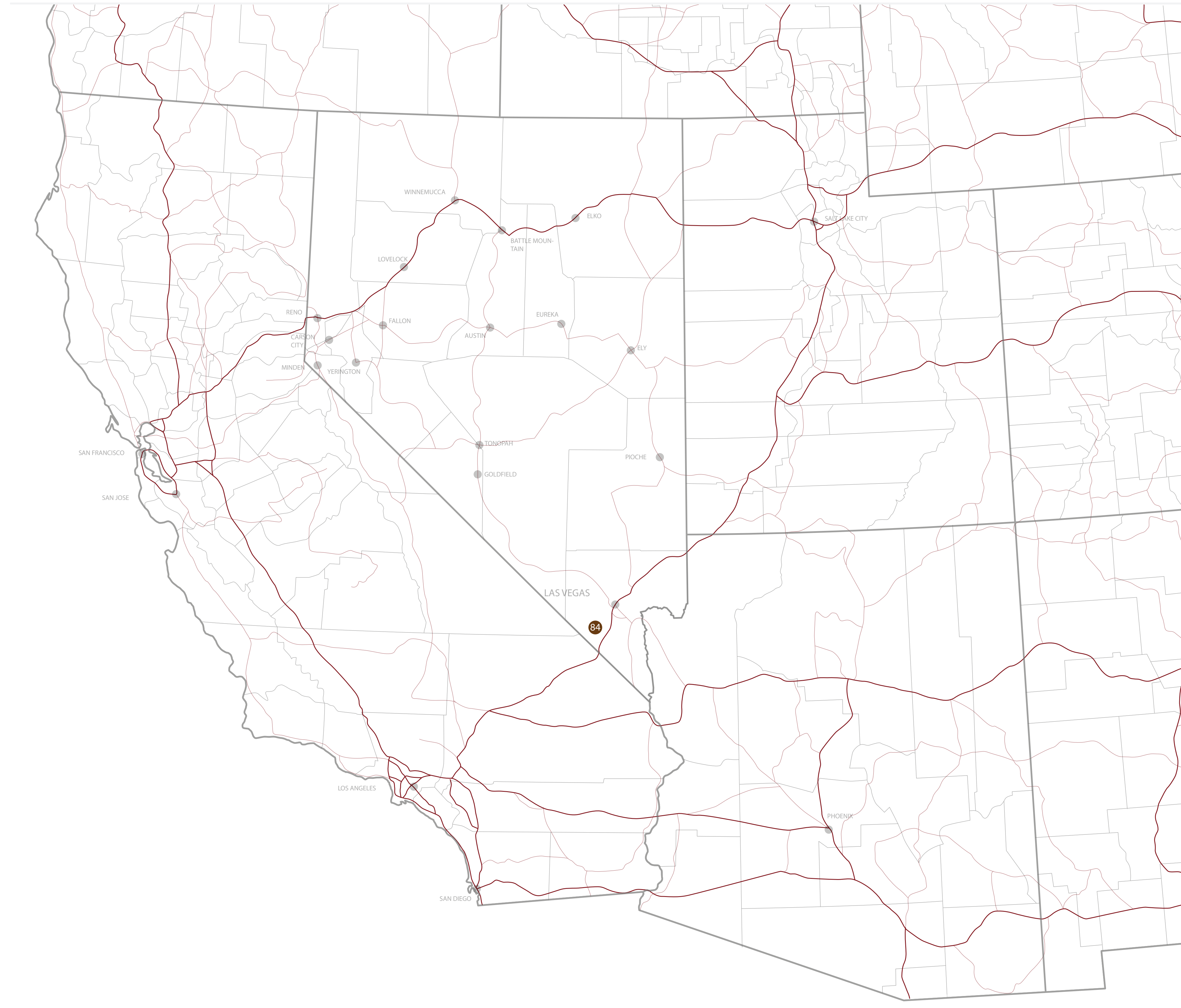
HEAT ENERGY RECOVERY

When heat is available as a by-product of other processes, waste heat energy recovery can be utilized to collect heat that would typically be wasted and use it to generate power. It is a form of combined heat and power (CHP) that makes use of one fuel source to generate thermal power and electricity. For example, in a topping cycle (the process of cogeneration), a turbine burns fuel to generate electricity. A heat recovery unit located adjacent to the electricity generator could captures thermal energy exhausted by the electricity generator to generate additional energy within its system. This process only works with systems that have exhaust temperatures above five-hundred degrees Fahrenheit and are usually found in industrial processes.

As of 2012, there were thirty-four waste heat recovery projects in the U.S. One of those facilities is located south of Las Vegas in Goodsprings. The first of its kind in Nevada, the plant is located next to a natural gas compression station that pumps gas between Nevada and California. Three heat exchangers in the station capture thermal energy which is delivered to a generator that produces electricity.

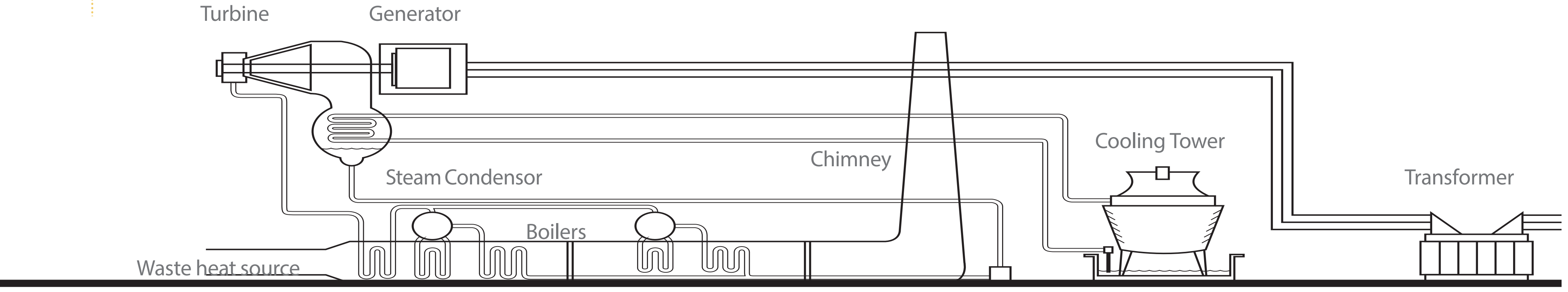
Biomass/ Landfill	Petroleum	Heat Recovery
0.2%	0.1%	0.1%

Southern Nevada Heat Energy Recovery Plants



GENERATED AMOUNT

	MEGAWATTS	AGE (YEARS)
84. GOODSPRINGS ENERGY RECOVERY	7.5 MW	4



ENERGY DEMAND

BALANCING SUPPLY AND DEMAND

Utilities and other energy providers must balance supply with demand. While this happens on a daily basis throughout the year, the summer months pose the most challenging balancing times of year because of high energy consumption in Southern Nevada when air conditioning use is at its maximum in the late afternoon to cool buildings. During these times of peak demand, energy prices are typically higher. Power plant operators familiar with daily and seasonal patterns can adjust supply to meet demand and can increase or decrease production to accommodate base loads, intermediate loads, and peak loads.

Base load is the minimum amount of power required in a given period of time that is supplied by a steady stream of energy. Base load power plants are the backbone of the electrical system, with load factors that annually exceed 75 percent. These are large plants with outputs greater than 400 megawatts. They run continuously to be efficient and are only shut down for maintenance or repair. Although electricity is instantaneous and quick to transmit, base load plants require at least a day to ramp up production. Their generating capacity is about equal to the needs of low demand, are engineered to produce power relative to the needs of the geographic area they serve and are typically less expensive to operate, using coal or natural gas. Some forms of renewable energy, such as hydroelectric, geothermal, biomass, and solar thermal, can be used for base load power as well.

While the base load plants are always running, intermediate or load following plants are active in the daytime and early evening, and inactive in times of low demand. They "follow" the base load to provide intermediate power when demand begins to rise and provide forty to sixty percent of the energy load annually. The most efficient and cost-effective plants in Southern Nevada are put into use first depending on demand needs within the region and the status of the electrical grid. Hydroelectric and natural gas power plants are typically used as load following plants.

Peak load occurs when consumers need electrical power at above average levels. "Peaking" power plants can be started quickly and can respond to fluctuations in demand meet this power need. These plants, usually fueled by natural gas, do not run continuously and are shut down when not in use. They produce between five to fifteen percent of the annual demand load. Twelve peaking units were installed at the Clark Generating Station in Henderson in 2009 and can produce up to 600 megawatts, enough to power 370,000 homes in times of high demand.

Rising demand, especially at peak periods, created the need for more generating plants. In July 2001 during the Western Energy Crisis, when Southern Nevada's energy demand was around 4,600 MW, Nevada Power Company was forced to purchase both expensive base load and peak power on the open market because it lacked generating capacity. This shifted the company's strategy to construct and operate more of its own generation. Over the ensuing fifteen years, demand has continued to increase. Peak demand jumped to 5,587 MW in 2005 and 5,618 MW in 2006. In July 2007, when the demand for electricity was approximately 5,800 MW, resorts on the Strip were requested to conserve power in the late afternoon by turning off computers, nonessential machines, and lighting. In the summer of 2013, NV Energy projected that at least 6,000 MW of electricity would be required for peak periods in Southern Nevada. Investment in additional energy sources and renewable resources has helped alleviate stress and vulnerability to Southern Nevada's electrical grid.

RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL ENERGY CONSUMPTION

Energy consumption in the United States has steadily increased every year since the 1950s. Consumption grew from 35 quadrillion Btu in the 1950's to 98 quadrillion Btu in 2010, with peak consumption of 101 quadrillion Btu in 2007 and a recession-induced drop to 95 quadrillion Btu in 2009. Overall in-home energy usage has similarly increased over time. In 2014, the Southern Nevada residential sector consumed 8.9 billion kWh of electricity and 231 million therms of natural gas.

The Residential Energy Consumption Survey conducted by the U.S. EIA shows that while heating and cooling homes still requires the most energy, space heating is no longer the majority of energy used at home. In 1993, appliances, electronics, and lighting consumed twenty-four percent of a home's energy. By 2009, that number increased to almost thirty-five percent due to the increase rechargeable personal electronics and in-home entertainment systems. While these electronics have boosted the share of energy consumed within the home, overall average home energy consumption is actually decreasing, and has been over the past thirty years. Newer homes, although typically larger, have energy efficient air conditioning, space heating, and appliances.

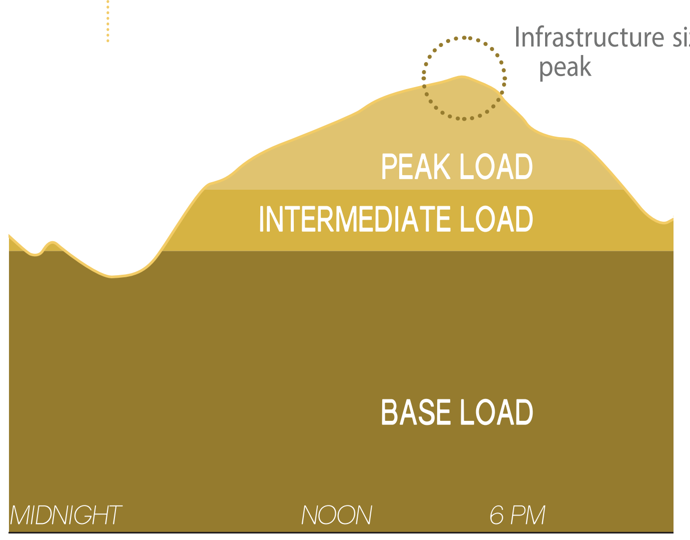
While there have been shifts in new building technologies, new Federal, state, and local codes have addressed energy consumption through conservation. Over the past decade, Southern Nevada's building officials initiated adoption of more efficient energy codes to ensure that new residential, commercial, and industrial buildings are built as efficiently as possible, and now require buildings to be constructed to 2012 International Energy Conservation Code (IECC) standard. The code's provisions are intended to ensure the design of energy efficient building envelopes, conservation of resources, and reduced energy costs.

Although these standards might address new building stock, existing buildings must also address older technologies, and outdated standards.The first step to understanding a home or building's energy consumption is to have an energy audit or energy assessment completed on a structure. These assessments, done professionally with energy modeling software, can reveal many comfort, durability, health and safety issues. Assessments also reveal how much energy is being used and provide an estimate on energy costs and environmental impact. Since the efficiency of furnaces and air conditioners have increased over time, there is often room for improvement on those systems, but other areas must be addressed; improving the areas that separate conditioned space from unconditioned space through better or more insulation, weatherization, and air sealing can often be more cost effective than replacing a furnace or air conditioner. Updating and replacing appliances or home features such as a pool, spa, or electronics help, as well as changing behavioral habits and can all contribute to greater residential energy efficiency.

2015 RESIDENTIAL ELECTRICITY RATES

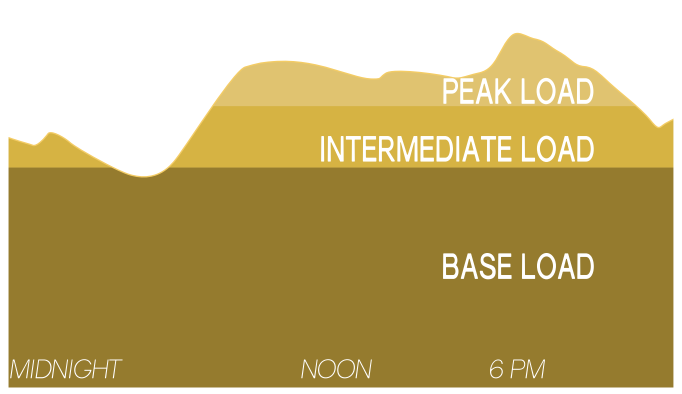
Energy costs can impact residents of all income levels. Based on information from the Energy Information Administration and NV Energy:

- The average rate in Southern Nevada is 10.68 cents/kWh
- The average rate in Southern Nevada is 2.7 percent greater than Nevada's average of 12.93 cents/kWh
- The average Southern Nevada rate is 9 percent greater than the national average of 12.52 cents/kWh
- Nevada's average electricity rate ranks 35th in the U.S.
- Nevada's average consumption is 894 kWh/month, ranking at 24th in the U.S. (national average is 911 kWh/month)
- Nevada's average monthly electric bill is $116, ranking at 32nd in the U.S. (national average is $114)



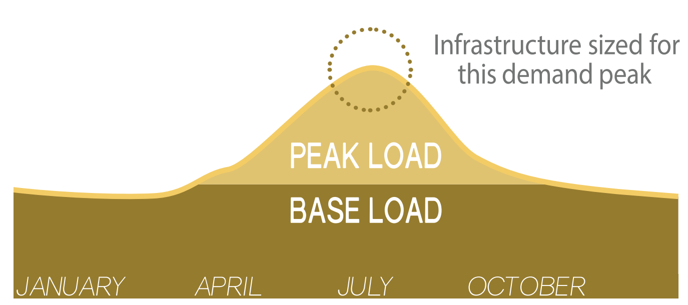
SUMMER PEAK LOAD

Daily electricity load on the total grid during the summer, where higher energy loads occur.



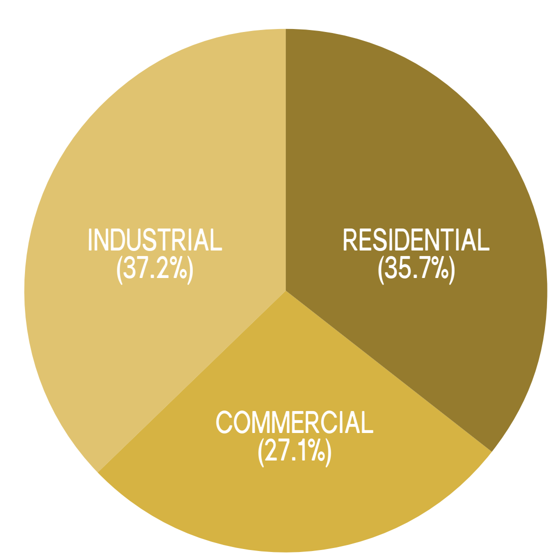
WINTER PEAK LOAD

Daily electricity load on the total grid during the winter has a smaller peak load.



YEARLY PEAK LOAD

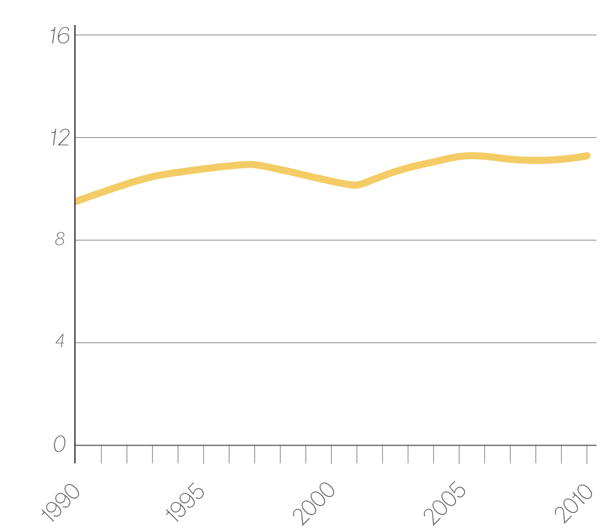
Summer is Southern Nevada's annual peak demand period.



NEVADA ENERGY USE

Sector energy usage in Nevada.

RESIDENTIAL IS THE FASTEST GROWING SECTOR, ADDING 3 BILLION BTU'S IN 20 YEARS



RESIDENTIAL ENERGY USE

Growth in billion BTU's of energy from the residential sector.

The Southern Nevada commercial sector, consisting of hotels, casinos, retail stores, offices (business and government), restaurants, schools and other similar buildings, consumed 11.3 billion kWh of electricity and 108 million therms of natural gas in 2014. The industrial sector represents production and processing of goods, including manufacturing, and consumed 8.9 billion kWh of electricity and 540 million therms of natural gas during the same period. Much of the natural gas consumed was transportation gas used for power generation. While total energy use in these sectors has increased in the last decade, the share of energy use in the industrial sector has substantially decreased due in part to efforts to increase building efficiency.

Commercial and industrial buildings can increase energy efficiency through design and management using techniques such as centralized building management systems and upgrades to major systems. Space conditioning is also the largest area of energy consumption area for commercial and industrial buildings and represents approximately 30 percent each sector's total energy use. Lighting plays a much larger role for these uses than it does in the residential sector, accounting for 25 percent.

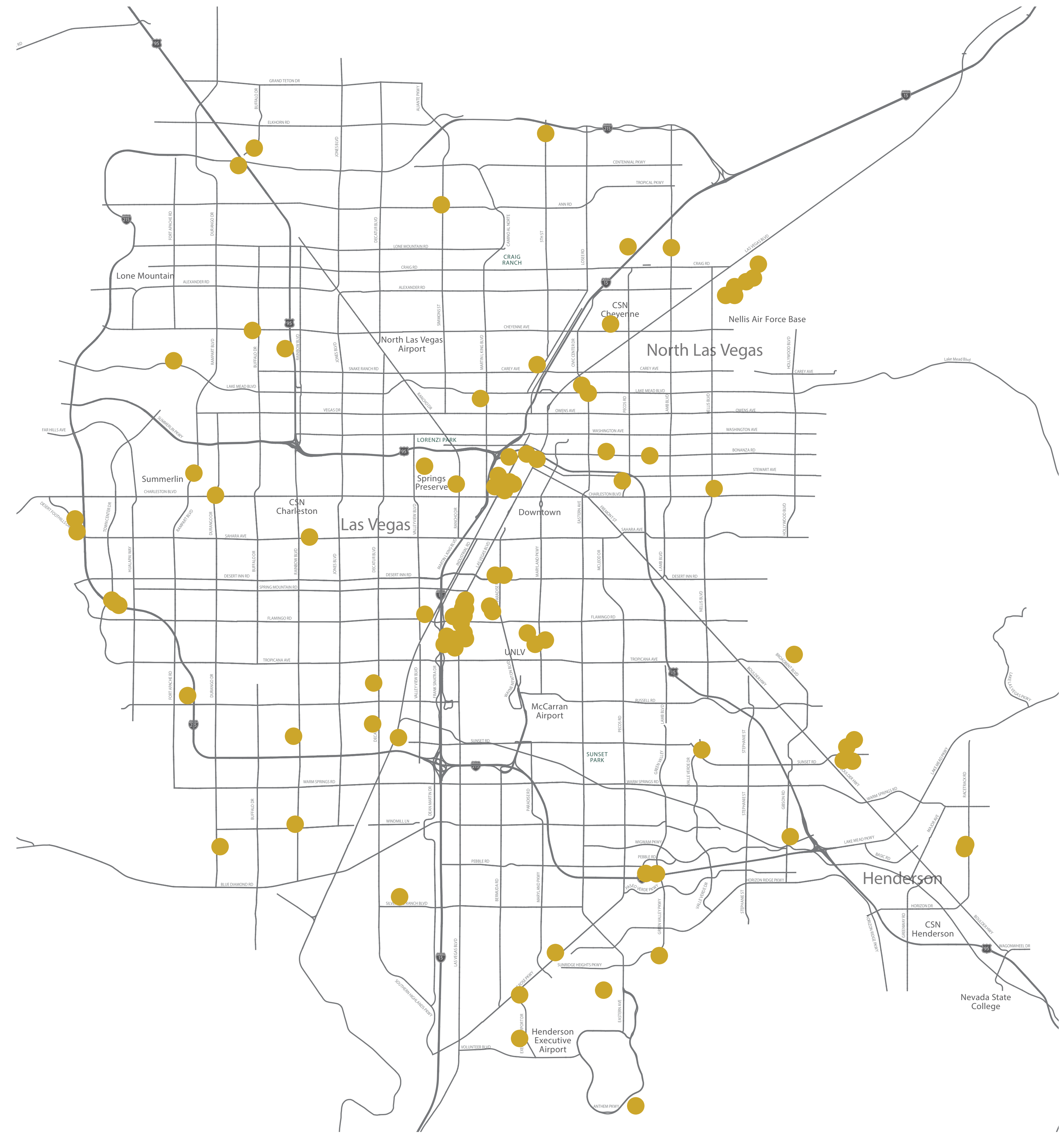
Green certified commercial and industrial building stock surged in Nevada after the 2005 Legislature authorized a 50% abatement of property taxes for LEED certified buildings for ten years; while the standard has since been modified, 66 LEED buildings in Nevada have received tax abatements through this program, including some of the largest casino-resorts on the Las Vegas Strip like the Palazzo, CityCenter, Venetian, Sands Expo Center. The buildings range in type and include new construction, core and shell, and renovation of existing buildings.

In addition, public buildings, such as Las Vegas City Hall and the Las Vegas Springs Preserve, a green friendly attraction that teaches visitors about the Southern Nevada environment and the importance of conservation, have demonstrated and showcased green building techniques. Seven buildings at the Preserve have achieved Platinum LEED certification and make use of straw bale insulation and rammed earth. These were the first Platinum-rated buildings in Nevada. 120 LEED certified buildings and homes have been added to Southern Nevada's building stock, making Nevada one of the leading states for LEED certified building square footage per capita.

HOW RESORTS HAVE BECOME MORE ENERGY EFFICIENT

- CityCenter has its own 8.5 MW natural gas co-generation plant
- Rio All-Suite Hotel & Casino has its own 5 MW natural gas co-generation plant
- Light fixtures retrofitted with CFL or LED lighting in the exterior and interior of their properties (parking garages, hotel rooms, slot machines, public spaces, service areas)
- Specially designed low-wattage bulbs for unique fixtures
- Radiant floor cooling
- Light motion sensors turn off lights in guest rooms and office spaces
- Thermostat sensors reduce cooling when guests are not present in room
- Improved HVAC systems
- Shade louvers (ARIA and Veer) to decrease solar heat gain
- Using captured hot air to heat water in buildings and pools
- Using natural light from skylights
- Variable frequency drives regulate electricity flow for cooling air depending on need
- Buildings oriented north/south to reduce east/west sun
- Solar powered DJ booth
- Guest room master control light switch turns off all lights in hotel room
- Solar pool heating
- Hiring sustainability officers to evaluate resort operations and make recommendations

LEED CERTIFIED BUILDINGS



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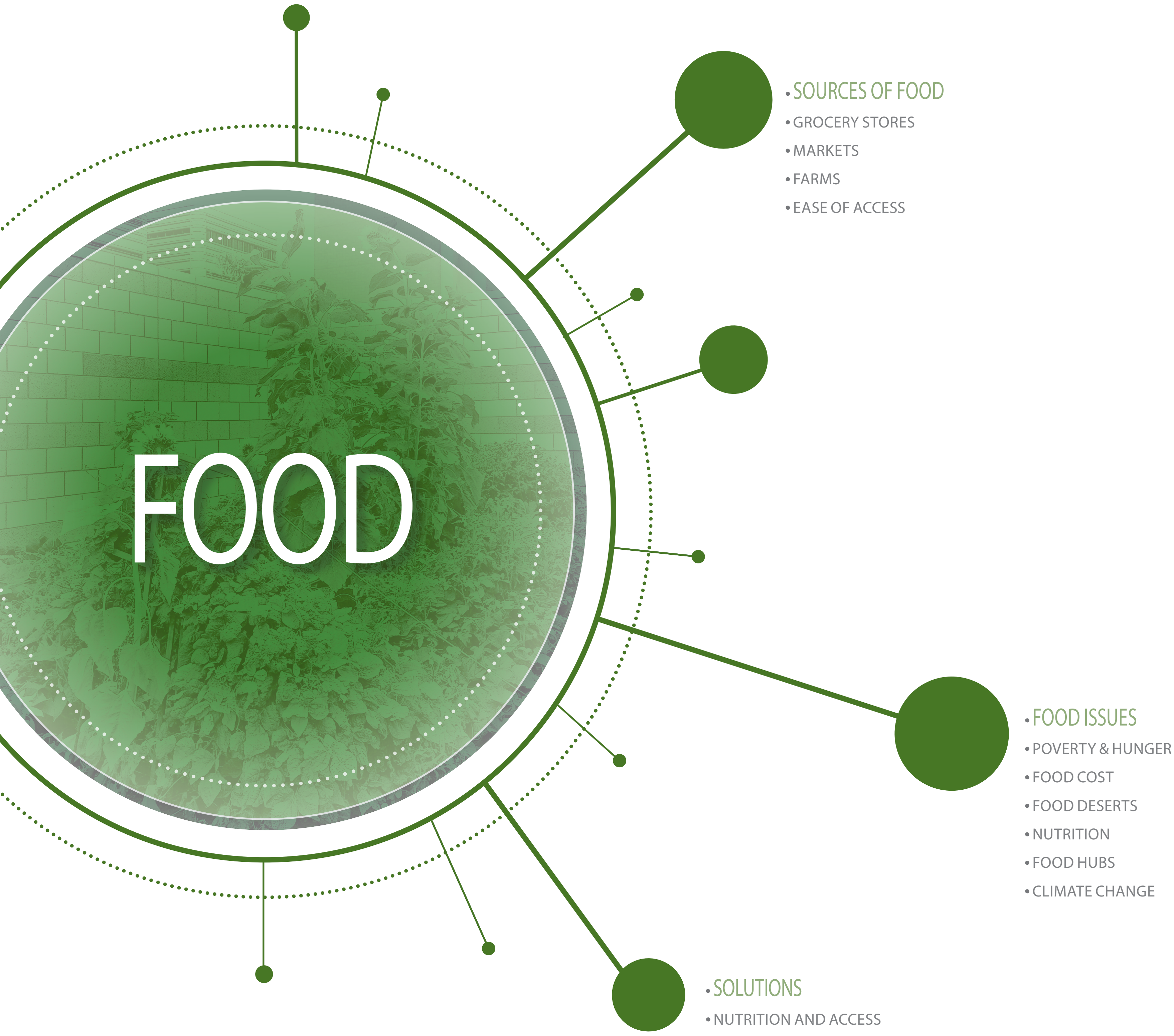


Southern Nevada is a uniquely situated due to its location in relation to agricultural areas where food is grown or derived from. Residents and visitors depend on distant sources for about ninety percent of the food supply. As a result of its reliance on trucking, the region's vulnerability could lead to cost increases, which may have disproportionate effects on lower income populations. Southern Nevada's food supply could also be at risk due to factors beyond the region's borders, including rising temperatures and lack of water resources across the nation, and even across the world. Food justice is also another issue facing Southern Nevada; some populations, including minority groups and low income populations have poor access to good, affordable, and nutritional food. With a high dependence on imports of food, and the sensitivity to changes in the food system, Southern Nevada must investigate its capacity to grow food to enhance the local food supply and increase accessibility of food to vulnerable residents.

THE FOOD NETWORK: FROM FARM TO TABLE

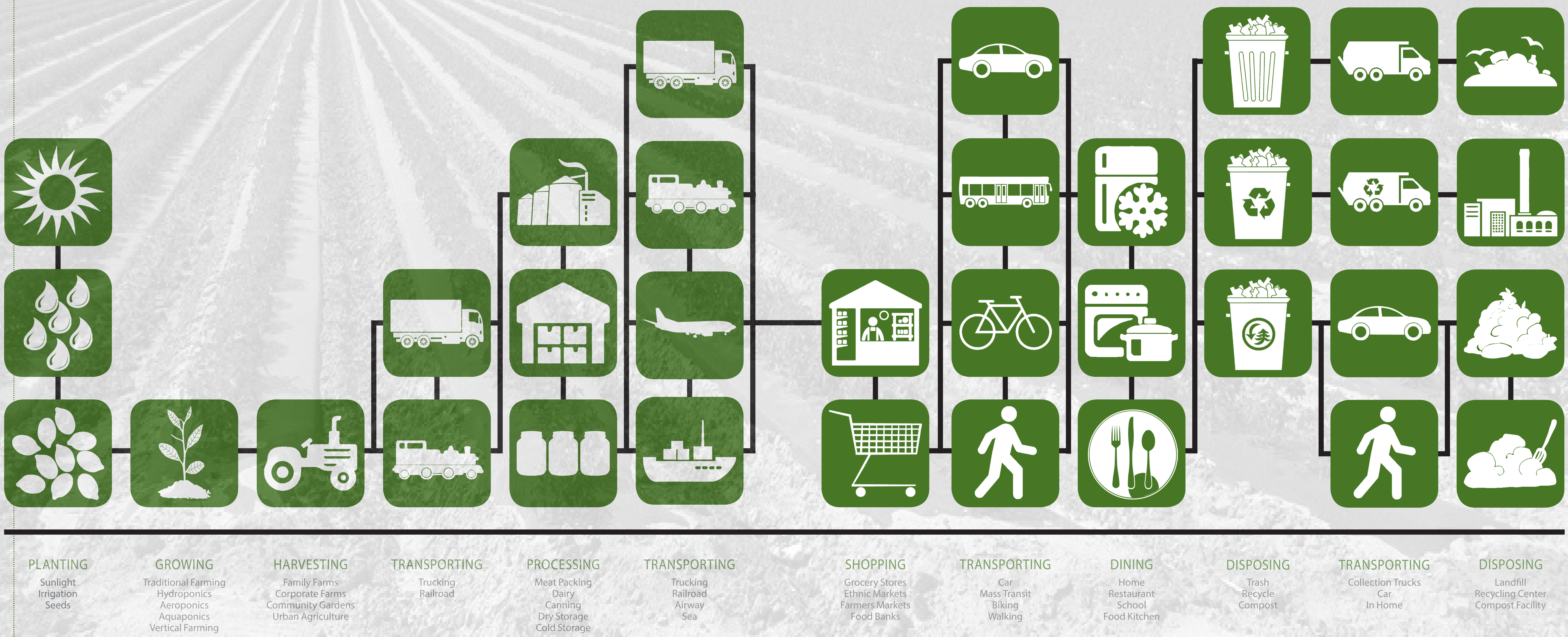


Photo by Ken McCown

FOOD ACCESSIBILITY, FARMING, AND MARKETS

Throughout its history, farm and ranch based agriculture have been limited by water and the size of Southern Nevada's small towns. Most early farming existed in the Virgin and Moapa Valleys along the Virgin River in the 19th Century Mormon established towns of Mesquite, Bunkerville, Logandale, and Overton. The Las Vegas Mormon Fort and Rancho, operated by the Stewart family and Octavius Decatur Gass, Kiel Ranch, and Tule Springs were among the first farming and ranching operations in the Las Vegas Valley.

According to a study done by the Federal Highway Administration's Freight Analysis Framework and the U.S. Department of Commerce's Bureau of Economic Analysis, 92 percent of all the food in Las Vegas is shipped by truck. Only eight percent of the foods purchased in grocery stores and markets are grown locally or within the region. In the same study, 87 percent of the food consumed in restaurants is also brought in by truck, while three percent is transported by rail and two percent is shipped by air. This high rate of food importation by way of truck leaves Southern Nevada potentially vulnerable due to disturbances in the ground transportation system. Trucker strikes, a closure of Interstate 15, or spikes in fuel prices, all of which have occurred in the past, have the potential to impact food prices. Today, only one major livestock farm, RC Farms (a pig farm) remains in Southern Nevada, and will soon relocate from its location in North Las Vegas to Apex. RC Farms accepts food scrap leftovers from local resorts which becomes compost and feed for pigs.

Food access considers location of food from one of Southern Nevada's 150 grocery, convenience, or drug stores and affordability. According to the United States Department of Agriculture (USDA), the Treasury Department and the Department of Health and Human Services, an urban food desert is defined as an area with between a thousand and eight thousand low income residents (poverty rate of 20 percent or more, or a median family income at or below 80 percent of the state or metropolitan area) in which either 500 or one-third of the population live more than one mile from a grocery store – a place with at least $2 million in annual sales and contains all major food departments. In rural areas, this distance is up to ten miles. In terms of transportation accessibility, access is determined by areas of the city where a hundred or more households have no access to a vehicle.

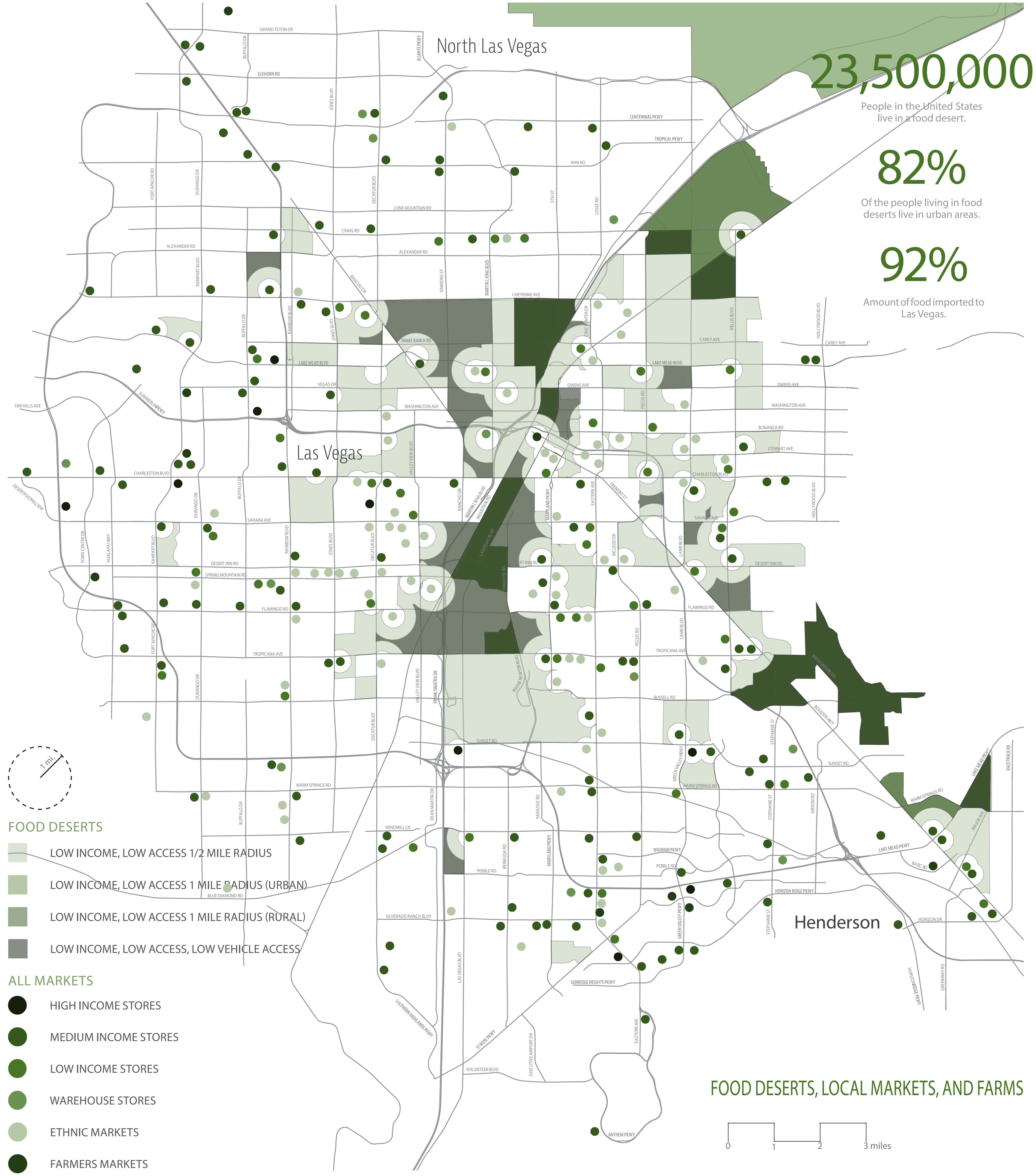
In urban areas, access to public transportation may help residents overcome the difficulties posed by distance. Economic and land use forces, including land value, lease rates, and population density determine grocery store location decisions. Even if transportation is adequate in some areas, grocery stores may not be close enough. Higher wages for grocery employees in urban areas can increase food costs. These factors, alone and in tandem, can mean major grocery stores will have difficulty being profitable in low income neighborhoods.

Southern Nevada's food deserts include neighborhoods that lack major grocery retail outlets around the Strip, Downtown, McCarran Airport, and northeast and southeast Las Vegas because the majority of these area's poor residents do not have access to a car. As a result, these residents are at a higher risk of hunger, poor nutrition, and poor health.

More than 100 farmers and ethnic markets operate throughout Southern Nevada. Due to the lack of major agricultural production in Southern Nevada, farmers markets are small, specialized, typically do not offer a fixed stock of supplies, and are not typically used by the average consumer for food staples. Most farmers markets import food from growing regions in California, Northern Nevada, or Utah; because most are small and have less than $2 million in annual sales, their presence does not necessarily mitigate food deserts; however, their locations in the Downtown and central Las Vegas areas, in addition to locations in other parts of the metropolitan area provide supplemental food access. Ethnic markets offer specialized food, often in addition to traditional grocery store fare, but in limited quantity and square footage. In many cases, the food caters to local clientele and is less expensive than at a traditional grocery stores. Given the diverse demographic makeup of the Southern Nevada's residents, ethnic markets are an important source of food. Their proliferation over the past several years helps reduce the spread of food deserts in certain parts of Southern Nevada.

While there are less than thirty certified food producers in the region, the majority of these producers use traditional growing techniques and are either small-scale family-owned operations or community supported agriculture (CSA), which offer shares for purchase by the subscribers who receive seasonal produce each week throughout the growing season. For both systems, farmers can market the food and plan how much and what to grow, receive early payment to aid cash flow, and have direct contact with consumers. In return, consumers get fresh food directly from a farm often for much less, given that packaging and transportation costs are largely eliminated.

Some alternative farming operations have been established in Southern Nevada, including hydroponic and aquaponic systems. While both systems are water-based – hydroponics using nutrient-laden water rather than soil for plant nourishment and aquaponics using fish to provide nitrogen to plants – both use five to ten percent of the water used in traditional farming and a fraction of the land use area. As a result, while these systems may have high initial costs, they can be operated in a climate controlled settings and provide an efficient alternative to traditional farming.

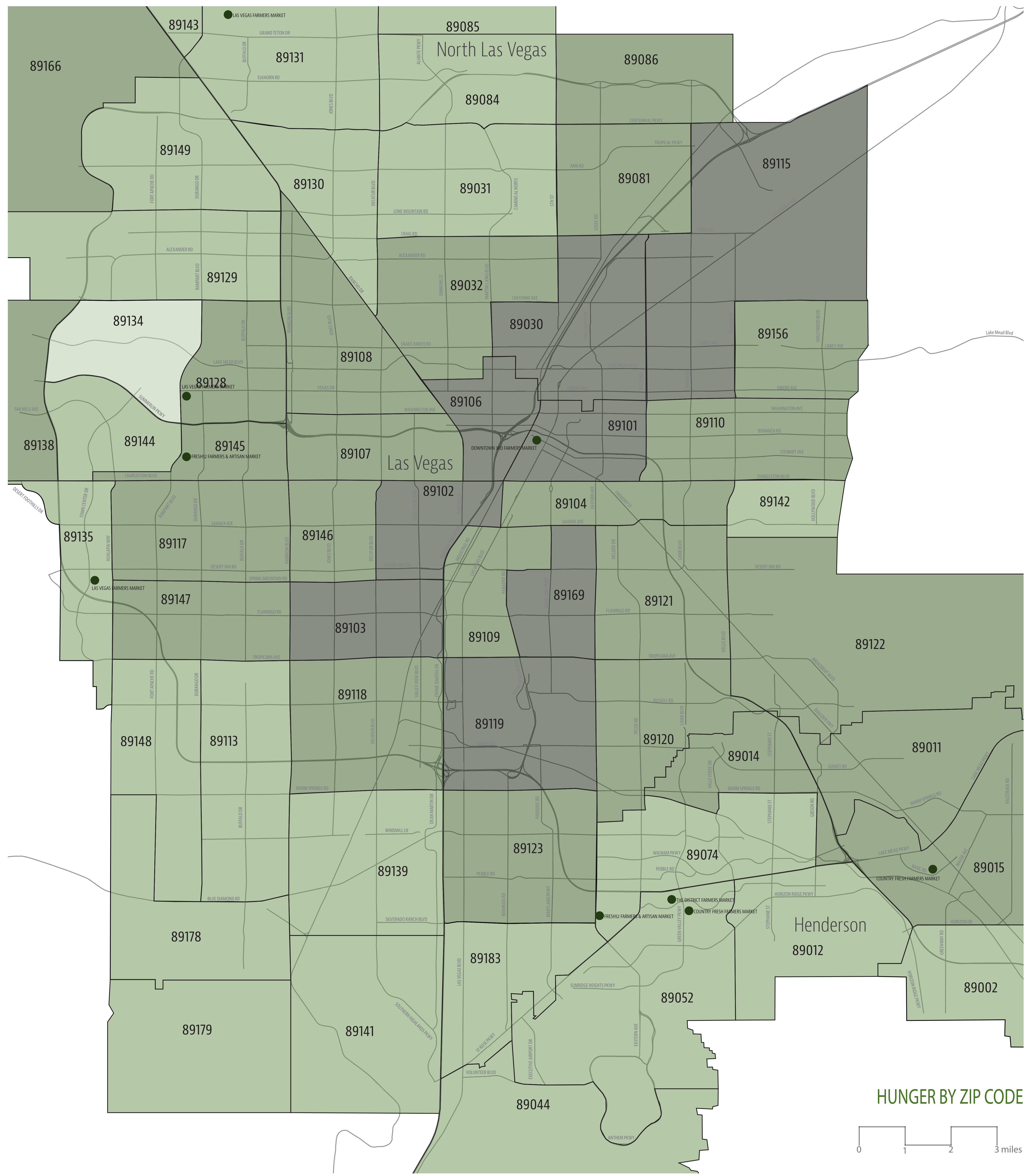


FOOD DESERTS, LOCAL MARKETS, AND FARMS

POVERTY & HUNGER

Hunger is a term to describe the acute condition of food insecurity resulting from an individual's or family's insufficient supply of food needed to lead healthy and active lives. Since the financial crisis in 2008, hunger has been an increasing public health concern in the United States. In 2012, 15 percent of U.S. households (17.6 million), or one out of every seven families, were food insecure. The USDA correlates hunger and unemployment; because Nevada had the highest unemployment rate (51st) in the United States in 2013, a corresponding number of residents were also food insecure. Persistent unemployment could pose further challenges to food security especially if drought or food price increases were factors. A majority of Southern Nevada's zip codes report that 15 percent or greater of their residences suffer from hunger.

The Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program, provides nutrition assistance to people with low incomes, allowing families to purchase healthy foods. More than 106,000 households, equal to one out of every ten people in Clark County, receive an average SNAP benefit of $260/month. For many households, this is most, if not all, the monthly food budget. Nearly 50 percent of these SNAP recipients are children 18 years of age and younger. The USDA published a report on SNAP's impact on local economies. For every dollar spent in SNAP benefits, $1.80 is generated through local economic activity where money is being spent at grocery stores, convenience and drug stores, and farmers markets. This activity creates and sustains jobs through the purchase of goods and services. In 2010, SNAP recipients in Nevada received $414 million in benefits, stimulating the economy by $746 million.



HUNGER BY ZIP CODE

HUNGER

- 0% - 10%
- 10% - 15%
- 15% - 20%
- 20% OR GREATER
- FARMERS MARKETS

POVERTY & HUNGER

There are several ways food is distributed to those in poverty or suffering from hunger. Three Square is Southern Nevada's only major food bank, whose mission is to help reduce hunger in Southern Nevada. Three Square combines food banking (warehousing donated canned and boxed goods), food rescue (obtaining surplus or unused meats, bread, dairy and produce from hospitality and grocery outlets), and pre-cooked meals.

Food pantries distribute non-perishable grocery products to families struggling with hunger. These products can be taken home by families to prepare and consume. Pantry partners select from an average of 90 items, schedule a time to come by and use the opportunity to visit the Agency Store (where perishable food items are available) at the same time. If a program partner requires a larger order than they can transport, food can be brought to them through a delivery program. The Summer Food Service Program (SFSP), funded by the USDA and administered by the Nevada Department of Education's Office of Child Nutrition and School Health, provides meals to children 18 years of age and younger in low-income areas during the summer. The program ensures that children have access to nutritious meals during their school breaks when free and reduced meals are not available to them.

In 2013, Three Square served more than 180,000 meals at 56 sites across Southern Nevada and packed approximately 4,000 SFSP meals Monday through Friday during the summer. Finally, community meal sites provide hot meals to those in need. Community meals occur in a safe place where people can go, seven days a week, and have at least one healthy meal.

Food Pantries

Food & Funds are Donated
Food donations come from manufacturers, the public, retailers and corporations. Donated funds go towards foodpurchase,transportation, storage and distribution.

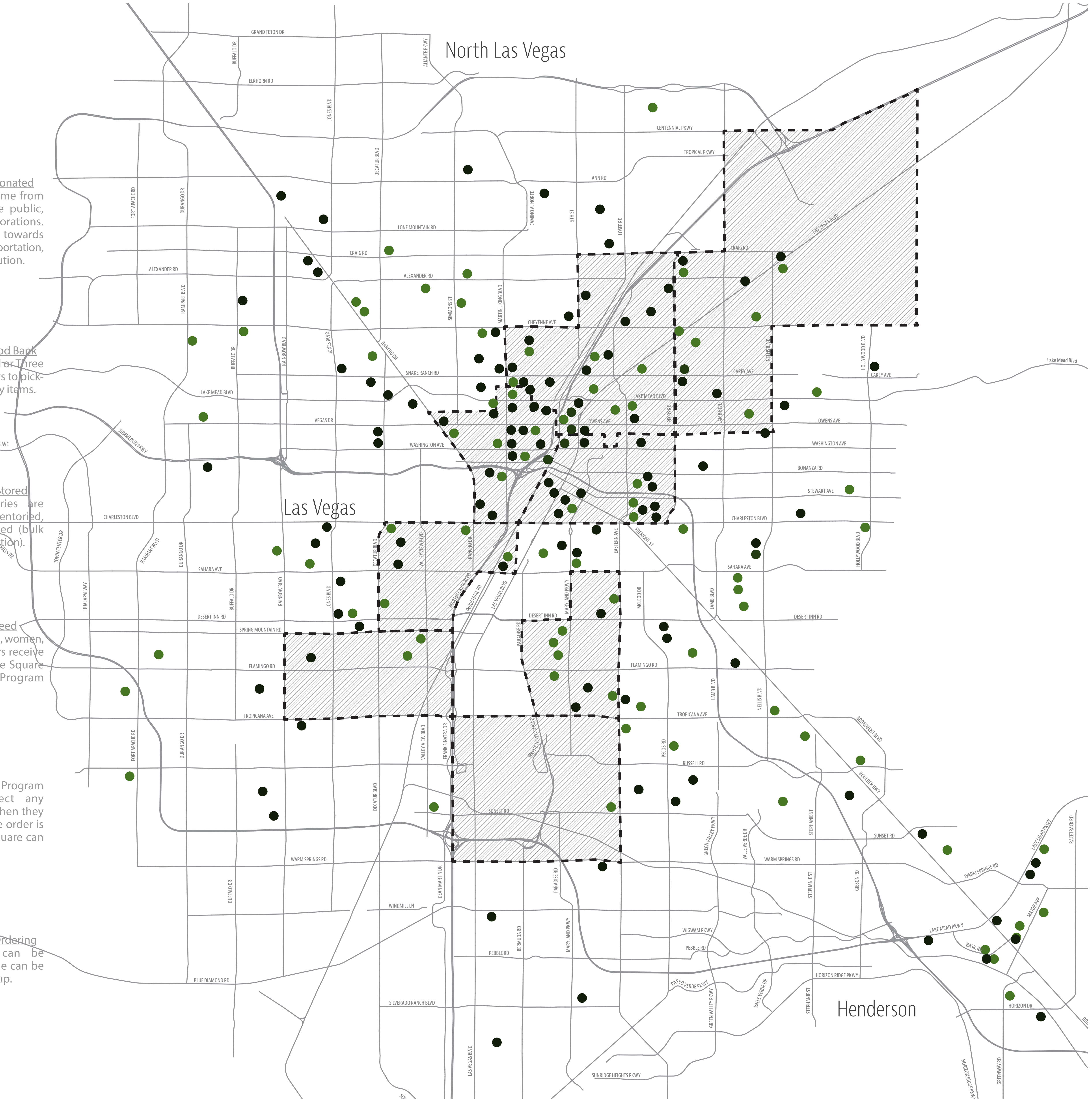
Transport to the Food Bank
Product is delivered or Three Square sends drivers to pick-up food and grocery items.

Products Sorted & Stored
Food and groceries are properly sorted, inventoried, stored and repacked (bulk product for distribution).

Reaches Those in Need
Nearly 100,000 men, women, children and seniors receive food through Three Square and their 144 Program Partners monthly.

Pick Up
During pick up the Program Partner can select any perishable items when they are available. If the order is too large, Three Square can set up a delivery.

Program Partners Ordering
Over 90 items can be selected, and a time can be scheduled for pick up.



FOOD PANTRY AND MEAL SITE LOCATIONS

FOOD PANTRIES & MEAL SITES

- FOOD PANTRIES
- COMMUNITY MEAL SITES
- SUMMER MEAL SITES
- HUNGER ZONE 20% OR GREATER

Transportation of products goes from the food bank to the Program Partner.

There are 82 summer meal sites and six community meal sites across the Valley. They are located in schools, churches, recreation centers and apartment buildings.

The food is then cooked and distributed to those in need.

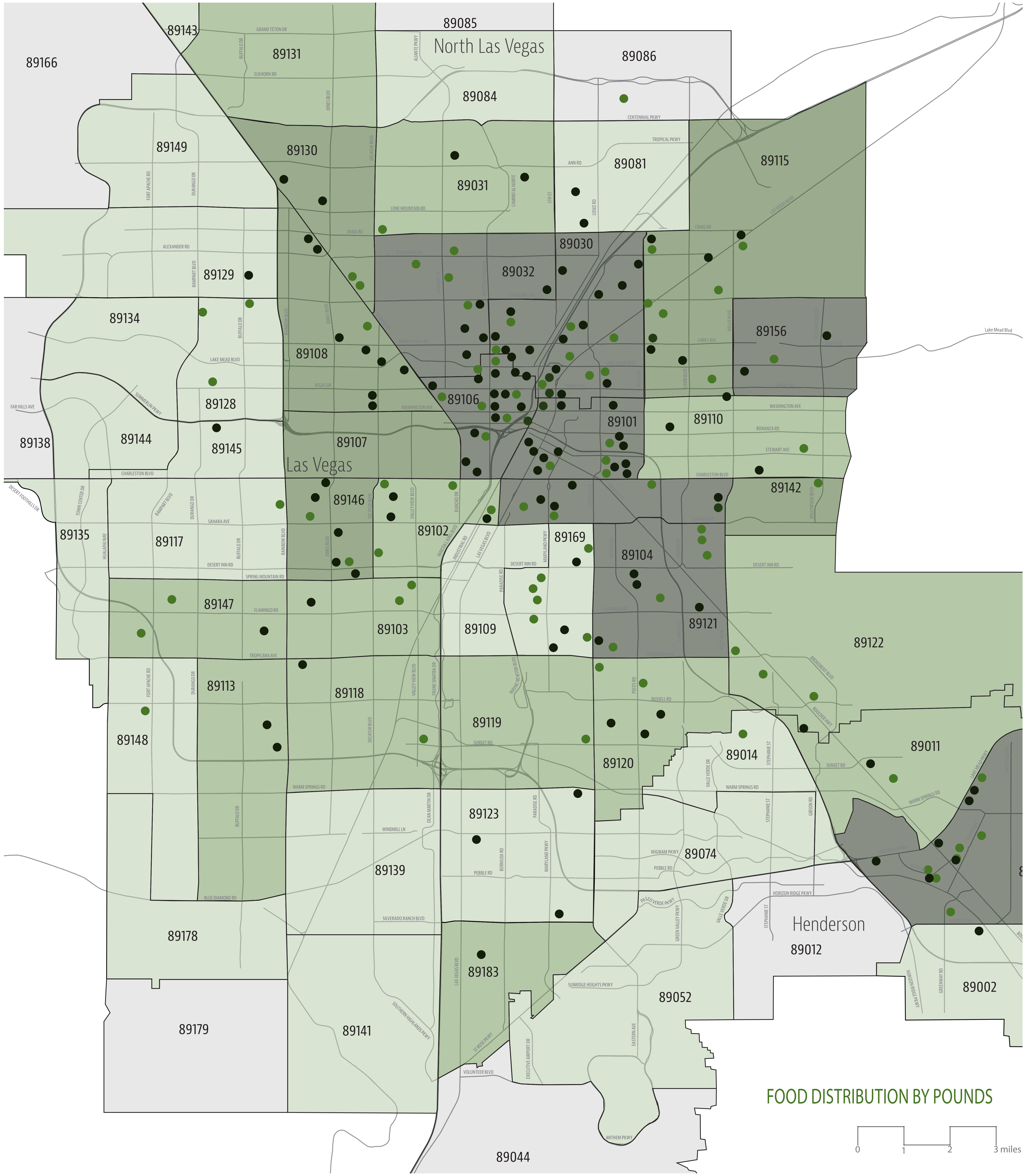
FOOD DISTRIBUTION

Over 30 million pounds of food and meals are distributed in Southern Nevada. A comparison of the Las Vegas metropolitan area with Los Angeles and Phoenix shows fairly consistent rates of food and meal distribution. Though these rates are relatively similar, the amount of food distributed is astonishing. An average U.S. citizen consumes about a ton of food per year. In this case, 30 million pounds of food distributed annually would only feed 15,000 people, well below Southern Nevada's 300,000 that may be considered food insecure. Meal costs are also higher in both Phoenix and Los Angeles, even though Arizona and California are major agricultural producers. While the percentages of those that are food insecure between the metropolitan areas are relatively close, the population of the Phoenix metro area is twice that of Las Vegas, and the population of Los Angeles County is more than five times greater.

Las Vegas (Clark County)
15.7% = 307,310 people are food insecure
Average cost of a meal = $2.69

Phoenix (Maricopa County)
15.7% = 601,540 people are food insecure
Average cost of a meal = $2.67

Los Angeles (Los Angeles County)
16.3% = 1,603,910 people are food insecure
Average cost of a meal = $2.90



FOOD DISTRIBUTION BY POUNDS

POUNDS OF FOOD DISTRIBUTED

- 0 POUNDS
- 1 - 100,000 POUNDS
- 100,000 - 500,000 POUNDS
- 500,000 - 1,000,000 POUNDS
- 1,000,000 POUNDS OR GREATER

FOOD PANTRIES & MEAL SITES

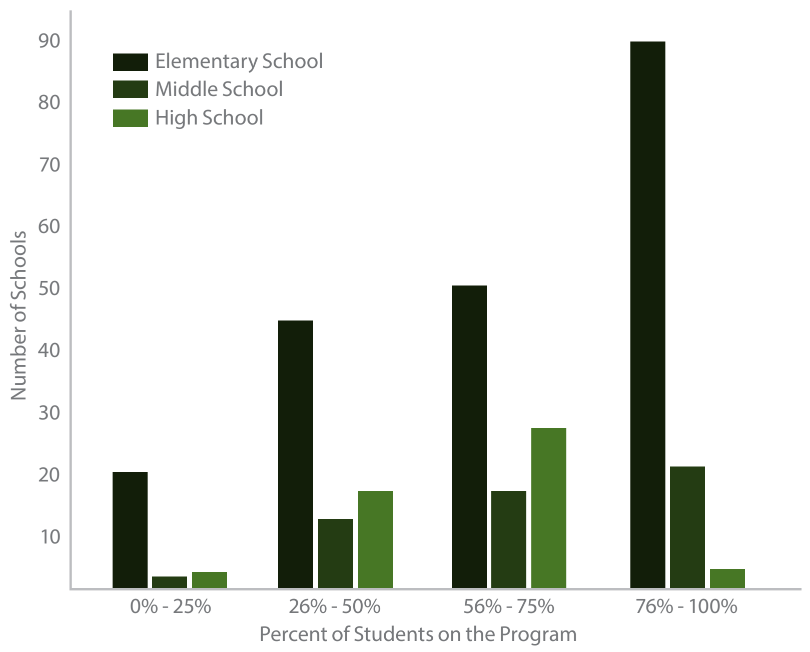
- FOOD PANTRIES
- COMMUNITY MEAL SITES
- SUMMER MEAL SITES

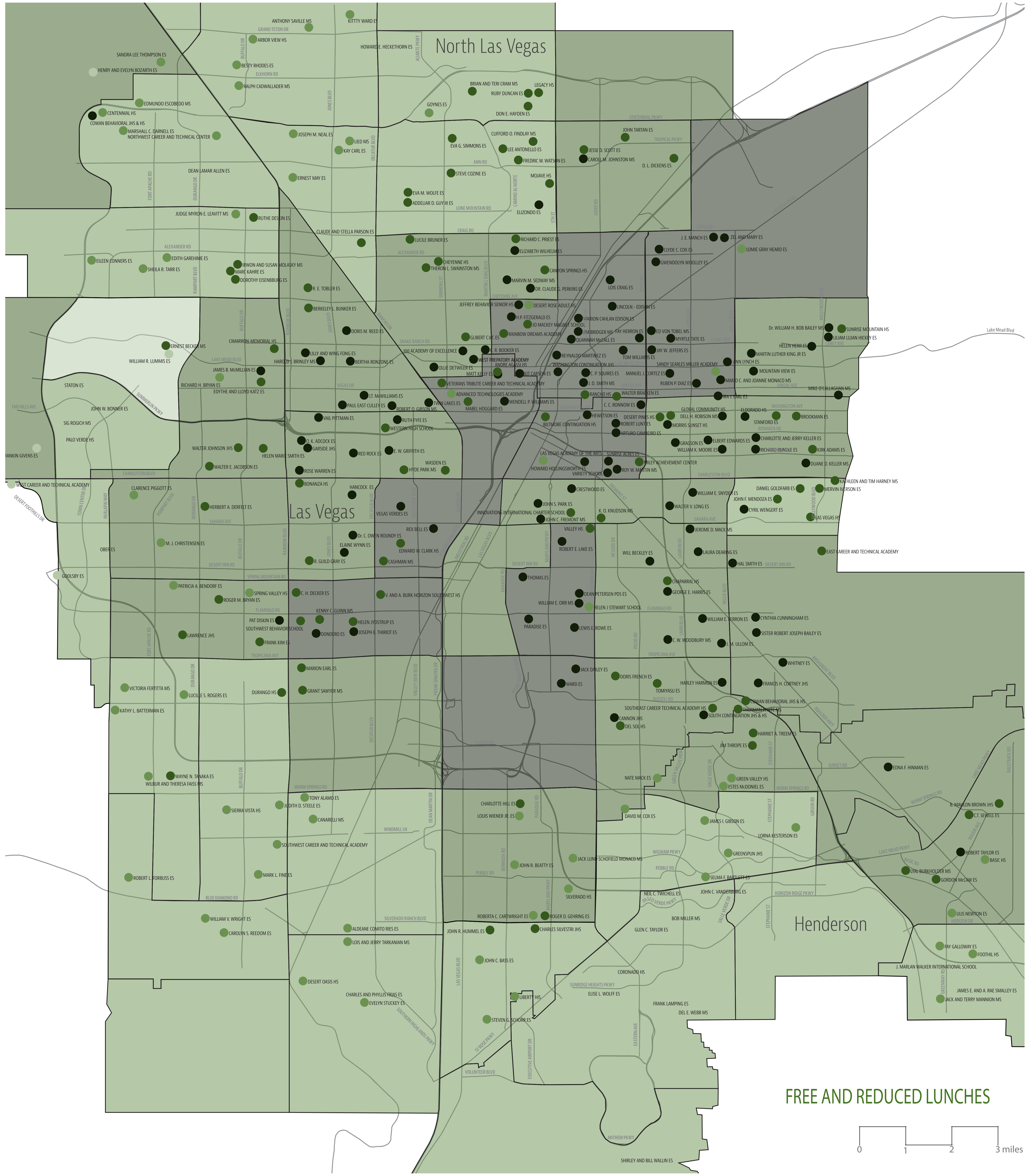
CHILDHOOD HUNGER

Hunger is also an issue that impacts children; not only does it affect childhood growth and development, it can also affects performance in school. Of the more than 300,000 students enrolled in schools in the Clark County School District (CCSD), approximately 180,000 children are a part of the Free and Reduced Lunch Program, the Federally assisted meal program that provides nutritionally balanced, low cost or free breakfasts and lunches to children on school days. This equates to about six out of ten students in Clark County being in the meal program – significantly higher than the national rate of four in ten. Participation rates gradually decrease over time: 63% of all CCSD elementary school students participate, 60% of all middle school students, and 48% of all high school students. Given Nevada's low performance in many education and student performance indices, childhood hunger is likely a contributing factor.

58%

of Valley students are on the Free and Reduced Lunch Program.





HUNGER

- 0% - 10%
- 10% - 15%
- 15% - 20%
- 20% OR GREATER

FREE & REDUCED LUNCH IN SCHOOLS

- 0% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

FREE AND REDUCED LUNCHES

FOOD DESERT REDUCTION

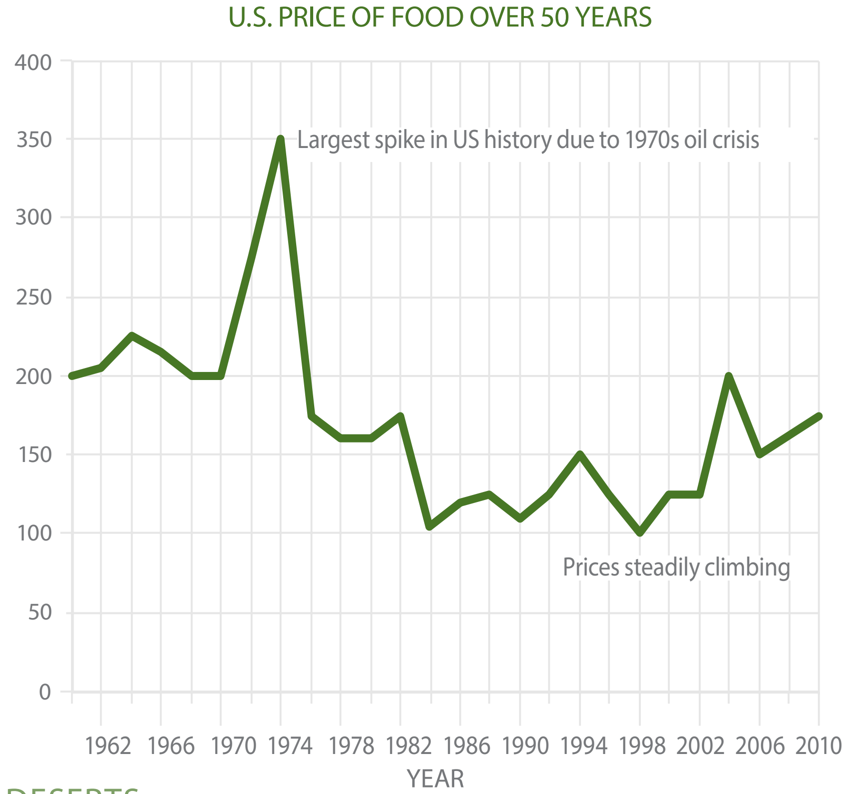
Since 2006, food costs have been rising. The average American household spends approximately 15 percent of its budget on groceries. The USDA reports that supermarket prices will continue to rise 3 percent annually, while some types of food will increase by as much as 15 percent. Beef prices increased 4.2 percent from July to August 2014 because the U.S. cattle inventory was at its lowest point since 1951. Similarly, milk cost less than $3 per gallon in 2004 before spiking to $4 per gallon in 2007 and falling to $3 in 2009. The price has climbed steadily since. In August 2014, a gallon of milk sold for an average of $3.67. These increases can affect disposable income as well as challenge people to pay for other necessities. Difficult economic choices can lead to hunger and poor nutrition as people choose less nutritious options for their meals. When food pantries and other meal sites are mapped, their impacts on low income populations with limited access to transportation have been notable; food pantry and meal site locations have helped mitigate the impacts of food deserts, as evidenced in the agglomeration of sites in North Las Vegas. Additional work, however, is required to address the communities around the Las Vegas Strip, McCarran Airport, and Nellis Air Force Base where food deserts persist.

13% - 17%
Household Food Budget

$54,000
Average Household Income in Las Vegas

$7,020
Average Household Food Budget in Las Vegas

U.S. PRICE OF FOOD OVER 50 YEARS

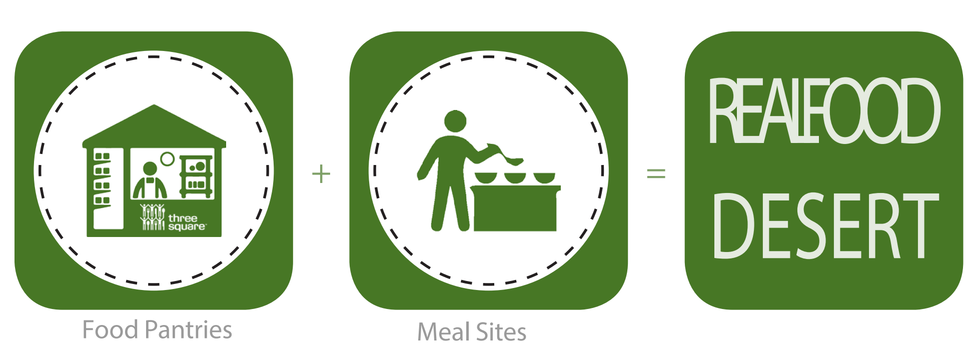


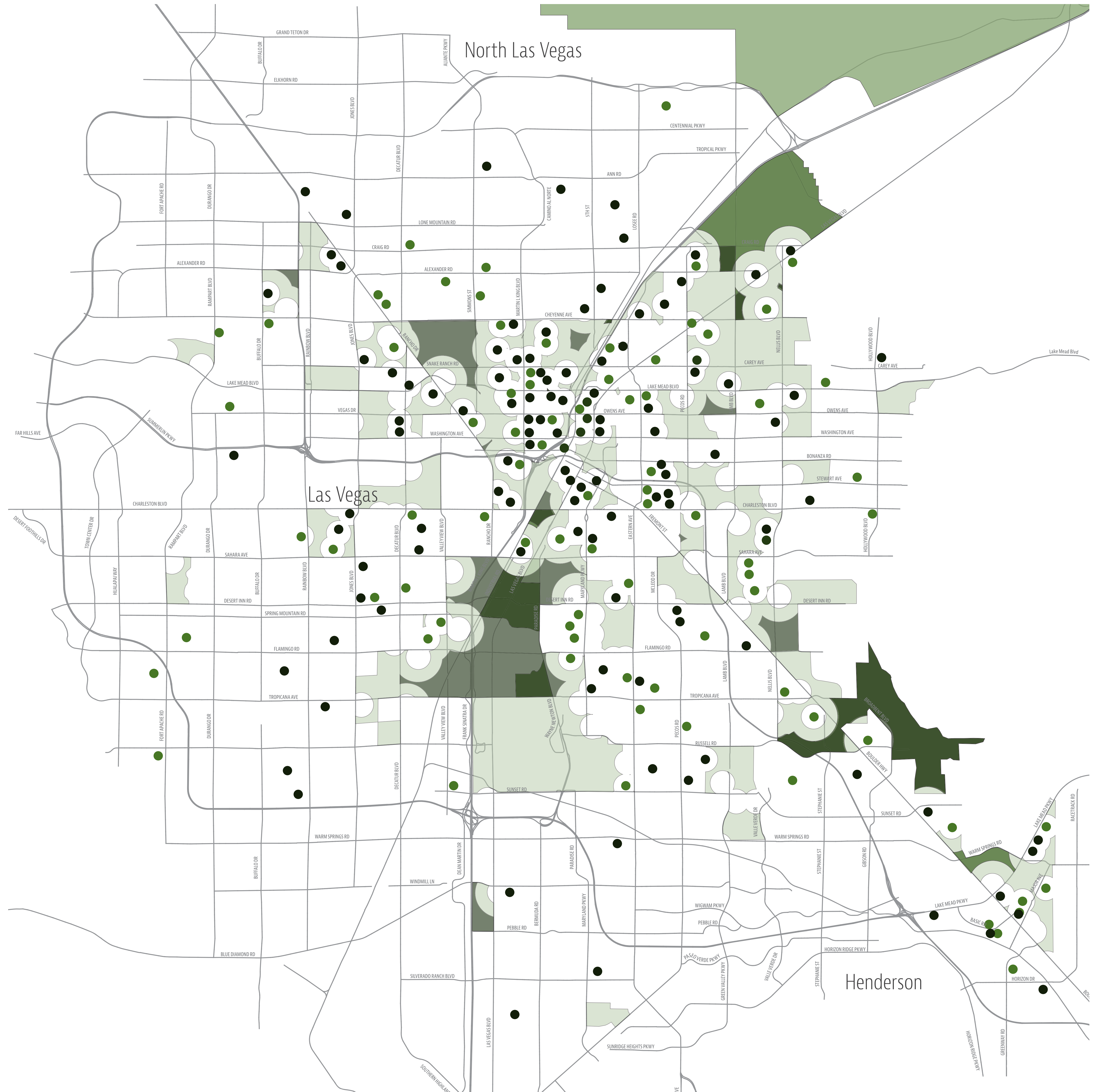
FOOD DESERTS

- LOW INCOME, LOW ACCESS 1/2 MILE RADIUS
- LOW INCOME, LOW ACCESS 1 MILE RADIUS (URBAN)
- LOW INCOME, LOW ACCESS 1 MILE RADIUS (RURAL)
- LOW INCOME, LOW ACCESS, LOW VEHICLE ACCESS

FOOD PANTRIES & MEAL SITES

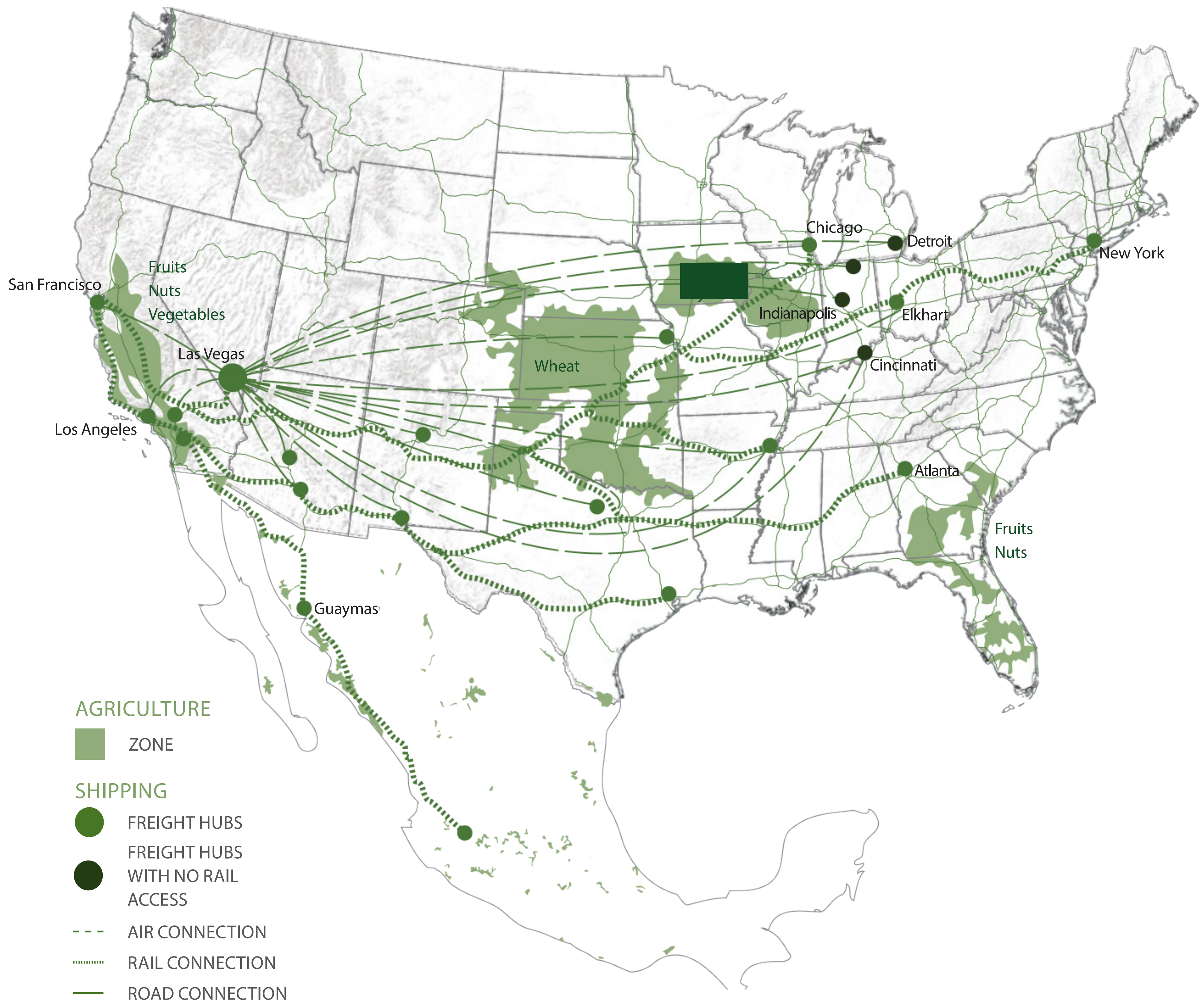
- FOOD PANTRIES
- COMMUNITY MEAL SITES
- SUMMER MEAL SITES





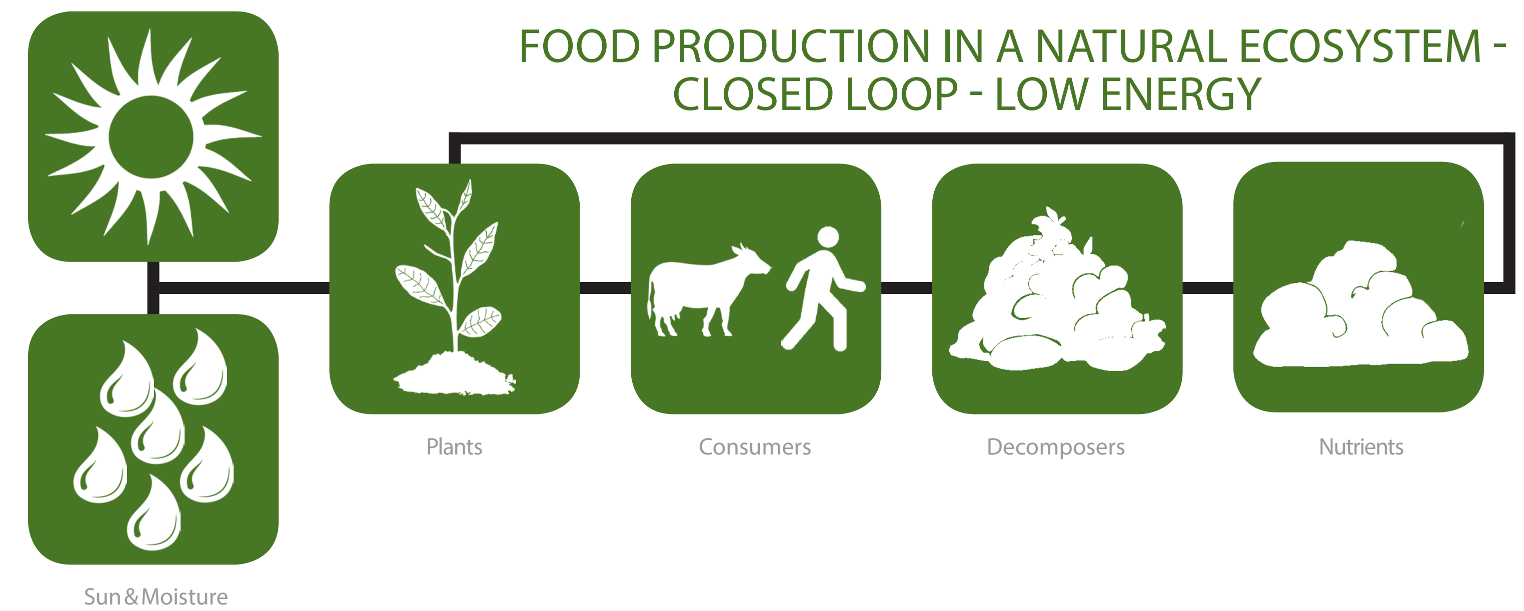
FOOD DESERT AND HUNGER RESPONSE SITES

HIGH FOOD COSTS

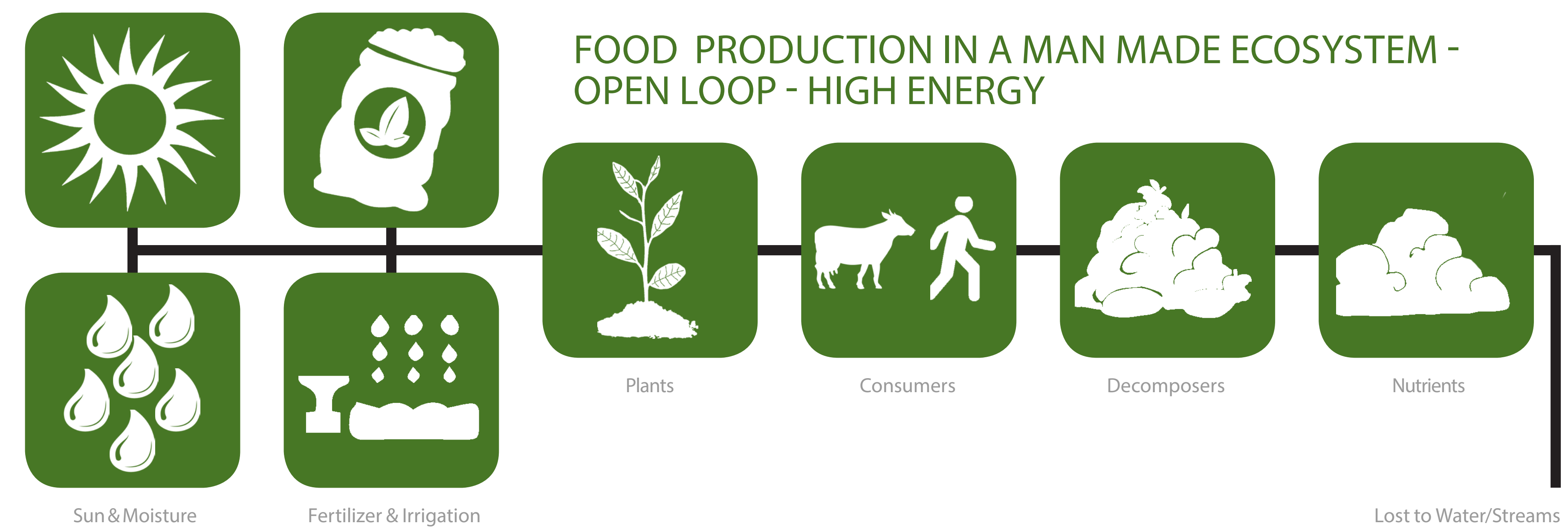


Nearly all of the food consumed in Southern Nevada is imported domestically or from across the world. Different zones of food production have different means of accessibility to transportation. Air and truck freight are sensitive to oil prices, while rail freight may be more efficient in terms of bulk movement. The Port at Long Beach and Interstate 15 corridor has long been important to the Southern Nevada; projections have shown that agriculture may eventually be transported through Mexico and utilize the Interstate 11 Corridor. However, whenever the distance between producers and consumers increases, an increase in energy prices will have a ripple effect on food costs that directly correlate to food costs that is more impactful with distance. Nutrition may also be a factor as well, as food loses a bulk of its nutrients after four days. A person may need to eat more to get the same amount of nutrients in fresh food. While, canning, drying and freezing can minimize the loss of nutrients, food trip length can create challenges for healthy food to be in supply and affordable.

FOOD PRODUCTION IN A NATURAL ECOSYSTEM - CLOSED LOOP - LOW ENERGY

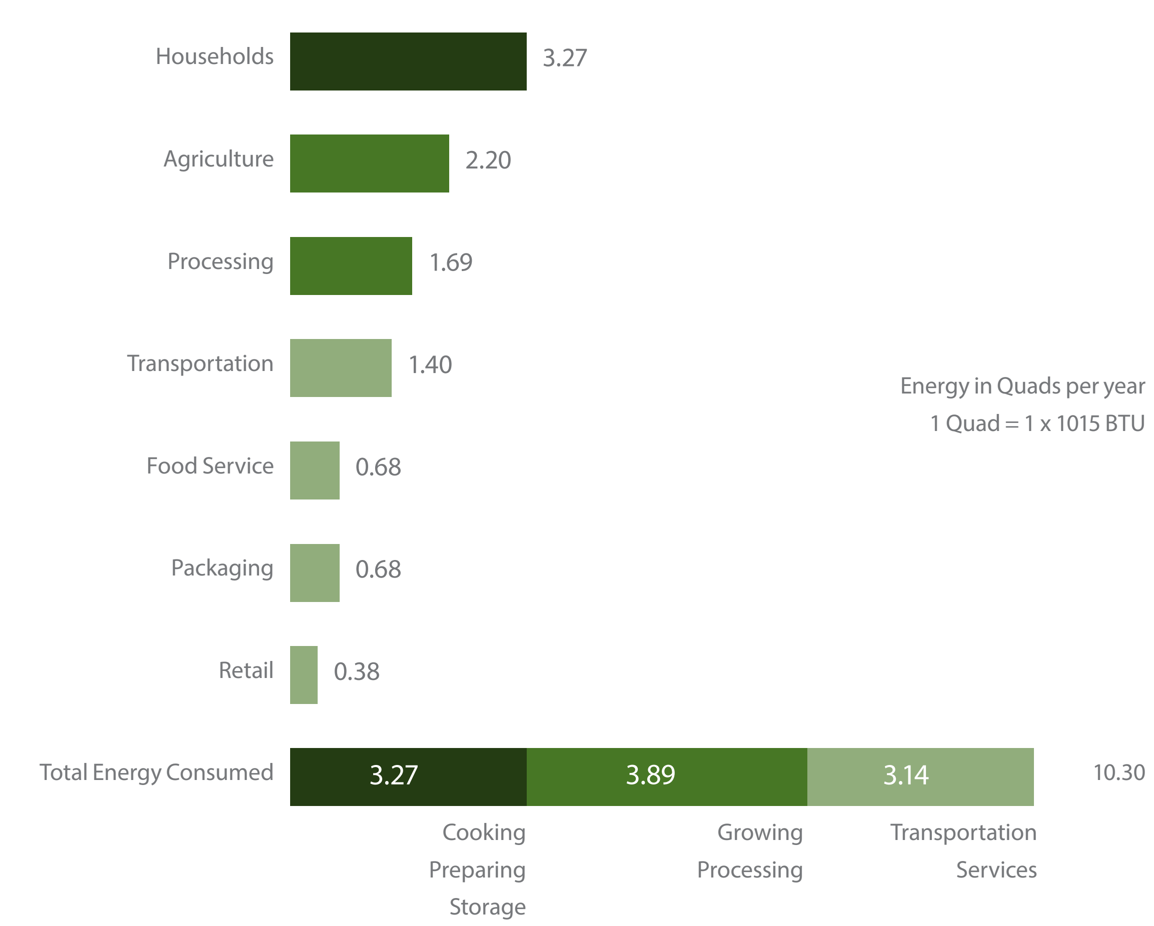


FOOD PRODUCTION IN A MAN MADE ECOSYSTEM - OPEN LOOP - HIGH ENERGY

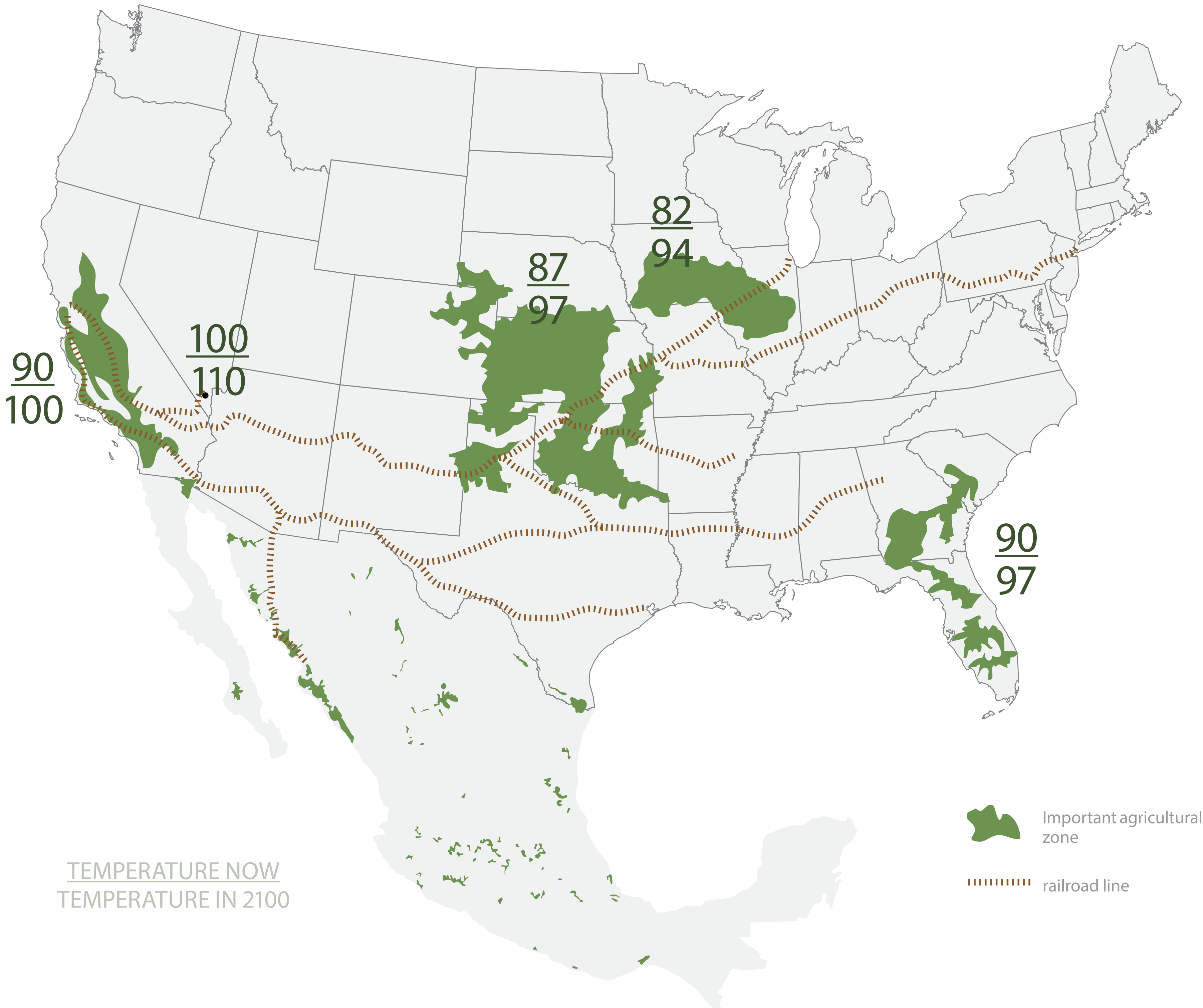


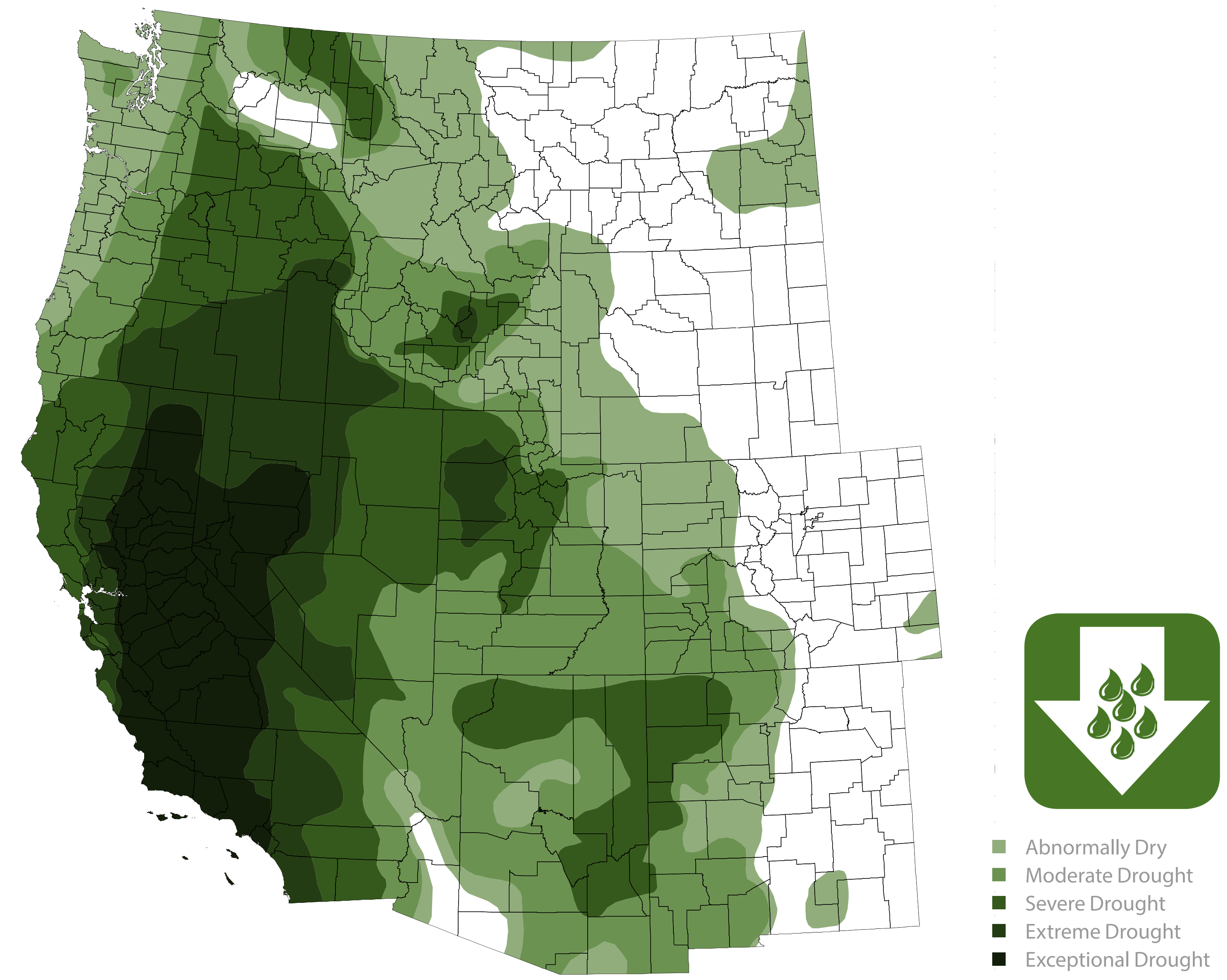
21st Century food production requires high levels of energy consumption in order to feed millions of Americans and meet demand for products. Energy use is distributed almost evenly between growing and processing, transportation and services, and cooking, preparation, and storage. In the growing and processing stage, farmers must invest in infrastructure for their properties, utilize fertilizers, and pay for fuel to pump water to irrigate their farms. They use planting and harvesting machines that run on fossil fuels. Natural gas is used to create fertilizers and pesticides, which must be shipped to farmers; automated, GPS controlled planting and harvesting equipment requires some form of gasoline or diesel; pesticides and herbicides are commonly broadcast by plane, adding to fuel costs. Electricity costs can make harvesting and processing more expensive to operate sorting, cooking and packaging machinery, but is dependent upon the type of processing. Low processed foods are fresh fruits and vegetables that only require washing, sorting, and packing in addition to some refrigeration to maintain freshness until product consumption. Intermediate processed foods are those treated to extend their shelf life such as canning or baking. Highly processed foods require several processors in different locations to provide separate components. An example includes ready to eat meals where meat, vegetables, and starches come from different sources and are then packaged into one container.

ENERGY USE IN THE U.S. FOOD SYSTEM



POTENTIAL IMPACTS OF CLIMATE CHANGE



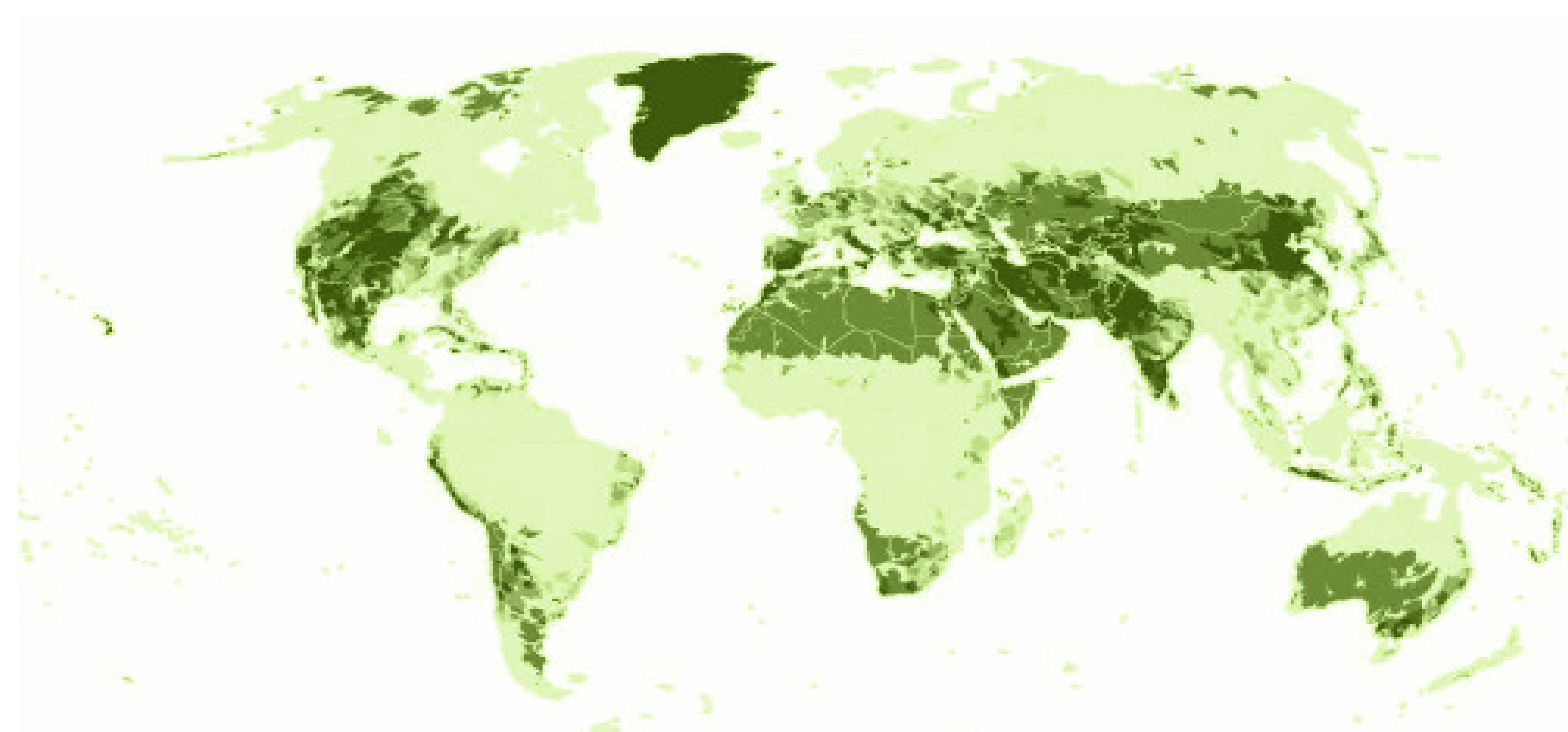


Temperature increases and drought due to climate change may have an impact on food production, especially in prime agricultural areas, which not only impacts Southern Nevada, but the rest of the country. Because plants are sensitive to high temperatures during the flowering and seed development stages, changing climatic conditions may reduce yields, and therefore impact food quality and cost. California, one of the world's largest and most diverse agricultural economies of the world, is already showing impacts from the overuse of its water supply. Increased temperatures in the Great Plains, where wheat and corn are among the most important crops and are staples for breads and starches, could stress overall plant growth and production. The southeast, home fruit and nut orchards, are also projected to pass the threshold of ninety four degrees that impacts plant photosynthesis. Should climate change increase temperatures to these levels, prices could increase by 90% for wheat, 12% for rice, and 35% for corn by 2050.

Climate change may result in further drought, altered participation patterns, and increased water stress, both domestically and abroad. U.S. drought conditions have reduced output of the citrus crop in Florida, corn and soybean crops in the Midwest and the vegetable and dairy production in California. Higher temperatures and less easily available water have resulted in a three percent price increase in most fruits and vegetables. Due to lower corn production, animal feed costs have also been rising; this is then reflected back in the prices consumers pay when buying meat and poultry.

94°F

Temperature threshold above which photosynthesis in plants decreases



FOOD HUBS

According to the USDA, a food hub is a business or organization that actively manages the aggregation, distribution and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand. A food hub has several functions to build capacity for a diverse and robust local and/or regional food system:

• Food hubs can help facilitate access for producers to market to outlets that would typically be inaccessible due to economic and product scale or location. Food hubs also allow consumers to access producers.

• Many producers need support and education including help with transportation and storage. Food hubs with education programs and marketing mechanisms can help producers work with larger corporate and institutional markets.

• Transportation and distribution is costly and can be complicated to manage. Staff at food hubs can help facilitate planning to minimize trips, maximize connectivity between producers and maximize fuel efficiency for fleets.

• Staff at food hubs can help connect producers with the correct market to maximize sales of their goods.

• Food hub staff can help farmers work together, which supports fair pricing and crop diversity. This provides direct benefits to the community and benefits producers by having viable markets for goods.

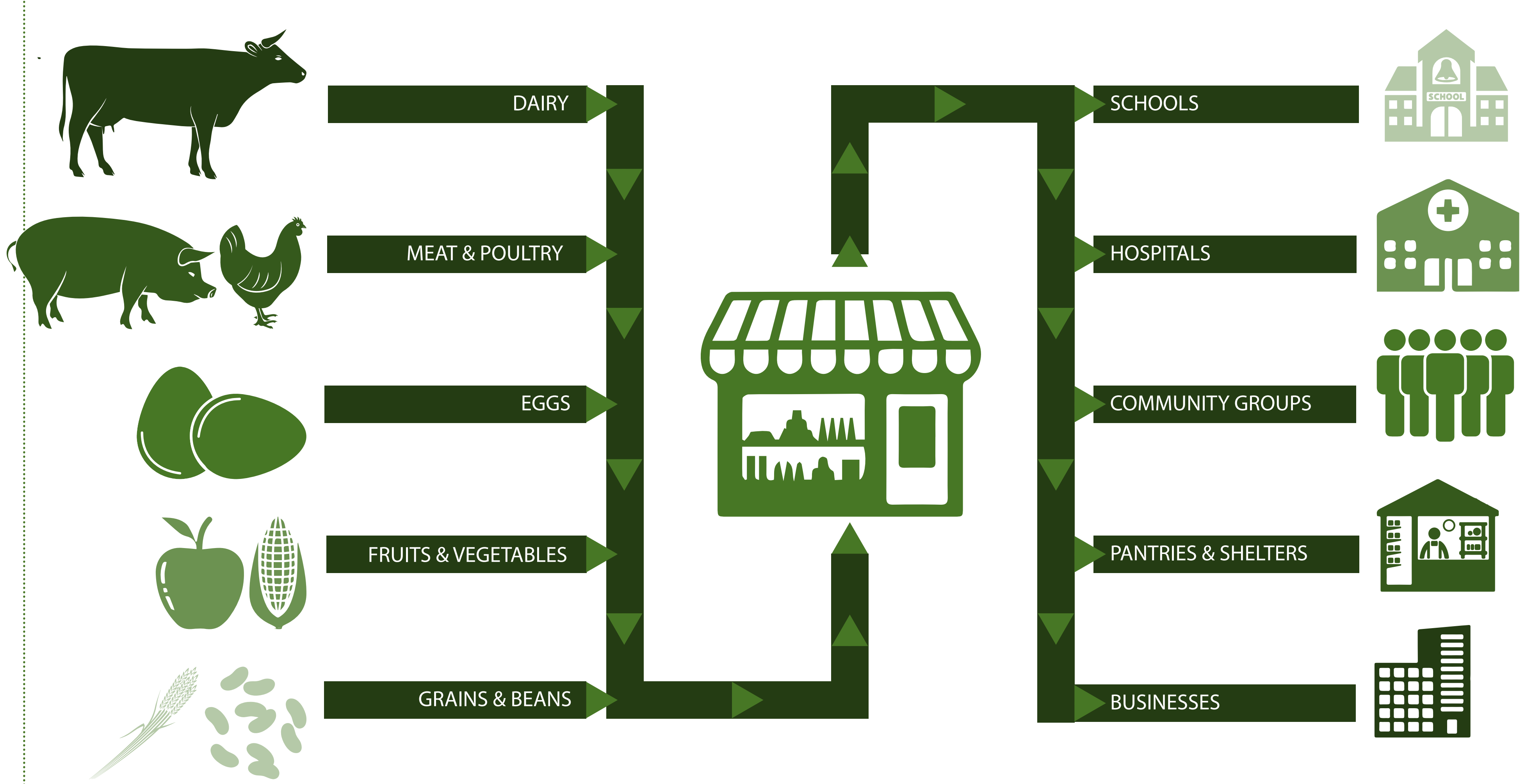
• With food hub staff coordination, the extension of growing time and complimentary crop diversity may allow for operation of farms in our region almost the entire year. Alternative farming systems like hydroponics and greenhouses, also may help extend the season and increase crop and food diversity.

• As a community institution related to food systems, food hubs can help personal connections between farmers and community members, and help sustain those relationships in a positive way.

• Food hubs can expand capacity for urban agriculture and regional growing. Food hubs can have teaching facilities where consumers can learn where their food comes from and how to grow food in their own communities.

• Regional food hubs have significant economic, social, and environmental impacts within their communities. Entrepreneurial thinking and sound business practices coupled with a desire for social impact are necessary for a food hub to thrive.

While Southern Nevada does not currently have a food hub, introduction of one, similar to Great Basin Community Food Co-Op in Reno, may help expand and sustain local capacity for urban agriculture.



POOR NUTRITION

Rising food prices could have a cascading impact on nutrition, especially for the low-income. Food may be affordable and be available, but its nutritional quality may be poor. Consider three meals for three income classes, essentially eating the same foods based on interviews with Southern Nevadans from different brackets to discern their meal habits: All meals contain beef, starch/potato, an apple dessert, and some type of grape juice.

THREE FAMILY MEALS

LOW INCOME

Entree:
• All Beef Patty
• Bun
• American Cheese
• Onions
• Pickles
• Ketchup
• Mustard

Sides:
• French Fries

Beverage:
• Grape Soda

Dessert:
• Apple Pie Pastry

A low income meal may have no vegetable but is the cheapest to purchase and the easiest to acquire. All of the ingredients are produced in the United States; however, they are not the freshest available. Out of the three, it is the most unhealthy.

MEDIUM INCOME

Entree:
• T-Bone Steak

Sides:
• Glazed Carrots
• Baked Potato

Beverage:
• Grape Juice

Dessert:
• Slice of Apple Pie

All ingredients are produced in the United States. They can be found in grocery stores, and while they might be a little more expensive, their nutritional value and freshness is worth the cost.

HIGH INCOME

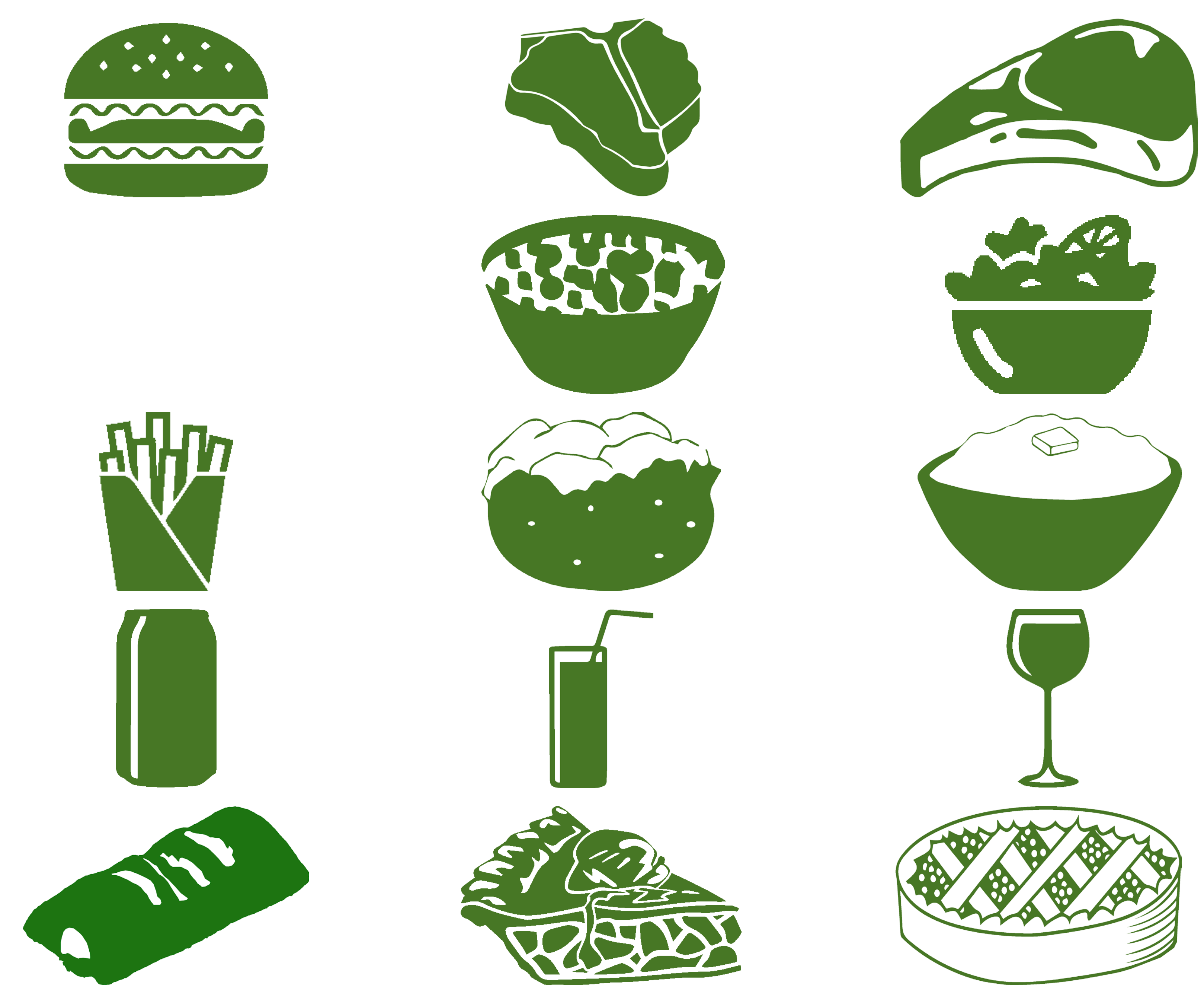
Entree:
• Filet Mignon

Sides:
• Caesar Salad
• TruffleMashedPotatoes

Beverage:
• Cabernet Sauvignon

Dessert:
• Apple Tart A La Mode

This meal can be found in a number of homes and is often eaten in restaurants. Some of the ingredients are found here, while some are imported from Asia and Europe. The nutritional value is similar to the medium income meal, but the price is much higher.



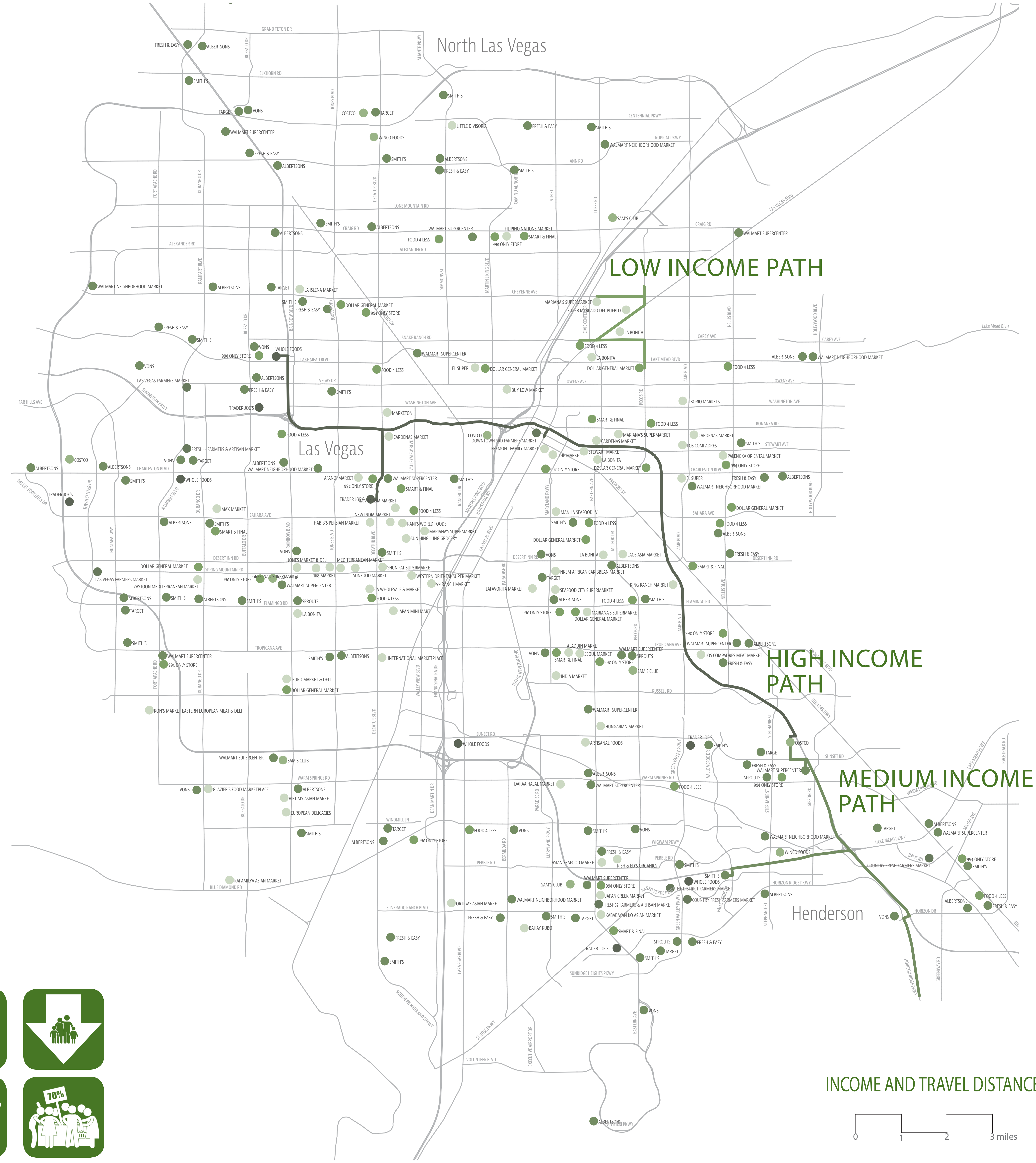
POOR NUTRITION AND FOOD ACCESS

In a high, low, and medium income food access scenario, people from different groups with different resources access food in different ways. During a typical week, a high income family visited a Whole Foods, a Trader Joe's and a Costco. From their home in Downtown Las Vegas, they traveled twenty miles and spent a few hours to get groceries. Despite the distance and proximity of the specialty grocers, the high income family was willing and able to travel farther to acquire the best, most nutritious, and organic food. They were also able to dine out at least once per week for dinner and frequently ate out for lunch during the work week.

A medium income family in Henderson obtained groceries at a Walmart Supercenter, Smith's, and Costco, also traveling twenty miles. Their choices were based on brand preference, food variety and coupons. With higher accessibility and average income, they are able to gather relatively fresh and mostly nutritious food within a couple of hours a week.

The low income family shopped at a Mariana's Supermarket, Food 4 Less and Dollar General Market, in addition to being able to access fast food. All three stores were relatively close to their homes; travel was approximately five miles by various modes of travel. This family sought discounts and affordability, but bought food that was not the freshest or the most healthy because they could not neither afford higher quality foods, nor could they access them.

While different circumstances arise from everyone, these scenarios may be representative of general trends -- food that's close and affordable will be eaten by those that can easily obtain it.



INCOME AND TRAVEL DISTANCE TO FOOD

TRAVEL ROUTES

- HIGH INCOME ROUTE
- MEDIUM INCOME ROUTE
- LOW INCOME ROUTE

ALL MARKETS

- HIGH INCOME STORES
- MEDIUM INCOME STORES
- LOW INCOME STORES
- WAREHOUSE STORES
- ETHNIC MARKETS
- FARMERS MARKETS

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WASTE

THE WASTE SYSTEM
- WASTE PROCESSES
- LANDFILLS
- RECYCLING

MUNICIPAL SOLID WASTE AND DISPOSAL
- RESORT INDUSTRY RECYCLING
- LANDFILL TRANSFER
- HAZARDOUS WASTE

WASTE DIVERSION AND RECYCLING
- RECYCLING RESOURCES
- FOOD WASTE
- EFFECTS OF RECYCLING

Waste is an important “behind-the-scenes” component of Southern Nevada’s sustainable systems given the high rate of imports coming into the Las Vegas metropolitan area, the high rate of visitation, and the rapid and projected growth of the population. Trucks move waste and recyclables from homes and businesses to transfer stations daily, ultimately ending at a landfill or recycling plant. The average Southern Nevadan produces over seven pounds of solid waste per day, which inflates when visitors are factored in. However, investments in a new landfill, the nation’s largest recycling center, and the introduction of single family residential co-mingled recycling by Republic Services, the region’s primary service provider, have helped create a foundation for a more sustainable future in the waste system.

WASTE IN SOUTHERN NEVADA

Safe, long-term storage and management of solid waste is a critical component of a resilient city. Toxins can leach out of landfills, and without a liner in the bottom, can infiltrate water supplies. The disposal and recycling systems for municipal solid waste in Southern Nevada must service a resident population of two million, as well as an additional visitor population of approximately 750,000 on a weekly basis.

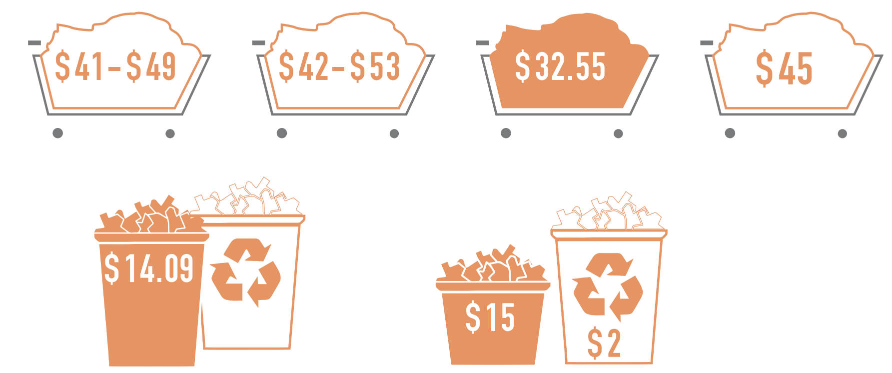
In Nevada, solid waste is categorized as either "Municipal" or "Industrial & Special." Municipal Solid Waste (MSW) contains everyday items from homes, schools, hospitals, and businesses that are used and thrown away. MSW is the largest component of the waste and recycling stream, but does not include construction and demolition debris, biosolids (such as sewage sludge), automotive parts, and most industrial process waste and hazardous waste. MSW does include household hazardous waste such as paints, cleaners, solvents, oils, batteries, and pesticides which are often disposed of at the municipal landfill, but are also collected in larger quantities for disposal in designated "Class III" hazardous waste landfills.

The MSW disposed of in Nevada landfills is reported to the Nevada Division of Environmental Protection's Bureau of Waste Management as generated in-state or out-of-state (i.e., imported). Wastes categorized as Industrial & Special include debris from construction and demolition projects such as wood, concrete, asphalt and drywall, and several types of solid waste that have specific management requirements for permitted landfill disposal, such as asbestos and biohazard waste. About 90 percent of Industrial and Special waste, by weight, is construction and demolition waste.

From 1953 until 1993, when it was decommissioned and capped, Sunrise Landfill received 18 million tons of municipal solid waste. Sunrise Landfill was unlined and contains mostly municipal solid waste, but also contains medical waste, sewage sludge, hydrocarbon-contaminated soils, asbestos, and construction waste. Apex Regional Landfill, located about 20 miles northeast of Las Vegas, is the largest municipal landfill by volume in the United States. With an expected lifespan of 200 years, it is currently holding 60 million tons of trash and accepting 7,500 tons per day – equivalent to 300 tons from approximately 160 trucks every hour.

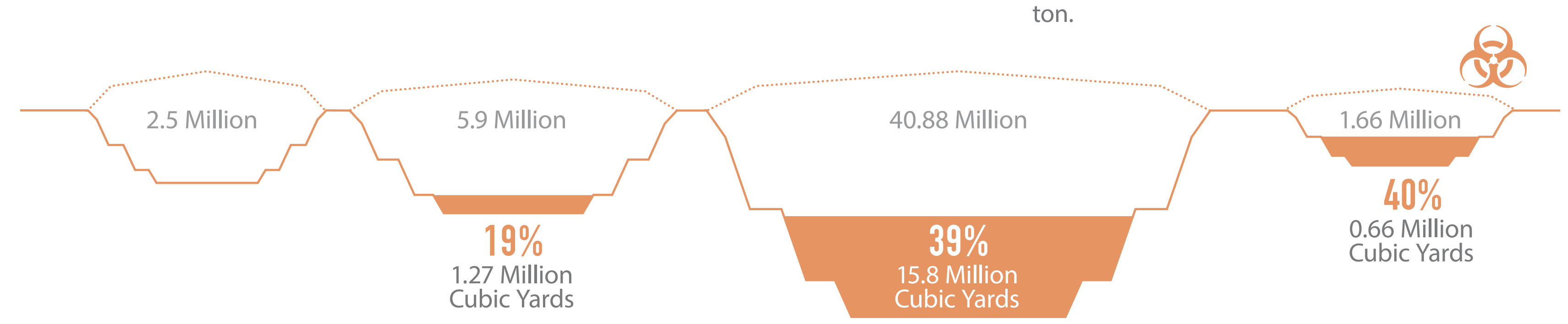
The landfill is subdivided, with 300 of 2,200 available acres developed. MSW, construction debris, decontaminated medical waste, small amounts of household hazardous waste (<1 percent), and municipal sludge are added incrementally to one area at a time. Cells are capped when full, after approximately 300' of depth. Current subdivisions are expected to reach capacity in 2034, which will consume more than half of the landfill's total capacity. This is the same size as New York City's Fresh Kills Landfill, the largest U.S. landfill by footprint.

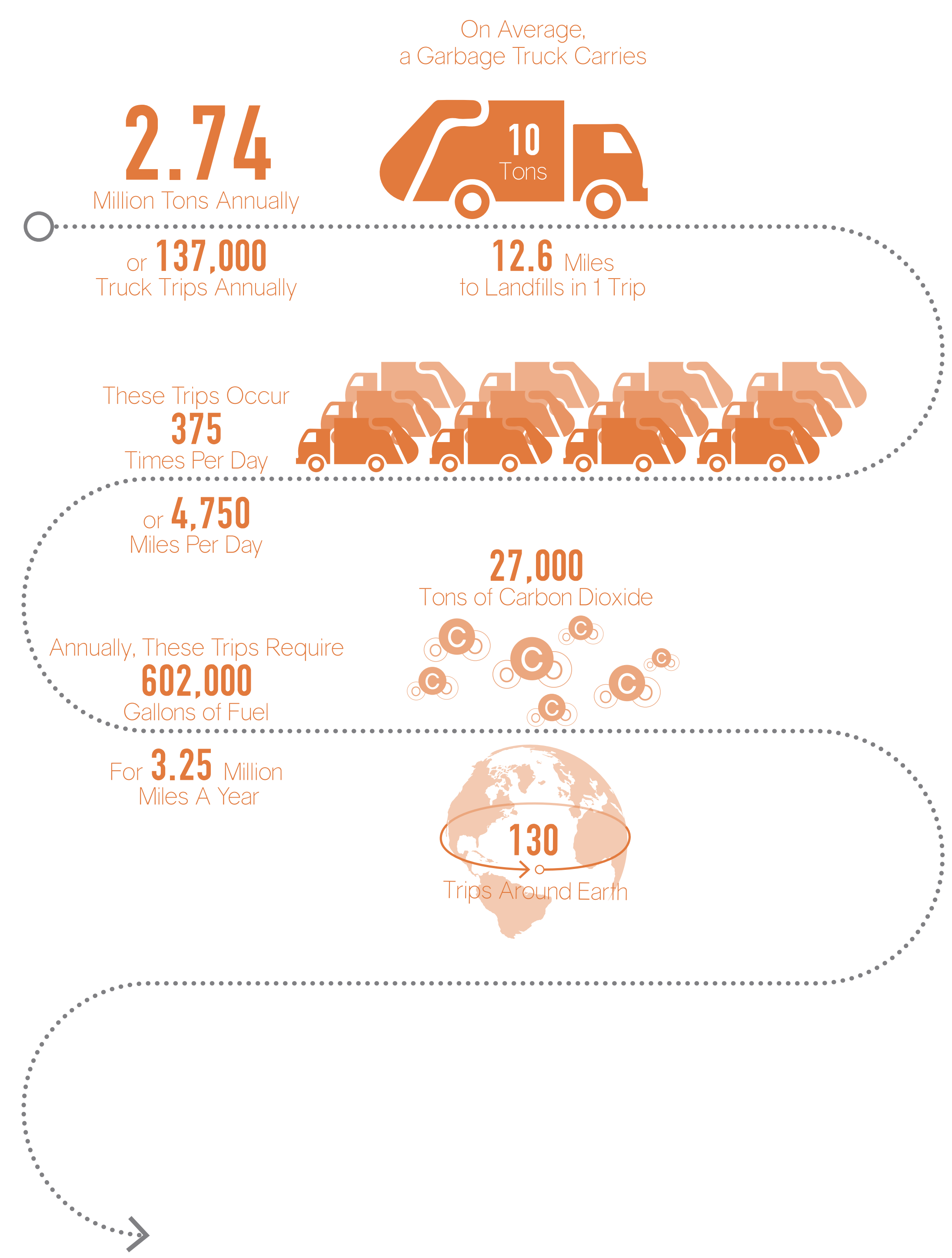
Although landfill gas is captured and burned for energy at the Apex site, there are no traditional trash or waste to energy incineration facilities operating in Southern Nevada.



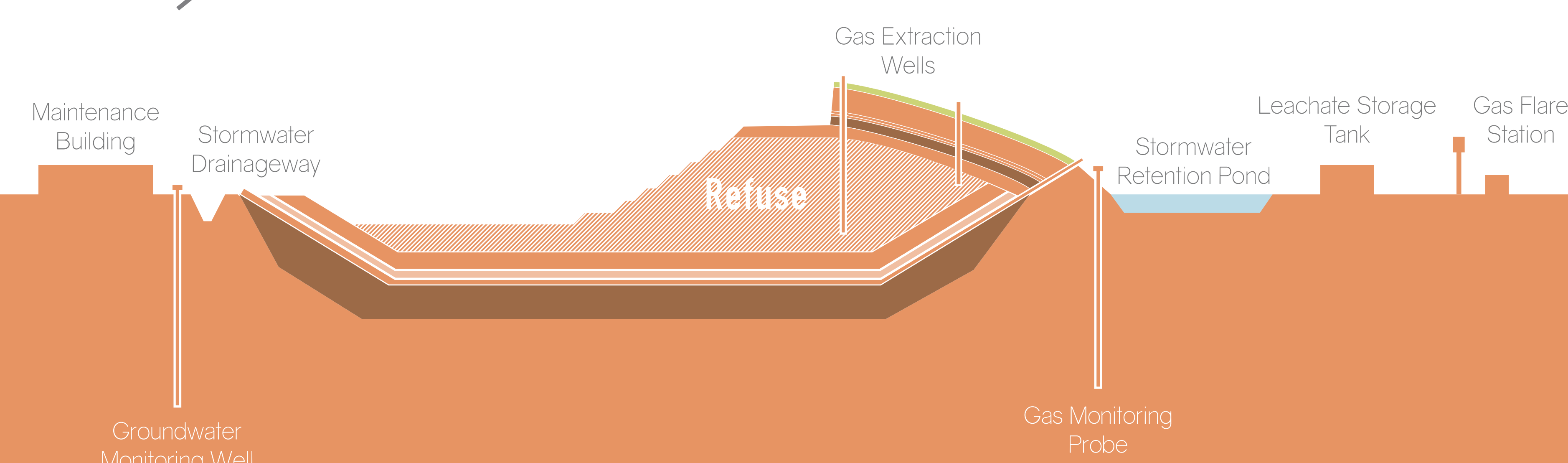
TIPPING FEES IN NEVADA

A tipping fee is assessed upon an amount of waste received at a waste processing facility. The fee can offset the cost of taxes, opening, maintaining and closing the landfill. In spite of the significant reduction in the number of landfills in Nevada, the large capacity of regional landfills allows costs to stay low for residential and commercial customers. Tipping fees at Apex are approximately $32 per ton (2015), well below the national average of $45 per ton.





Nevada has many regional unlined landfills. Even when landfills are capped, they can contribute to soil, groundwater, and atmospheric pollution long after decommissioning. Prior to 1979 EPA regulations, landfills often existed in peripheral urban areas, sometimes even low-lying wetlands that were considered undevelopable. Updated regulations on landfill design and operations in 1991 required all new landfills have composite liners and monitoring systems to control the escape of pollutants. However, flooding from a major storm in 1998 swept through the covered Sunrise Landfill site, resulting in 100,000 cubic yards of waste being released into the Las Vegas Wash and wetlands, flowing into Lake Mead. Fifteen years later, repairs were completed, a new cap, dam, and drainage were constructed, and the landfill was reinforced against future storms after $60 million in investment.



WASTE STREAMS

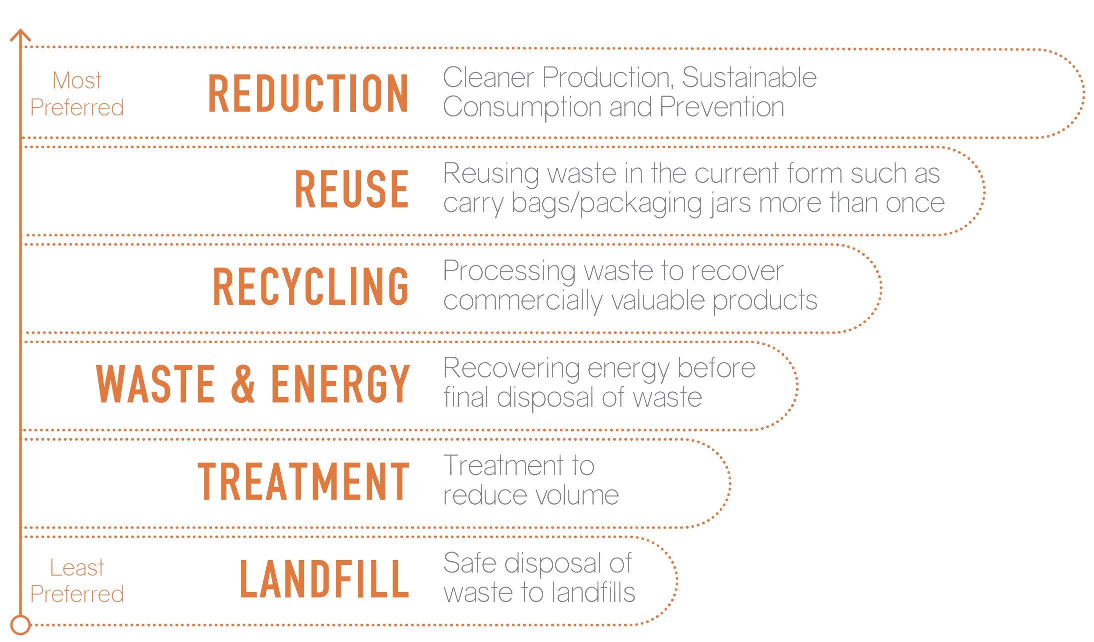
Southern Nevada has a unique waste stream due to the types of waste generated by the region's two largest economic drivers: gaming and resorts, which are responsible for large volumes of food and human waste, but not significant amounts of trash; and construction, which is responsible for the large proportion of construction and demolition waste. As a result of the increasing number of tourists visiting Southern Nevada, the gaming and resort industry in Las Vegas has made strides in increasing recycling rates as well as reducing the amount of recyclables, organics and food waste sent to the landfill. The recycling programs at the major resort properties help reduce rates of trash from tourists. The Las Vegas Sands Corporation, for example, reported a recycling rate of 57 percent in 2013; MGM Resorts International properties recycled 52.6 percent, the Cosmopolitan Resort recycled 43 percent and in 2012, Caesars Entertainment properties recycled 25 percent of total waste. After organics and kitchen grease, the next highest recycled materials from resort properties are cardboard (10 percent) and glass (9 percent).

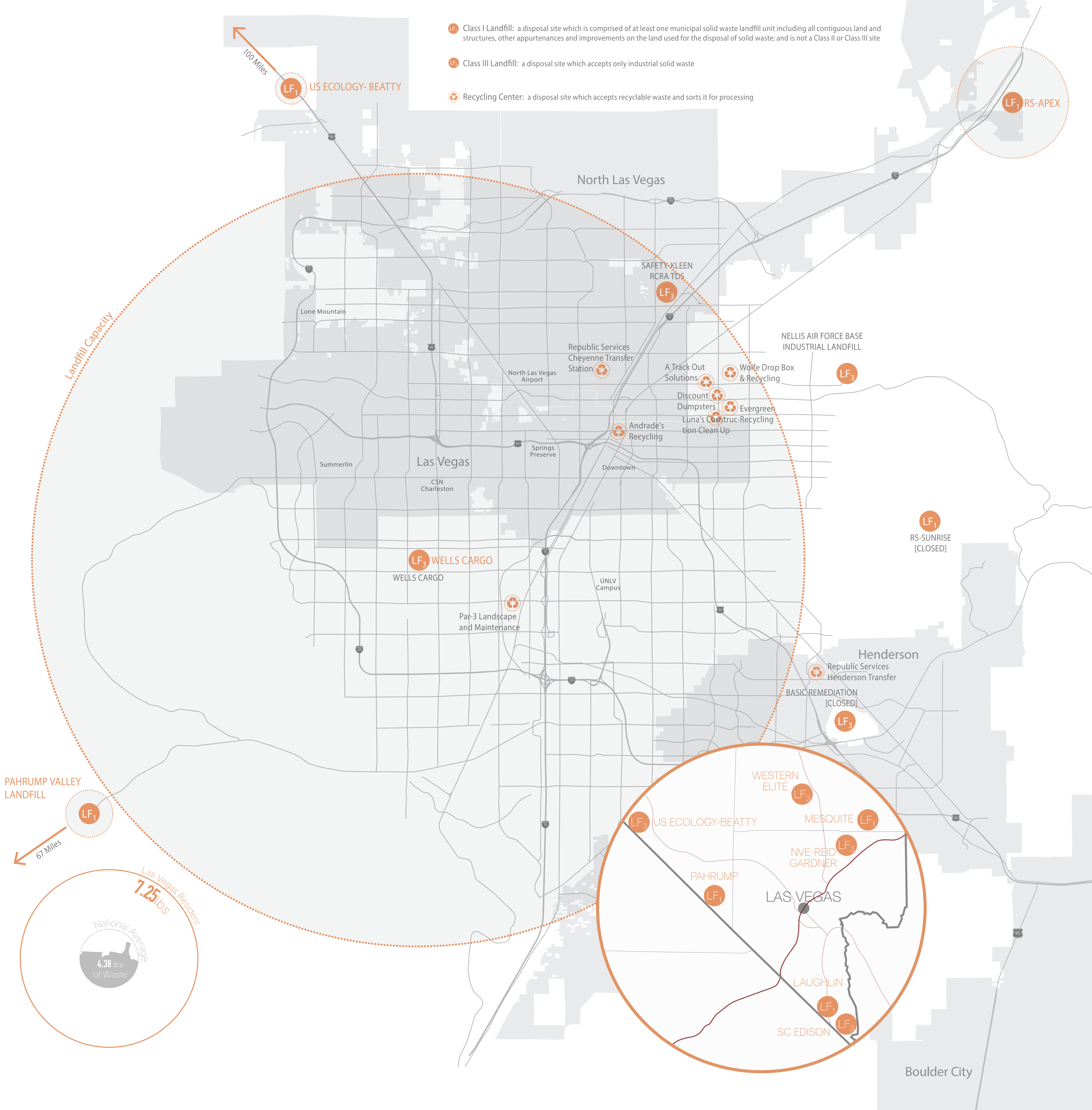
On average, Republic Services makes ten trips to each Southern Nevada house per month. This includes one visit per week for trash pick-up and one visit per week for recycling pick-up, with bi-weekly pickups for bulk items. This schedule has been a change since the full adoption of single-stream recycling, in which Republic Services collected trash twice weekly and recycling bi-weekly. In addition to the emissions eliminated from diverting recyclables from the landfill, Republic Services uses computerized routing to optimize trash and recycling pick up routes. Computerized routing helps the company minimize truck idling times and resulting emissions.

Residential and commercial trash collection trucks bring their loads to one of two transfer stations where it is loaded into larger 30 ton trucks for transfer to the Apex landfill. Republic Services customers may also bring large items or other waste that will not fit into a trash bin to the transfer stations at no cost (and in unlimited quantities). The Republic Services Cheyenne transfer station handles nearly 5,000 tons a day (approximately 70 percent of Apex's 7,000-ton daily intake volume, while the Henderson transfer station processes 2,000 tons per day.

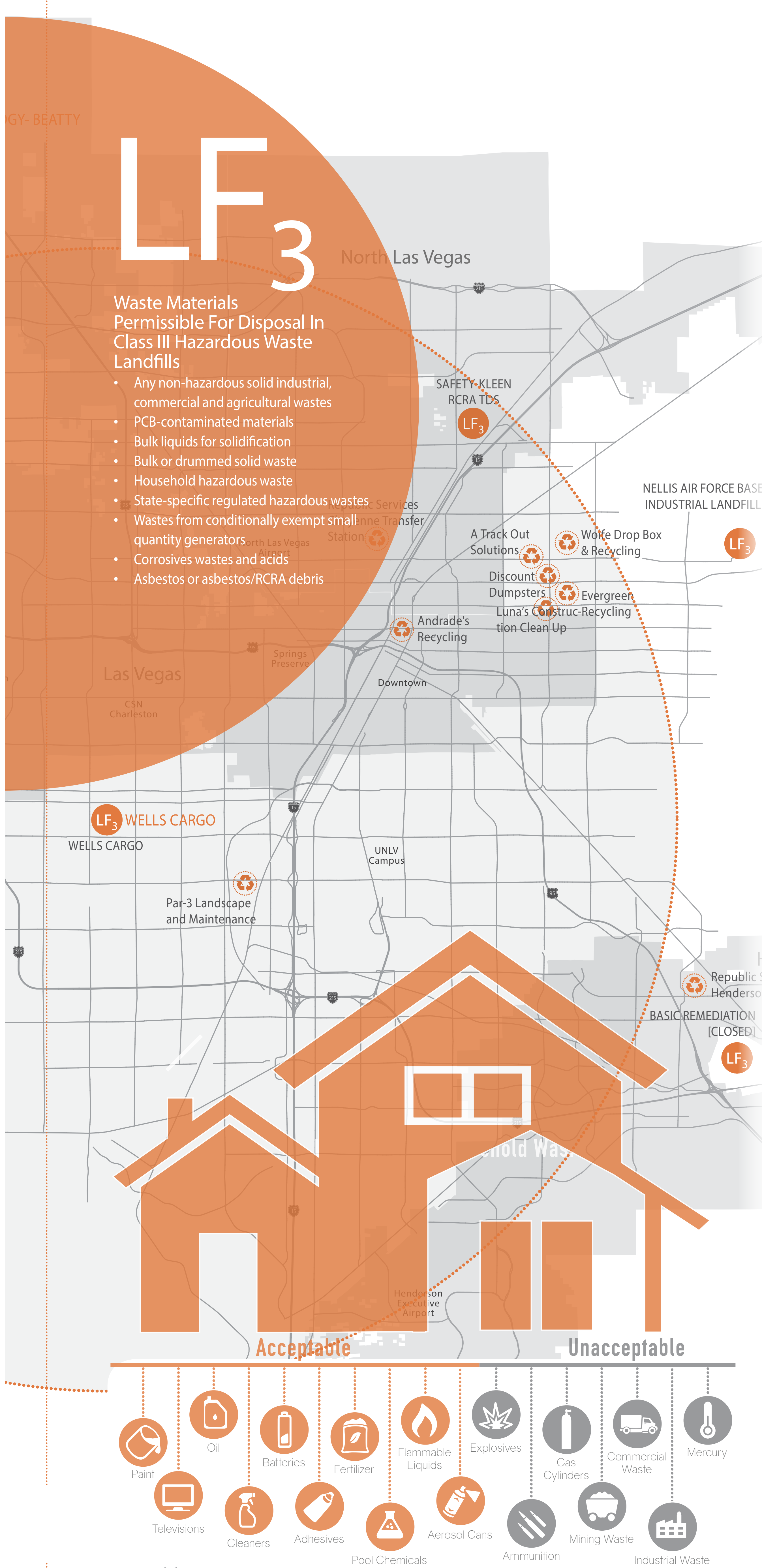
The collection of recyclables every other week at single-family homes became available in Clark County after state legislation enacted in 1991 established a statewide recycling goal of 25 percent. The legislation also established an extensive network of transfer stations and rural public waste storage bin facilities from which waste is hauled to regional landfills. Covered roll-off or waste transfer trucks bring waste to the Apex Regional Landfill from public storage bins and transfer stations.

Republic Services operates a regional material recovery facility (MRF) in North Las Vegas for its single-stream recycling program. This automated facility sorts recyclable materials from residential and commercial customers. First completed in 1991, the MRF was expanded in 2015 with to include a new 110,000 square foot building adjacent to the existing 88,000 square foot facility. Together, they serve 535,000 households throughout the area and can process 200,000 tons annually. The expanded Southern Nevada Recycling Complex began operations August 2015.





HAZARDOUS WASTES AND INDUSTRIAL SITE CLEANUP



Hazardous wastes are wastes that can cause, or significantly contribute to, death, serious irreversible or incapacitating illness, or pose a substantial hazard or potential hazard to human health, public safety or the environment if improperly treated, stored, transported, or disposed of. Hazardous waste can include materials that are toxic, corrosive, flammable, or combustible. Industrial solid waste, categorized as waste from industrial or manufacturing processes, electricity generation, and building construction and demolition, must be properly contained and labeled before being transported by a licensed hauler to an approved Class III landfill – a site that only accepts industrial solid waste. Industrial waste does not include waste generated by mining. With the exception of waste generated at industrial brownfield sites, Southern Nevada is not a significant generator of hazardous waste; however, it does contain a large industrial site containing hazardous wastes. During World War II, the largest magnesium plant in the world was constructed between Las Vegas and Boulder City near what is now known as Henderson. Basic Magnesium Inc. was contracted by the Federal Government to produce magnesium needed to build airplane bodies, munitions casings, engines, frames, and other materials and machinery for war efforts. A 5,000-acre site was selected due to its inland location and close proximity to Los Angeles, Lake Mead for water, Hoover Dam for power, Gabbs for brucite, and the nearby Three Kids Mine, which was also producing manganese. Basic consisted of a massive complex two miles in length with an ore preparation plant, chlorination plant, metals recovery plant, and necessary support facilities. While most manufacturing took place in Southern California, Basic Magnesium would separate the metal from its ore by electrolysis with a quarter of all US wartime magnesium coming from the plant. The plant has continued operations in some capacity decades after the war ended, however, its operations left significant hazardous wastes, including a 55 acre EPA designated Class III Corrective Action Management Unit (CAMU) Landfill designed to manage four million cubic yards of contaminated soil removed as a result of the ongoing cleanup of the site. Only material derived from onsite and adjacent remediation and cleanup actions are permitted to be disposed at the site. Soil contaminants include perchlorate, PCB's and hexavalent chromium, the largest constituent chemicals of two plumes first discovered as sources of groundwater pollution in the Las Vegas Wash and Lake Mead. Since 1998, remediation measures and site cleanup have resulted in over 4,000 tons of perchlorate being removed.

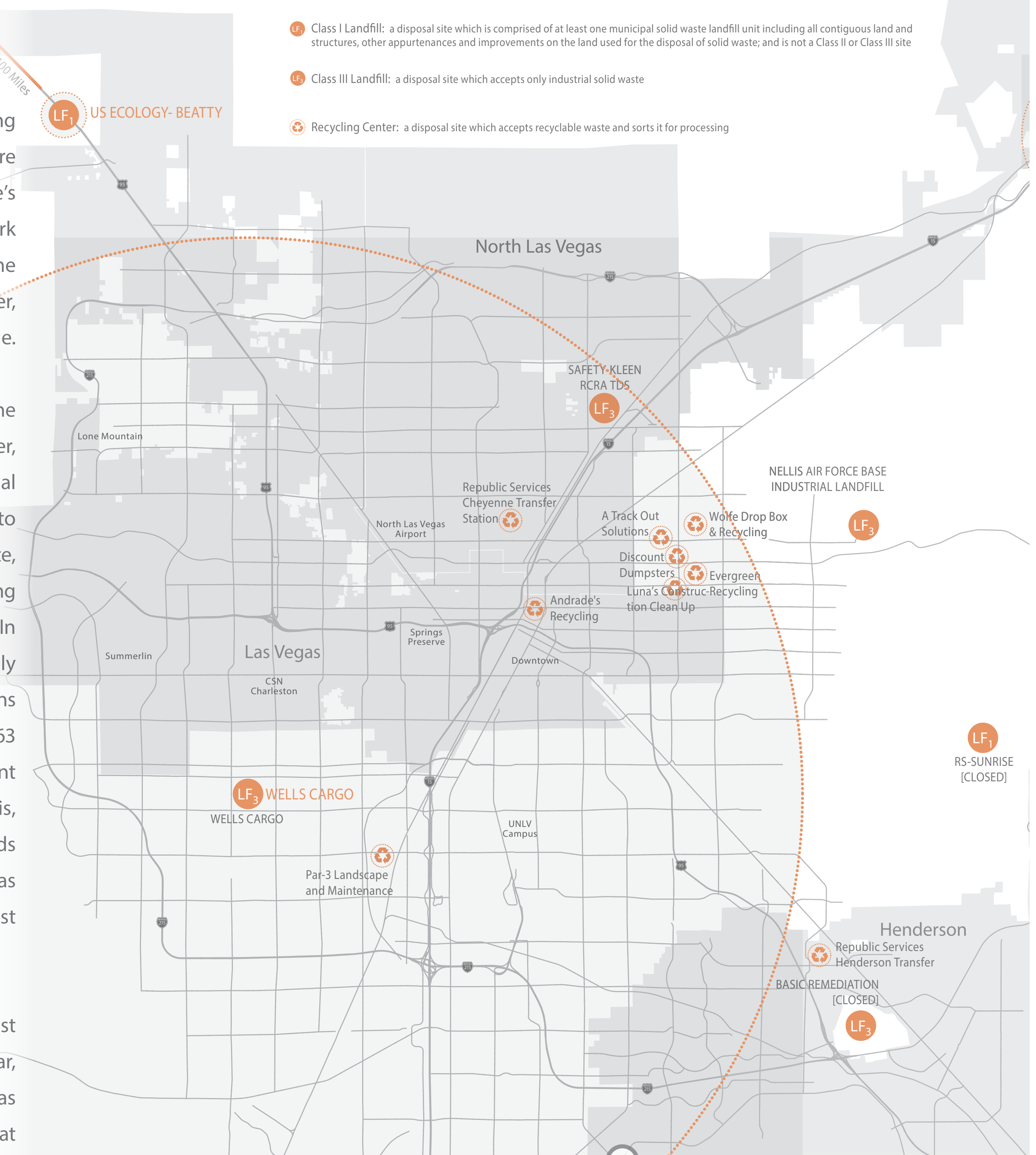
WASTE DIVERSION & RECYCLING

In response to single digit statewide recycling rates in the late 1980's, the Nevada Legislature established a goal to increase the state's recycling rate to 25 percent. In 2012, Clark County exceeded that goal for the first time with a rate of 27.5 percent; this value, however, was still 7.5 percent below the national average.

The Southern Nevada Health District tracks the amount of all recycled goods, including paper, metals, plastic, glass, organic materials, special waste, and textiles. The top contributors to the organics category have been food waste, restaurant grease and yard debris. The recycling rate of organic waste has been increasing. In 2006, recycled organics accounted for only 14 percent of total waste. In 2014, 70,850 tons of organic materials were recycled. Nearly 63 percent was from food waste and restaurant grease, and 33 percent from yard debris, representing 12 percent of the total goods recycled that year. Recycled food waste has increased over twofold since 2006, from just under 19,000 tons up to 44,658 tons in 2014.

Republic Services estimates that of the almost three million tons of MSW generated per year, each of the two million residents in the Las Vegas Valley generates just over one ton. That number also includes the 40 million tourists who visit Las Vegas annually. Southern Nevada Health District regulations permit recycling centers to divert up to 10 percent of municipal solid waste by weight and up to 75 percent solid waste for MRFs.

Construction and demolition (C&D) materials recycled represents 45 percent of the total recycling in Clark County and is the largest percentage of recycled material by weight. Three materials make up nearly all C&D recycled material: Asphalt, concrete and gypsum wall board ('drywall'), which are all recycled, reprocessed or re-used locally due to their low cost to transport and high economic viability economically.



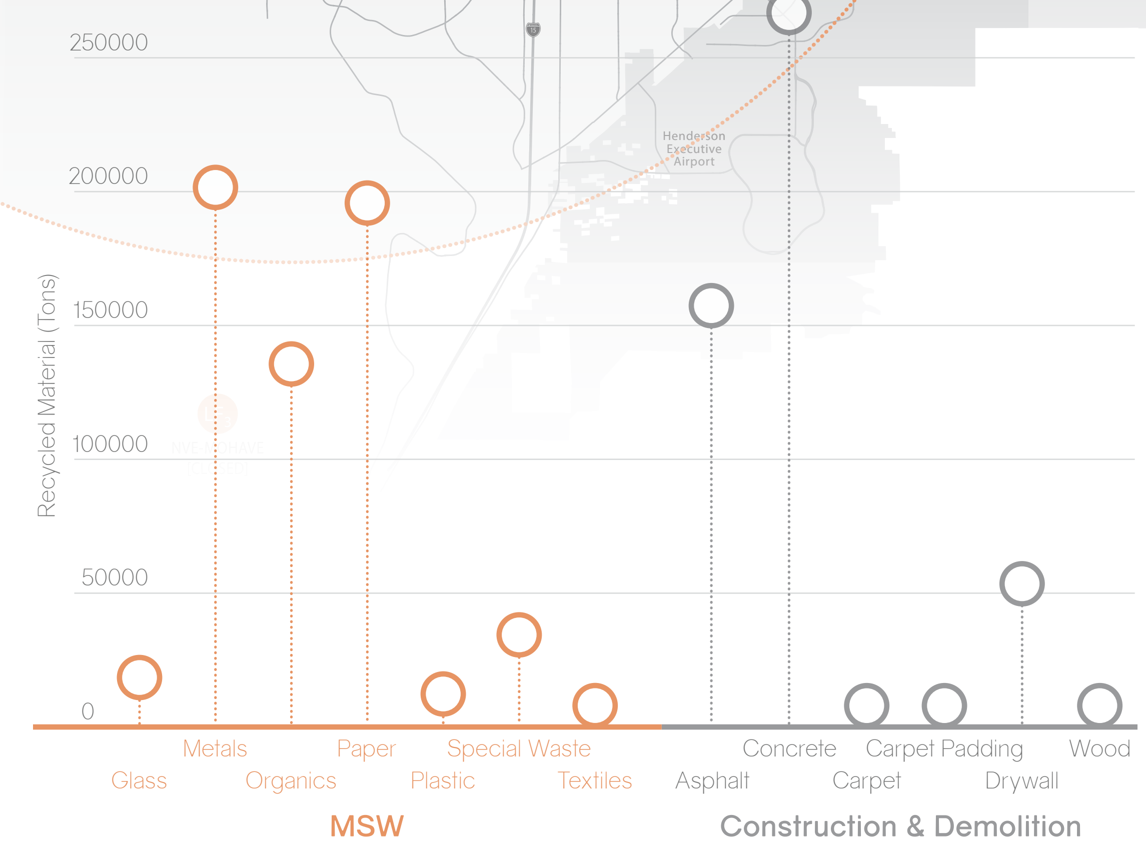
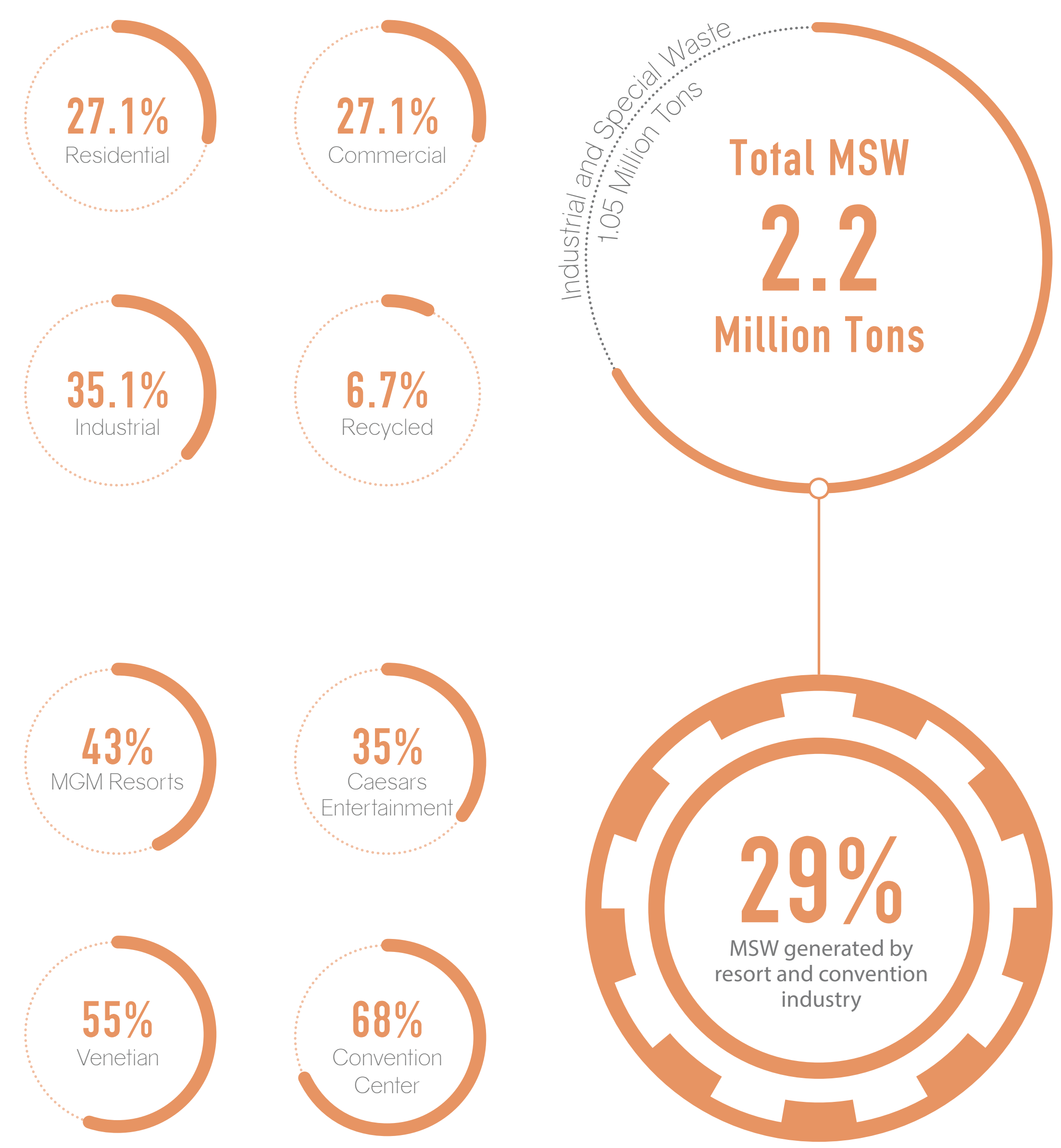
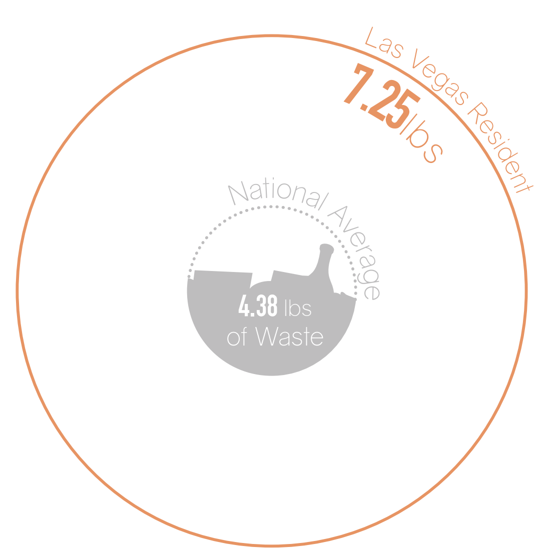


Chart Of Recyclable Materials; List Materials Not Considered In Waste Diversion Rate

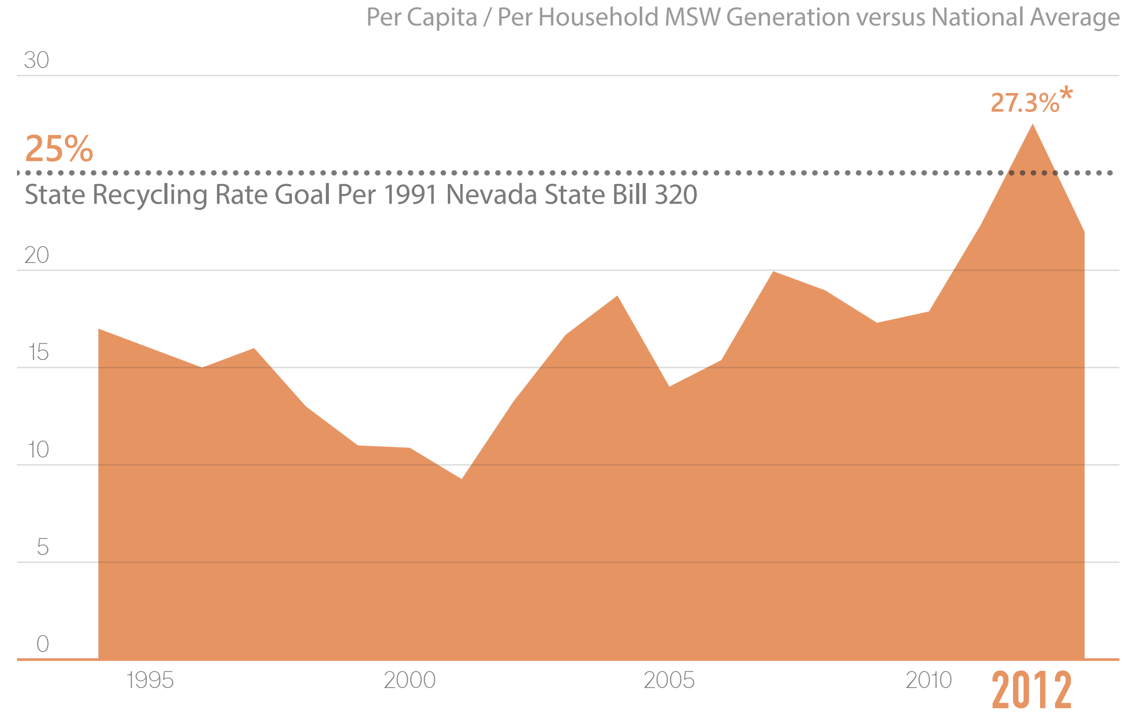
WASTE DIVERSION & RECYCLING



CLARK COUNTY HAS INCREASED ITS RECYCLING RATE BY 57%

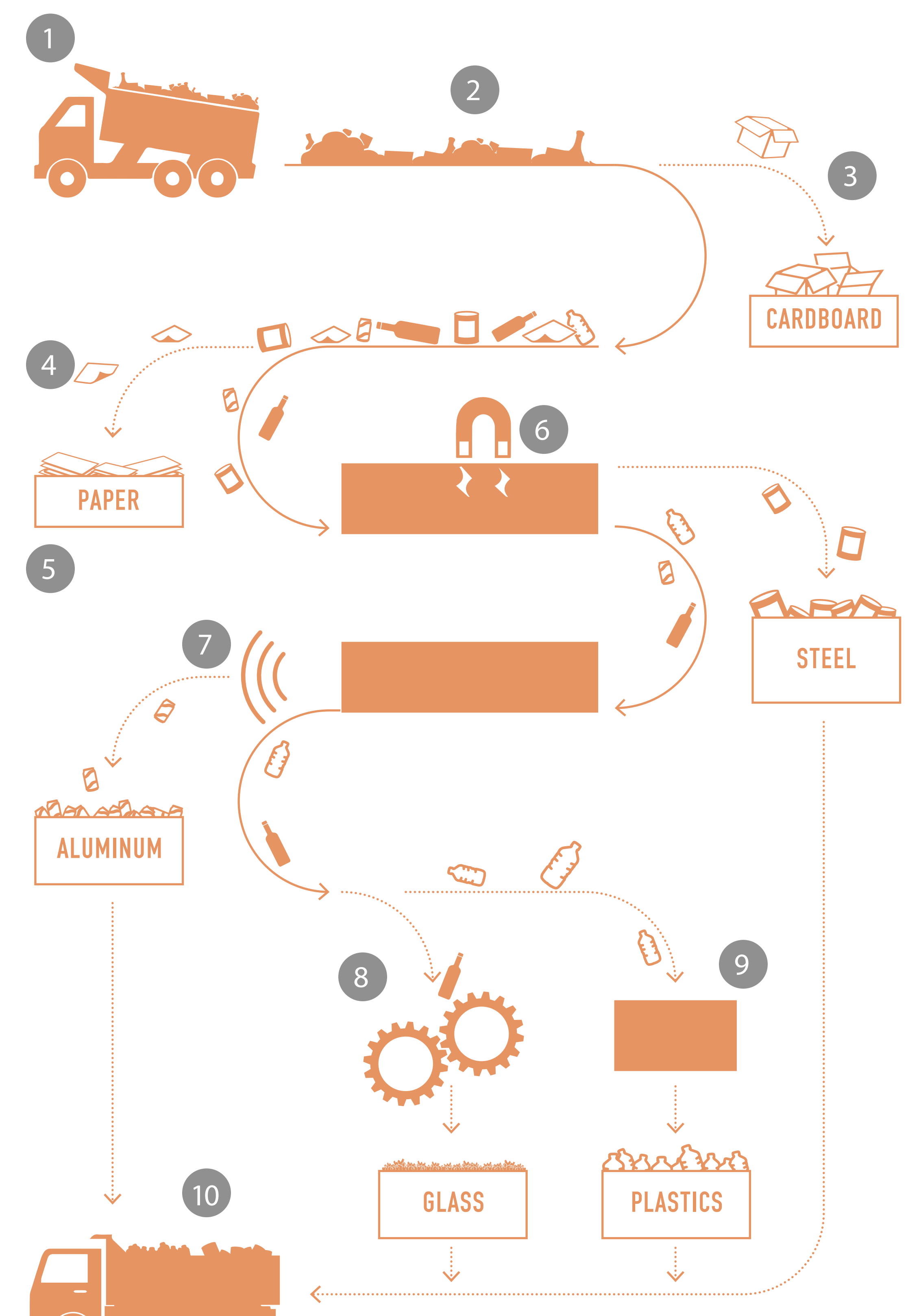


Per Capita / Per Household MSW Generation versus National Average



*The 2013 recycling rate of 22% fell 5.4 percentage points or 25% from 2012. An SNHD analysis concluded that the difference was due to double counting in previous years rather than a significant decline of overall recycling in Clark County in 2013.

ASPHALT AND CONCRETE MAKE UP 89% OF TOTAL CONSTRUCTION AND DEMOLITION RECYCLING

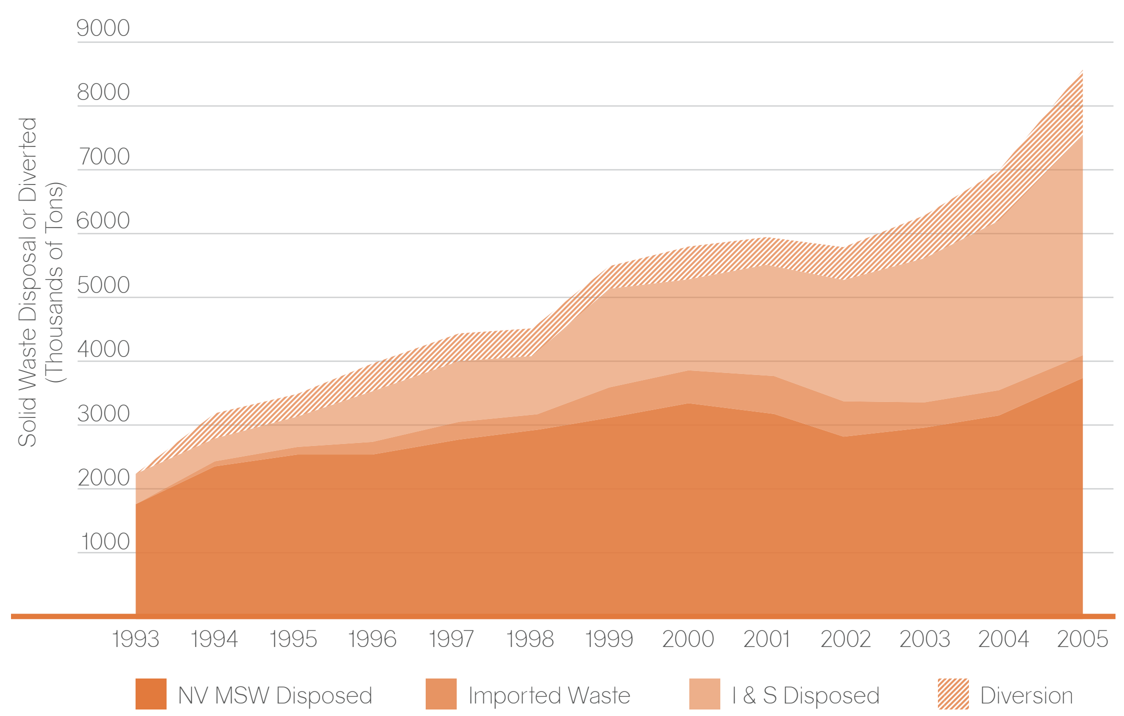


Process Diagram Of Single-Stream Recycling

1. Trucks unload mixed recycling onto the tipping floor at the MRF. A front loader moves the recycling to a conveyor belt.
2. Film, non-recyclable and bulky items are removed manually.
3. A screen removes cardboard and it is propelled into a holding area. Smaller objects fall through the screen and proceed for further separation.
4. A screen separates objects by dimension; paper rides up to the top of the screen and is sorted for further separation. Remaining objects fall through the screen.
5. Non-fiber contaminants are removed in a quality control check with manual or optical sorting by grade.
6. A magnet removes steel cans.
7. An eddy current separator repels the aluminum cans and foil from the conveyor.
8. Glass bottles and jars are screened out and shattered by steel discs, with shards falling
9. An optical or manual sorter separates plastic by resin code (type).
10. The crushed cans, broken glass and bales of aluminum and plastic are all sent to manufacturers as raw materials.

WASTE DIVERSION & RECYCLING

Why have recycling rates been so low and why did it take two decades to achieve the goal? Several factors have contributed to Southern Nevada's historically low recycling rates.



- For many years, Southern Nevada residents had bi-weekly trash pick-up and weekly recycling pick-up using a multi-stream recycling system in which materials were to be separately sorted into paper, plastic, and glass bins by residents. Over time, local governments working with Republic Services gradually introduced single family residential single stream recycling, in which all materials can be placed into a single bin. According to a 2013 report conducted by Clark County of Republic Services residential recycling, a homeowner recycled 10 pounds per month on average using multi-stream recycling; homes using single-stream recycling were found to recycle four times that amount. As a result, continued investment in the new, expanded recycling center, introducing new automated trucks to handle trash and recycling pickup, and changes to pickup schedules were introduced beginning with the Cities of Henderson and North Las Vegas, and followed by Clark County and the City of Las Vegas. The expansion of the Republic Services material recovery facility, along with the ability to offer weekly trash and recycling pick up, has already made significant impact on the overall recycling rate by making it more convenient for the residents and less costly for the franchisee.

- When compared with other cities across the country, Southern Nevada's waste and recycling costs and tipping fees are low. Because financial incentives are not offered in Southern Nevada to recycle or to "pay as you throw," and that the hauling costs to send recycled materials for processing out of state are usually higher than the cost of landfill disposal. It can be possible in some metropolitan areas, that the trash collection franchisee has little financial incentive to expand recycling when they own and operate a regional landfill. A disconnect can exist for residents and visitors between waste generation and the potential environmental harm because of the seemingly limitless desert landscape surrounding Las Vegas. The landfill is relatively cheap to operate and is "out of sight, out of mind." There is a tremendous amount of space to put trash, a cheap fee to do it, and there can be incentive for the franchisee to promote disposal.

- Many multi-family apartment and condominium complexes in Southern Nevada do not have recycling; those that do have low recycling rates. Many are not designed to accommodate both recycling and trash dumpsters in garbage enclosure areas, which limits the capacity of extra bins for recycling. Residents are often likely to put their materials only in one type of bin, not wanting to make multiple stops on a trip to take out the trash. A study by Republic Services of their pilot recycling program in multi-family housing areas indicated that residents often threw trash into the recycling containers. This contaminated the recycled materials to the extent that their recycling value was mostly negated. For now, the Republic Services recycling program at multi-family housing developments primarily focuses on mailroom paper recycling because residents are more likely to recycle unwanted items directly from the mailbox.

- The lack of regional agriculture limits local market demand for compost as a fertilizer/ soil amendment. Southern Nevada Water Authority's efforts to limit and reduce turf and other water-intensive landscaping over the past decade also limited the amount of available yard waste for composting.

Challenges remain for Southern Nevada to further increase its recycling rates and, over the long term, achieve net-zero waste. The large annual tourism and convention population, coupled with a misperception that Las Vegas is a city of excess, makes comprehensive commercial recycling efforts more difficult. Still, Republic Services has invested significant resources to minimize the negative environmental impacts of transport and disposal of waste for Southern Nevada's residents. The expanded material recovery facility, now the largest recycling center in the country, should increase community recycling rates to over a third of the waste stream. Other positive trends in sustainability and resilience in the waste system include the installation of landfill gas capture and energy production at the Apex Landfill and landfill gas flaring at the closed Sunrise Landfill. The usage of renewable energy at Republic's facilities and alternative fueled garbage and recycling trucks running on compressed natural gas will further reduce emissions from the waste sector.

FOOD WASTE

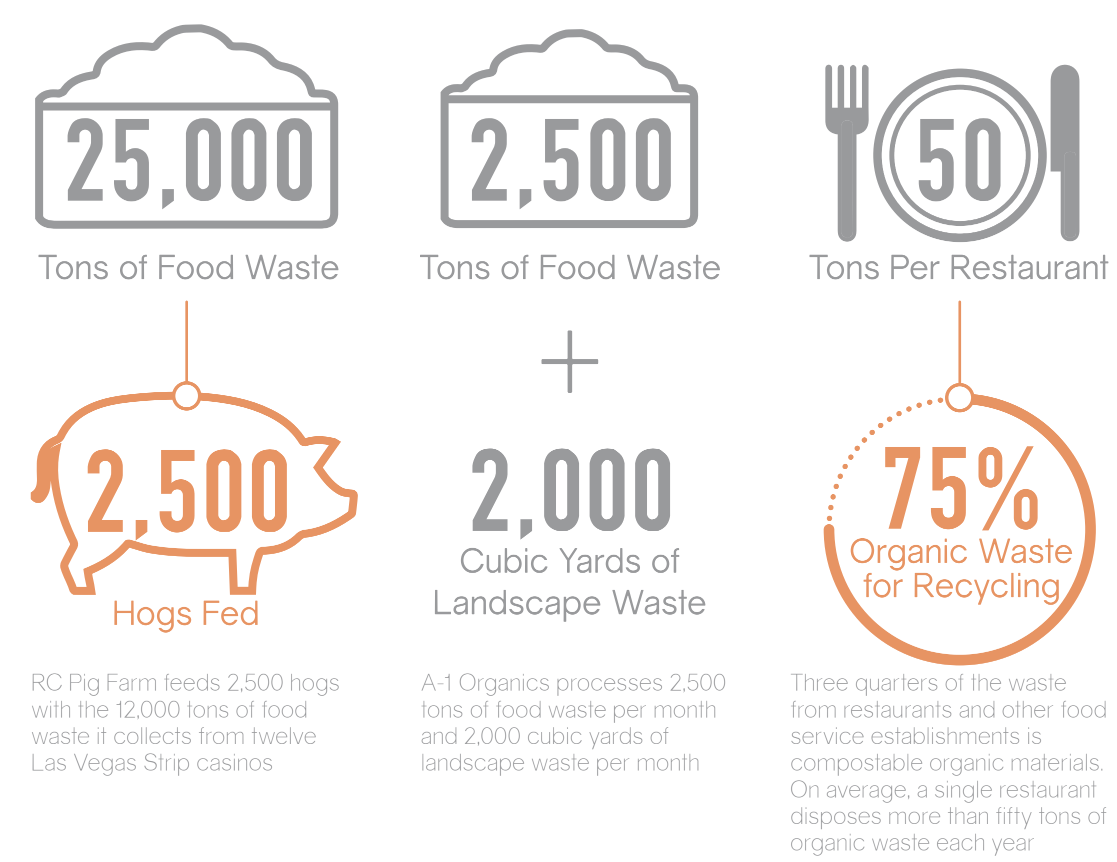
Food waste, including partially consumed scraps, expired, or unused food from residents, restaurants and retailers is another significant portion of the waste stream. Although data for residential food waste Southern Nevada is not collected, it accounted for 36 percent of the national municipal solid waste stream in 2012. Given Southern Nevada's tourism industry, the many buffets, restaurants and convention meals can produce a significant amount of food waste. The resort industry produces approximately 800,000 tons of waste each year -- 100,000 tons of which is estimated to be food waste.

The effects of food waste go beyond simply reducing the available amount of global food supplies; food waste has a negative effect on transportation systems. Extra food shipped or taken to waste areas uses fuel, increases carbon emissions, and places an unnecessary burden on the energy and potable water supplies needed for the production of food, for its transportation and eventually for its disposal.

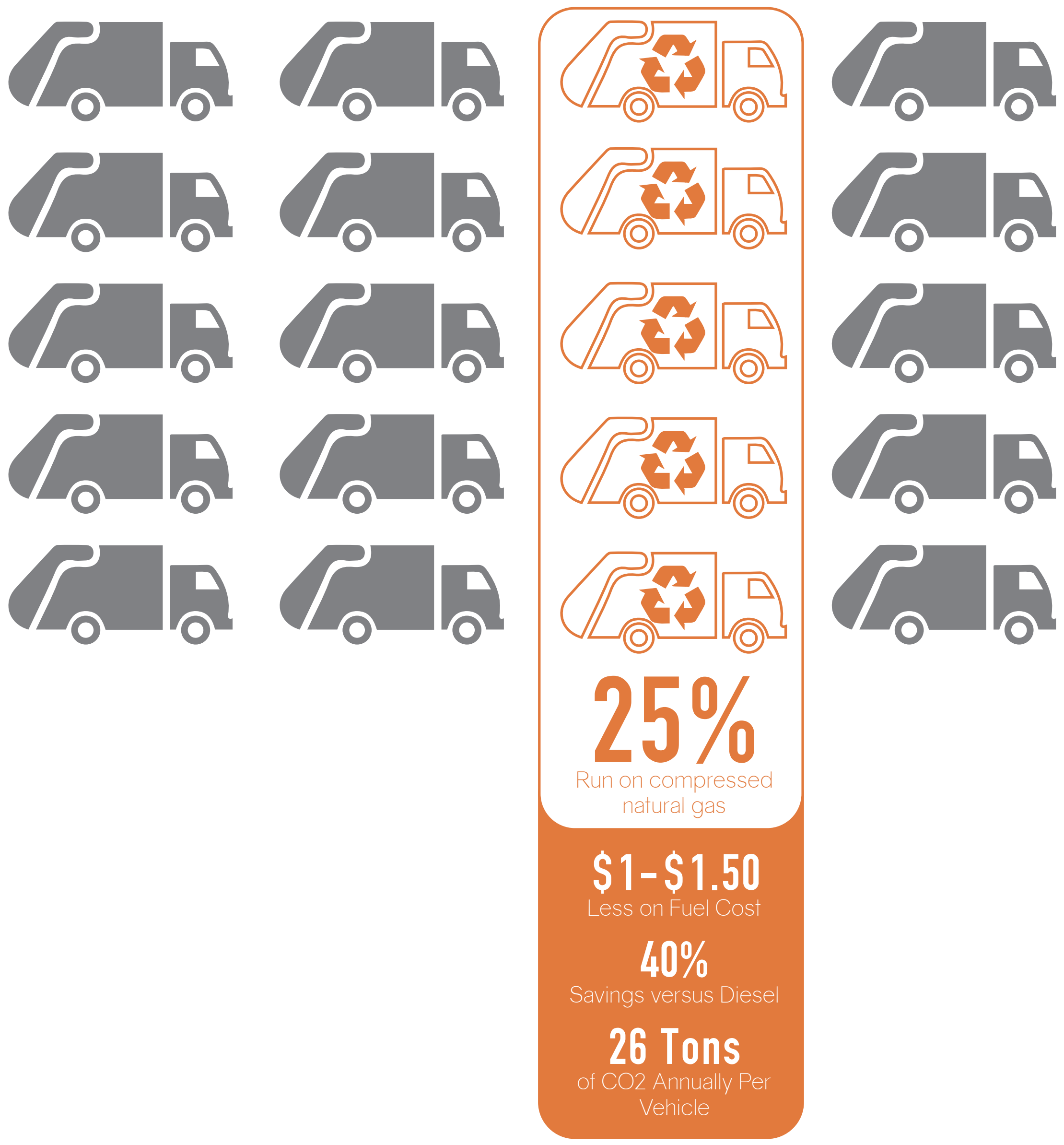
Food waste uses almost three percent of the United States total energy consumption per year. The food discarded by consumers and retailers in just the most developed nations would be more than enough to sustain all the world's 870 million hungry people if effective distribution methods were available. Most uneaten food goes to landfills where it decomposes and produces methane gas. If food waste was compared to total emissions per country, it would be the third largest amount behind only China and the United States, according to the United Nations Food and Agriculture Organization. Production of this wasted food required consumption of approximately three hundred million barrels of oil and over a quarter of the total freshwater consumed by agriculture in the United States. In 2010, an estimated third, or 133 billion pounds of the 430 billion pounds of food produced was not available for human consumption at the retail and consumer levels, amounting to an estimated total loss of $162 billion. The United Nations estimates that if farmers around the world fed their livestock on agricultural by-products and food that we waste, enough grain would be liberated to feed three billion people per year.

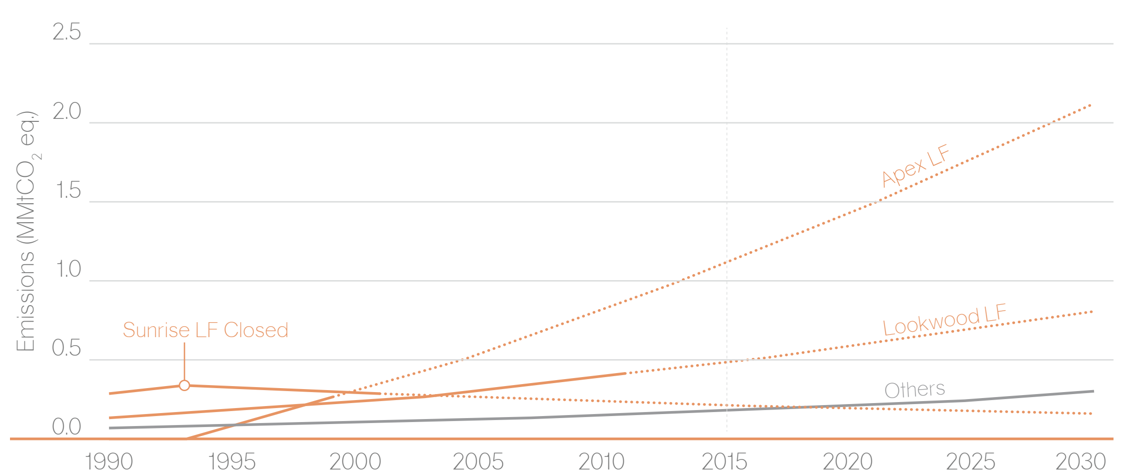
Resorts, including MGM Grand, Caesar's Entertainment, and Las Vegas Sands have been active participants in food waste recovery and diversion and have been nationally recognized for efforts in reducing food waste. At many of these resorts, inedible food scraps in guest dining facilities and employee dining rooms are composted and used as animal feed. Thirteen properties owned by MGM Resorts in Las Vegas diverted almost 26,000 tons of food to compost instead of a landfill, roughly equivalent to conserving 50,000 gallons of gasoline.

Compost, the material produced by the natural decomposition of organic materials and food waste, is a valuable soil conditioner, that adds organic material and nutrients to soil. Compost can improve plant growth, conserve water, reduce the reliance on chemical pesticides and fertilizers, and help control runoff and erosion while sequestering carbon in the soil. While the lack of regional agriculture limits local market demand for compost as a fertilizer or soil amender, the use of organic compost and mulch has expanded in Southern Nevada over the past decade and is increasingly used in residential and commercial landscapes. Raised bed gardens, golf courses, and community food gardens can also benefit from compost use; the need for organic amendments to the highly alkaline, sandy soils in the Las Vegas Valley will continue to create a growing market for these recycled materials.



LANDFILL EMISSIONS



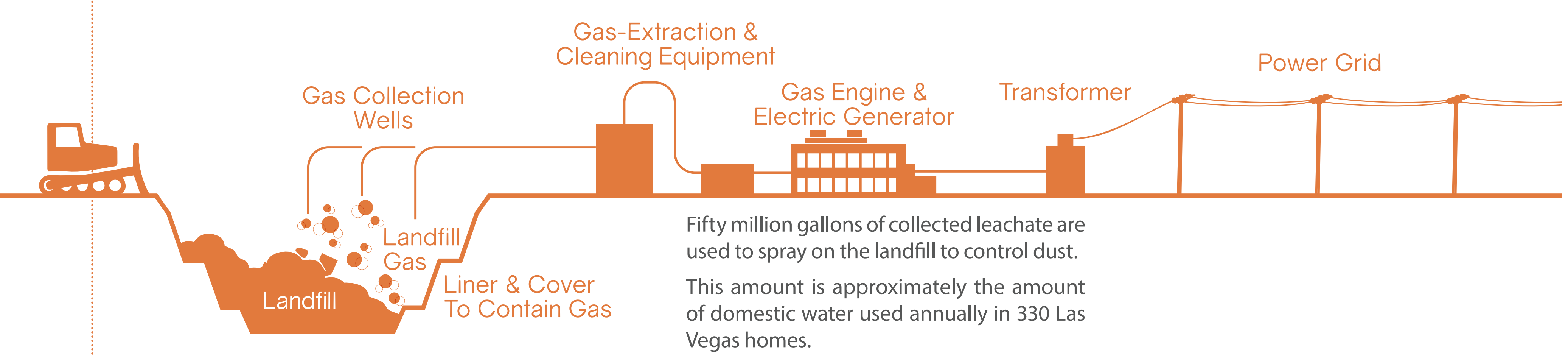


Solid lines identify the period when the landfill (LF) did not have gas recovery technology. Dashed lines identify the period when such technologies were present in the landfill.

Producing products using recovered, rather than raw materials uses significantly less energy, resulting in less burning of fossil fuels in production. Recycling and composting also reduce the amount of waste sent to landfills, which reduces the quantity of greenhouse gas emissions, especially methane, nitrous oxide and chlorofluorocarbons. By reducing waste at its source and by expanding recycling in the residential and commercial sectors, significant reductions have been realized from reductions in emissions from transportation and in water and energy consumption.

However, according to the Nevada Division of Environmental Protection, greenhouse gas emissions from waste are projected to account for about six percent of statewide emissions by 2030. Emissions from Nevada's controlled landfills (those with gas control and recovering systems) are projected to account for about 70 percent of landfill emissions, more than doubling their contribution of thirty percent in 2010. Although the amount of greenhouse gas emissions from the waste sector in Nevada is currently small (two to three percent of total state emissions), population growth will continue to place large demands on waste disposal and recycling.

A landfill emission mitigation strategy currently in use is methane recapture; the 10 megawatt plant at Apex captures between 60-90 percent of the methane gas generated by the landfill and can produce an estimated 96 million kWh/year enough to power approximately 4,000 homes. NV Energy purchases the electricity generated by the facility through a power purchase agreement and receives credit towards the state's Renewable Portfolio Standard.



Fifty million gallons of collected leachate are used to spray on the landfill to control dust.

This amount is approximately the amount of domestic water used annually in 330 Las Vegas homes.

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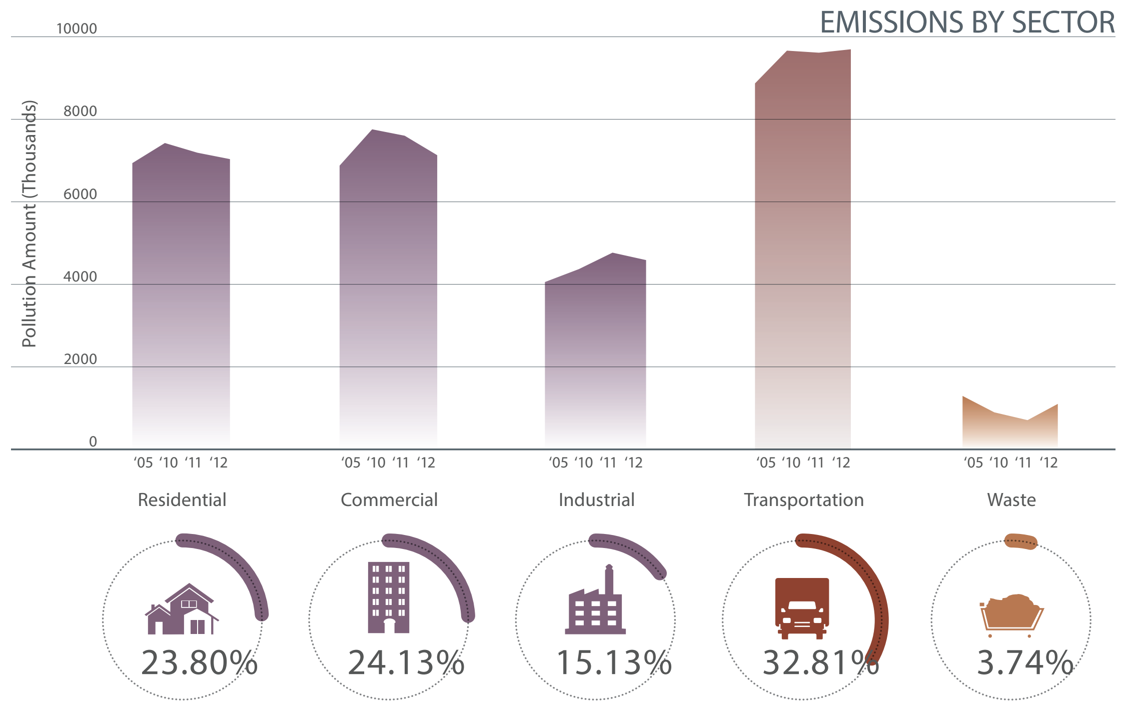
Pollution is a byproduct of other systems that impact Southern Nevada's water, ground, and air. Small particles, often measured in the parts per million or billion can affect the health of living things. Sensitive populations, including children, those in poor health, the elderly, the poor, and low income populations may be disproportionately affected by pollution.

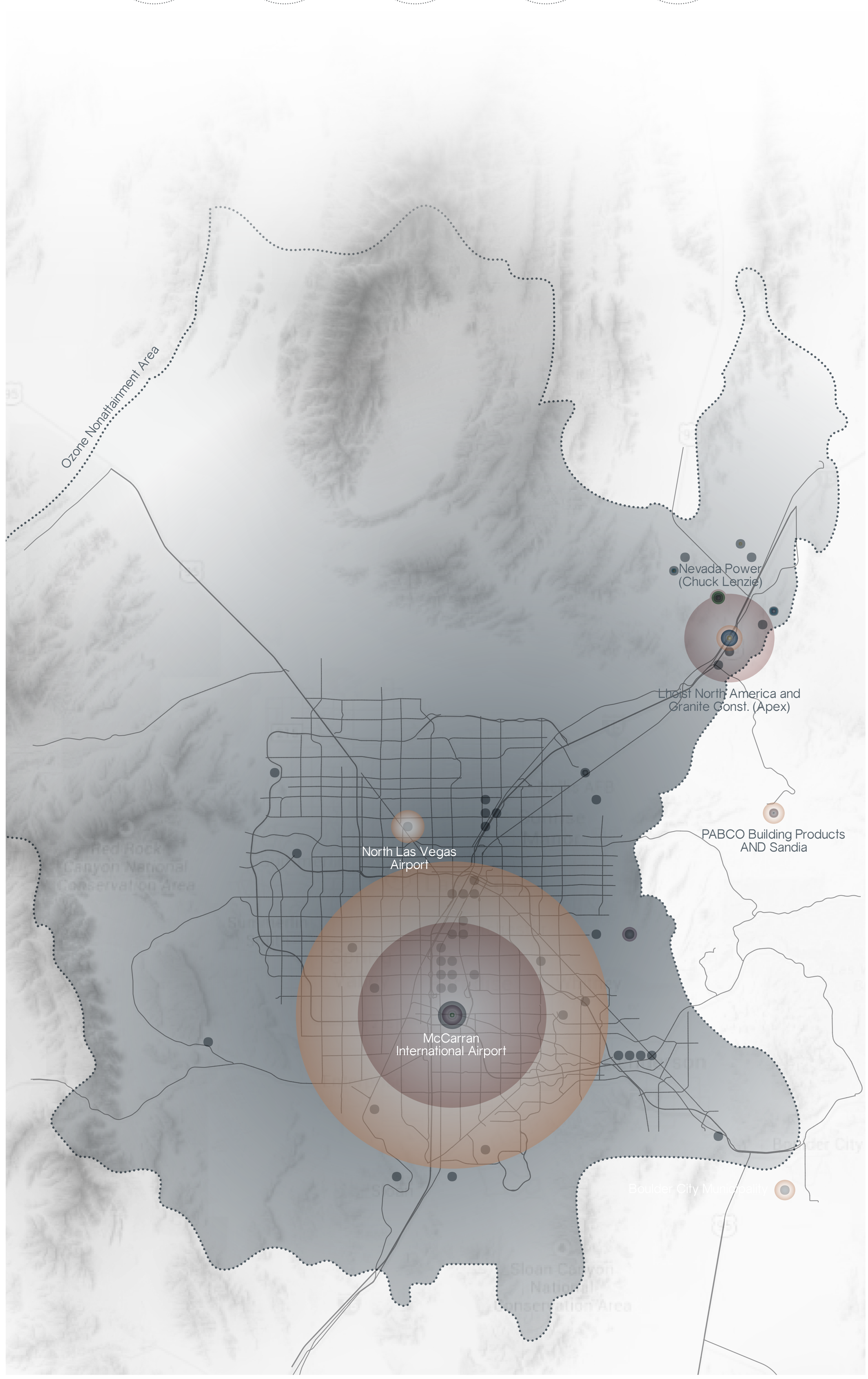
Southern Nevada's pollution challenges are a result of several factors; industrial sites have with a legacy of pollutants, not dissimilar to other parts of the country, have impacted land and water in Henderson. Air pollution, caused primarily from mobile combustion from the automobile, mixed with the desert's dust and the Valley's natural topography contributes to unhealthy air. Our capacity to monitor pollution keeps increasing and our attention to technology to reduce pollution and remediate it are becoming more sophisticated. Taken from this perspective, pollution may not be a substantial issue in resilience scenarios, but a lack of rain and increasing temperatures can contribute to higher levels of airborne pollutants. If water must come from lower in Lake Mead as a result of drought, more remediation of the water will be necessary given the higher load of pollutants in the lake.

AIR POLLUTION

The greatest source of Southern Nevada's pollution is transportation-related emissions that contribute to air pollution, which can have profound impacts upon human health, the native ecosystems, and can translate into significant economic costs. Non-compliance with Federal air quality standards can also affect transportation funding.

Air pollution is a regional issue, and many factors contribute to its development and dispersal. More than three quarters of air pollution generated in the Las Vegas Valley comes from engine or machine exhaust, transportation generated emissions, and construction. Particulate matter from soil and dust can also impact the quality of the air we breathe. Southern Nevada's air quality is monitored and measured within the boundary of Nevada Hydrographic Area 212, which encompasses the greater metropolitan area. 10 official air pollution monitoring sites in record meteorological data and measure criteria pollutant concentrations for carbon monoxide (CO), nitrogen dioxide (NOx), ozone (O3), particulate matter (PM), sulfur dioxide (SOx), and lead (Pb). The monitors provide air quality information in near real time and have EPA equivalent continuous monitors. Air quality monitoring station locations vary during the year as pollution varies; there have been 71 sites used for air quality monitoring, with about 16 in use at any given time.

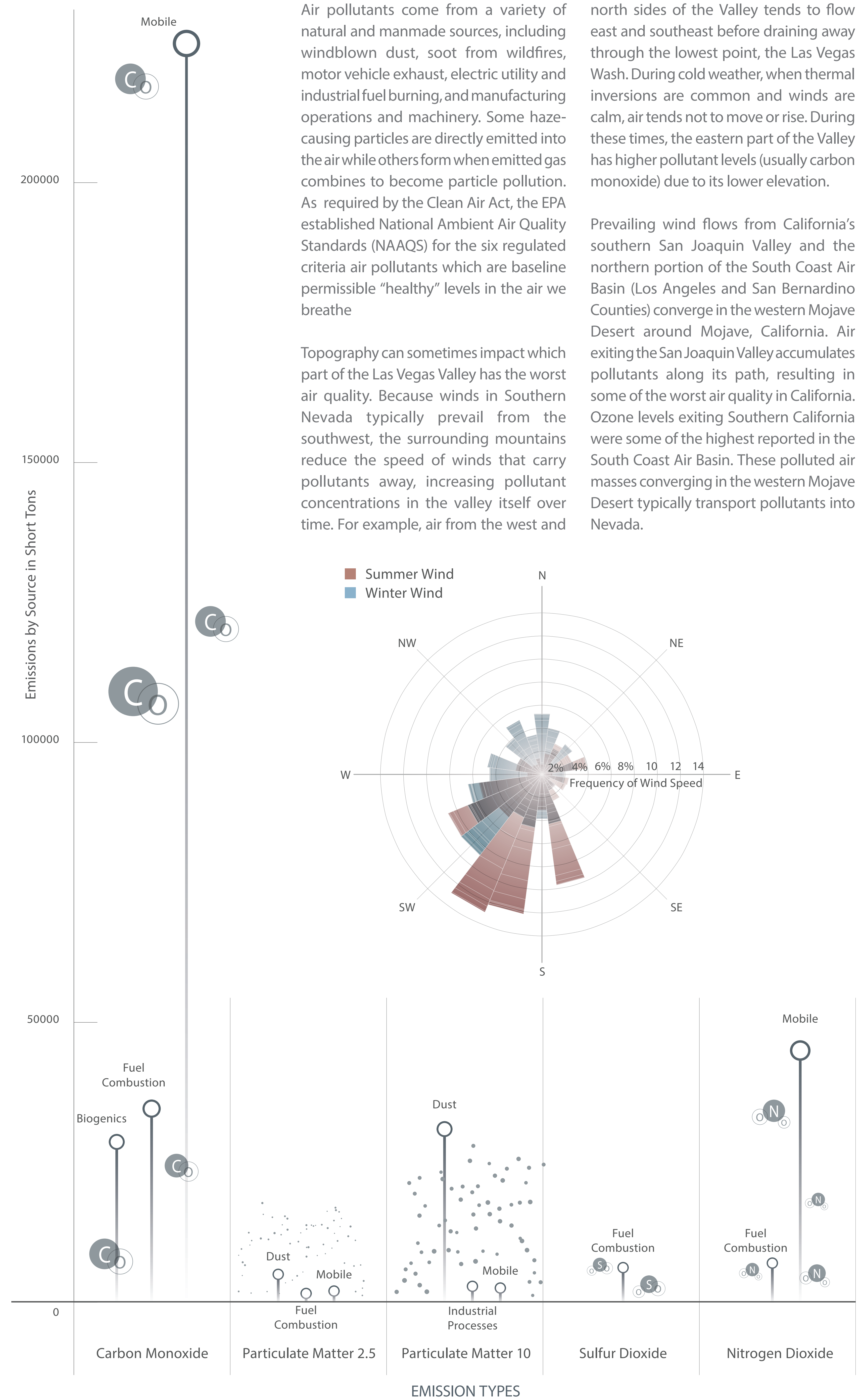




Air pollutants come from a variety of natural and manmade sources, including windblown dust, soot from wildfires, motor vehicle exhaust, electric utility and industrial fuel burning, and manufacturing operations and machinery. Some haze-causing particles are directly emitted into the air while others form when emitted gas combines to become particle pollution. As required by the Clean Air Act, the EPA established National Ambient Air Quality Standards (NAAQS) for the six regulated criteria air pollutants which are baseline permissible "healthy" levels in the air we breathe

Topography can sometimes impact which part of the Las Vegas Valley has the worst air quality. Because winds in Southern Nevada typically prevail from the southwest, the surrounding mountains reduce the speed of winds that carry pollutants away, increasing pollutant concentrations in the valley itself over time. For example, air from the west and north sides of the Valley tends to flow east and southeast before draining away through the lowest point, the Las Vegas Wash. During cold weather, when thermal inversions are common and winds are calm, air tends not to move or rise. During these times, the eastern part of the Valley has higher pollutant levels (usually carbon monoxide) due to its lower elevation.

Prevailing wind flows from California's southern San Joaquin Valley and the northern portion of the South Coast Air Basin (Los Angeles and San Bernardino Counties) converge in the western Mojave Desert around Mojave, California. Air exiting the San Joaquin Valley accumulates pollutants along its path, resulting in some of the worst air quality in California. Ozone levels exiting Southern California were some of the highest reported in the South Coast Air Basin. These polluted air masses converging in the western Mojave Desert typically transport pollutants into Nevada.



AIR QUALITY

The EPA uses the Air Quality Index (AQI) to rate air quality based on the National Ambient Air Quality Standards (NAAQS). The scale includes categories of good, moderate, unhealthy for sensitive groups, unhealthy, and hazardous.

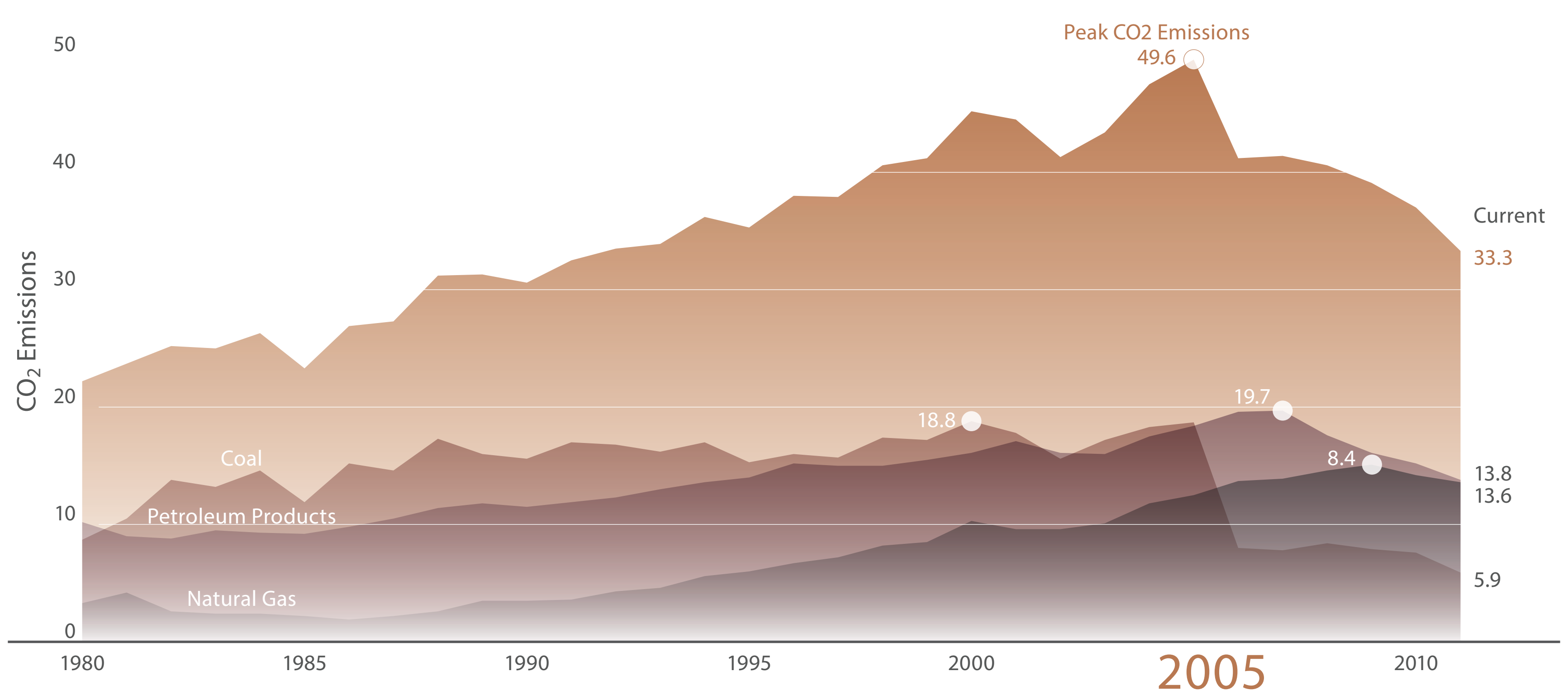
Ozone is a photochemical oxidant that is a main component of smog at ground level. Ozone differs from other air pollutants in that it is not directly emitted. The action of sunlight hitting volatile organic compounds and nitrogen oxides catalyzes the formation of ozone. While we may think of ozone as a good gas in the upper levels of the atmosphere, at the ground level this gas can irritate the respiratory system and cause people to cough, choke, and impact lung capacity and function. Triggered by the sun, the highest levels of ozone are typically on sunny days with light winds. In Clark County, the official ozone season is April 1 - October 31. Ozone is measured by an eight-hour average with the highest levels of ozone approaching Federal standards on weekdays; it is significantly higher on windless days. The EPA has determined that prolonged exposure to ozone poses serious chronic health threats including respiratory irritability, the aggravation of asthma, scarring of lung tissue, reduction of lung function, and skin burns similar to sunburn. The EPA and the American Lung Association determined that long term exposure to ozone may cause harm to the central nervous system and cause damage to the reproductive system. Ozone can also cause developmental harm in young children. The Clark County Department of Air Quality issues advisories when ozone and particulate matter levels become unhealthy and recommends those with sensitive respiratory systems stay indoors. Concentrations of ozone are not uniform in the troposphere. Tree cover, the amount of vehicular traffic, and prevailing wind patterns affect ozone levels. The amount of ozone present in the troposphere also varies from day to day and from place to place. Other environmental impacts from long term ozone pollution include damage to ecosystems and landscaping, and the degradation of building materials.

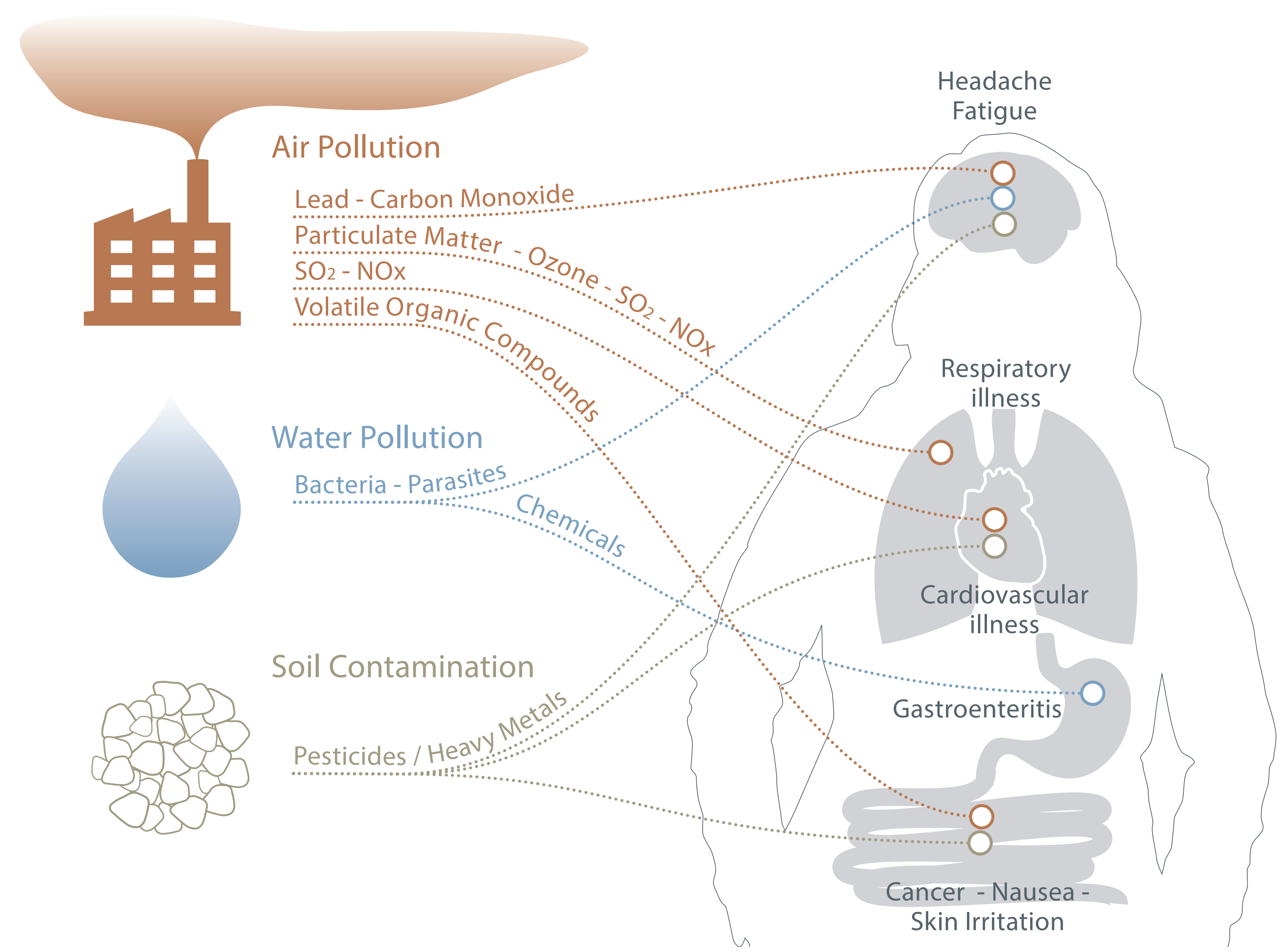
During winter months when stable atmospheric conditions exist, carbon monoxide levels tend to rise in Southern Nevada. Carbon monoxide is a colorless, odorless, gas produced by the incomplete combustion of carbon-containing fuels. Also measured on an eight-hour standard, inhaled carbon monoxide can block oxygen from the brain, heart, and vital organs. Fetuses, babies, and people with chronic illnesses are especially susceptible to the effects of carbon monoxide. Long-term exposure to low levels of carbon monoxide may lead to increased respiratory illness and heart conditions. Individuals already having respiratory ailments or heart problems are at the greatest risk for further negative health impacts from breathing high concentrations of carbon monoxide. The Las Vegas Valley was designated as a 'serious' non-attainment area in 1993. Conditions improved after implementing and maintaining a State Implementation Plan. The Las Vegas Valley has maintained attainment levels for carbon monoxide (CO) since 1999, due to regulations on gasoline that help to control CO emitted into the atmosphere. Programs targeted to the repair of gross emitting and smoking vehicles also had a positive impact on air quality due to the large proportion of air pollution coming from these (most often older) vehicles.

Burning sulfur-containing fuels (such as coal), smelting metallic ores with sulfur, and distillation of sulfur from fuels can cause airborne sulfur dioxide. Two sulfur dioxide standards exist: a one-hour standard and a three-hour standard. Exposure to sulfur dioxide can lead to respiratory issues; at-risk population includes the elderly, young children and asthmatics.

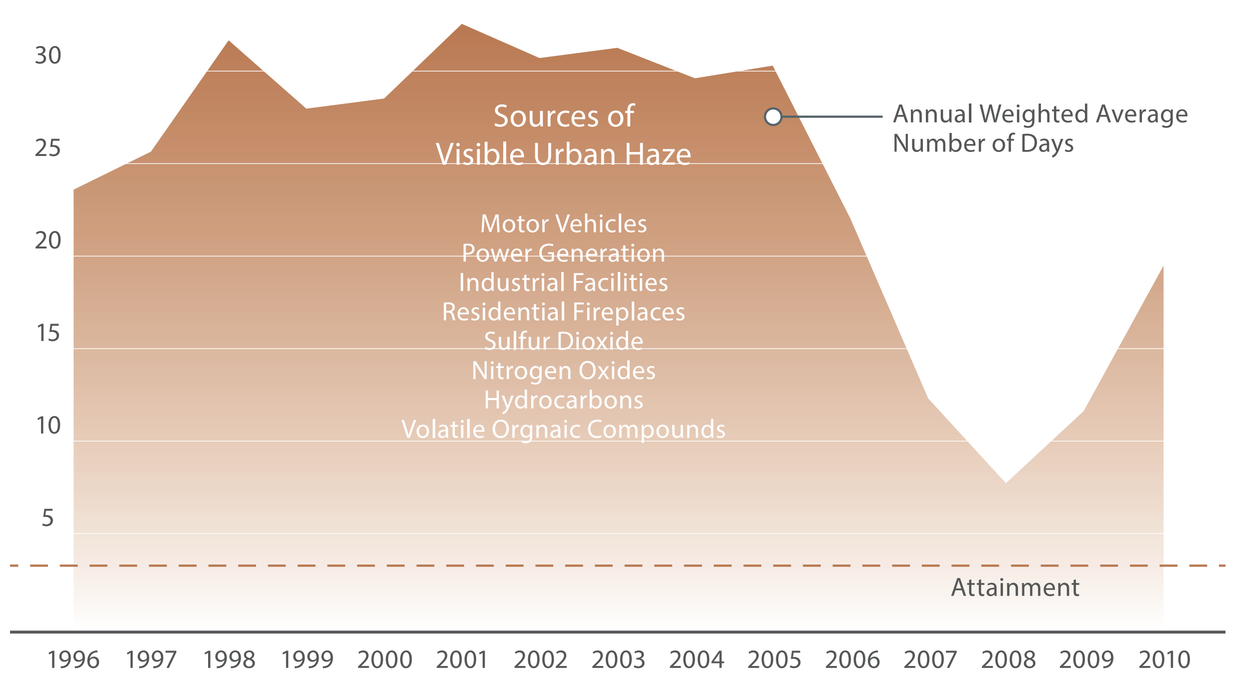
There are several nitrogen oxide types produced by high-temperature combustion. The NAAQS only charts nitrogen dioxide, where there is an annual and one-hour standard. These pollutants may cause lung irritation and potentially make people more prone to respiratory infections such as pneumonia and influenza. According to EPA data, the coal-fired Reid Gardner Generating Station in Moapa is responsible for 80 percent of the total NOx emissions in Clark County. The upcoming closure of this plant will significantly reduce NOx emissions in Clark County.

Particle pollution (also called particulate matter or PM) is the name for a mixture of airborne solid particles and liquid droplets that can be inhaled. Primary particles come directly from construction sites, unpaved roads, fields, smokestacks or fires. Airborne particulate matter in Southern Nevada is dominated by 'crustal' dust. Other particles, known as secondary particles, come from complicated reactions in the atmosphere. Chemicals, such as sulfur dioxides and nitrogen oxides emitted from power plants, industry and automobiles, react to form these. Secondary particles typically dominate winter-time high concentration events in locations such as Bakersfield, Fresno, and Riverside, California. Diesel exhaust is also a major contributor to PM in the air. Particulates are categorized as PM-10 and PM-2.5; particle size is linked to the potential to cause health issues. PM-10 particles are between 2.5 to 10 micrometers in diameter and are called coarse particles; the PM-10 category includes the PM-2.5 particles. This particulate matter consists of solids or liquids in the air which can settle in the lower portion of the lungs. Some particles are large or dark enough to be seen. PM-2.5 particles are known as fine particles and are less than 2.5 micrometers in diameter. While they can only be seen by an electron microscope, when many particles are present, they produce a 'haze' that can be observed in the air. Smoke (from fires or industrial activity) and vehicle exhaust create fine particulates of air pollution which can contribute to reduced visibility. Fine particles may form in the air from chemical reactions when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds interact.





HAZE AND AIR QUALITY



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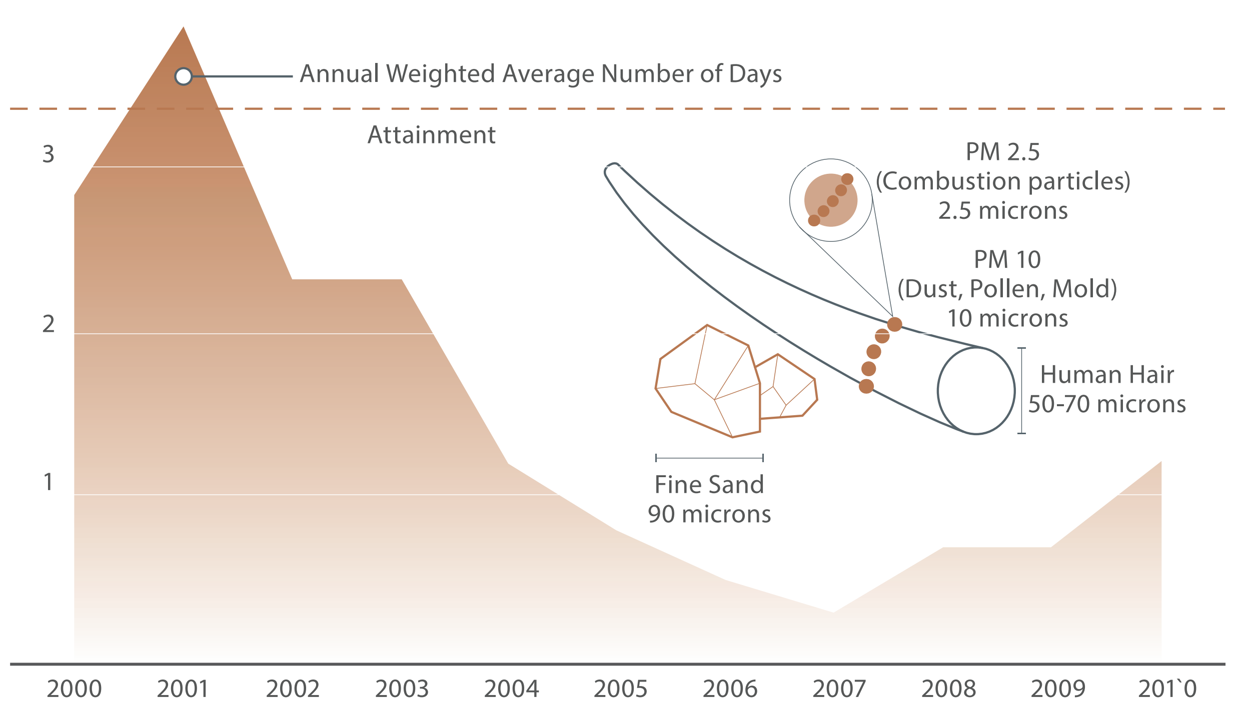
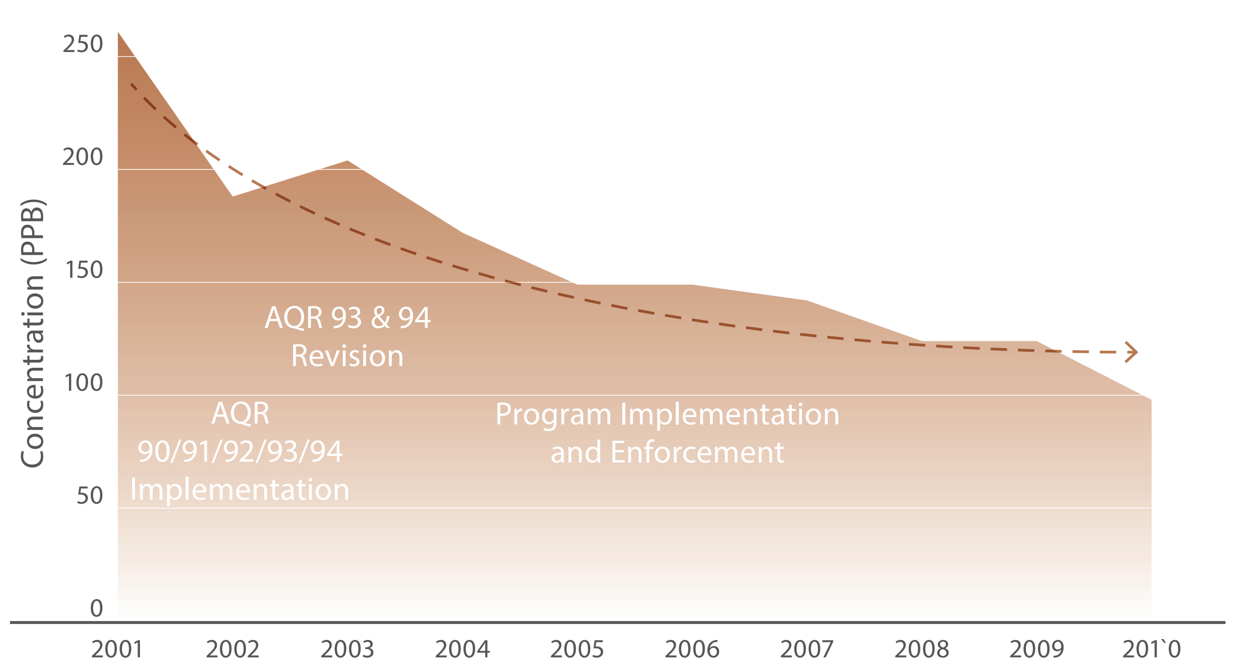


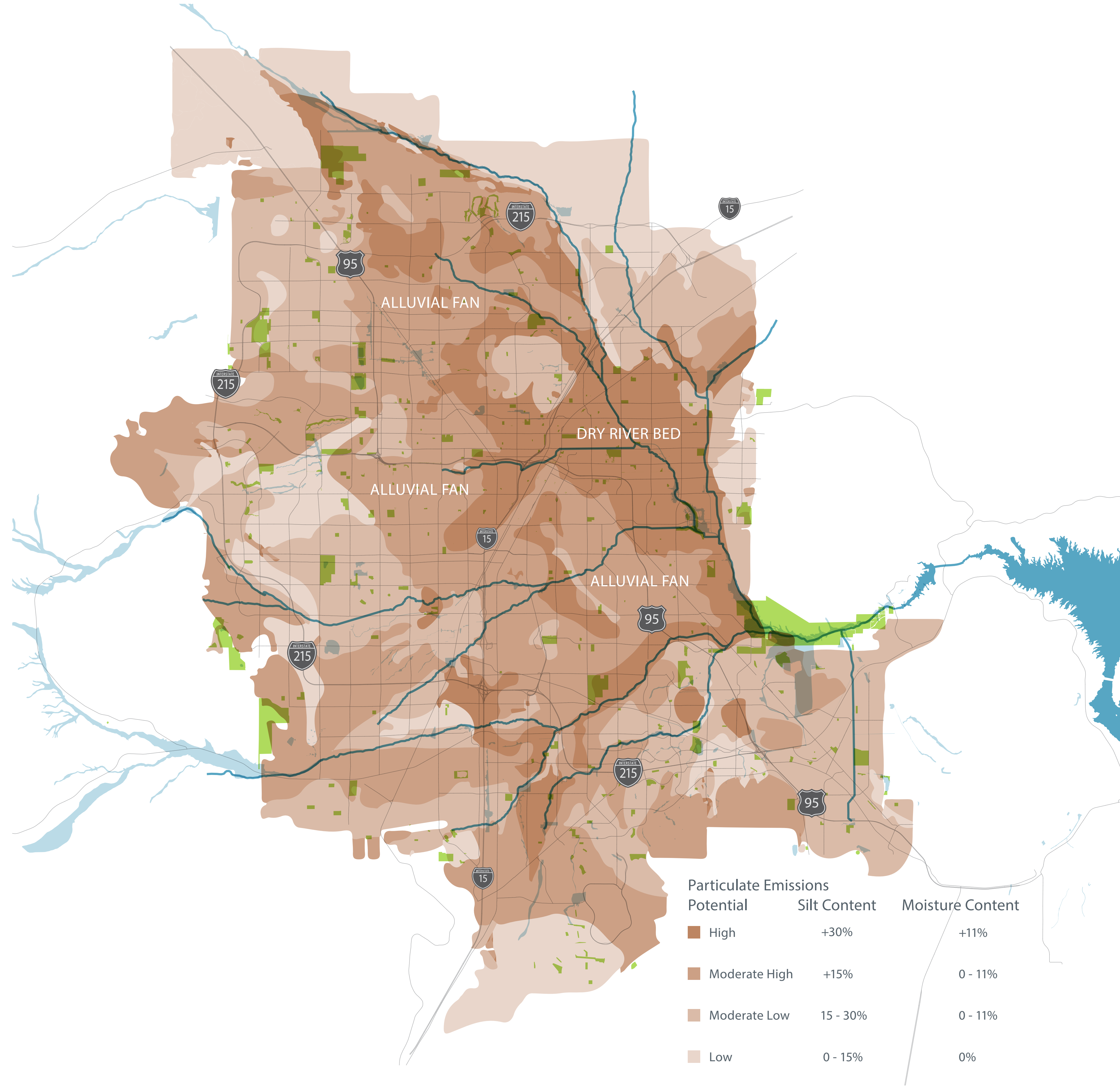
PM DAYS UNHEALTHY FOR SENSITIVE GROUPS SINCE 2000



PM-10 Trend

During portions of the year, a veil of white or brown haze hangs in the air over the Las Vegas Valley, blurring the city's skyline. Haze comes from sufficient smoke, dust, moisture, and vapor suspended in air to be visible. Sources hundreds of miles away can contribute to haze.

Over time, transportation and construction activities have contributed to ozone alert days; however, as the economy slowed down during the recession resulting in less construction activity and reduced driving, ozone pollution dropped. Similarly, monitored levels of PM-10 have shown a continued decline since the early 2000s despite rapid growth in the Valley. A total of three consecutive years of non-violating air quality data is necessary to attain the 24-hour standard of 150 microns per cubic meter per year.

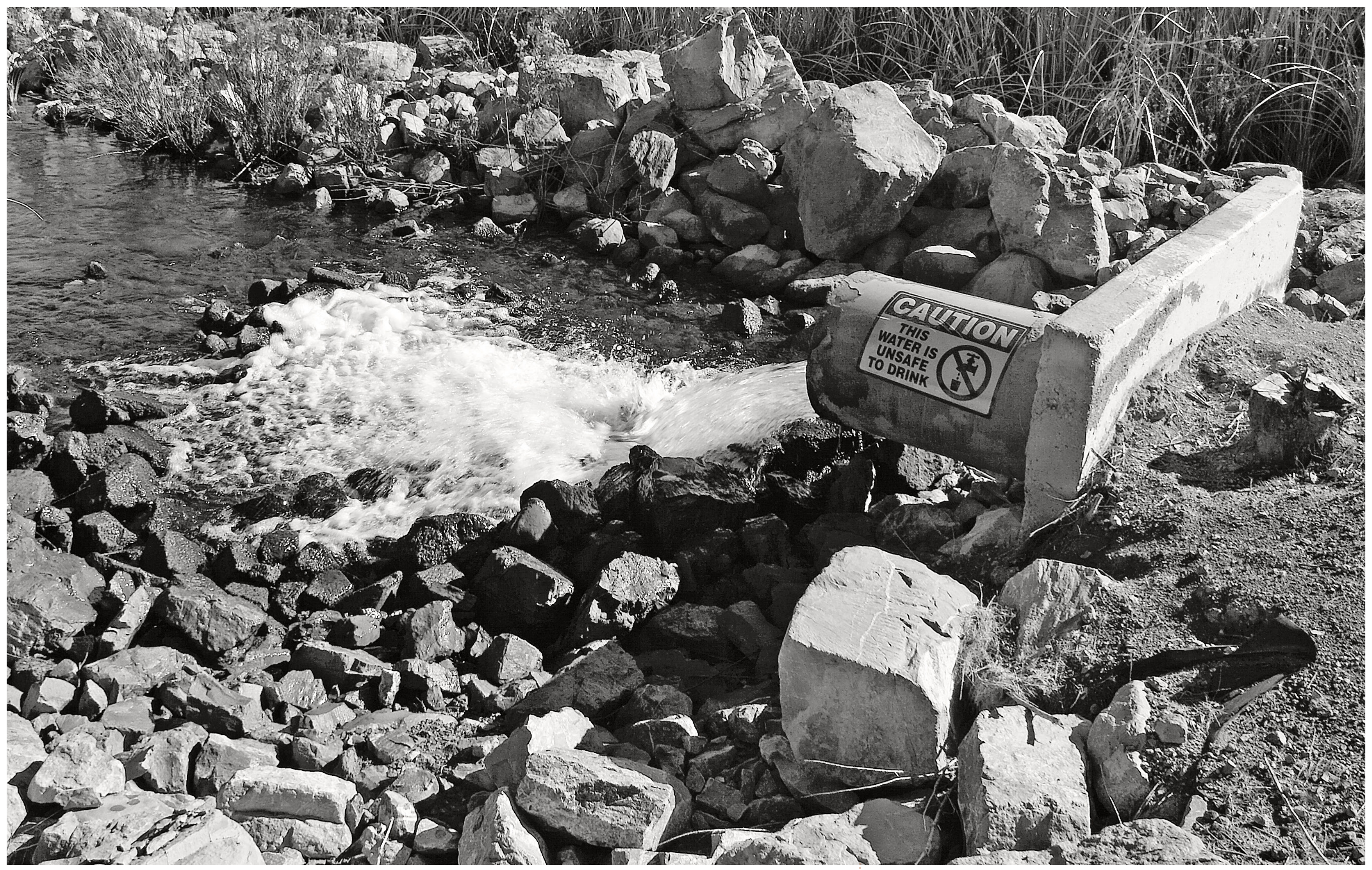


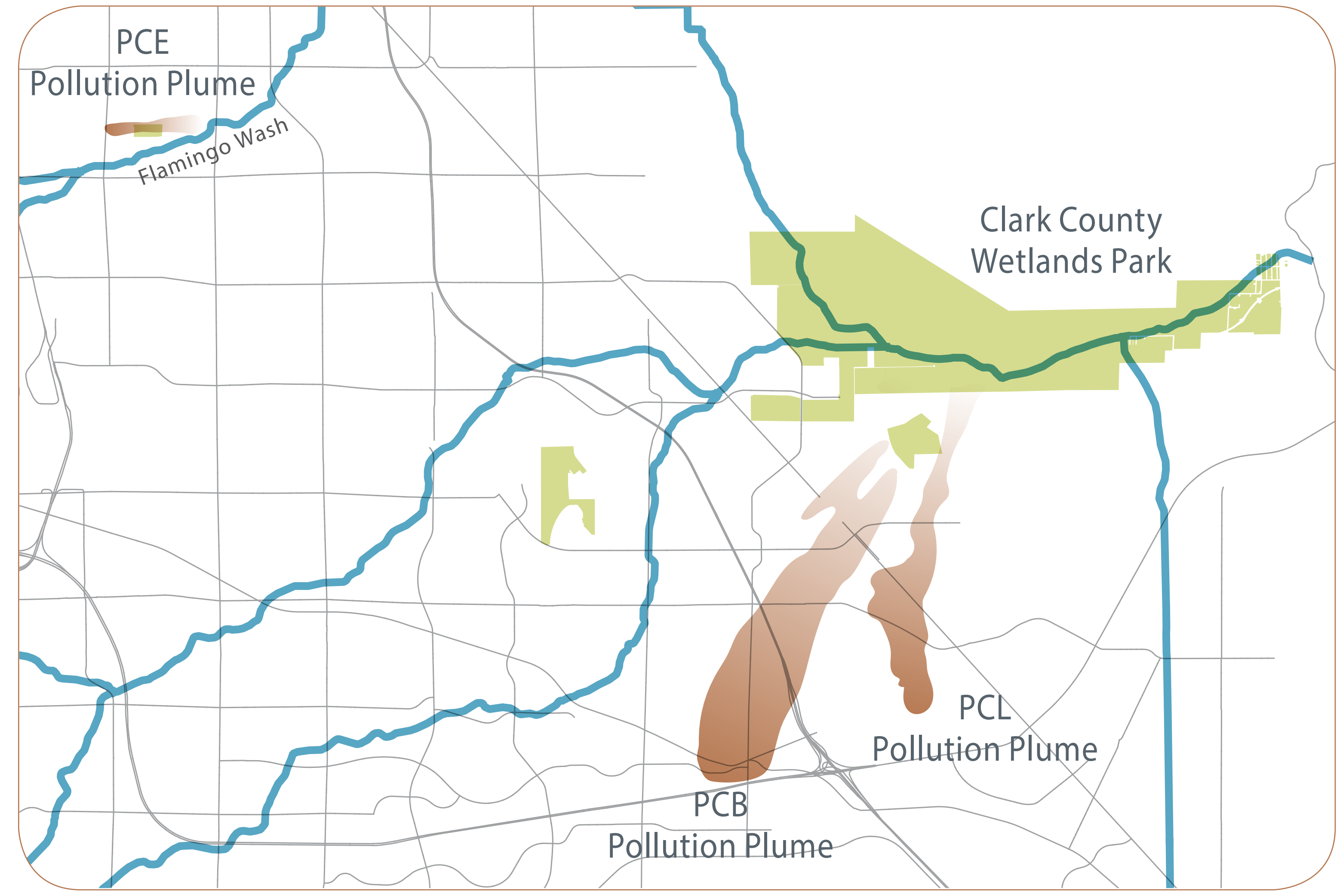
Particulate matter also dropped in correlation to economic activity; while it is on the rise again, the PM level is still well within federal attainment. Soils with much higher silt content are more readily suspended in the air from strong winds or soil movement than areas with less silt in the soil composition. If appropriate mitigation measures are not taken, the likelihood of high fugitive emissions from soils on the periphery of the Las Vegas Valley during strong wind events, should they be disturbed through recreational use or construction, is high. In 2005, Clark County implemented the Natural Events Action Plan for High-Wind Events (NEAP). The NEAP protects public health by warning of impending wind events; dust control permittees are reminded to employ all best management practices for dust control. When wind events do occur, the public is notified of the health hazards of airborne particulate matter. Through the actions taken related to soil and dust, Clark County has attained the PM-10 standard since 2004.

Clark County's implementation and enforcement of control requirements and poor air quality mitigation efforts significantly contributed to the improvement of air quality in Southern Nevada. As a result, Clark County's non-attainment designation by the EPA was lifted in 2014.

GROUNDWATER AND SOIL POLLUTION

Pollution could threaten Southern Nevada's groundwater and soils through both natural and anthropogenic contamination. Non-point source (NPS) water pollution occurs when rain, snowmelt and irrigation water flows over developed or disturbed land, carrying contaminants with it. This contaminated water makes its way into waterways directly or through storm drains. NPS pollution, unlike point-source pollution from industrial and wastewater treatment plants, comes from many diffuse sources. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, and ground waters. NPS pollution is a challenge to manage and control and is a leading cause of water quality problems in Nevada. Sources of pollution can be difficult to locate and the effects of NPS pollutants on specific waters vary. It can be hard to assess and identify how to eliminate NPS to minimize harmful effects on drinking water supplies, recreational waters, fisheries, and wildlife.





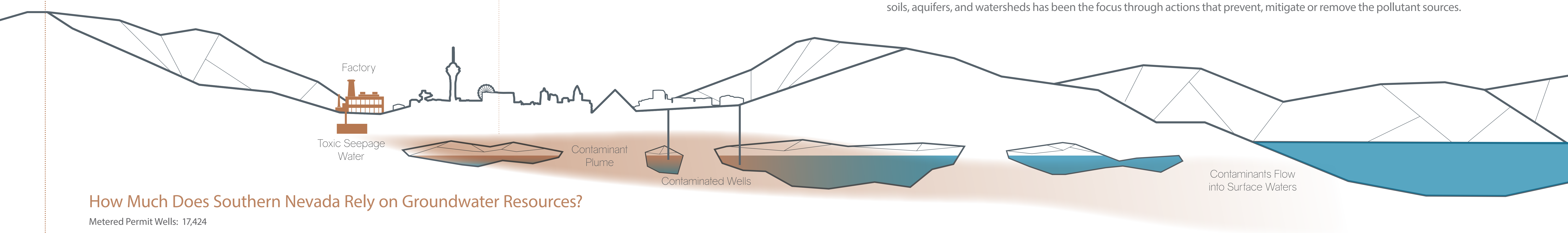
Water percolating through soil picks up naturally-occurring minerals, salts and organic compounds. As water migrates downward, the concentrations of dissolved minerals and salts increase in a process called mineralization. The mineral concentrations can often become high enough that groundwater no longer can be used as a water supply without treatment. More common natural contaminants include hydrogen sulfide, radon, arsenic, asbestos, iron and manganese.

Threats to water quality typically include spills, leaking pipes and underground storage tanks, urban runoff, mining and industrial operations, and forms of agriculture. Well-managed groundwater basins are monitored to detect leaks so that any harmful intrusions can be addressed quickly by local agencies. Gas stations, having underground storage tanks, have been prominent polluters in the past. Most of the groundwater contamination occurring nationally comes from leaking underground storage tanks and from other subsurface dumping or leakage by industrial and military/government sources. Military bases have been part of the group of largest generators of hazardous waste. Nellis Air Force Base has several active and inactive landfills and evaporation ponds containing hazardous waste and contaminated soils.

Subsurface mining excavation and drilling can disrupt groundwater flow and concentrate naturally occurring minerals such as arsenic and asbestos. Soil and ground disturbance decouples arsenic and asbestos, freeing them from a stable state. Minerals associated with mine tailings, waste and drainage can also produce acidic effluent, possibly changing the pH balance of water.

Improperly built wells can contaminate groundwater by establishing a pathway or conduit for pollutants. Pollutants can enter a well from surface drainage or by creating a conduit of flow between aquifers of varying water quality. Unused wells or even capped 'dry wells' can contaminate groundwater by allowing poor quality water or illegally dumped contaminants to move vertically from one aquifer to another.

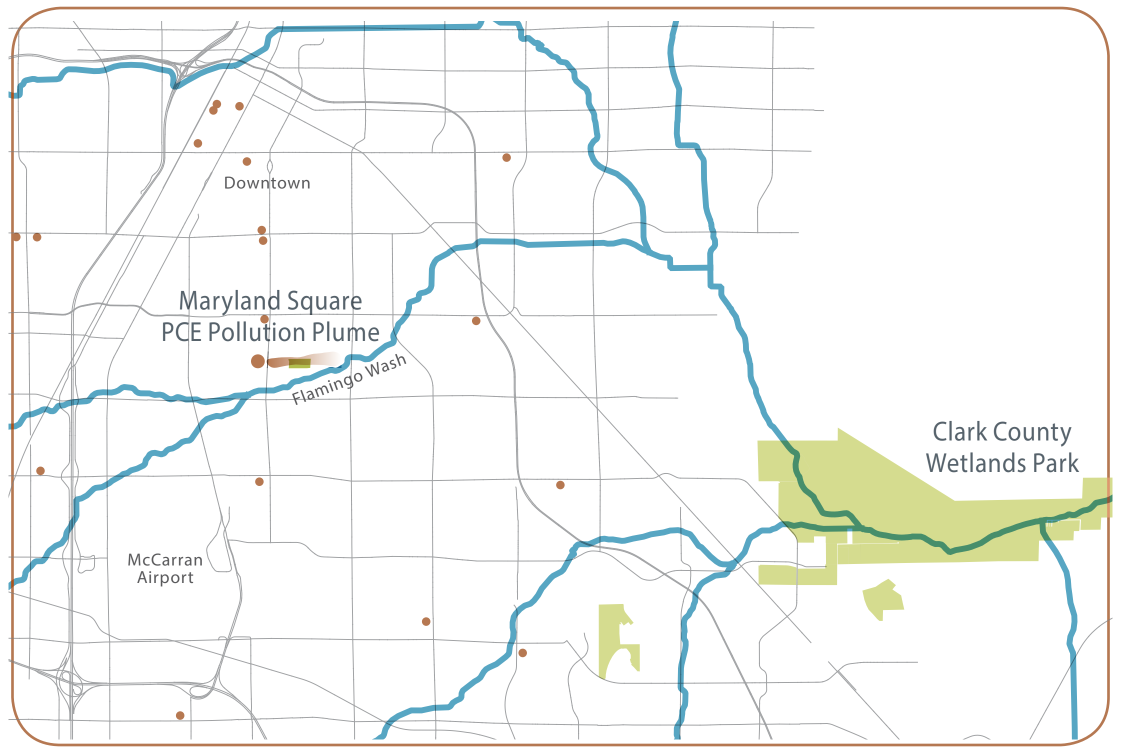
There are several contaminated site within flood areas in Southern Nevada that impact groundwater and soils. To minimize the spread of pollutants, keeping contaminated sites that have the potential for pollutant discharge from further polluting soils, aquifers, and watersheds has been the focus through actions that prevent, mitigate or remove the pollutant sources.



How Much Does Southern Nevada Rely on Groundwater Resources?

Metered Permit Wells: 17,424
Unmetered Permit Wells: 2,665
Domestic wells: 4,557
Total Permitted Groundwater Pumped: 74,098 Acre-Feet per year (18% of water use)

COMMERCIAL & INDUSTRIAL SITE POLLUTION AND REMEDIATION



There are several pollutants generated by commercial and industrial uses that could threaten Southern Nevada's groundwater and land: perchlorate, asbestos, arsenic, manganese, carcinogenic PAHs (polycyclic aromatic hydrocarbons), aluminum, lithium, strontium, and vanadium.

One of the best known examples of commercially generated pollution in Southern Nevada involved improper disposal of PCE (perchloroethylene, or 'perc'), a solvent/ degreaser used by dry cleaners to clean fabrics. It is also found in some common household products, such as glues, spot cleaners, brake part cleaners, and some spray polishes. A dry cleaning business located at the Maryland Square shopping center in operation from 1969 through 2000 generated large quantities of PCE that leached into the soil and subsequently migrated into the shallow groundwater basin. PCE contamination migrated off the site, forming a 'plume' in the groundwater. A 2005 report presented the first data showing that the PCE plume migrated over 2,000 feet east of the source area, extending beneath residential neighborhoods east of the Boulevard Mall. By 2014, the plume had migrated 4,000 feet further east, ending near the Flamingo Wash, a tributary that leads into the Las Vegas Wash. The base of the PCE plume is approximately 80 feet deep. Municipal sources of drinking water come from pumping of the deep aquifer and from Lake Mead. Wells pumping the deep aquifer typically withdraw water from depths of hundreds of feet. Municipal wells and drinking water are routinely monitored, and there is no evidence that the PCE has caused widespread contamination in the deep aquifer.

While cleanup of this PCE-contaminated groundwater is difficult due to the types of geologic deposits present in the valley, remediation strategies must be designed to avoid spreading the plume into areas currently unaffected. The Nevada Division of Environmental Protection evaluated the results of testing and EPA computer modeling to assess the potential for PCE vapor intrusion into homes. Although the model output indicated there was no immediate health threat to residents, it also predicted that concentrations of PCE in the indoor air of these homes could exceed the EPA's health-protective level for long term (30 years or more) exposure. Remediation efforts are ongoing and include pumping and treatment of the groundwater within the PCE plume and sub-slab vapor depressurization in several homes where indoor PCE vapor levels were measured at several times higher than acceptable EPA levels.

An example of industrially generated pollution in Southern Nevada is the Basic Magnesium Incorporated (BMI) site in Henderson, which generated what is now the largest perchlorate groundwater plume in the United States. Perchlorate is a salt and an oxidizing component of rocket fuel and explosives. Prior to the 1988 explosion at the Pepcon complex (also in Henderson), 100 percent of the perchlorate production in the U.S. was housed at the BMI site.

The disposal of perchlorate-containing wastes in unlined ponds from the early 1940s to 1976 contaminated groundwater. Perchlorate production was curtailed on the site beginning in 1998 and was ceased permanently in 2002. Groundwater at the BMI site also contains hexavalent chromium. Soils were left with perchlorate, chromium and other metals, chemicals and dioxins. Although perchlorate is no longer manufactured at the BMI complex, contaminated groundwater remains in the soil and groundwater aquifer. The plume of perchlorate reached the Las Vegas Wash and ultimately made its way to Lake Mead. Long term exposure through contact or ingestion can interfere with the production of thyroid hormones, which are needed for prenatal and postnatal growth and development, as well as for normal metabolism and mental function in adults.

Although perchlorate is not regulated under EPA's Safe Drinking Water Act, the EPA issued a preliminary reference dose equivalent to 15 parts per billion. Lake Mead, which is the source of approximately 90 percent of Southern Nevada's drinking water, contains low concentrations of perchlorate. As of 2014, more than 4,000 tons of perchlorate have been removed from soil and groundwater. A historic $1.1 billion settlement in 2014 will fund the continued cleanup. To capture the contaminated water and prevent additional perchlorate from entering the Las Vegas Wash, the Nevada Division of Environmental Protection has overseen the installation of an interception system that uses wells to extract the contaminated water. This system has reduced the amount of perchlorate entering the Las Vegas Wash by approximately 90 percent to nearly undetectable levels in the lake. In 2012, concentrations in treated drinking water averaged 1.2 parts per billion.

Polychlorinated biphenyls, commonly known as PCBs, were used as coolants, insulating materials, and lubricants in electric equipment and can still be found in products such as old fluorescent light fixtures, electric appliances, and some paints and glues. PCBs were used in hundreds of industrial and commercial applications for 50 years until banned in 1979 because of health concerns. As pollutants, they originate from landfill runoff and industrial waste discharge. These man-made organic chemicals are known to cause cancer and a range of other health problems including skin changes, immune system deficiencies, and damage to the thymus gland, reproductive and nervous systems. PCBs do not break down naturally; they linger in the environment for a long time, as they evaporate slowly, do not dissolve readily in water, and

Cornerstone Park Brownfield Re-use (Photo: A. Perlas)

Symphony Park Brownfield Redevelopment (Photo: Las Vegas 360)

attach to soil particles making them difficult to remediate. In bodies, they are stored in animal fat and become more concentrated as they move up in the food chain.

Titanium Metals Corporation (TIMET) agreed as a part of a $13.6 million settlement with the EPA in 2014 to investigate and clean up the contamination from the unauthorized manufacture and disposal of PCBs at its 108-acre site in Henderson, part of the BMI Industrial Complex.

The Resource Conservation and Recovery Act (RCRA) of 1976 established regulatory standards for the disposal of hazardous waste. The presence of hazardous constituents in contaminated soil, sediments, groundwater, surface water, and air at, or emanating from, RCRA Corrective Action sites can increase the risk of adverse health effects to exposed populations. The EPA estimates that more than 35 million people, or roughly twelve percent of the United States population, live within one mile of an RCRA Corrective Action site.

Pollution can also negatively impact already impoverished communities. This can be especially critical for minority and poor communities, as well as sensitive sub-populations such as children, pregnant women, and the elderly, all of whom can be disproportionately affected. Short term dangers of RCRA sites include acute health effects such as poisoning and injuries from fire or explosions. Long-term effects include poisoning, cancers, birth defects, and other chronic non-carcinogenic effects (e.g., damage to kidney, liver, nervous and endocrine systems). Contamination of soil, groundwater, surface water, and other media degrade ecosystem functioning by affecting the health of various plant and animal species. The effects vary widely from site to site depending on the species, contaminant, and ecosystem involved, but the overall impact is a change to an ecosystem's species composition and functioning. In addition to potential harm to plant and animal communities, these changes can lead to a reduction in the benefits, both direct and indirect, that ecosystems provide to people.

RCRA Corrective Action cleanups also reduce liabilities associated with reusing contaminated sites. Sites can be converted from vacant, underutilized land into productive resources. Converted sites may reduce blight, improve aesthetics and community well-being. It is common to see a boost in property values in nearby communities after site clean-up.

A re cent reveals details associated with pollution and hazards in the Valley. This site shows the persistence of pollutants remaining from industrial types of activity, and the potential threats to drinking water for Valley residents.

The Three Kids Mine east of Henderson is an RCRA site; it is a 1,000 acre abandoned manganese mine and mill site near the Lake Las Vegas Resort community, the Calico Ridge subdivision, and Lake Mead National Recreation Area. The Three Kids Mine has been abandoned for about 50 years but still has large, unprotected tailings ponds containing approximately two to three million cubic meters of material with high concentrations of lead, arsenic, manganese, strontium, and petroleum hydrocarbons. There are also large open pits, and the remains of seven circular ore processing thickeners.

At the base of the tailings ponds is a water culvert belonging to the Lake Las Vegas Resort. This culvert carries contaminated runoff from the mine site. The runoff makes its way downhill and northward into the Las Vegas Wash. Before Lake Las Vegas was built, the runoff from the tailings ponds flowed freely downhill to the Las Vegas Wash, which in turn discharged into Lake Mead. Over the years, large quantities of tailings may have been transported by water to the Wash and to Lake Mead. In several test areas surrounding the mine site, the EPA regional screening levels for arsenic, lead, and manganese were exceeded. As these pollutants are in soils in or close to washes, a large flood event may displace the contaminated soil, moving it closer to the Lake, or into the Lake itself.

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