

BICYCLE & PEDESTRIAN MASTER PLAN



WORKING PAPER 1: CURRENT AND FUTURE CONDITIONS
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WILSON & COMPANY **ADOT**



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Nogales Bicycle & Pedestrian Master Plan



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1.0 | Introduction

The City of Nogales, Arizona strives to be a pedestrian and bicycling friendly community. The *Nogales Bicycle and Pedestrian Master Plan/Royal Road Multi-Use Path* is a guiding document providing direction on pedestrian and bicycling investments within the city. The ability to bike and walk are important to Nogales's future as they potentially alleviate several challenges such as safety, connectivity, and public health, all while providing a sense of community. By planning a multi-modal transportation network, the City can enhance the overall lifestyle and livability of the community.

1.1 | Purpose of Study

The purpose of this Plan is to provide safe pedestrian and bicycle connections within the existing transportation system and develop new facilities within strategic corridors currently lacking multi-modal facilities. The needs, issues, and opportunities within the community will be documented through working papers and eventually the Final Master Plan. Ultimately, the Plan will develop a prioritization of specific bicycle and pedestrian improvement projects, and identify potential funding sources.

1.2 | Study Area

Nogales, Arizona is 20 square miles and located within Santa Cruz County on the border of Arizona and Mexico. The city shares 5 miles of the United States and Mexico border and is a key location for border crossings. Figure 1-1 illustrates the location of Nogales within the surrounding region. Figure 1-2 depicts of the City of Nogales, Arizona.

Figure 1-1 | Vicinity Map

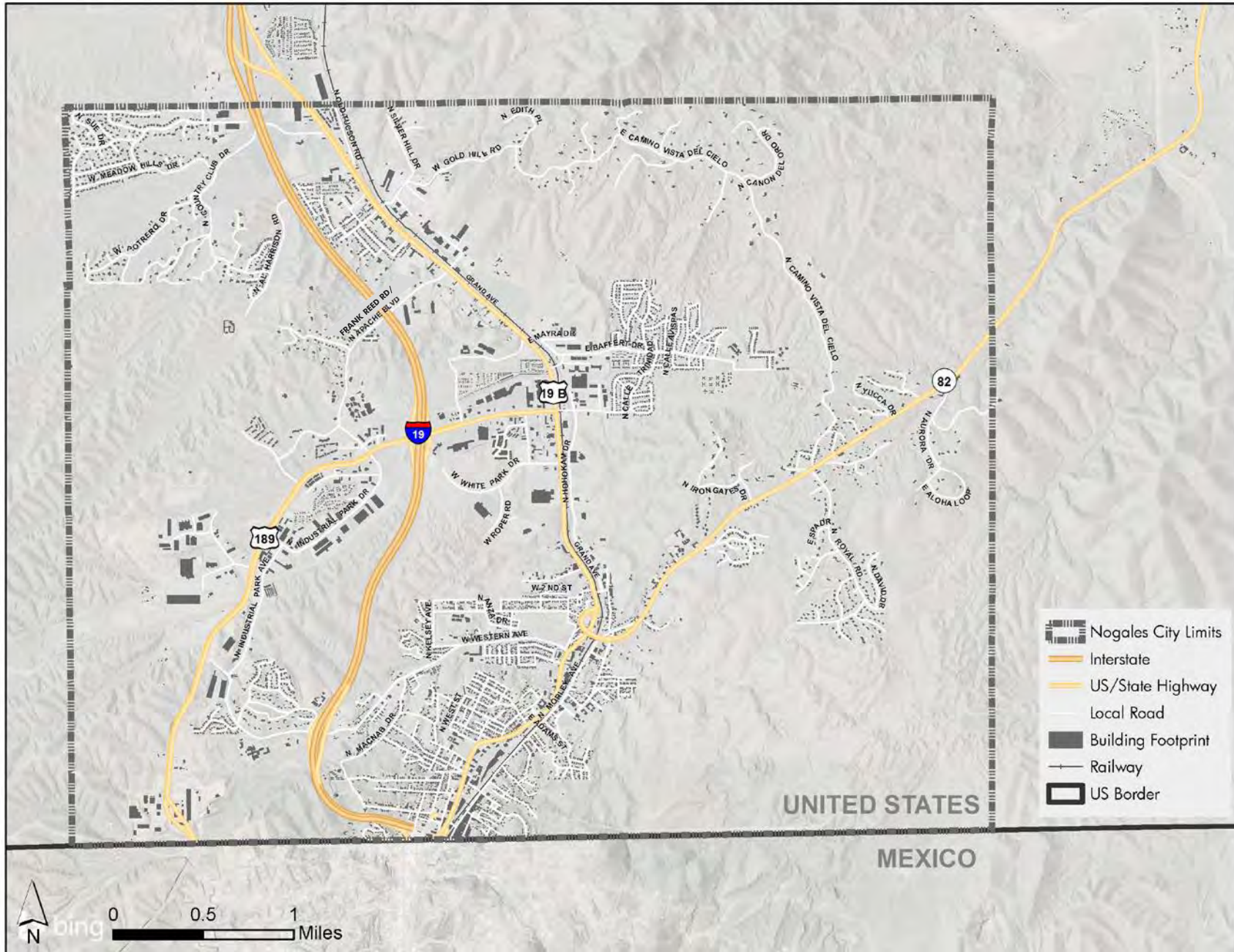


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Introduction



Figure 1-2 | Study Area





1.3 | Critical Corridors

There are six critical corridors within Nogales that do not currently provide or connect to bicycling or pedestrian facilities. The corridors were identified by the City as important routes to study. These corridors will be evaluated to understand the existing conditions, opportunities and constraints, and identify recommendations for multi-modal infrastructure. The six corridors are depicted in Figure 1-3 and outlined in Table 1-1.

Table 1-1 | Critical Corridors

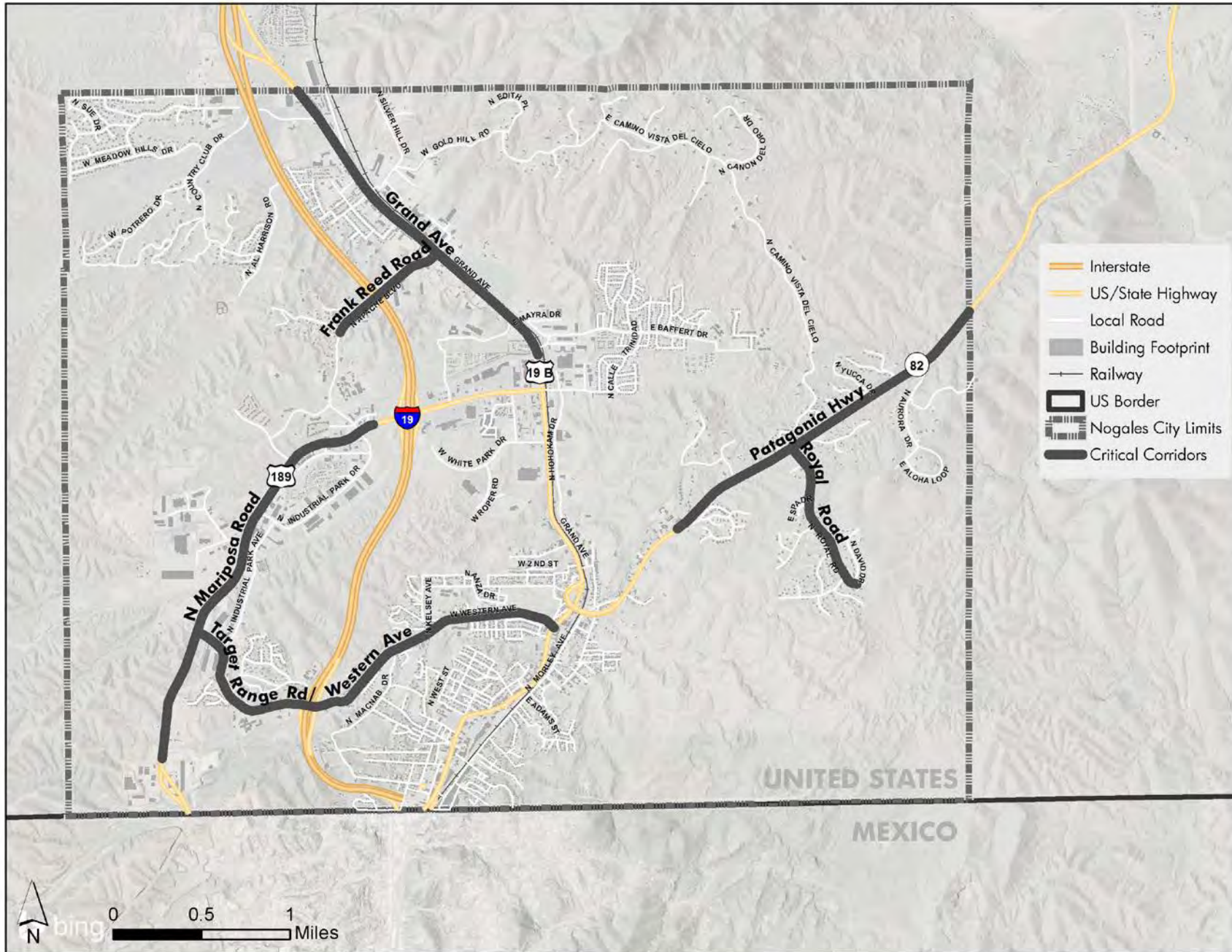
Name	Location	Length (in Miles)
Grand Avenue/ I-19 Business	North of Baffert Drive	2.0
Patagonia Highway (SR-82)	East of existing sidewalks	2.1
Frank Reed Road (Formerly Apache Blvd)	North of Nogales High School	0.7
Mariposa Road	From the existing Land Port of Entry (LPOE), to I-19 and the high school area	2.4
Target Range Road/Western Avenue	East of Mariposa Road to Grand Avenue	2.5
Royal Road	South of Patagonia Highway	0.9

1

Introduction



Figure 1-3 | Critical Corridors





1.4 | Report Organization

Working Paper 1 of the *Nogales Bicycle and Pedestrian Master Plan/Royal Road Multi-Use Path* is organized in a way to take the reader through the process of understanding the existing conditions analysis, which lays the groundwork for developing the final multi-modal transportation network. The existing conditions analysis is a multi-layered method, collecting an inventory of both demographic and physical characteristics to create a prioritization of needed improvements. Working Paper 1 integrates applicable elements of previous plans, as well as analysis of current roadway, bicycle, and pedestrian infrastructure. Working Paper 1 is organized as follows:

- Chapter 1 Introduction
- Chapter 2 Previous Plans
- Chapter 3 Community Characteristics
- Chapter 4 Transportation Network
- Chapter 5 Key Findings



2.0 | Previous Plans

This section summarizes the previous plans, studies, and reports that influence the City of Nogales. Prior to this Plan, various studies, plans, and policies have been developed to respond to the community needs. Table 2-1 provides a reference of planning documents which were reviewed in preparation for this planning process.

Table 2-1 | Previous Plan Review

Plan Name	Date	Publishing Agency
Five-Year Strategic Plan FY2018 - FY2022	July 2017	SEAGO
Transportation Coordination Plan Update 2017-2018	December 2016	SEAGO
2016 Title VI Implementation and Public Participation Plan	August 2016	SEAGO
Santa Cruz County Comprehensive Plan	May 2016	Santa Cruz County
Morley-Banker-Hohokam Bike Route Design Concept Report	January 2016	Nogales, AZ
City of Nogales PARA Pedestrian Circulation at Port of Entries	January 2016	Nogales, AZ; ADOT
Rio Rico Walking and Biking Study	July 2013	Santa Cruz County; ADOT
Arizona-Sonora Border Master Plan	February 2013	ADOT; FHWA
City of Nogales General Plan	August 2010	Nogales, AZ
Unified Nogales Santa Cruz County Transportation Plan 2010	April 2010	Unified Nogales Santa Cruz County

These documents identify key improvements to the local and regional transportation network. These recommended improvements seek to improve the safety and mobility of pedestrians, cyclists, and motorists as they traverse the city.

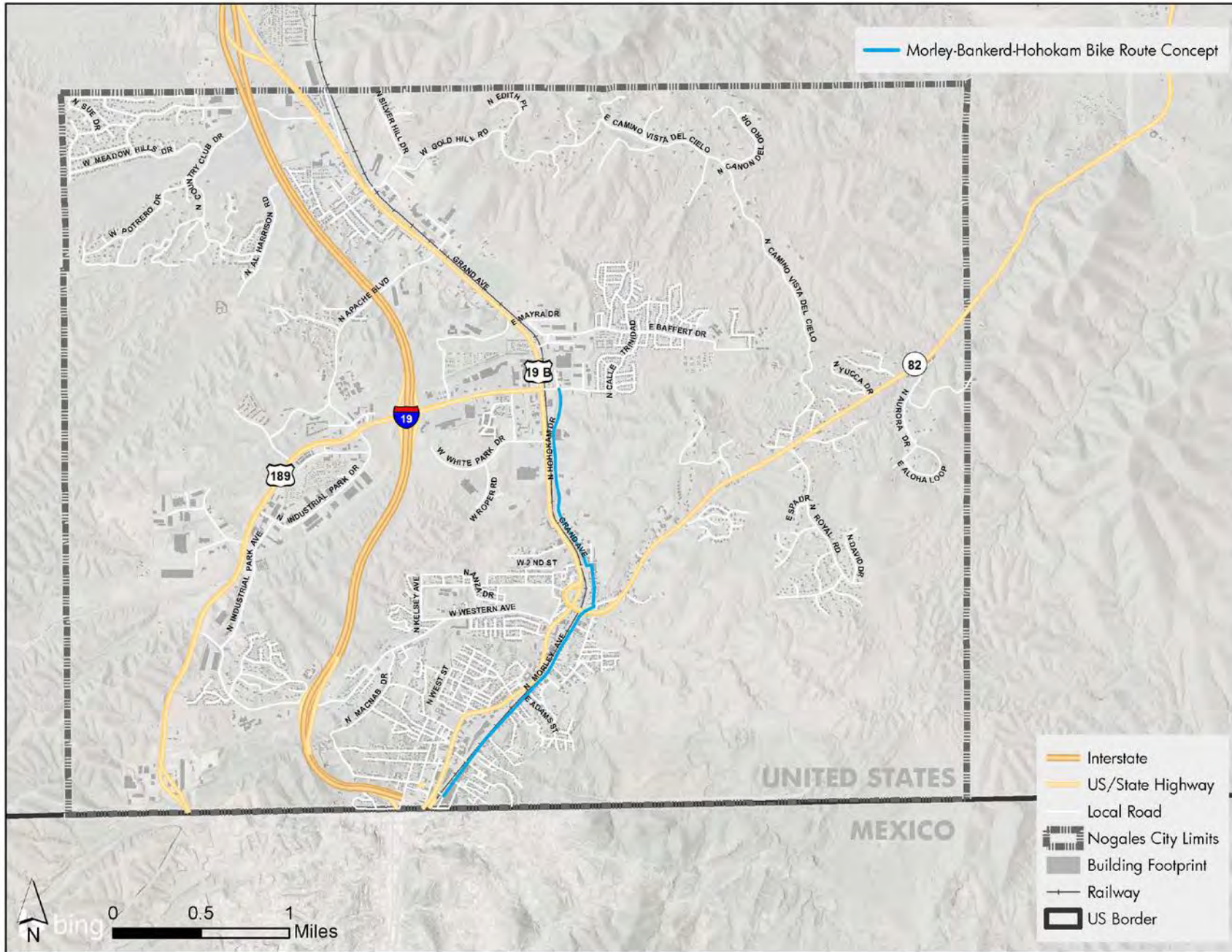
One of the recommended improvements for cyclists is outlined in the *Morley-Banker-Hohokam Bike Route Design Concept Report*. Local biking organization OS3 (“Zero Stress”) petitioned the City to study the corridor in order to increase the safety of riders during their Friday night rides. The route runs north-south along Morley Avenue, Bankerd Avenue, and Hohokam Drive -- just east of the Union Pacific rail and Grand Avenue/I-19 Business corridor (Figure 2-1). The plan suggests a combination of share-the-road lane markings and dedicated bike lanes along the route, and provides multiple options at several key locations. A final alignment has yet to be determined.

2

Previous Plans



Figure 2-1 | Proposed Morley-Bankerd-Hohokam Bike Route





The *Unified Nogales Santa Cruz County Transportation Plan 2010* provides a program of improvements to the transportation system throughout the Nogales and Santa Cruz County area. These improvements are a response to a critical need for safer traffic circulation for drivers, cyclists, and pedestrians traveling throughout the region. The recommendations from the plan were based on previous plans as well as discussions with local stakeholders and public input but are not part of a fiscally constrained improvement program. The Arizona Department of Transportation's (ADOT) Communication and Community Partnerships Division (CCP) assisted in facilitating the public input. Additionally, a Technical Advisory Committee (TAC) comprising of local and state officials -- as well as planning consultants -- were formed to guide the work program.

The recommended improvements within Nogales are shown in Figure 2-2 and Figure 2-3. The majority of roadway improvements for future capacity are planned along the Interstate 19 Business/Grand Avenue corridor. Many of the suggested improvements in this corridor seek to increase connectivity and safety of people traversing the Union Pacific (UP) rail line that runs to the east of Grand Avenue. Currently, out of the 10 rail crossings there is only one grade-separated crossing in Nogales at the intersection of SR-82/ Patagonia Highway. The development of strategic crossings in the corridor would not only increase circulation for travelers but enhance safety as well.

Other key needed improvements include:

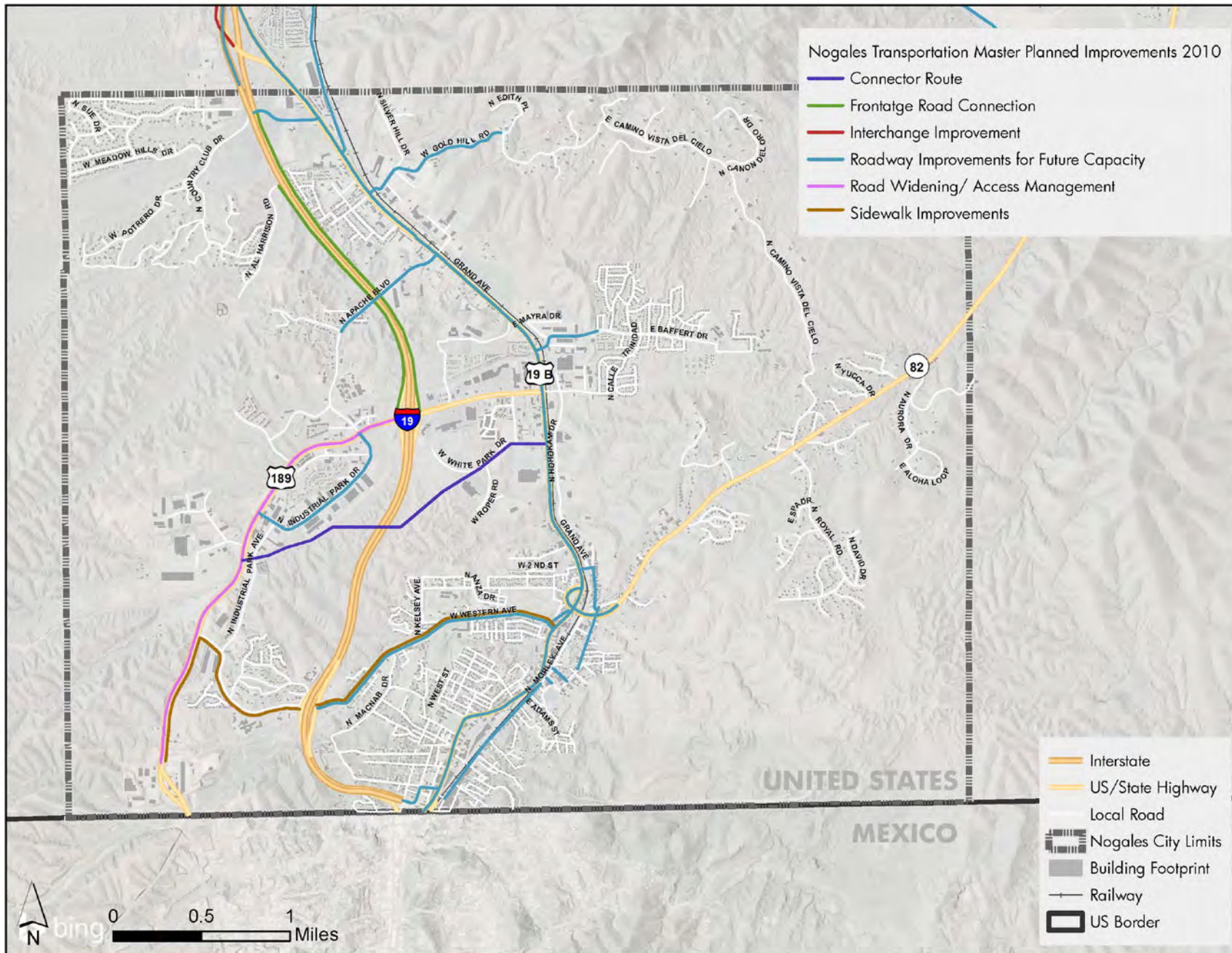
- Roadway widening and access management along SR-189/ Mariposa Road;
- Frontage road connections on Interstate 19 (I-19) between SR-189 and the northern city boundary;
- Interchange improvements at I-19 and I-19 Business;
- Sidewalks along Target Range Road and Western Avenue;
- Improved pedestrian crossings in the central commercial area;
- Gateway signage at high-traffic city boundaries;
- Traffic interchange and intersection improvements; and
- Overpass of rail in high pedestrian volume areas.

2

Previous Plans



Figure 2-2 | Nogales Identified Transportation Master Plan Linear Improvements 2010



2

Previous Plans



Table 2-2 | Multimodal Project Coordination AZ Border Master Plan 2013

			Capacity/Congestion Total Points	Project Cost (in \$1,000s)	Cost of Project vs. Projected Demand	Regional Benefit Total Points	Project Readiness Total Points	LPOE Connectivity Total Points	Weighted Combined Score	Arizona Multi-Modal Index Overall Rank
			12	-	3	8	5	9	100	Out of 108
Facility	Project Description/Extent	Proposed Improvement								
I-19	At Grand Avenue interchange	Capacity improvements	7	22,550	1	4	2	5	50	69
Grand Avenue	Country Club Drive intersection	Capacity improvements	5	1,050	2	4	2	5	49	74
SR 82	Grand Avenue to Thelma Street	Capacity improvements	5	12,150	1	5	2	6	49	76
E.-W. interconnector	SR 189 to SR 82	Corridor Study, Design and Construct	7	1,000	1	3	2	5	48	79
Morley Avenue	Banks Bridge to Park Street, Nogales	Capacity improvements	4	3,570	2	4	2	5	46	89
Bankerd Avenue	Doe Street to Morley Avenue	Capacity improvements	5	1,800	2	3	2	4	45	92
Doe Street	Grand Avenue to Bankerd Avenue	Capacity improvements	5	1,130	1	4	2	5	44	95
Industrial Drive Loop	Nogales	Capacity improvements	5	7,000	1	4	2	5	44	96
Old Tucson Road	Grand Avenue to Frontage Road	Design and Reconstruct to 5 Lanes	5	17,250	2	3	3	2	43	99
E.-W. Route	SR 189 / Mariposa Road to Grande Avenue (east of I-19 interchange)	New roadway	7	6,200	1	2	2	4	43	100
SR 289 Interconnector (Ruby Road)	New N.-S. Interconnector to SR 82	Corridor Study to preserve roadway alignment, Design and Construct	7	56,000	1	3	2	2	42	102
Calle Sonora	At N. Hohokam Drive - Nogales	Widen roadway & bridge; improve intersection	4	5,300	1	3	2	4	37	107
Pendleton Drive	Rio Rico Drive to Palo Parado Drive	Roadway reconstruction	4	42,500	1	4	3	1	36	108



3.0 | Community Characteristics

This chapter documents the community socioeconomic characteristics based on the U.S Bureau of the Census figures from the American Community Survey and 2010/2000 Census. Figure 3-1 displays the block-group geographies which were used to visualize demographic differences. The information on demographic, Limited English Proficiency (LEP), income, journey to work, vehicle availability and disability status are described herein. This chapter also describes the physical characteristics of the community in terms of connectivity, mobility, attractions/destinations and environmental considerations.

3.1 | Population & Age

Nogales has a population of 20,355, according to the 2016 estimate by the US Census Bureau. Table 3-1 shows the change in population since 2000 in Nogales, as well as in Santa Cruz County and Arizona. Population in Nogales has remained basically stagnant since 2000. The county added residents between 2000 and 2010 but has recently experienced a small drop in population. Statewide, there has been robust population growth over the same time period.

As shown in Table 3-1 and Figure 3-3, Nogales has a slightly older population overall than the county or state. A smaller share of residents under 18 years old could account for this (Figure 3-2).

Table 3-1 | Population & Age

	Nogales	Santa Cruz County	Arizona
Total Population			
2016 estimate	20,355	46,547	6,728,577
2010	20,837	47,420	6,392,017
2000	20,878	38,381	5,130,632
Percent of population under 18 years old, 2016	17.7%	21.2%	22.7%
Percent of population 65 years old and over, 2016	15.9%	15.9%	15.6%
Median age, 2016	37.1	36.4	32.7

Source: U.S. Bureau of the Census – Age by Sex: 2012-2016 American Community Survey 5-Year Estimate; Total Population 2010 Census and 2000 Census



There is a significant portion of Nogales households with Limited English Proficiency (LEP). Table 3-2 depicts and Figure 3-4 displays the proportion and distribution of LEP households. Over 20% of households in Nogales are LEP, or nearly seven times as much when compared with the 3.3% state average. Due to the high number of spanish-speaking households with limited English, bicycle and pedestrian wayfinding signage as well as educational materials ought to be developed in both English and Spanish.

Table 3-2 | Limited English Proficiency (LEP) Households

	Nogales	% of total	Santa Cruz County	% of total	Arizona	% of total
Total Households	6,368		15,538		2,448,919	
English-Only Households	584	9%	3,992	25.7%	1,780,847	72.7%
Spanish-speaking Households	5,749	90.3%	11,344	73.0%	477,905	19.5%
Limited English	1,290	20.3%	2,107	13.6%	81,749	3.3%
Not limited English	4,459	70%	9,237	59.4%	396,156	16.2%
Other language-speaking Households	35	0.5%	202	1.3%	190,167	7.8%
Other language-speaking, Limited English Proficiency	23	0.4%	40	0.3%	28,207	1.2%

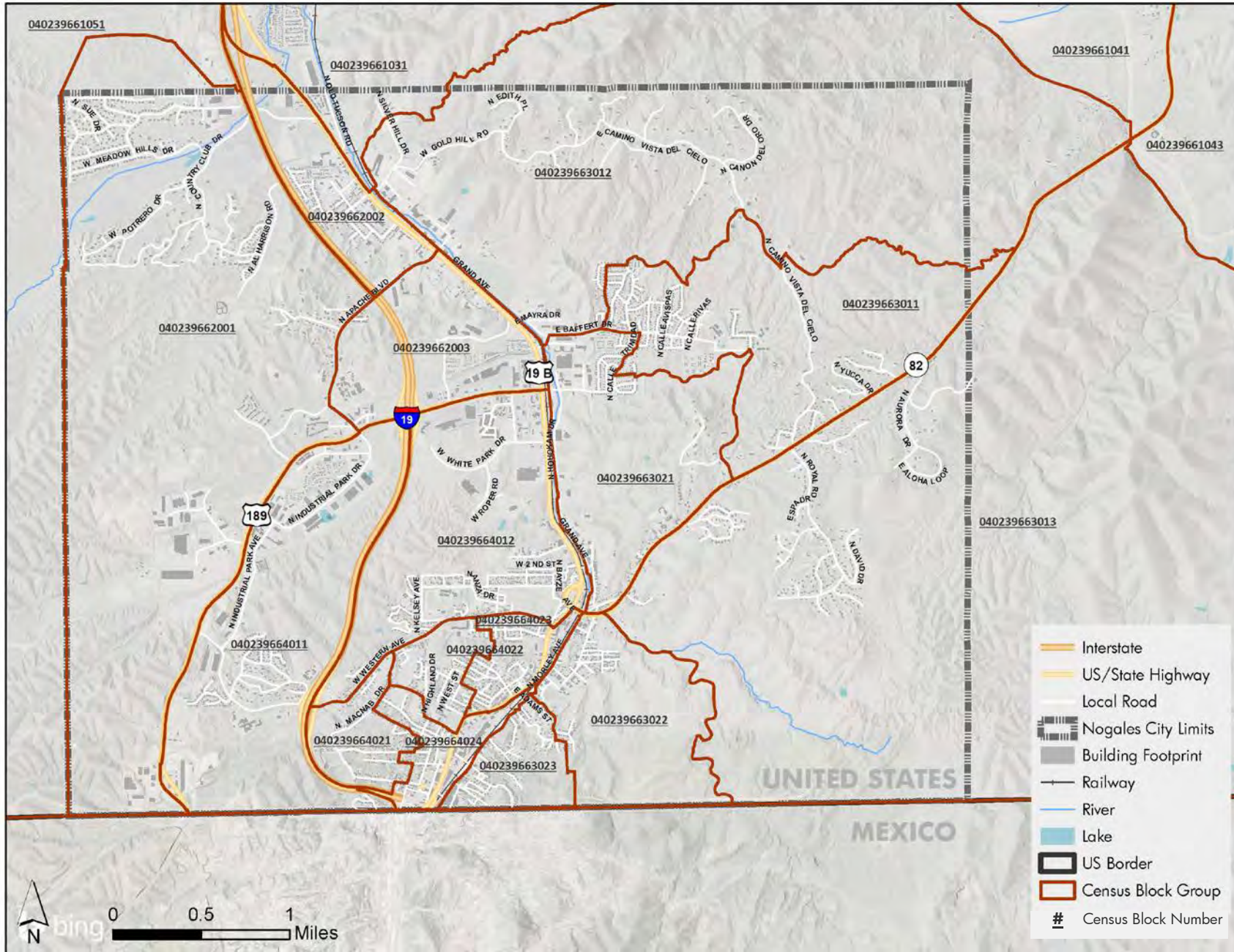
Source: U.S. Bureau of the Census – Household Language: 2012-2016 American Community Survey 5-Year Estimate

3

Community Characteristics



Figure 3-1 | Block Groups within Nogales, AZ

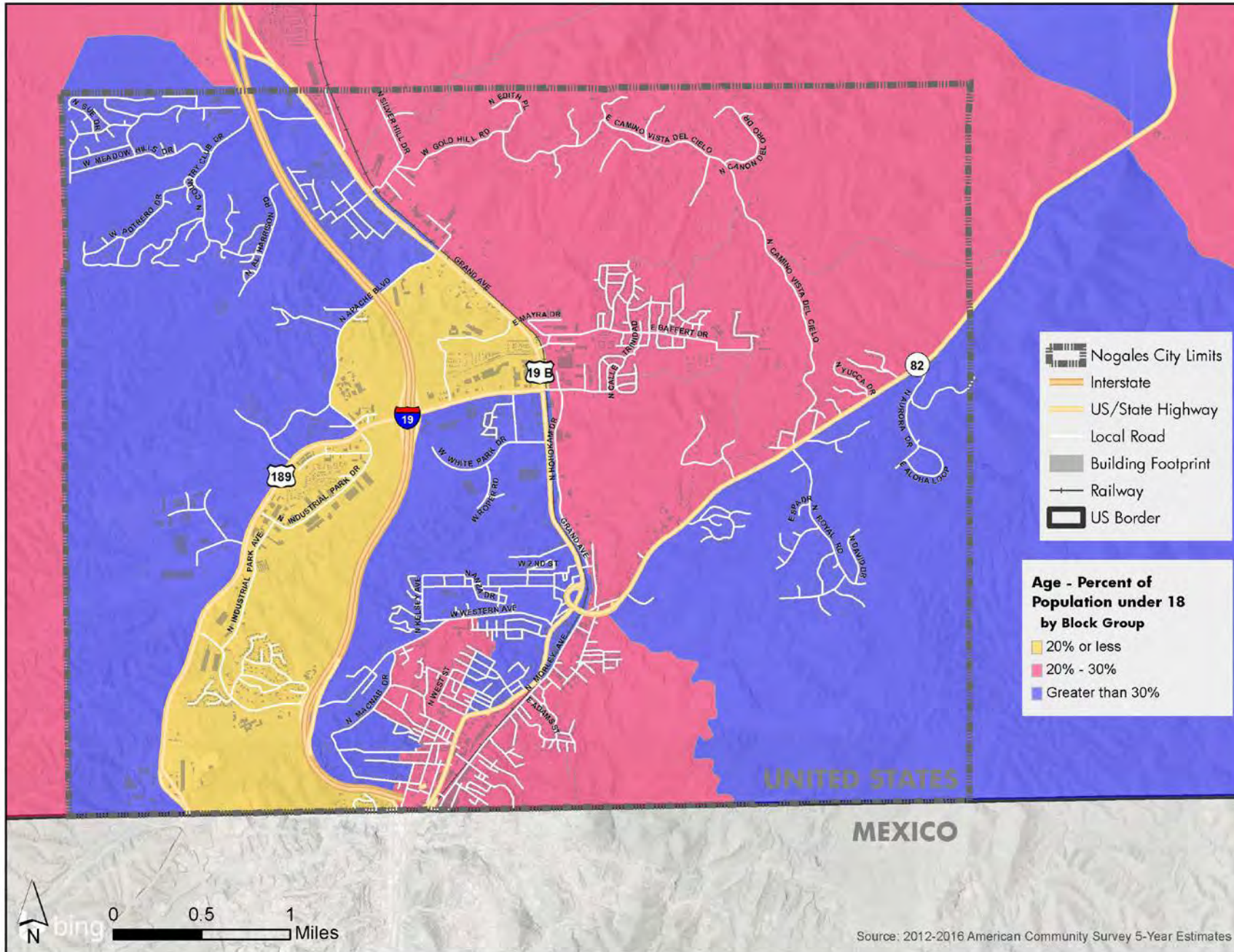


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Community Characteristics



Figure 3-2 | Percent of Population below Age 18 by Block Group

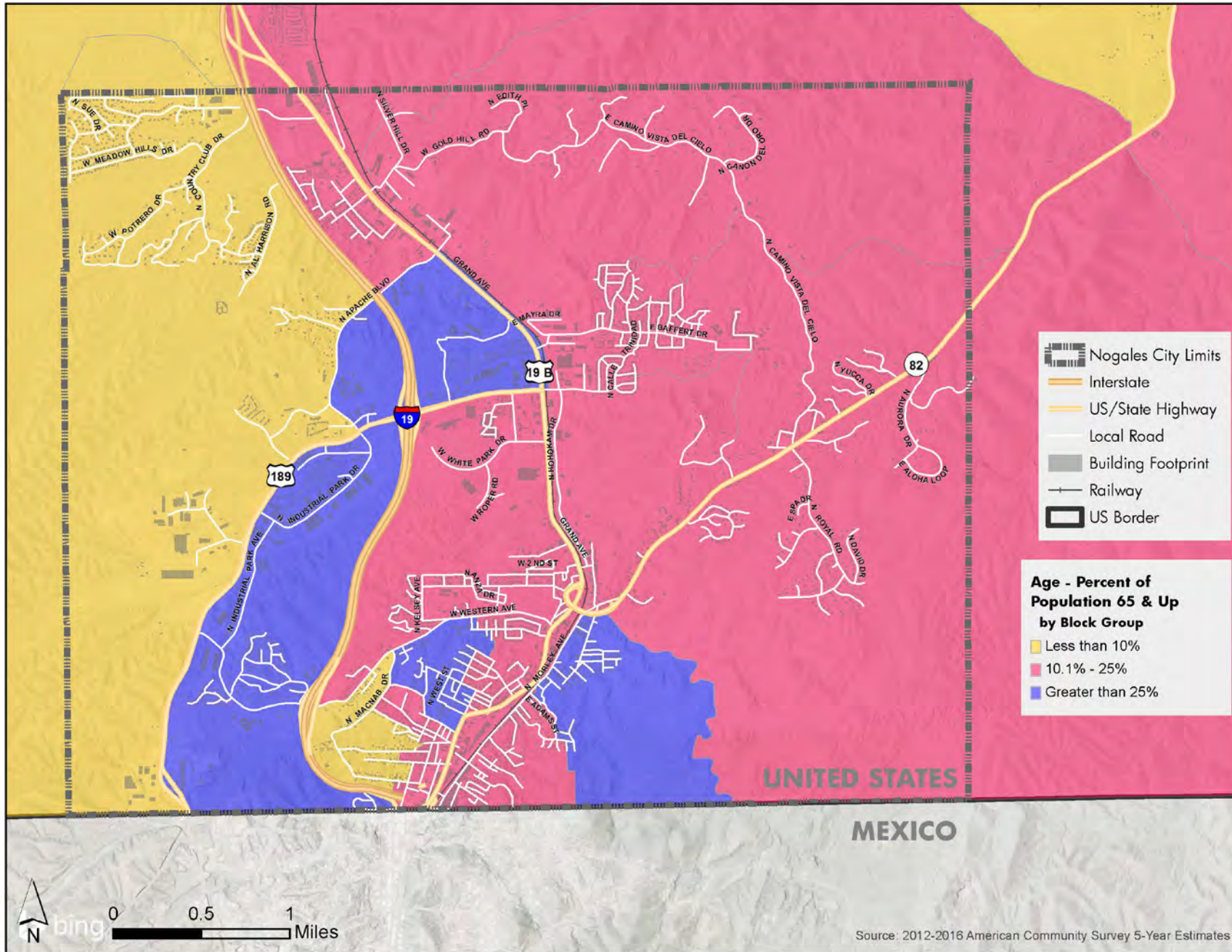


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Community Characteristics



Figure 3-3 | Percent of Population Age 65 & Up

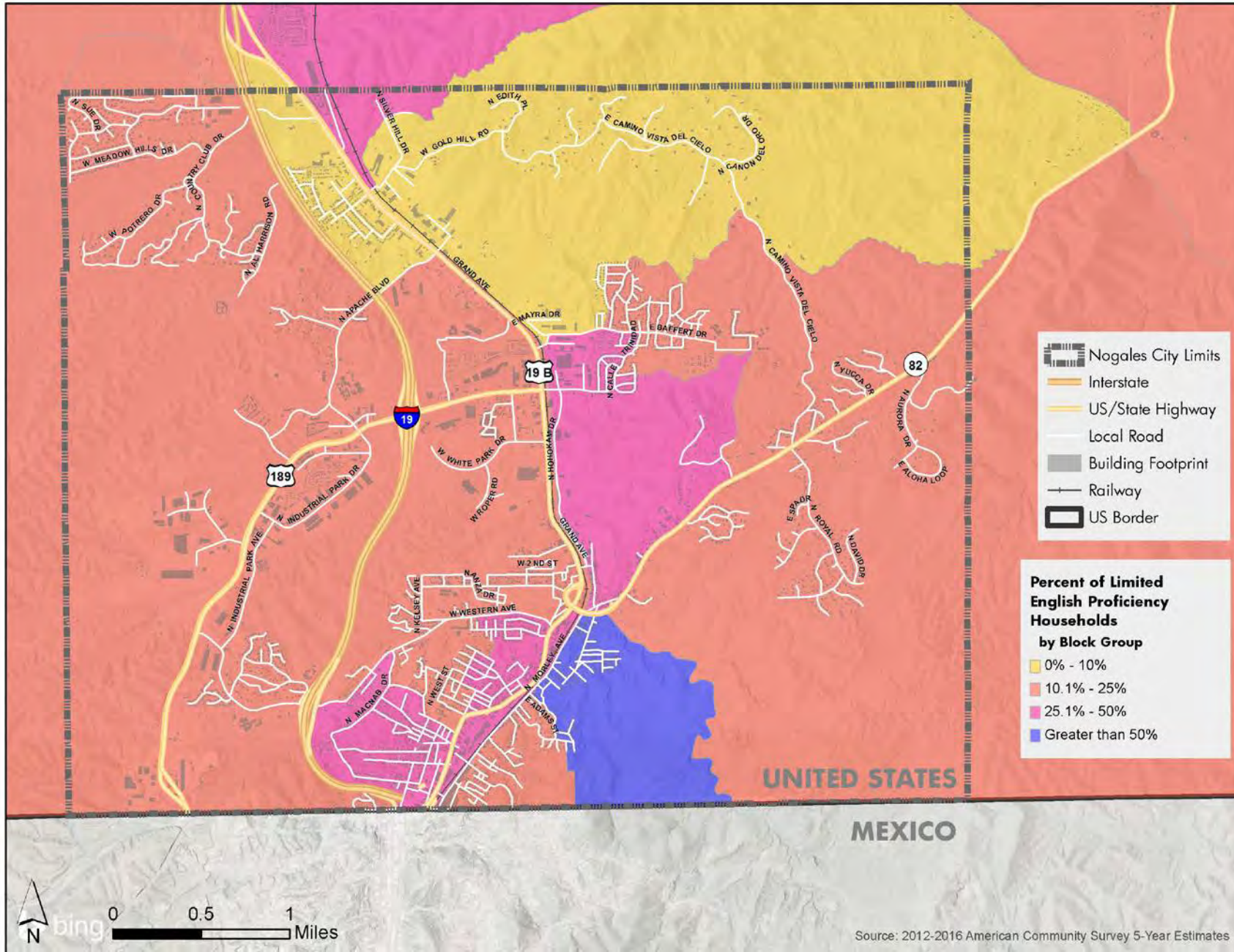


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Community Characteristics



Figure 3-4 | Percent of Households with Limited English Proficiency





3.2 | Employment & Income

Figure 3-5 shows jobs per acre in Nogales. The data is displayed by block, which is the most fine-grain scale for which this data is available. Because the size of city blocks can vary, the total number of jobs on each block is divided by the land area of that block to obtain jobs per acre. Figure 3-5 also highlights the concentration of employment across the city. Among the areas with the greatest concentration of jobs are the shopping center on Mariposa Road, the City and County government complexes, the Nogales School District complex, the downtown Centro Cultural. The largest employers by industry type are retail, wholesale trade, public administration, accommodation and food service, education, and healthcare.

Latest data on median household income shows a median of about \$28,000 in Nogales (Table 3-3). This is \$10,000 less than the average income for Santa Cruz County and is almost as low as half the median household income for the state of Arizona overall. Figure 3-6 displays median household income by block groups within Nogales. Income is classified by its relationship to Area Median Income for a household of four, which is a standard measurement for poverty and is a slightly different measure than simple median household income. In Nogales, this is the AMI for Santa Cruz County, or about \$45,000. Many of Nogales' block groups have median household income below the County AMI and two block groups along the Grand Ave corridor fall into the 30-50% of AMI, or "Very Low Income" category.

Table 3-3 | Median Household Income, 2016 Inflation-Adjusted Dollars

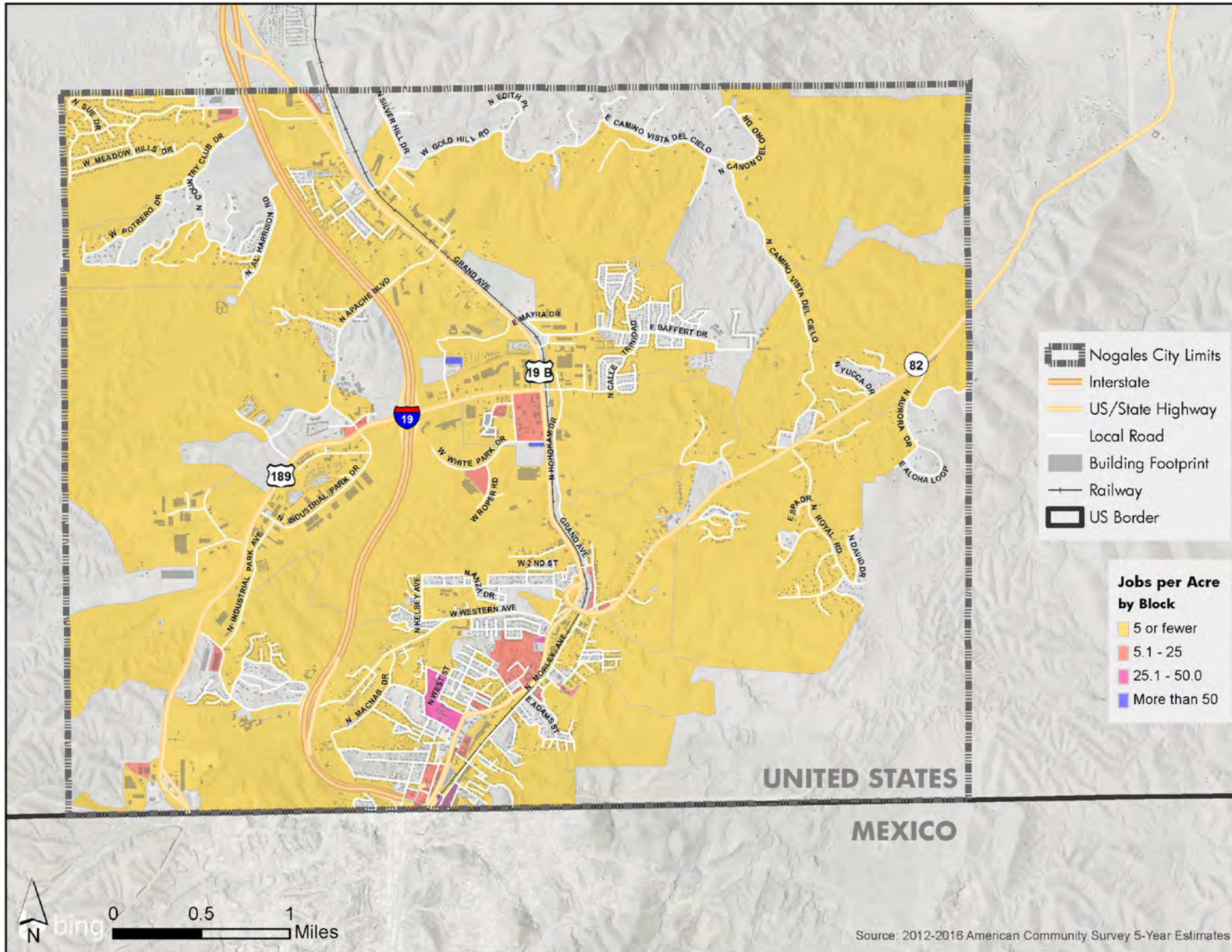
	Nogales	Santa Cruz County	Arizona
Median Household Income	\$27,929	\$38,941	\$51,340

3

Community Characteristics



Figure 3-5 | Jobs per Acre by Block

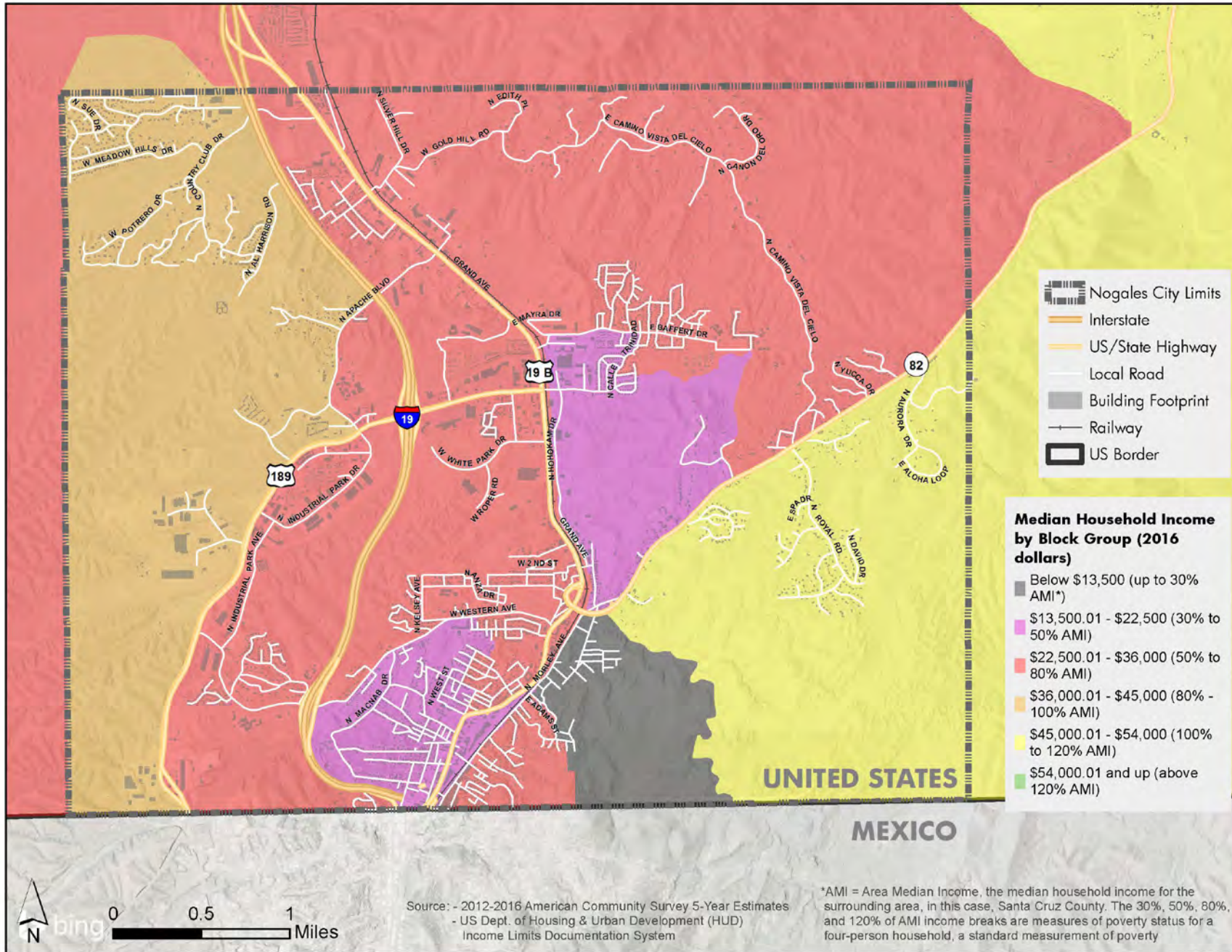


3

Community Characteristics



Figure 3-6 | Median Household Income by Block Group





3.3 | Transit Dependent Population

There are common factors that provide a foundation for understanding the level of transit dependency in a community, particularly related to vehicle availability, means of transportation to work and disability status. Tables 3-4 and 3-5 summarize the vehicle availability/means of transportation to work and disabled population groups within Nogales. A smaller portion of Nogales residents take transit or bike to work than the county or state averages; however, a greater proportion of Nogales residents walk to work. Figures 3-7 through 3-11 graphically depict the census data.

Table 3-4 | Vehicle Availability and Means of Transportation to Work

	Nogales	% of total	Santa Cruz County	% of total	Arizona	% of total
Total Workers 16 Years and Over in Households	7,028		17,200		2,822,094	
No Vehicle Available	322	4.6%	381	2.2%	84,217	3.0%
Means of Transportation to Work						
Car	6,436	91.6%	15,619	90.8%	396,156	88.0%
Transit	52	0.7%	56	0.3%	56,190	2.0%
Bike	23	0.4%	40	0.3%	28,207	1.2%
Walk	156	2.4%	268	1.5%	156	0.0%

Source: U.S. Bureau of the Census – Means of Transportation to Work: 2012-2016 American Community Survey 5-Year Estimate

Table 3-5 | Population with Disability

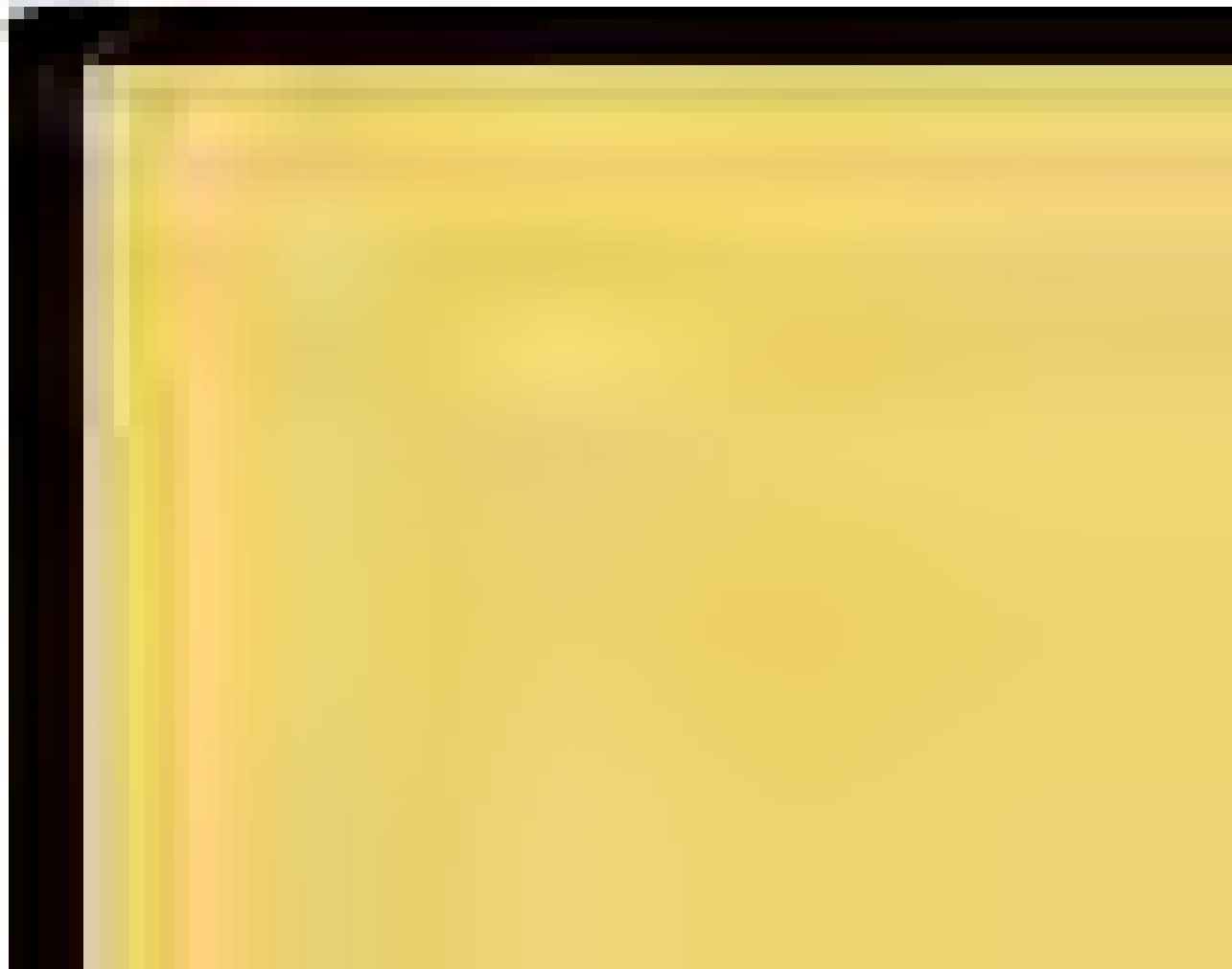
	Nogales	% of total	Santa Cruz County	% of total	Arizona	% of total
Total Population	20,068		46,228		6,620,233	
Total Population with Disability	2,441	12.2%	5,404	11.7%	833,586	12.6%

3

Community Characteristics



Figure 3-7 | Disabled Persons per 100 Residents

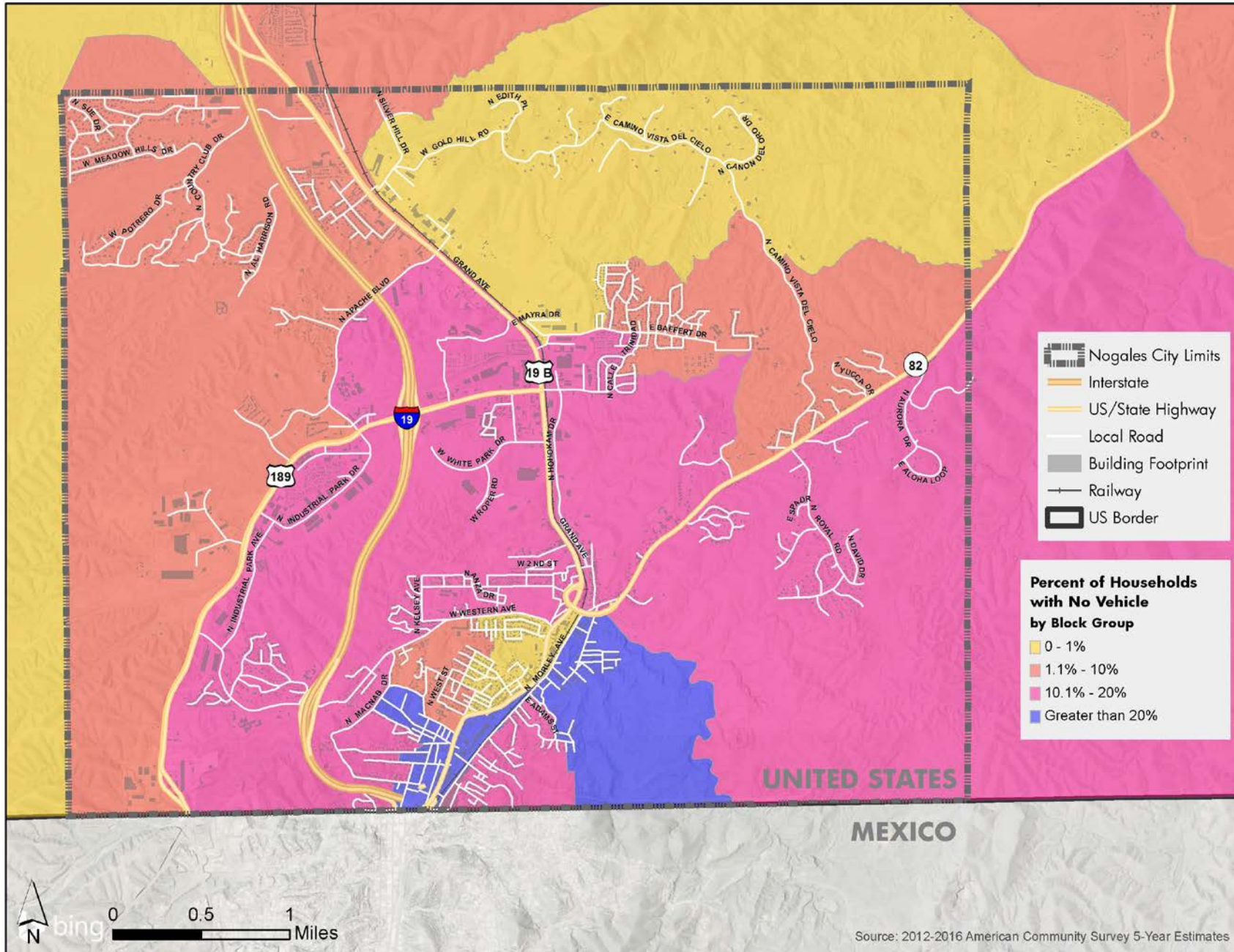


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Community Characteristics



Figure 3-8 | Percent of Households with No Vehicle by Block Group

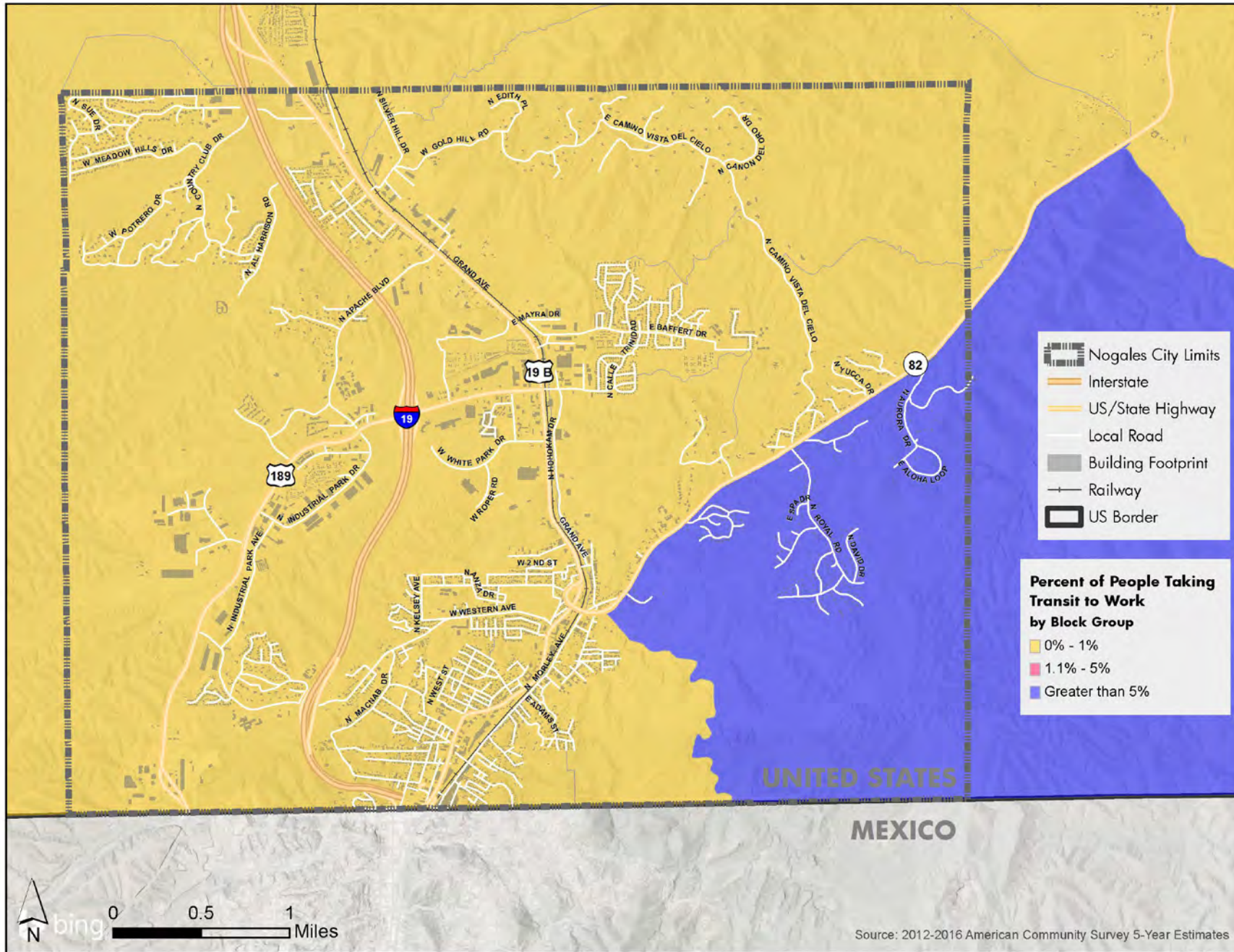


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Community Characteristics



Figure 3-9 | Percent of People Who Take Transit to Work

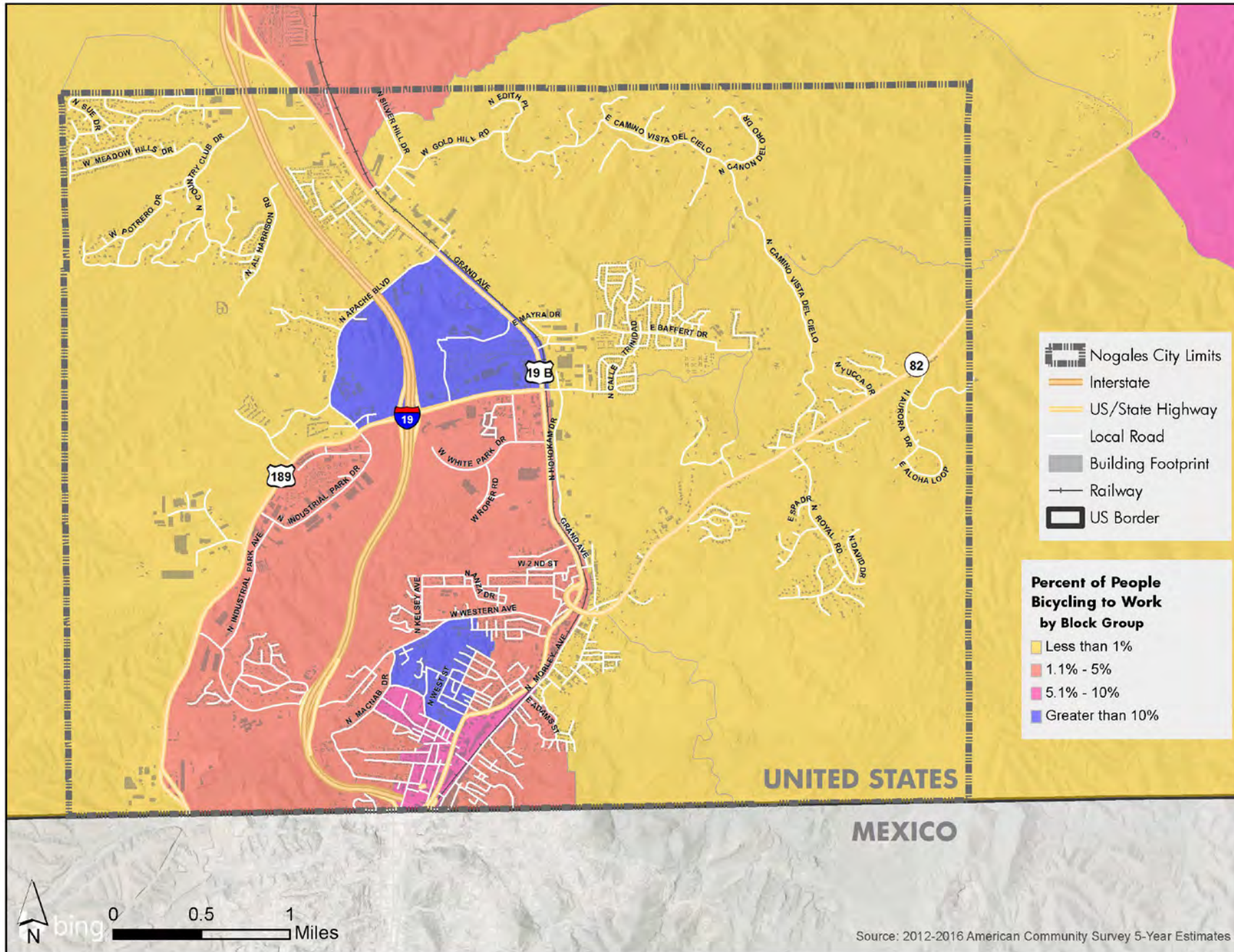


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Community Characteristics



Figure 3-10 | Percent of People Who Bike to Work

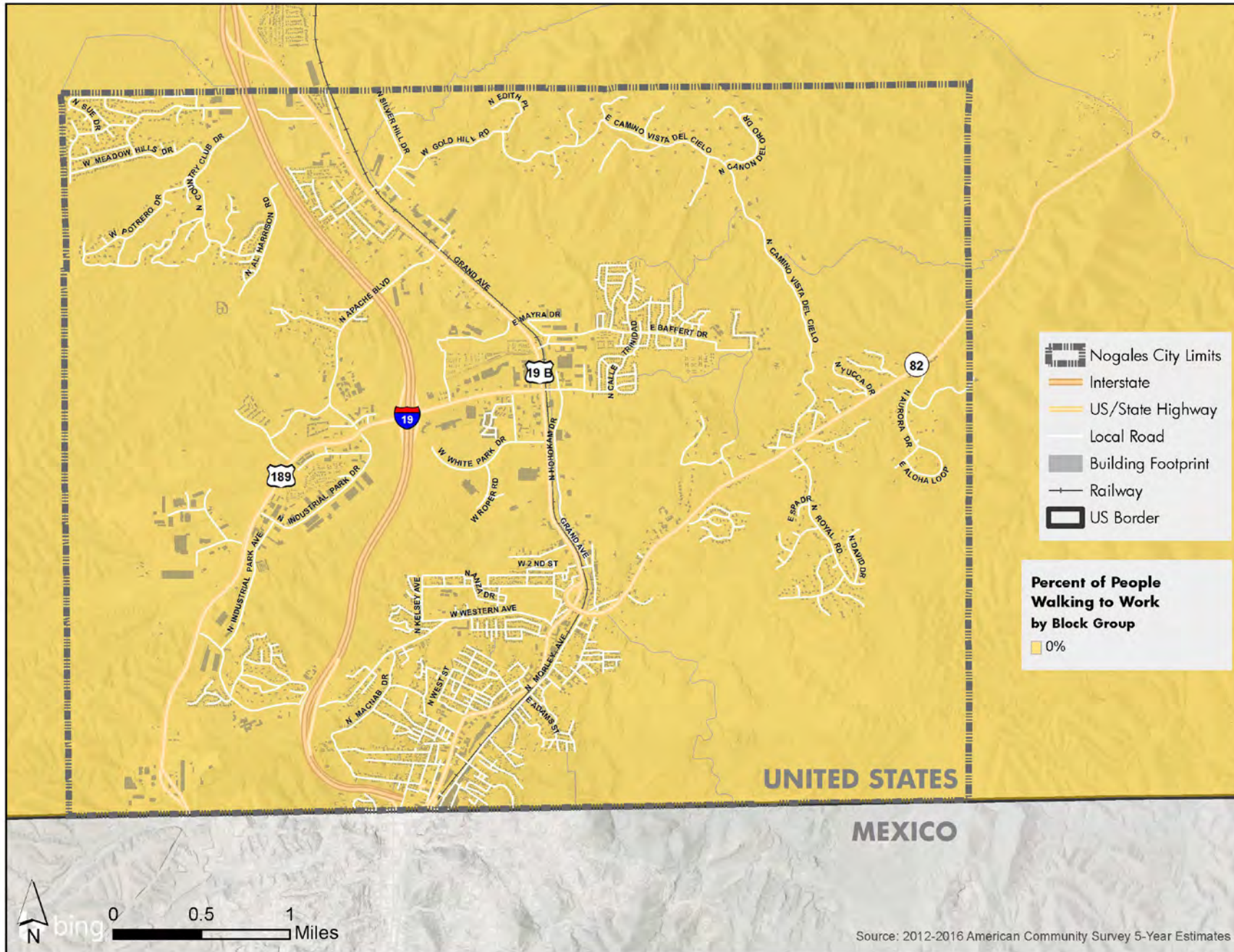


3

Community Characteristics



Figure 3-11 | Percent of People Who Walk to Work





3.4 | Urban Design

The physical layout of a city generates a perceived environment, which varies from person to person. A perceived environment is made up of paths, edges, districts, nodes, and key destinations or landmarks. These elements play an important role in determining the comfort level of bicyclists and pedestrians utilizing a route. In order to understand the overall layout of Nogales, the perceived environment was analyzed. Figure 3-12 depicts the urban design of Nogales.

3.4.1 | Paths

Paths are the channels of movement within a city and are typically comprised of streets and railroads. Rivers and/or canals are identified as paths if they are used for transportation purposes. Within Nogales, due to the topography of the city, paths consist of I-19, I-19 Business (Grand Avenue), SR-82 (Patagonia Highway), SR-189 (Mariposa Road), and the local roadway network.

3.4.2 | Edges

Edges typically consist of physical boundary elements such as rivers, topography changes, and highways. The entirety of Nogales is surrounded by physical boundaries. The United States/Mexico border, which borders Nogales on the south is a physical edge. The topography changes throughout Nogales create boundaries all over the City, causing development to occur in certain locations throughout Nogales. The railroad and canal, which run parallel to Grand Avenue on the east, provides a boundary. Additionally, I-19 traverses the City creating a linear edge for those on the west side of I-19 and those on the east side of I-19. Due to the physical geography, international border, and arterial roadways, connections across these edges is crucial to the success of a multimodal transportation network.

3.4.3 | Districts

Districts are perceived areas with common characteristics such as residential activities, civic activities, industrial activities, and commercial activities. Within Nogales, Grand Avenue primarily facilitates commercial activities. Pockets of industrial and civic activities exist in and around Grand Avenue; however, Mariposa Road serves as the hub for industrial activities. Residential areas are dispersed throughout Nogales in an organic pattern following the geography of the city.

3.4.4 | Nodes

Nodes are a concentration of some built characteristic or activity. A few nodes are present throughout Nogales. Two Ports of Entry (POE) act as nodes, which facilitate movement to and from Nogales, AZ and Nogales, Mexico. The downtown cultural center area is a node because of the various activities that exist. Nogales High School is a node of civic activities and the area encompassing Walmart, Home Depot, Safeway, and the strip mall north of Mariposa Road is a node of commercial activities. Additionally, the Nogales City Cemetery is a node due to the unique nature and history of the cemetery.



3.4.5 | Key Destinations

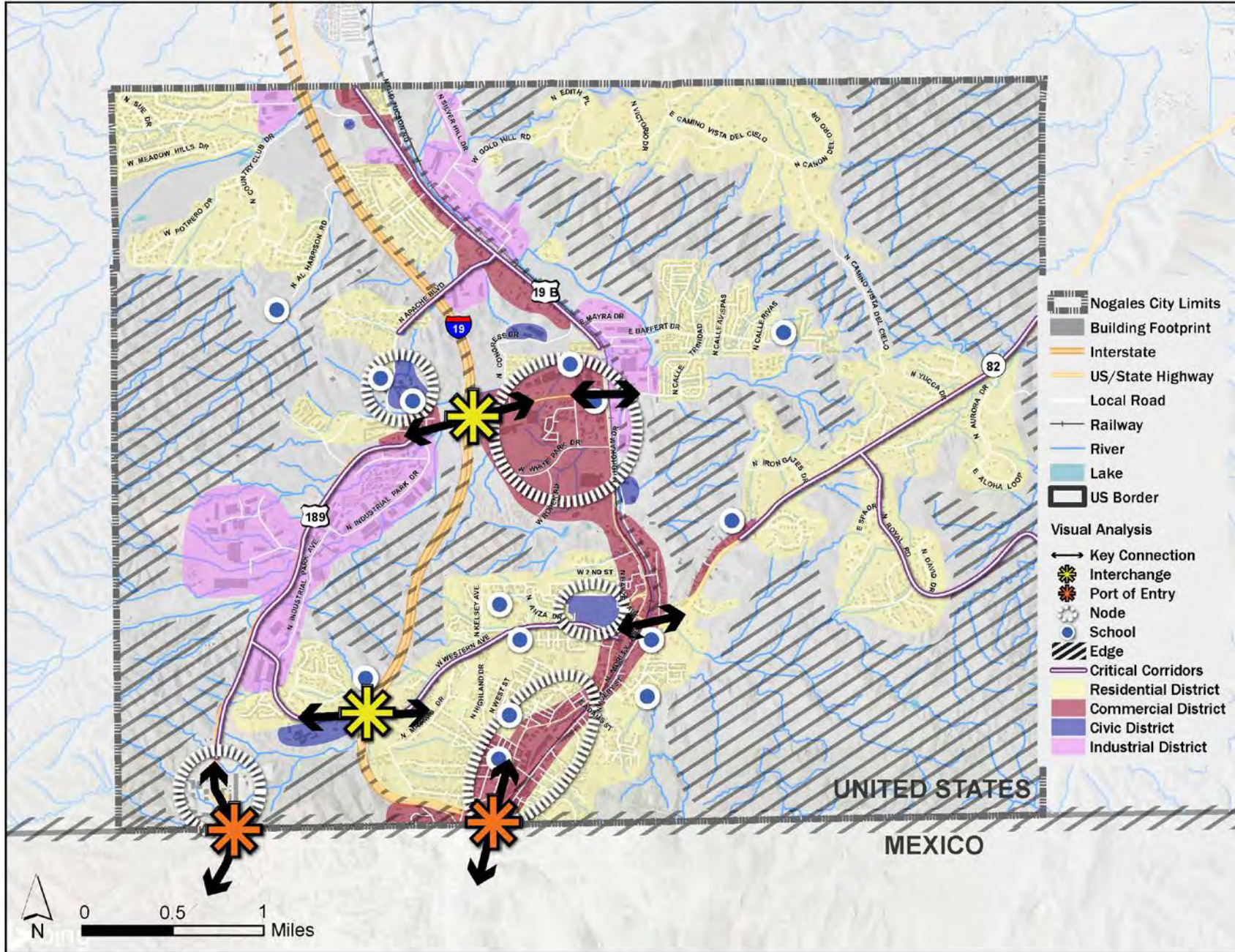
Nodes are made up of key destinations, and Figure 3-13 identifies the key locations or attractors within Nogales. Key destinations or landmarks are used as external reference points as people move throughout a space. Many of the key destinations exist along the Grand Avenue corridor. In addition to key attractors, schools also serve as key destinations throughout a city. Figure 3-14 illustrates the various locations of elementary, middle, and high schools throughout Nogales. A walkshed is used to determine the “comfortable” walking distance for a person walking from a stop to their destination. In this case, a ¼-mile walkshed is displayed around each of the school locations to show areas where sidewalks and crossings are of greater importance to enable a safe route to school.

3

Community Characteristics



Figure 3-12 | Urban Design of Nogales

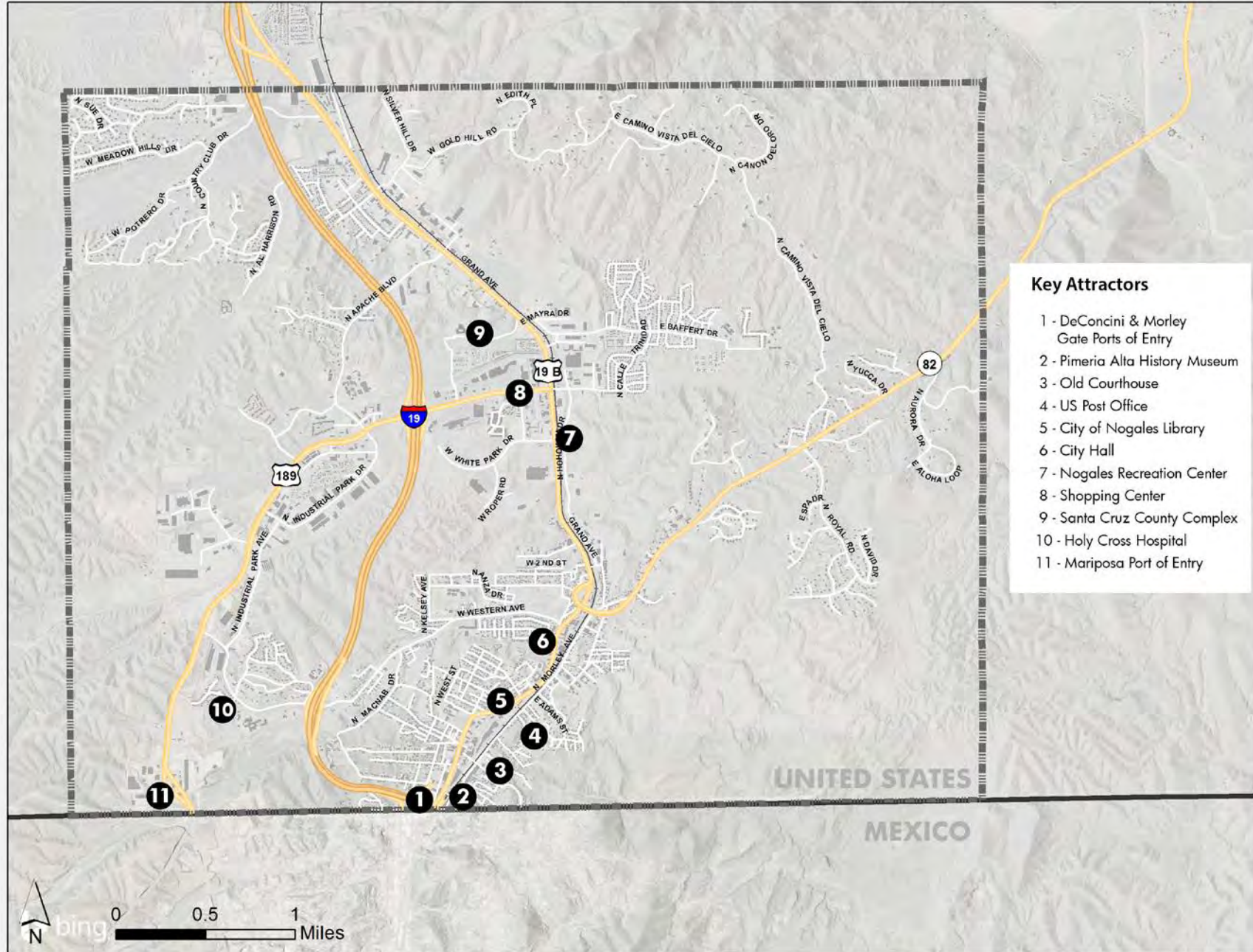


3

Community Characteristics



Figure 3-13 | Key Attractors

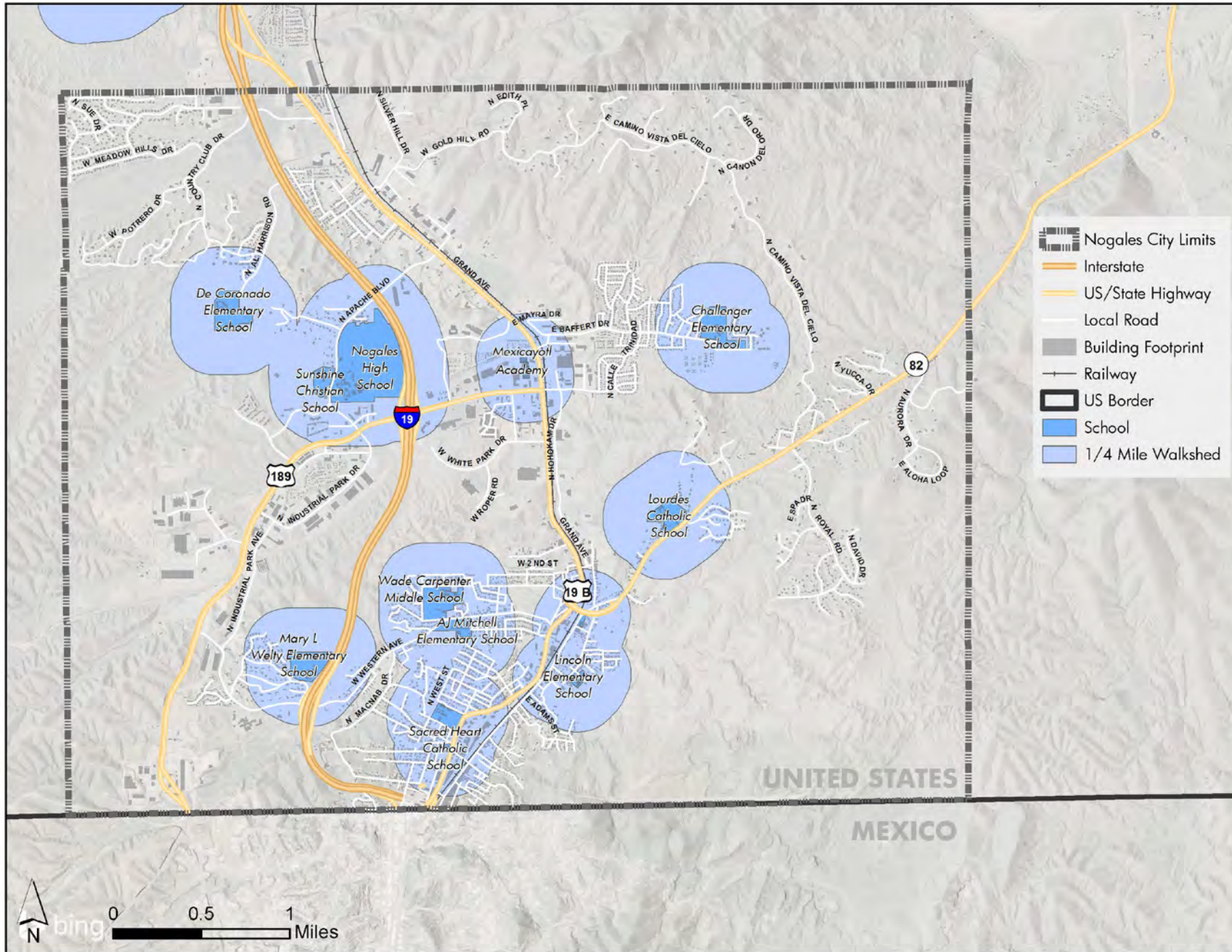


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Community Characteristics



Figure 3-14 | School Locations





3.5 | Environmental Analysis

An environmental analysis desktop review was conducted to identify environmental areas of concern throughout Nogales. The Arizona Department of Environmental Quality (ADEQ) provides spatial information related to air quality, hazardous materials, water quality, and grant projects. Additional resources were used to identify threatened and endangered species as well as 4(f) and 6(f) resources.

3.5.1 | Topography

The topography of Nogales, AZ is a significant factor as the city is nestled into the hills. Topography changes throughout Nogales create boundaries, causing development and transportation infrastructure to occur in strategic locations. Additionally, elevation changes cause safety issues along roadways as visibility is limited due to steep slopes (Figure 3-15). Figure 3-16 illustrates the existing topography throughout Nogales.

3.5.2 | Air Quality

The Clean Air Act set a National Ambient Air Quality Standard (NAAQS), which designates areas in the United States as being in “attainment” or “nonattainment” of the standard. According to the ADEQ, Nogales, AZ is currently designated as nonattainment due to present particulate matter (or particle pollution) between 2.5 and 10 ppm.

Bus Idling Policy

ADEQ has worked with school districts to provide a bus idling policy for schools, which includes turning bus engines off when reaching the school, not turning on the engine until ready to depart, providing a bus loading zone at least 100 feet away from the school’s air intake system, and posting signs to limit idling near schools. Currently, the northwest portion of Nogales participates in the Unified Bus Idling Program.

Figure 3-15 | Elevation Changes on SR-82

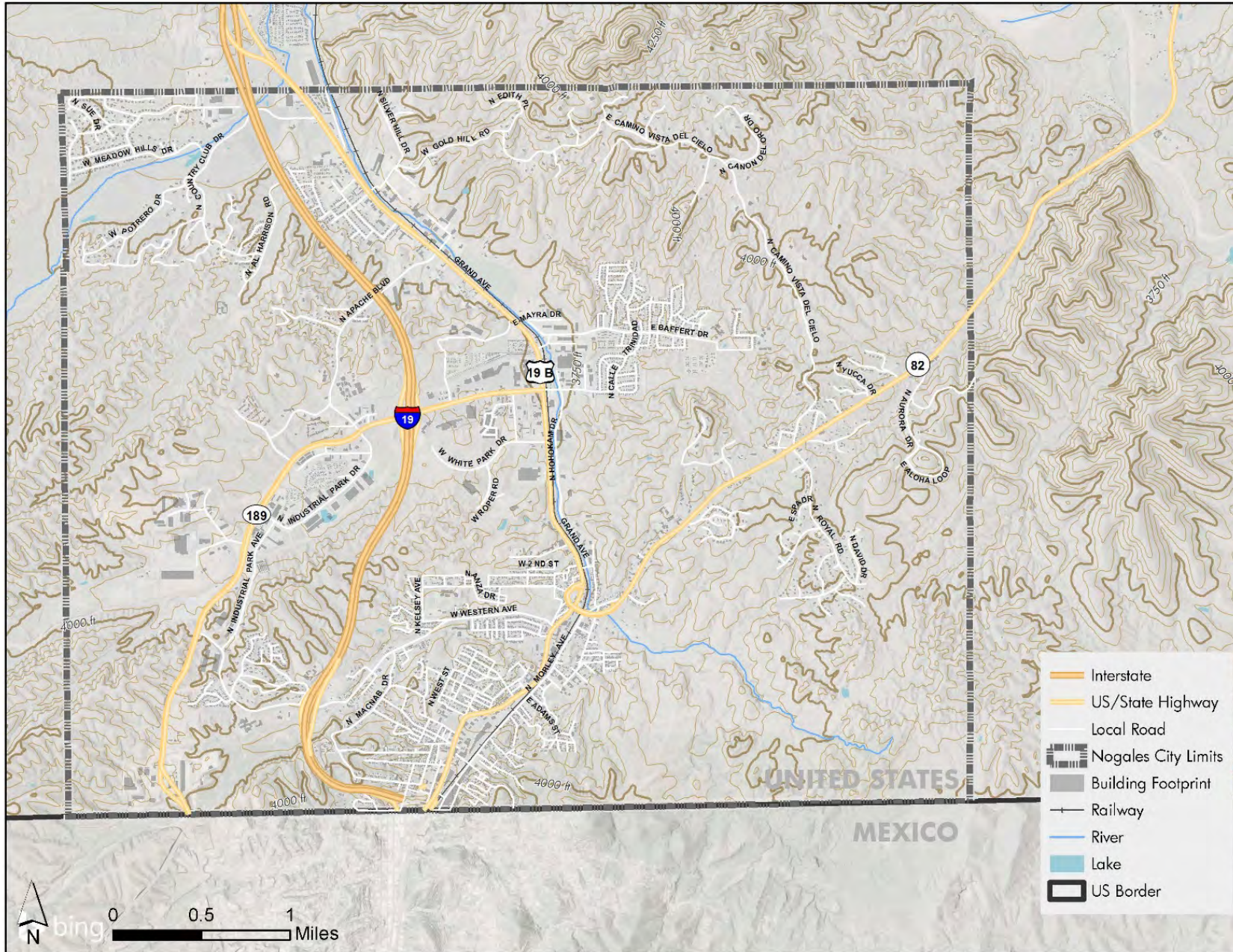


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Community Characteristics



Figure 3-16 | Existing Topography





3.5.3 | Hazardous Materials

Located within Nogales is Conn-Selmer, Inc. Groundwater Remediation System (GRS), which operates under the hazardous waste Post-Closure Permit. The permit allows Conn-Selmer Inc. to operate until they demonstrate the contamination levels of the groundwater remediation system meet the required standards. According to ADEQ, the concentrations of contaminants at the center of the contamination have been reduced by 97%. By 2008, the concentrations have been reduced to less than 250 parts per billion. The treated water now leaving the GRS contain no volatile organic compounds and was used to irrigate the City of Nogales Palo Duro Creek Golf Course when in operation. Additionally, active and non-active underground storage tank (UST) facilities exist throughout Nogales (Figure 3-18).

3.5.4 | Water Quality

The Nogales Wash, which runs parallel to Grande Avenue and Morley Avenue is currently designated a Category 5 impaired stream (Category-1 is least impaired; Category-5 is most impaired). The Nogales Wash is 6.2 miles long and spans from the Mexico border to Potrero Creek. The causes of impairment include ammonia, chlorine, copper, and E. coli.

WQI Grant Projects

The Water Quality Grant (WQI) program allocates funds from the EPA to Arizona projects that mitigate polluted runoff. Four WQI grant projects are located within Nogales and include the following:

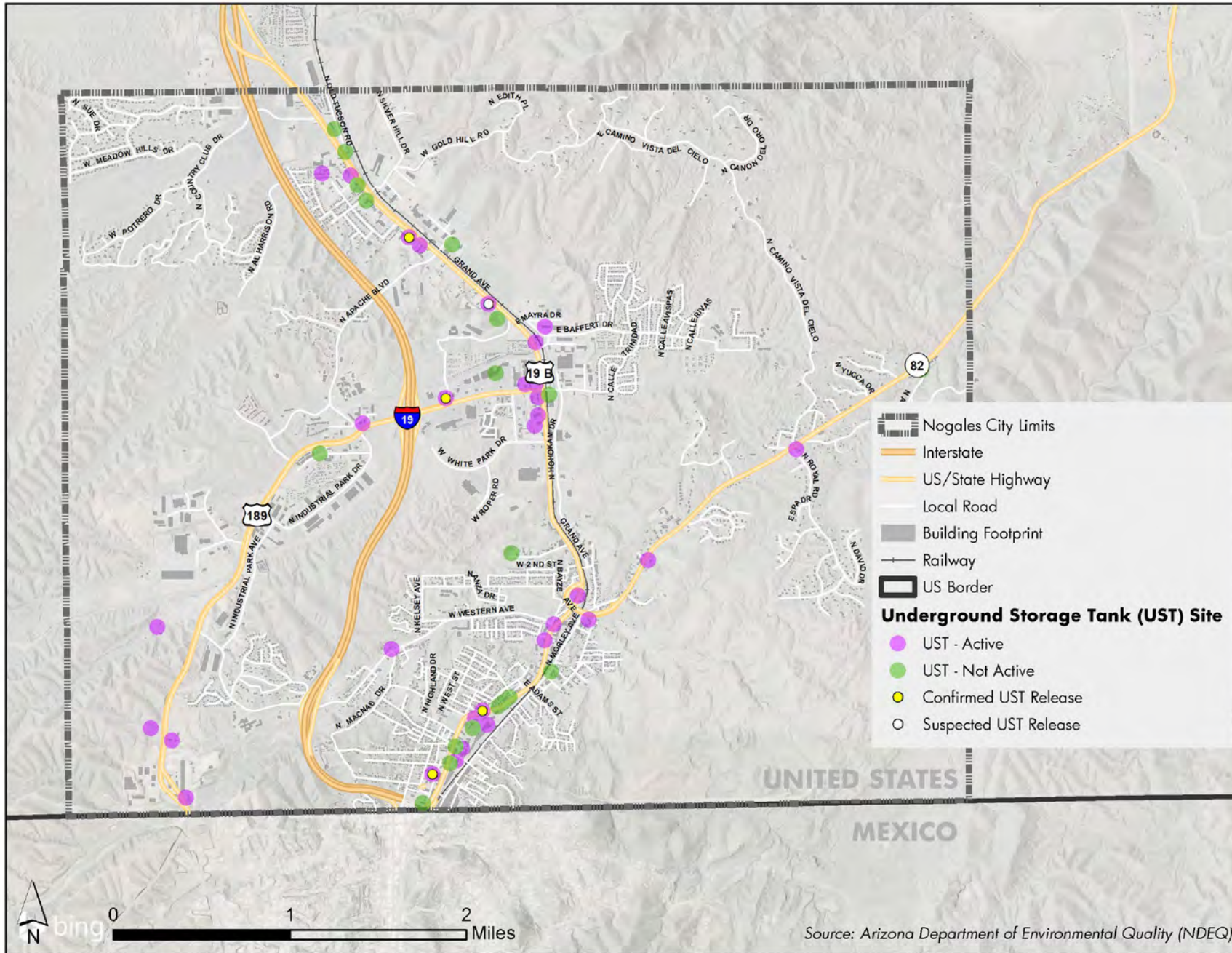
- Youth-led Erosion, E.coli Mitigation in Nogales Wash;
- Santa Cruz River Riparian Revegetation Plan;
- Santa Cruz River Sediment Control; and
- Implementation of BMPs to Control Sediment on the Santa Cruz River.

3

Community Characteristics



Figure 3-17 | Underground Storage Tank Sites in Nogales





3.5.5 | Threatened & Endangered Species

According to the U.S. Fish & Wildlife Service, Nogales is not currently listed as a critical habitat for any species; however, it is surrounded by areas that are critical habitats for the following species: Southwester Willow Flycatcher; Yellow Billed Cuckoo; Jaguar; and Mexican Spotted Owl.

3.5.6 | Floodplain

The existing floodplain is portrayed in Figure 3-18, following the streams and low areas of the Nogales. The 100-year floodplain means there is a 1% chance of flooding each year. Due to the potential of flash-flooding, it should be noted that there are potential safety risks from locating bicycle facilities in floodplains.

3.5.7 | 4(f) & 6(f) Resources

According to the National Register of Historic Places (NRHP), several cultural resources exist within the downtown Nogales area (Figure 3-19). Specific buildings and districts have been nominated mostly for architectural significance. The Juan Bautista De Anza National Historic Trail spans from San Francisco, CA along the coast to Los Angeles and heads east through Yuma, AZ along I-8 and diverts south along I-19. Through Nogales, the trail follows Grand Avenue into Mexico to San Miguel de Horcasitas. The Juan Bautista De Anza National Historic Trail route incorporates the Tumacacori National Historical Park, which is just north of Nogales. The Lone Macus Gordon Memorial Park cemetery is located in the heart of Nogales, just west of Grand Avenue. The cemetery is bordered by Western Avenue on the south, Kino Street on the north, Locust Street on the west, and Bejarano Street/Bayze Avenue on the east. Lands within Nogales that were developed and/or acquired with Land and Water Conservation Fund Grants are shown in Table 3-6.

Table 3-6 | Land and Water Conservation Fund Grants in Nogales, AZ

Name	Grant Amount	Year Approved	Year Completed	Type
Nogales Tennis Courts	\$4,225.00	1966	1967	Development
Madison Street Park	\$1,674.55	1968	1969	Development
Anza Drive Development	\$24,820.53	1973	1974	Development
Multi-Use Softball Field	\$18,500.00	1973	1974	Development
Jr. Olympic Swimming Pool	\$62,500.00	1974	1974	Development
Reg. Park and Golf Course	\$175,000.00	1978	1982	Acquisition

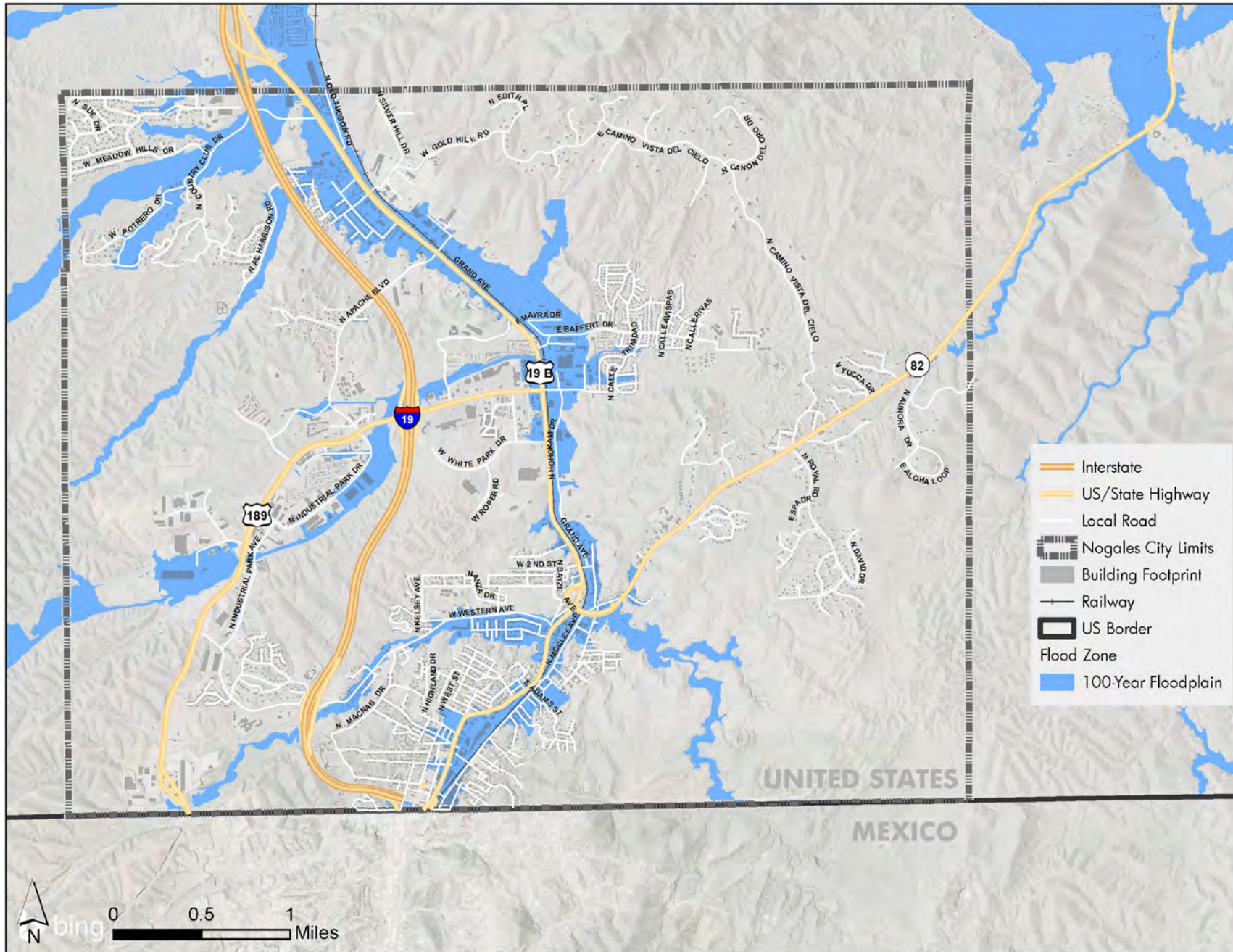
Source: <http://projects.invw.org/data/lwcf/grants-az.html>

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Community Characteristics



Figure 3-18 | Existing Floodplain

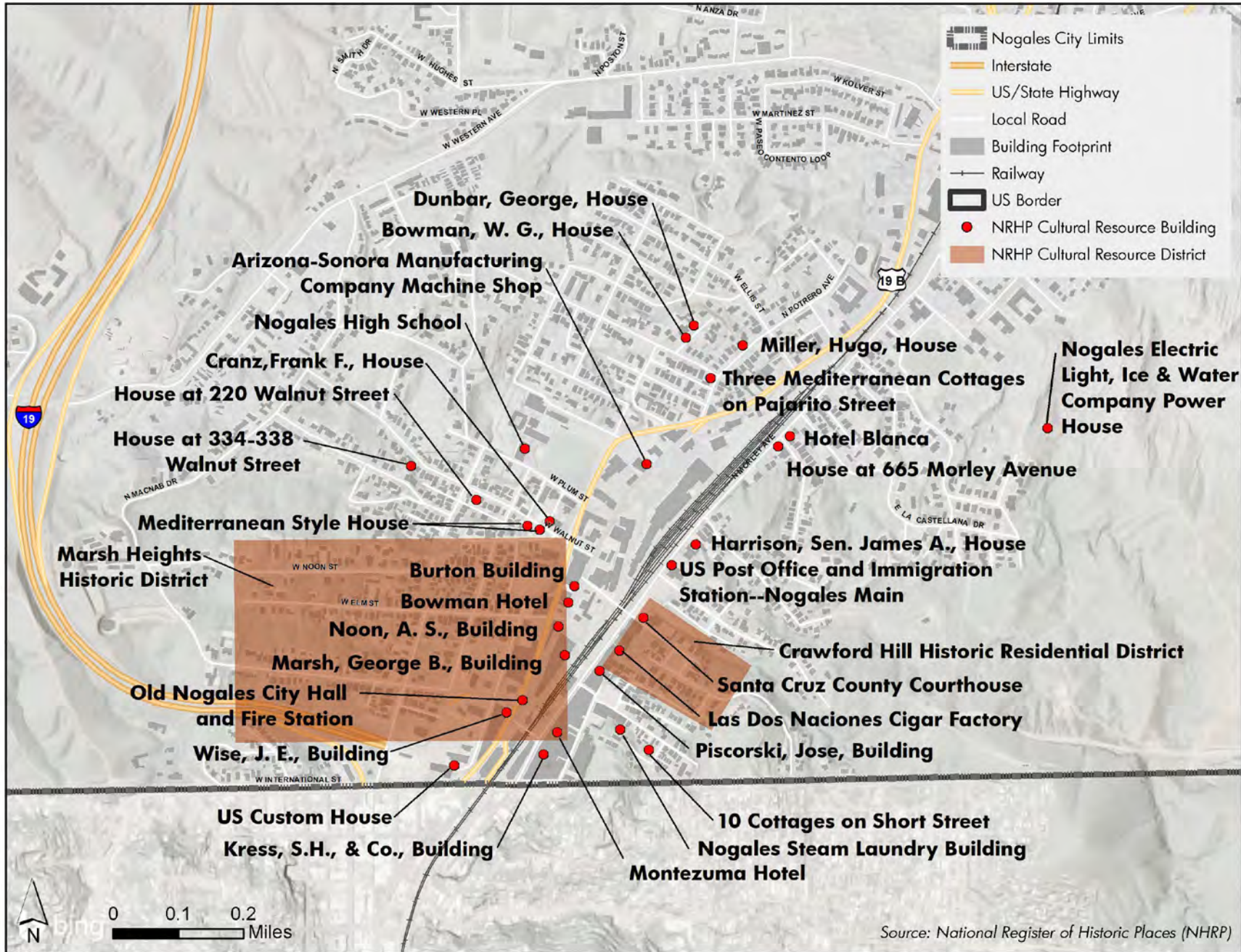


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Community Characteristics



Figure 3-19 | Historic Properties within Nogales





4.0 | Existing Transportation Network



Understanding where people walk, drive, bike, or ride transit in and around Nogales is important to identify how the community operates. Furthermore, understanding how goods move throughout a city is important to maintaining a vibrant local economy. The existing transportation network within Nogales consists of highways, local streets, and sidewalks. The primary form of transportation is by automobile; therefore, the roadway network is crucial to the transportation system. Two Ports of Entry (POE) are located within Nogales, providing an opportunity for pedestrians and vehicles to traverse into the United States and Nogales, Mexico.

This transportation section will provide information on the different roadway facilities, analyze the POE's, describe the existing multimodal infrastructure, and evaluate the existing conditions on each of the critical corridors.

4.1 | Roadway Facilities

Data was provided by the City of Nogales, Arizona Department of Transportation and the SouthEastern Arizona Governments Organization (SEAGO) to assist with understanding the physical and operational conditions of the existing roadway circulation network, as described herein.

4.1.1 | Roadway Characteristics

According to the U.S. Federal Highway Administration (FHWA), road functional classification is the method of how streets and highways are grouped together into classes or systems, according to their character of traffic service that they are intended to provide. At the federal and state level, streets and highways are grouped into one of three classifications, as described in Table 4-1. Figure 4-1 illustrates the existing roadway functional classification within Nogales. Four out of the six critical corridors previously identified are arterial roads, and the remaining two are collectors.

**Table 4-1 | Functional Classification**

Functional Classification	Service Provided
Arterial	Provides the highest level of service at the greatest speed for the longest uninterrupted distance, with some degree of access control.
Collector	Provides a less highly developed level of service at a lower speed for shorter distances by collecting traffic from local roads and connecting them with arterials.
Local	Consists of all roads not defined as arterials or collectors; primarily provides access to land with little or no through movement.

Source: Federal Highway Administration

Traffic Volume

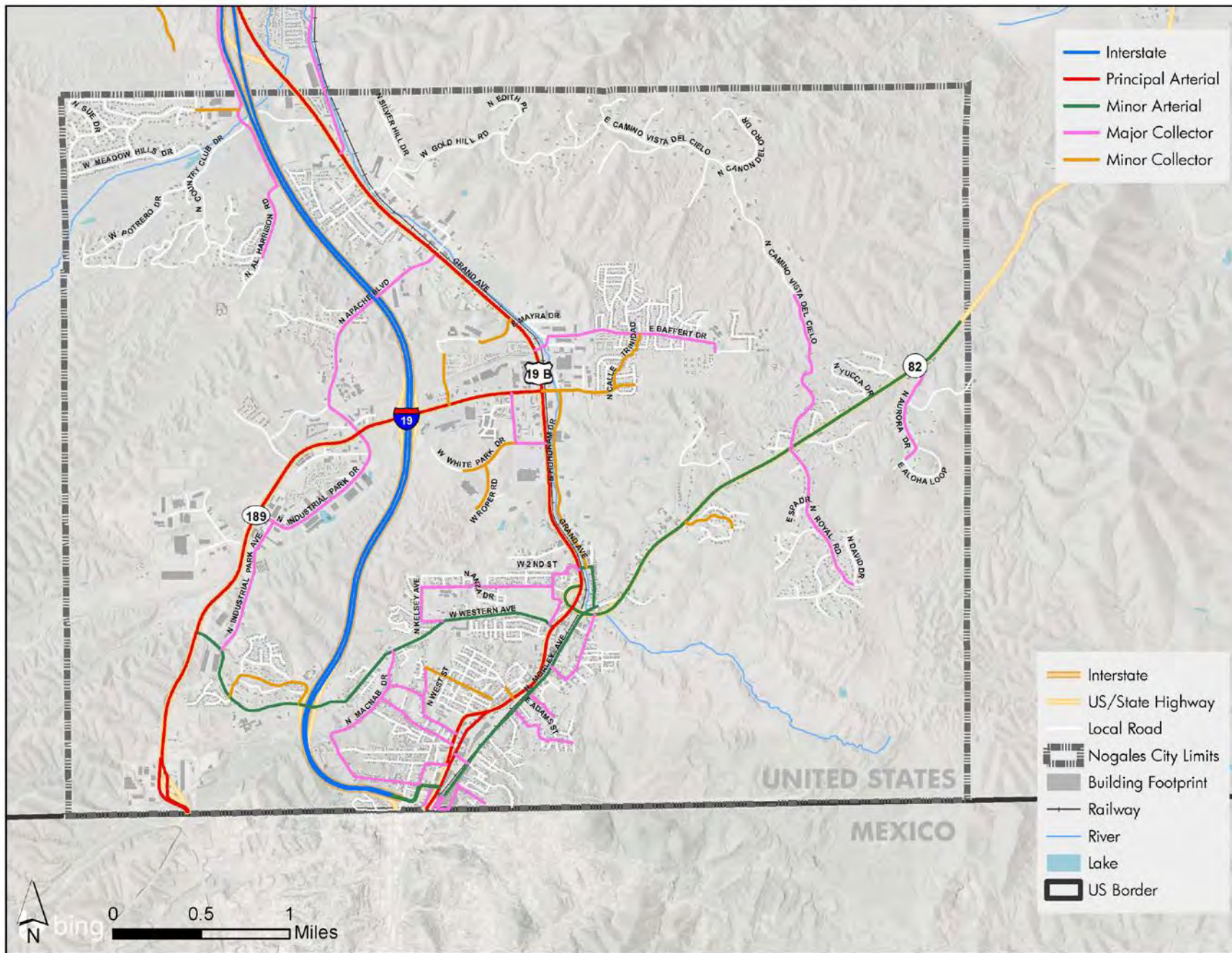
Understanding traffic volumes within Nogales is important for determining the level of traffic stress (LTS) for bicyclists. LTS is a rating given to a roadway to indicate the traffic stress imposed on bicyclists. Figure 4-2 illustrates the existing traffic volumes at specific locations throughout Nogales. The latest traffic counts were taken as recent as 2018 and as far back as 2016. Other than I-19, Grand Avenue carries the highest amount of daily traffic volumes within Nogales ranging from 12,000 to 23,000 vehicles. Traffic volumes indicate vehicles primarily use I-19 and the interchange at Mariposa Road or Grand Avenue to access areas throughout the city. Mariposa Road also carries a significant amount of daily traffic.

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Transportation Network



Figure 4-1 | Existing Functional Classification

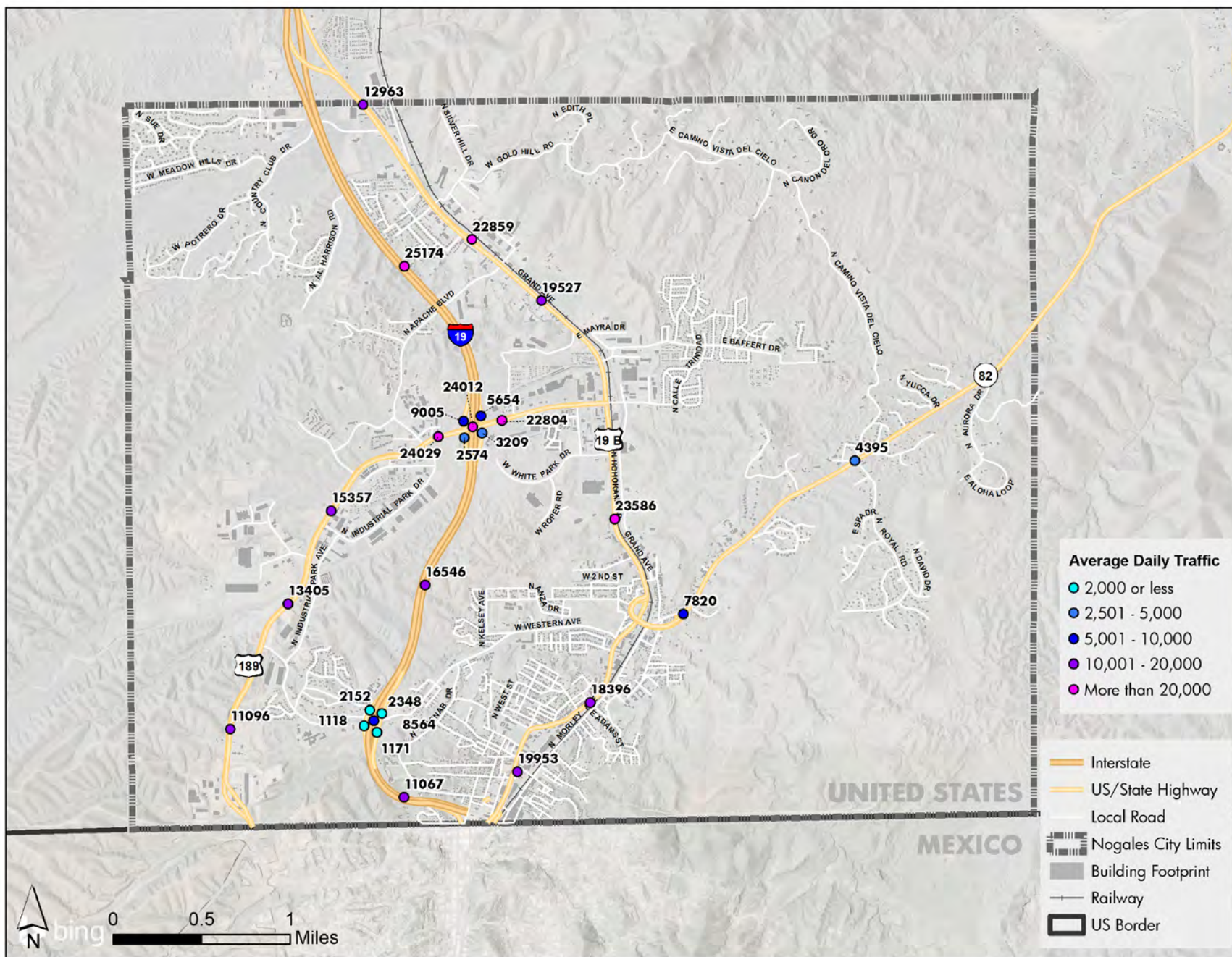


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Transportation Network



Figure 4-2 | Existing Traffic Volume





Level of Service

The performance of a roadway network is often defined in terms of Level of Service (LOS). LOS is determined through a comparison of the volume of traffic on a given roadway to the available capacity of that roadway. The capacity of a roadway to accommodate vehicles is dependent on many factors, including the number of travel lanes, speed limits, traffic control, and access management. Travel demand on a roadway is driven by a number of factors, including the type and size of development accessing the roadway, as well as the role the roadway plays in providing connectivity through a community and adjacent communities.

LOS for roadways is defined by six distinct levels of traffic operations measured by a letter grade of A through F. LOS A represents the best operating condition and LOS F represents the worst operating conditions. Roadway segments are classified into each LOS level based on the ratio of the volume to capacity. LOS A-D are generally regarded as acceptable, while LOS E and F are considered unacceptable. Figure 4-3 identifies the 2007 LOS from the *Unified Nogales Santa Cruz County Transportation Plan 2010*.

Roadway Safety

Various factors determine the level of safety of a roadway and transportation network. These factors include: speed, traffic control, topography (blind spots), amount of traffic, and lighting. Figure 4-4 identifies the existing speed limits throughout Nogales as well as the locations of existing traffic signals.

Figure 4-3 | Level of Service



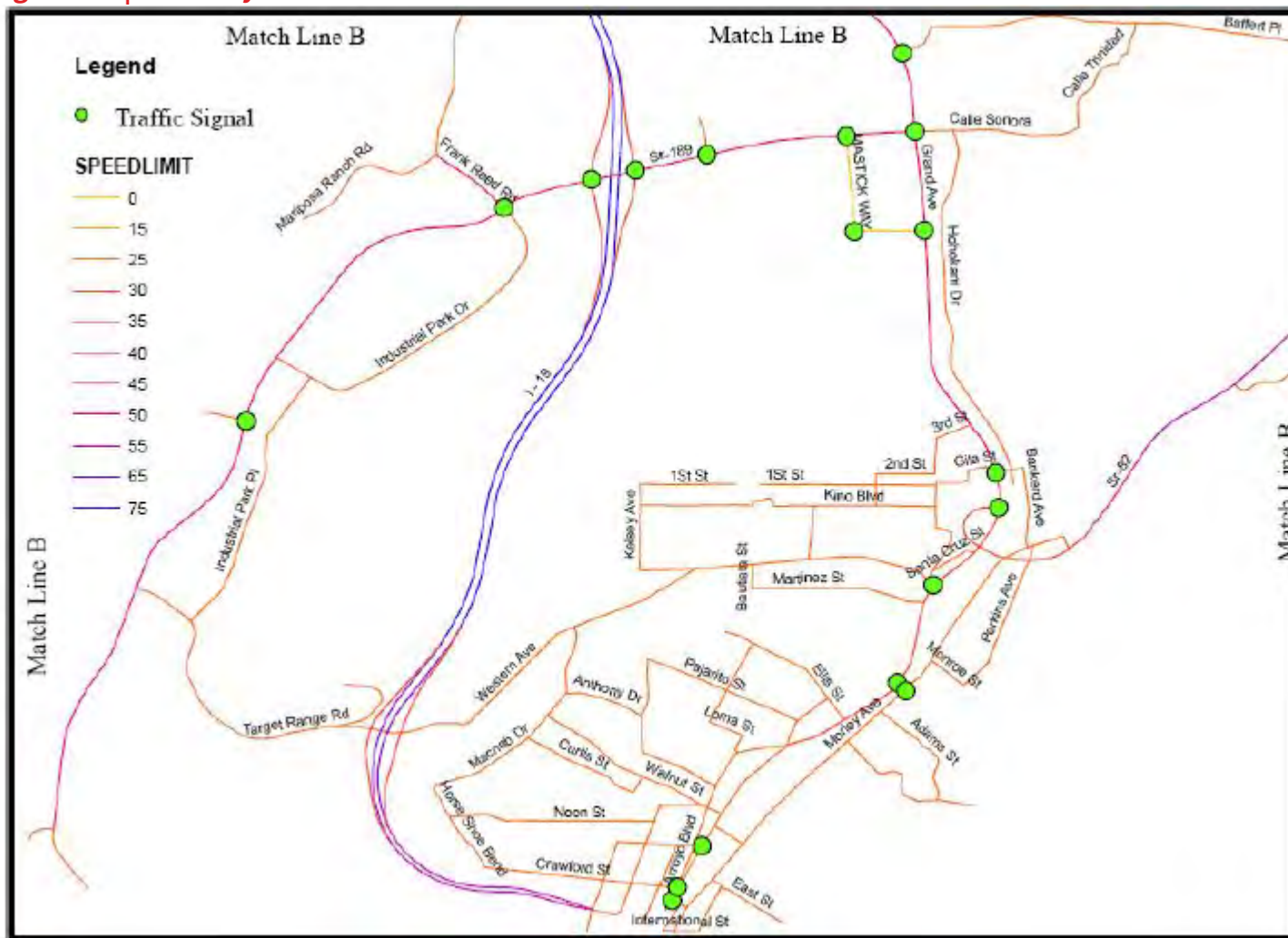
Source: *Unified Nogales Santa Cruz County Transportation Plan 2010*

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Transportation Network



Figure 4-4 | Roadway Characteristics



Source: Unified Nogales Santa Cruz County Transportation Plan 2010

Interchange

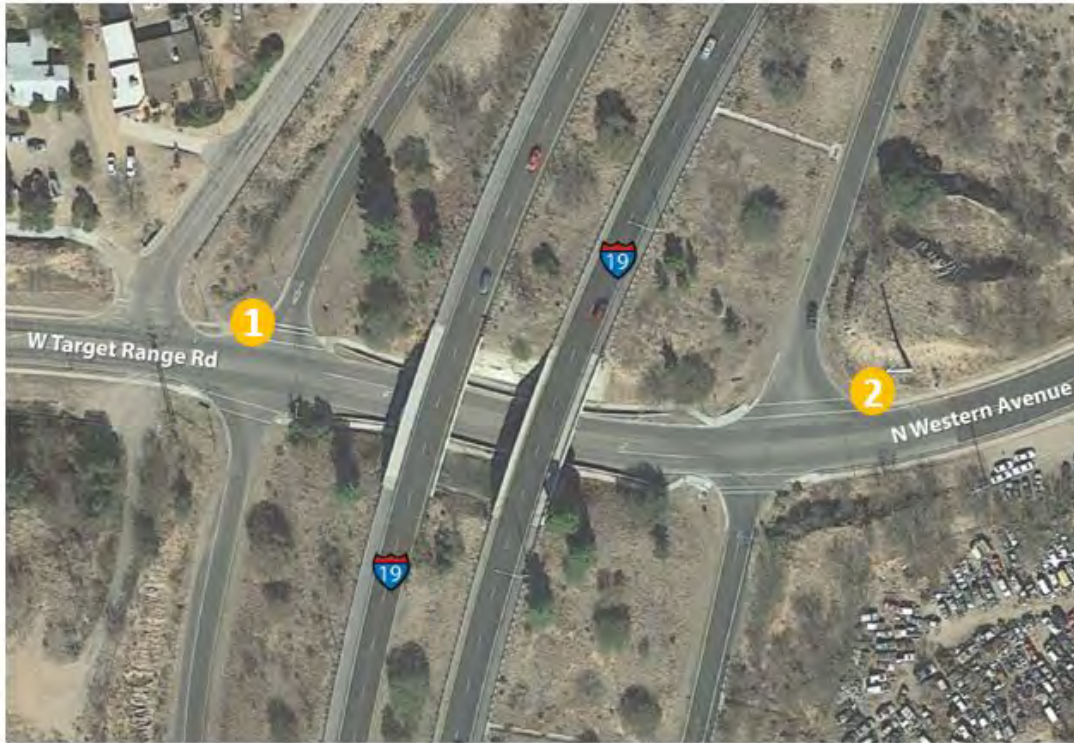
While highways allow for great vehicular mobility, they also act as physical barriers to pedestrians and cyclists who need to traverse across them. Interchanges often times are the only opportunity for traffic to pass under or over a highway, and it is important for all modes of traffic to do so safely. This means having ample traffic lane and sidewalk space. The two interstate interchanges are shown in Figure 4-5 and Figure 4-6.

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Transportation Network



Figure 4-5 | Interchange at I-19 and W. Target Range Road



4

Transportation Network



Figure 4-6 | Interchange at I-19 and W. Mariposa Road



4.2 | Land Port of Entry

Two Land Ports of Entry (LPOE's) are located within Nogales. The LPOE located along Mariposa Road primarily facilitates vehicular and truck crossings. The dual-gate De Concini/Morley Gate LPOE located across Grand Avenue to Morley Avenue facilitates personal automobile, pedestrian, and train crossings. The Morley gate allows pedestrians to enter the City at Morley Avenue, just to the east of the UP railway. Table 4-3 provides the border crossing data from the U.S Department of Transportation Bureau of Transportation Statistics. In 2017, the Nogales POE received the highest amount of pedestrian and personal vehicular passenger crossings compared to the other POE's within Arizona¹.

¹ USDOT, Bureau of Transportation Statistics 2017

**Table 4-2 | Nogales, AZ Border Crossing Data 2017**

Type	2017
Bus Passengers	191,750
Buses	12,891
Pedestrians	3,349,123
Personal Vehicle Passengers	7,630,386
Personal Vehicles	3,806,449
Train Passengers	2,600
Trains	649
Trucks	333,941

Source: USDOT, Bureau of Transportation Statistics

4.3 | Multimodal Infrastructure

The available infrastructure in the area is limited and non-contiguous. This section describes the available infrastructure and understood bicycle and pedestrian activity in the area.

4.3.1 | Bicycle and Pedestrian

Sidewalks are present throughout Nogales and consist of both attached and detached sidewalks. Detached sidewalks are sidewalks which incorporate a buffer between the traffic lane and the pedestrian zone. Within Nogales, these buffers consist of a landscaped area. Attached sidewalks are not separated or protected from the curb. These type of sidewalks are common in older historic areas with larger concentrations of commercial uses or in residential areas with reduced right-of-way. Sidewalk widths vary throughout Nogales; however, sidewalks tend to be wider downtown.

Currently, there are no dedicated bicycle facilities in Nogales. Bicyclists must ride in traffic or on the existing sidewalks causing issues for vehicles, pedestrians, and bicyclists. Figure 4-7 depicts the existing sidewalks within the City. While much of the historic areas in the central commercial district have ample sidewalks, there are gaps throughout the system. Specifically, along Western Avenue, routes to Walmart, and the residential areas in northwest Nogales.

Strava Data Trends

With new technologies, there is a growing amount of information that can be crowd-sourced. The GPS and fitness tracking company Strava collects route data on millions of users' recreational movements. Figure 4-8 and Figure 4-10 depict the level of running activity throughout Nogales as compared to the Functional Classification and Sidewalks. Many of the residential and school areas have a high level of running activity. Several of these high-activity running routes do not have sidewalks, forcing users to run in the road. Figure 4-9 and Figure 4-11 depict the biking trips that Strava users took. The majority of these bike rides tend to occur along Grand Avenue and Patagonia Highway. Additionally, these routes correlate to routes



which the OS3 (Zero Stress) bicycle advocacy group take on their weekend rides. This crowd-sourced information helps to validate critical corridors established from local stakeholders and government officials.

Anza Trail

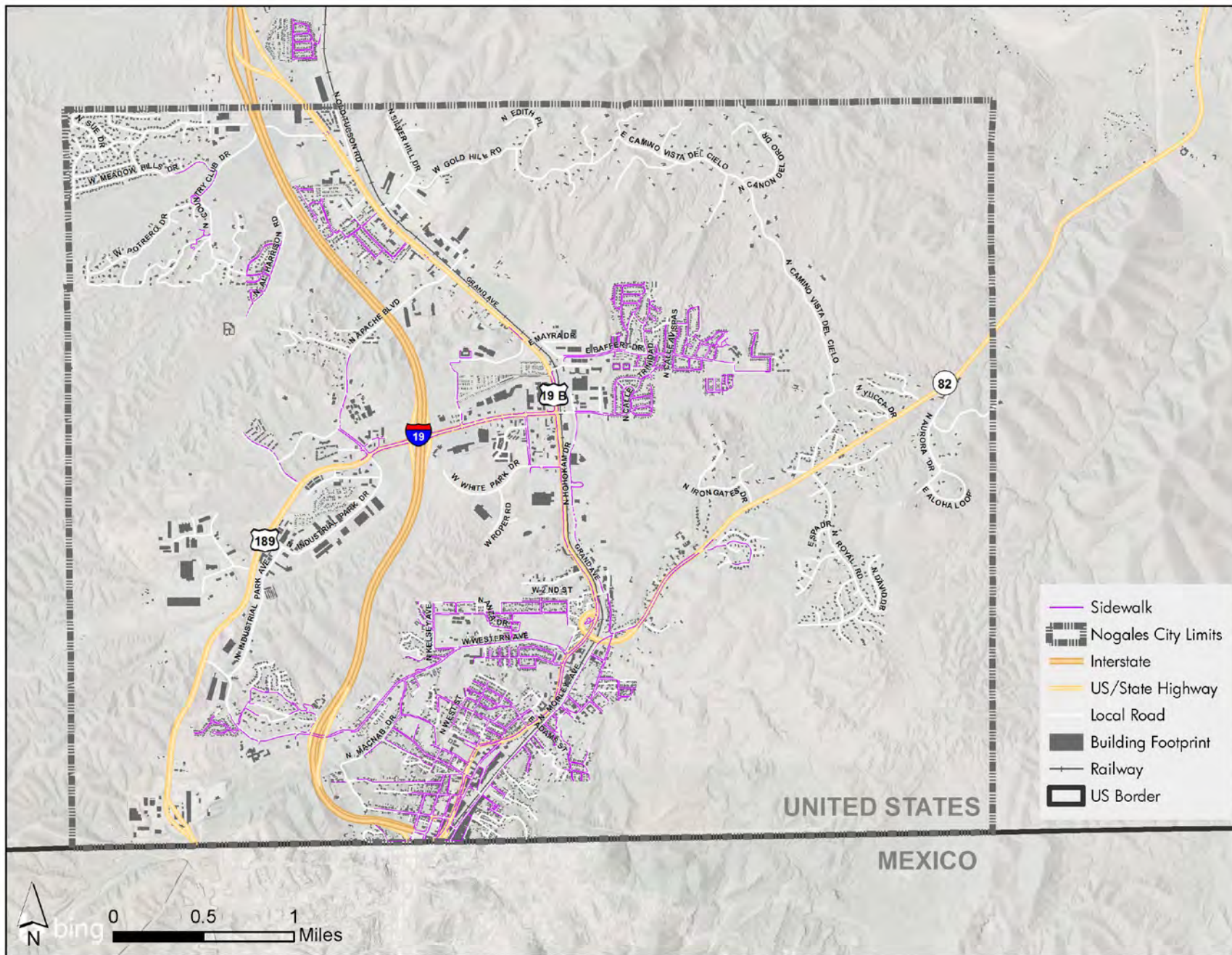
The Anza Trail is a National Historic Trail which runs through the heart of Nogales. It follows the path of Juan Bautista de Anza and his journey to establish a settlement at San Francisco Bay. The portion through Nogales is shown in Figure 4-12. The route through Nogales contains signage, yet the path is limited by its width and is aligned to the existing sidewalk. Other portions of the trail in Santa Cruz County allow for equestrian and cyclist activity. The trail continues north in Rio Rico, however there is currently no recognized connection which bridges this gap. If enhanced, this trail could aid in increasing safety along the Grand Avenue corridor. The trail could also follow the previously studied *Morley-Hohokam-Bankered Bike Route* alignment. Moving pedestrian and bike traffic off of Grand Avenue and towards the east would reduce the amount of potential traffic conflicts and increase safety for pedestrians and cyclists alike.

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Transportation Network



Figure 4-7 | Existing Sidewalks

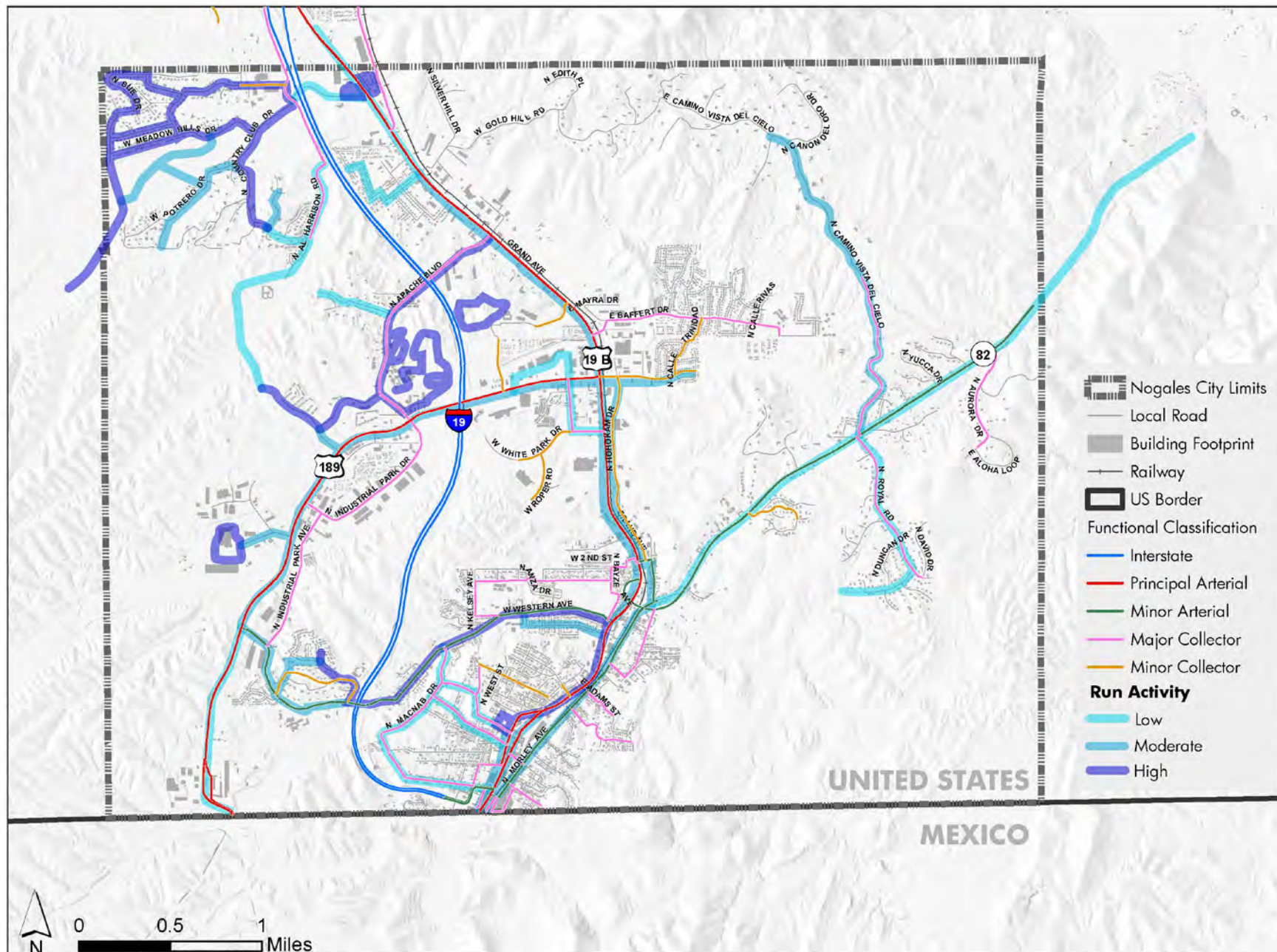


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Figure 4-8 | Strava Run Activity with Roadway Functional Classification

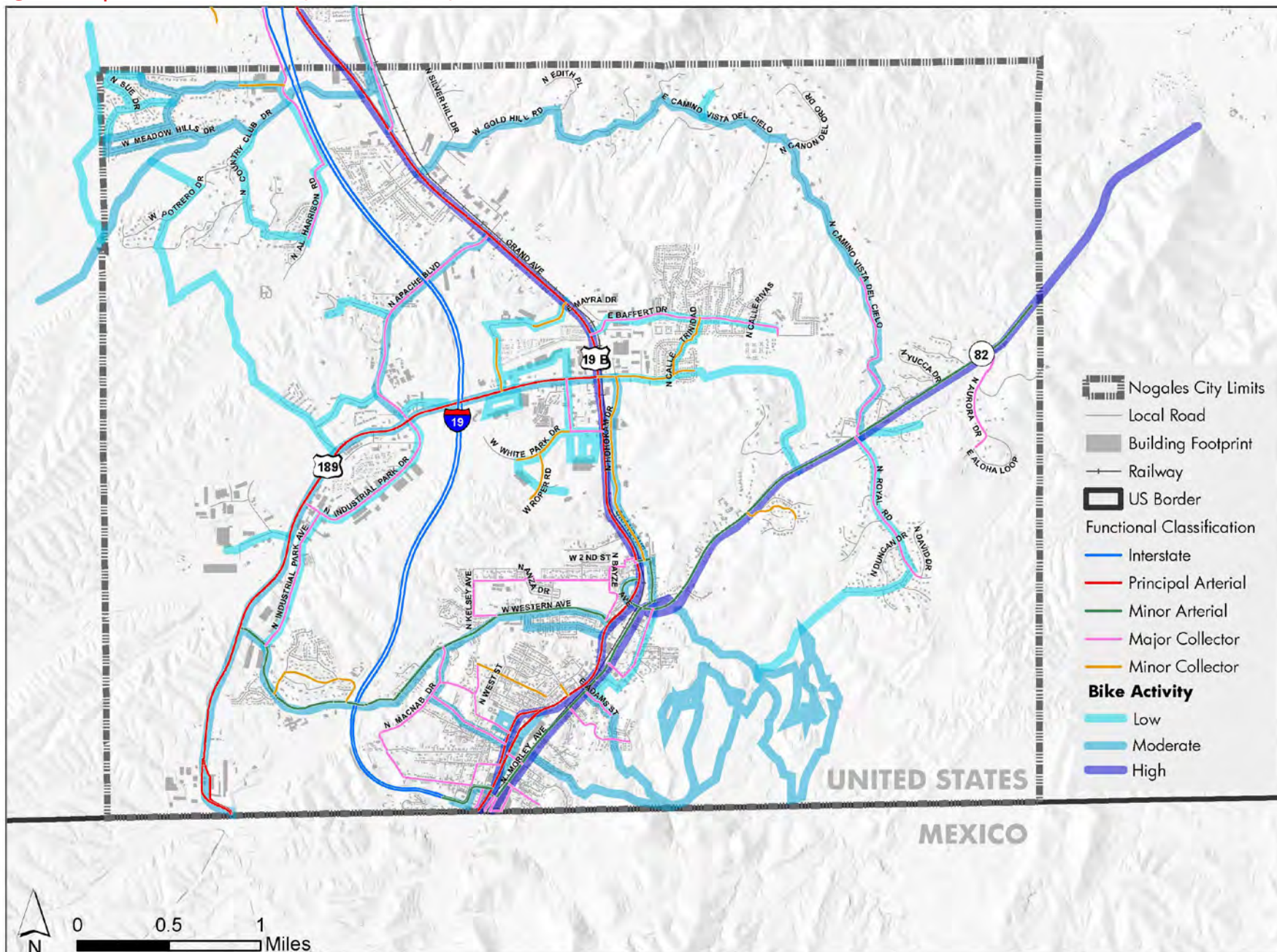


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Figure 4-9 | Strava Bike Activity and Roadway Functional Classification

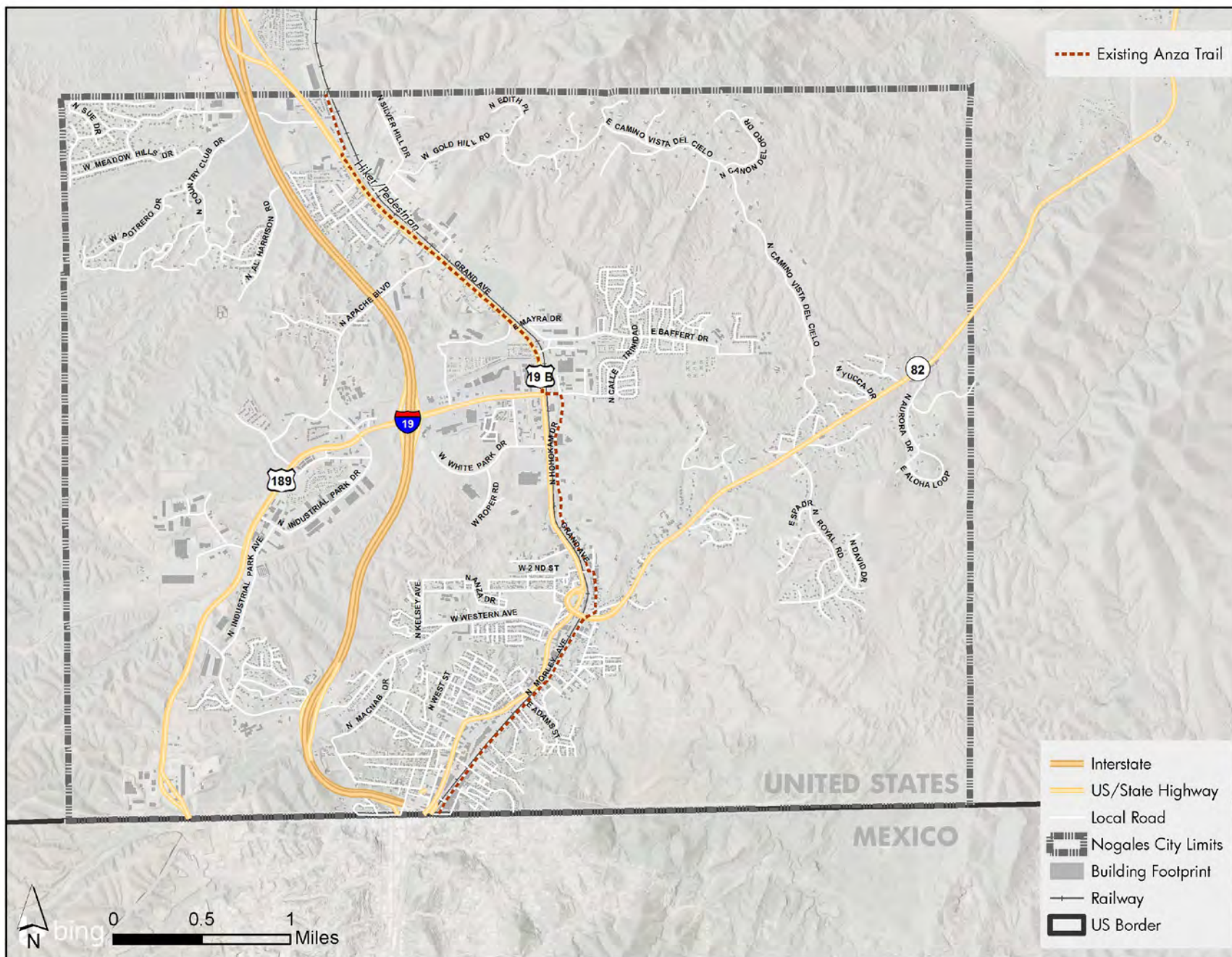


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Transportation Network



Figure 4-12 | Anza Trail through Nogales, AZ





4.3.2 | Transit

Currently within Nogales, AZ, there is no municipal fixed-route public transit service; however, there are local publicly funded transportation options within Santa Cruz County that include demand-responsive services for the elderly, disabled, and those with special needs through the following organizations:

- Easter Seals Blake Foundation
- Horizon Health and Wellness
- Nogales Infantil
- Pinal Hispanic Council
- Santa Cruz Council on Aging
- Santa Cruz Training Programs, Inc.
- Senior Citizens of Patagonia

Independent bus operators provide service between the US/Mexico border; yet the services are inconsistent and have varying fares. The Sahuaro Roadrunner Shuttle provides connections between Nogales (Arizona and Mexico), Tucson, and Phoenix. The Sahuaro Shuttle provides service every 30 minutes during peak hours. Furthermore, the Greyhound and Tufeso have stations in Nogales. The Greyhound provides service only within the U.S., while Tufeso provides service all the way to Guadalajara, Mexico. Table 4-3 provides the existing bus service locations in Nogales.

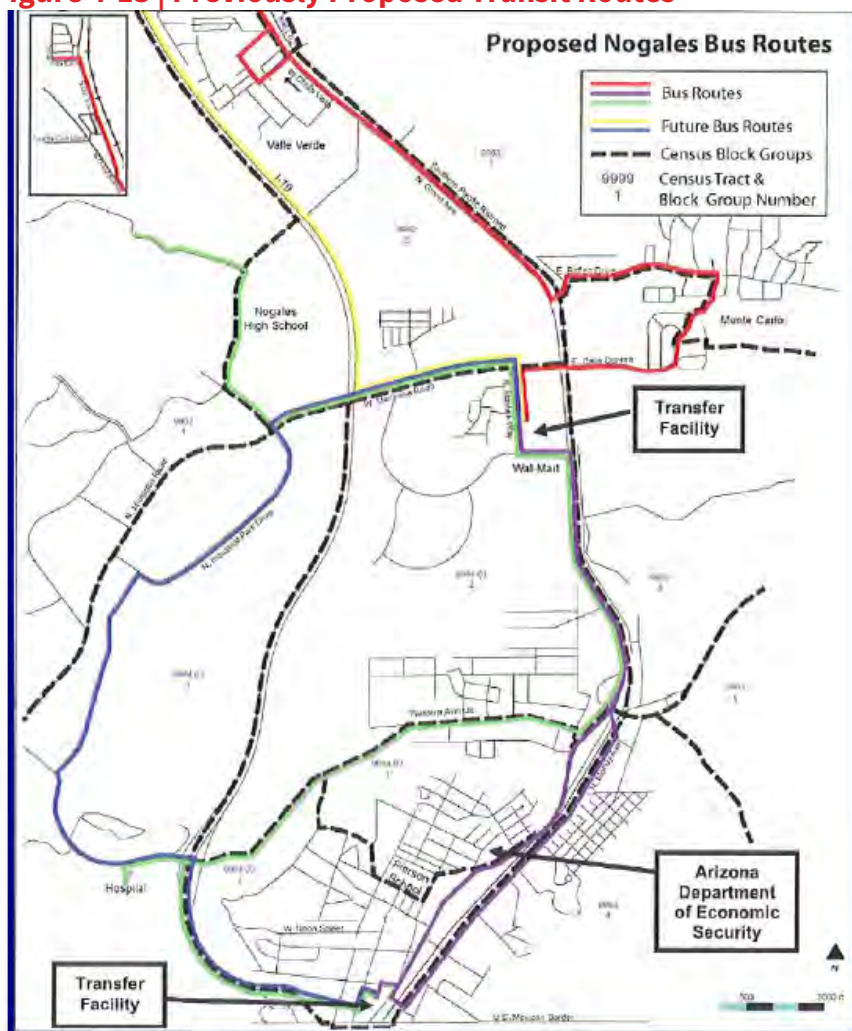
In previous plans, a commuter-oriented transit bus service from Rio Rico to Nogales was encouraged along with a passenger rail service to assist in the tourist activities in Santa Cruz County. A transit feasibility plan was conducted in 2006 to determine the viability of fixed-route service within Nogales. The recommendations included five total routes (Figure 4-13).

Table 4-3 | Existing Bus Service Locations

Bus Stop/Station	Location
Greyhound	82 North Terrace Avenue
Tufesa	181 North Arroyo
Sahuaro Roadrunner Shuttle	43 North Terrace Avenue



Figure 4-13 | Previously Proposed Transit Routes



Source: Nogales Transit Feasibility Review and Implementation Plan (Draft-October 2006)

4.4 | Safe Routes to Schools

Schools are a particular area of concern for addressing pedestrian and bicycle safety. Safe Routes to School (SRTS) is a type of program developed between schools, municipalities, and other stakeholders to improve students' ability to walk or bicycle school. The program – developed in line with national best practices – focuses on infrastructure and policy changes that make active transportation to school safe, comfortable, and enjoyable for students.



Often, SRTS programs lead to improvements to the physical environment, such as better sidewalks or crosswalks. Appendix A includes a mapped inventory of existing pedestrian infrastructure (sidewalks and marked crosswalks) around each school in Nogales. These maps will form the basis for Safe Routes to School infrastructure recommendations around Nogales schools as part of this plan.

Programming and policy changes are another focus of Safe Routes to School initiatives. Many schools or districts will organize “walk to school” or “bike to school” days to encourage active transportation among students. These are usually developed in coordination with local governments. Local government may collaborate on a case-by-case basis, but some governments have dedicated staff or programs to provide ongoing support to SRTS efforts. The City of Tucson has a permanent Safe Routes to School program operated through its transportation department and in partnership with a local active transportation advocacy organization. The program provides planning support and programming for several initial target schools and assists in organizing SRTS events at schools and districts throughout the city.”

4.5 | Critical Corridors

There are six identified corridors from the scope of work within Nogales that do not currently provide or connect to ample bicycling or pedestrian facilities. These corridors and cross sections are shown in Figures 4-14 through Figure 4-19. The cross sections provide the existing lane width, number of lanes, curb-to-curb roadway width (when present), shoulders (when present), medians (when present), and sidewalks (when present). The six corridors are not consistent throughout and typically change dimension. Figures 4-14 through Figure 4-19 illustrate the existing conditions along each of these corridors in order to identify the amount of space currently being used and for what purpose. Primarily, the roadways only serve vehicles with a few locations of sidewalks at Mariposa Road, Patagonia Highway, and Western Avenue. For the most part, the existing lane widths provide more than enough space for vehicular travel.

Identified Needs

The study Advisory Committee provided input related to where bike and pedestrian improvements are needed. Figure 4-20 portrays the locations where bike improvements are needed according to the community. The corridors with more callouts are noted as such. Figure 4-21 illustrates the locations where pedestrian improvements are needed. Areas with more callouts are identified accordingly.

According to the community, areas with the most bike needs include:

- Grand Avenue
- Patagonia Highway
- Waverly Avenue

According to the community, areas with the most pedestrian needs include:

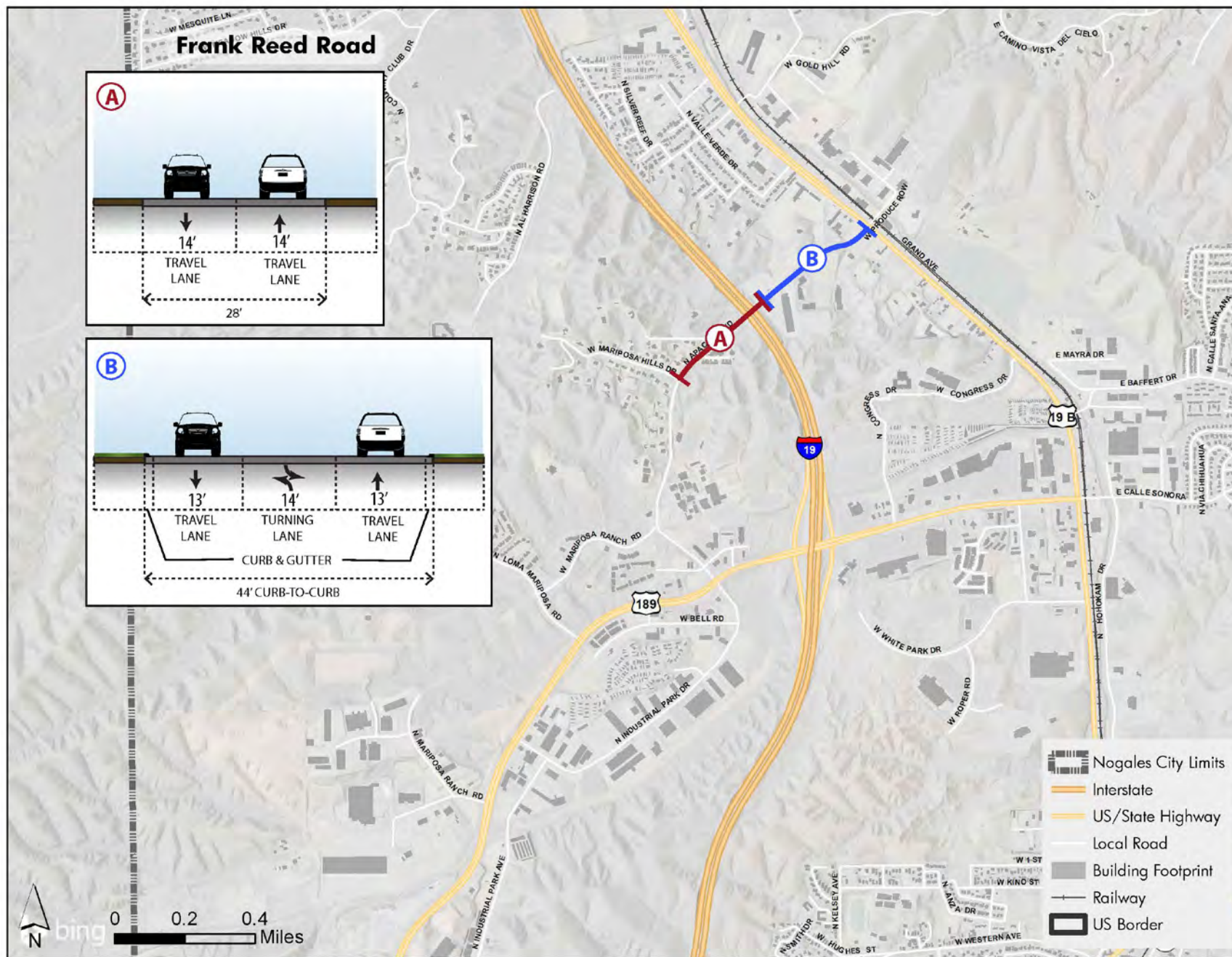
- Grand Avenue
- Patagonia Highway

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Figure 4-14 | Critical Corridor - Frank Reed Road

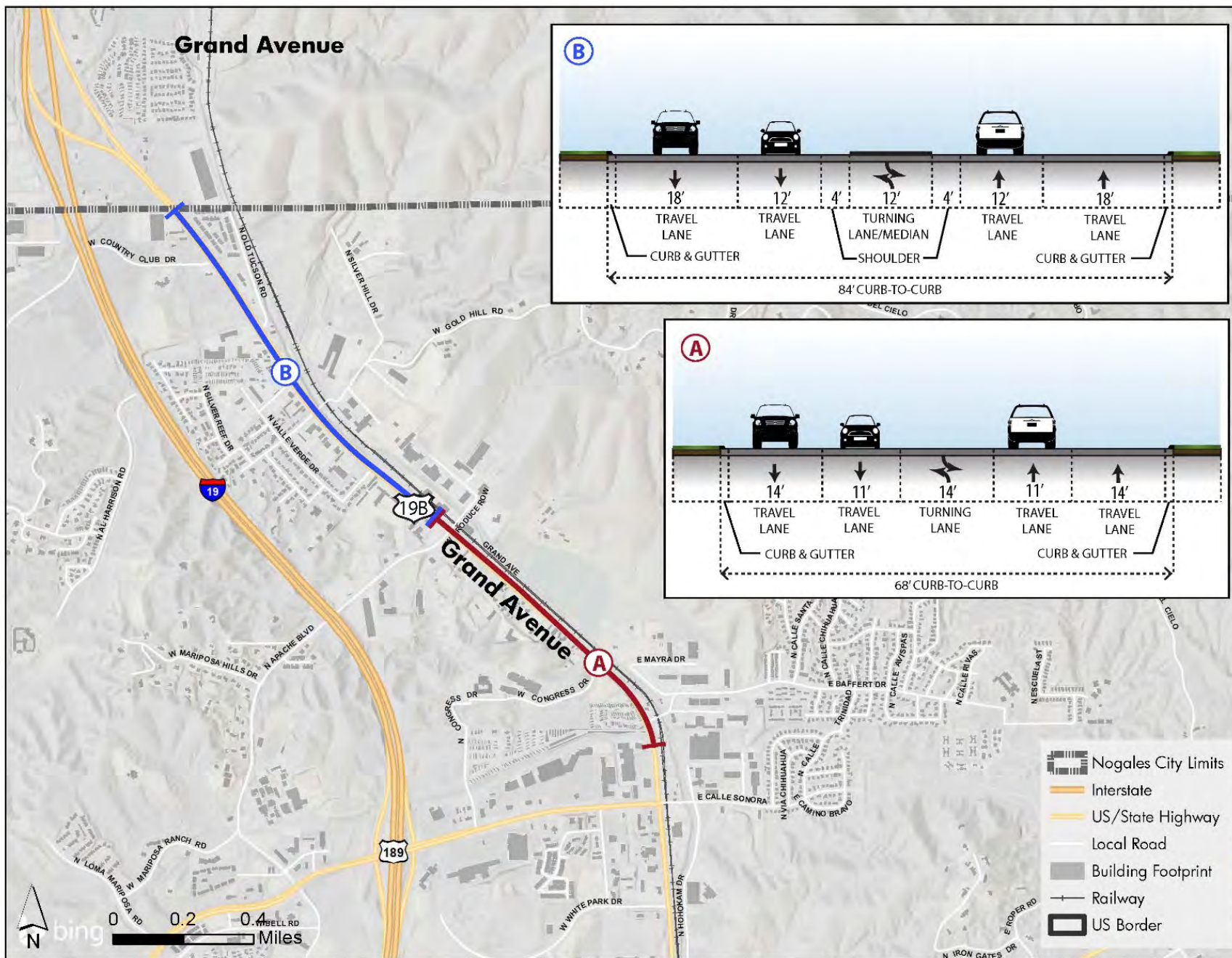


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Figure 4-15 | Critical Corridor - Grand Avenue

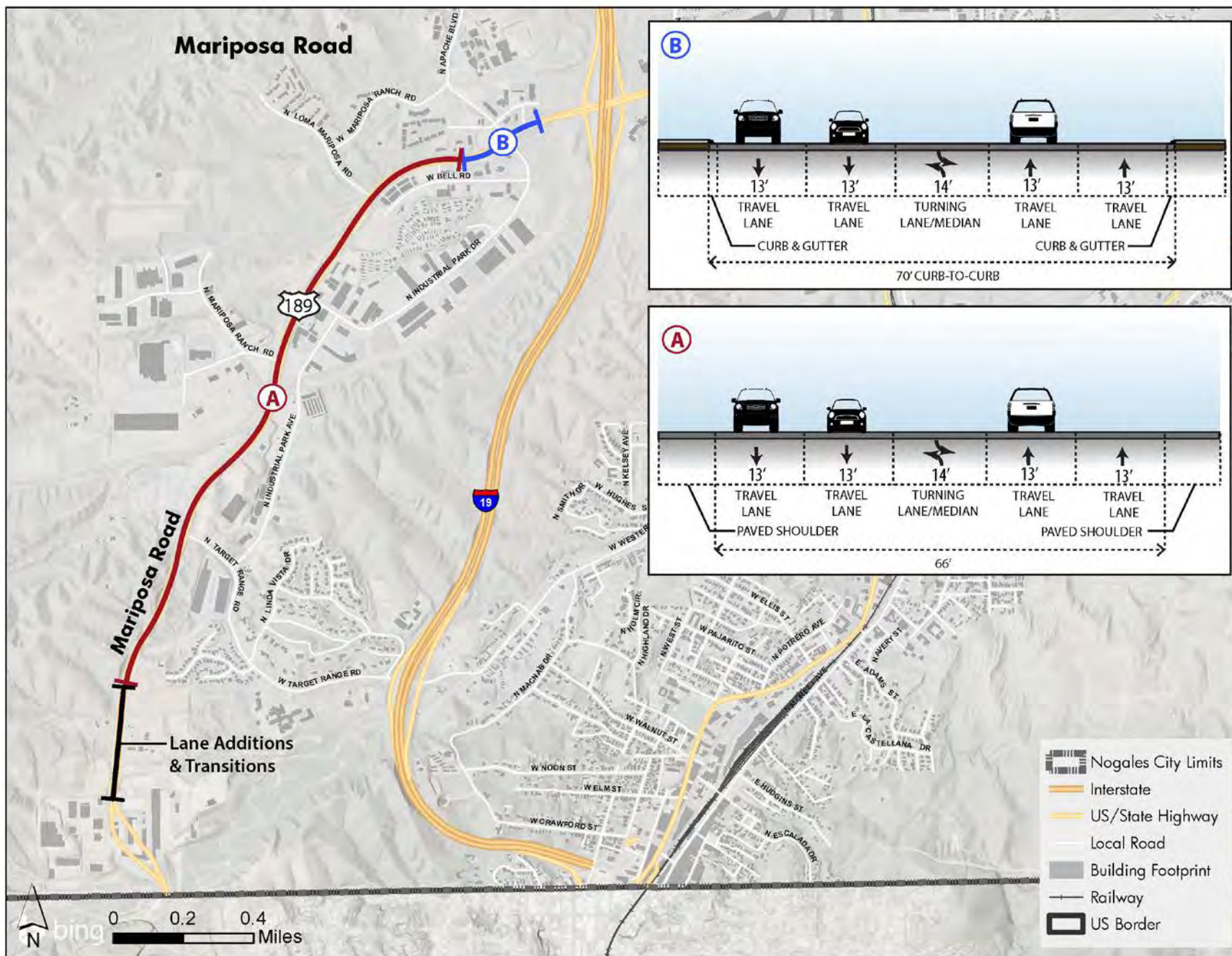


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Figure 4-16 | Critical Corridor - Mariposa Road

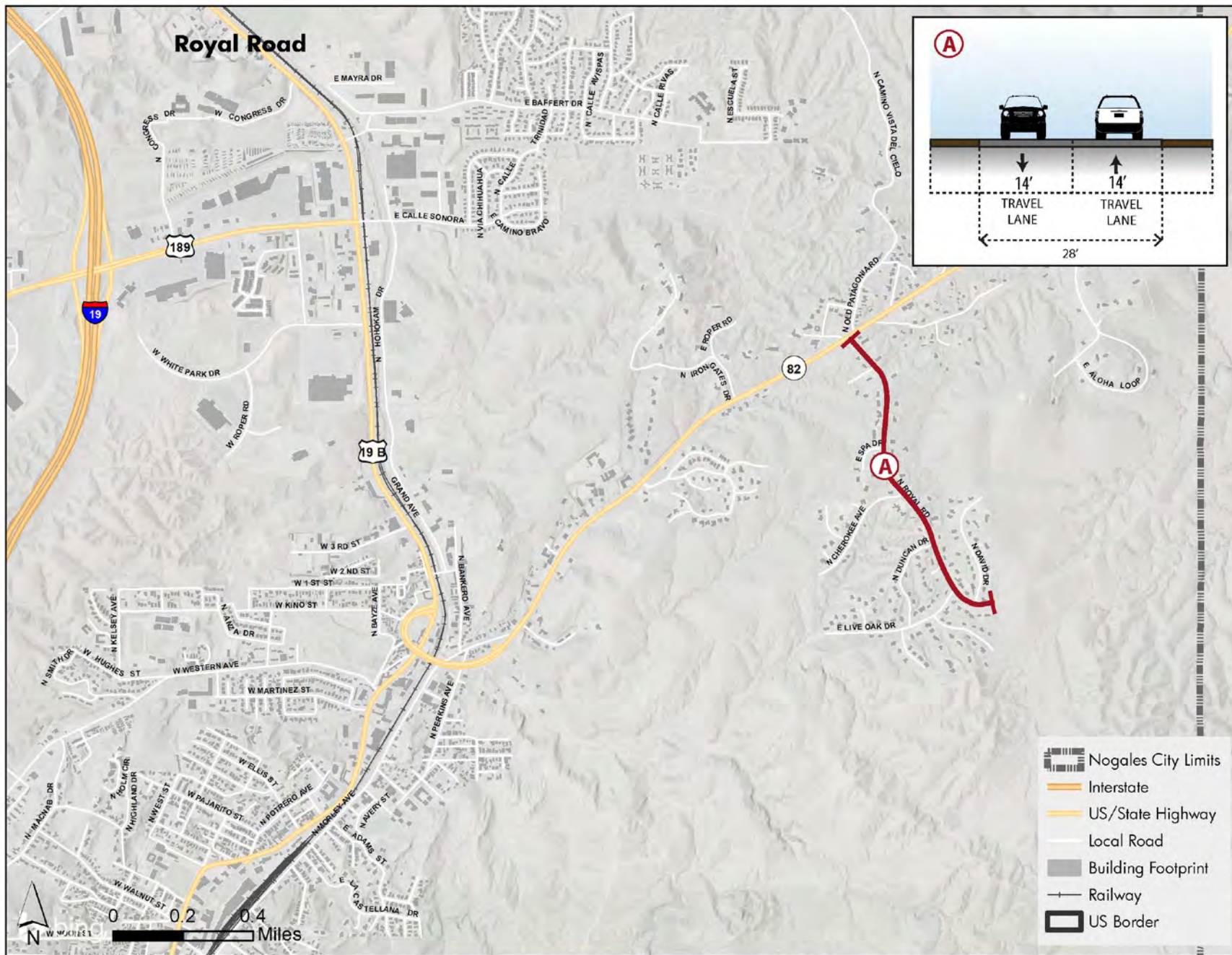


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Figure 4-18 | Critical Corridor - Royal Road

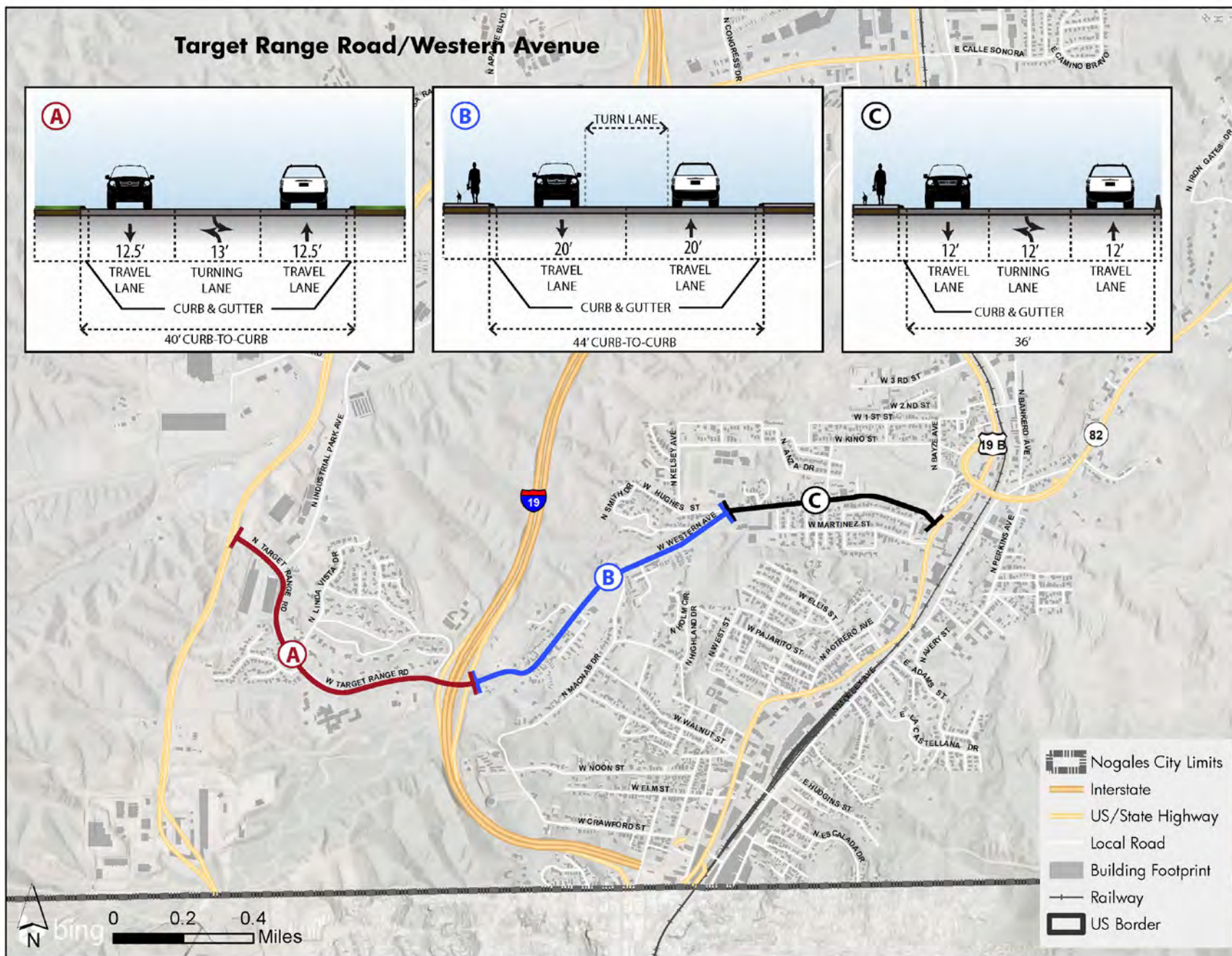


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Figure 4-19 | Critical Corridor - Target Range Road/Western Avenue

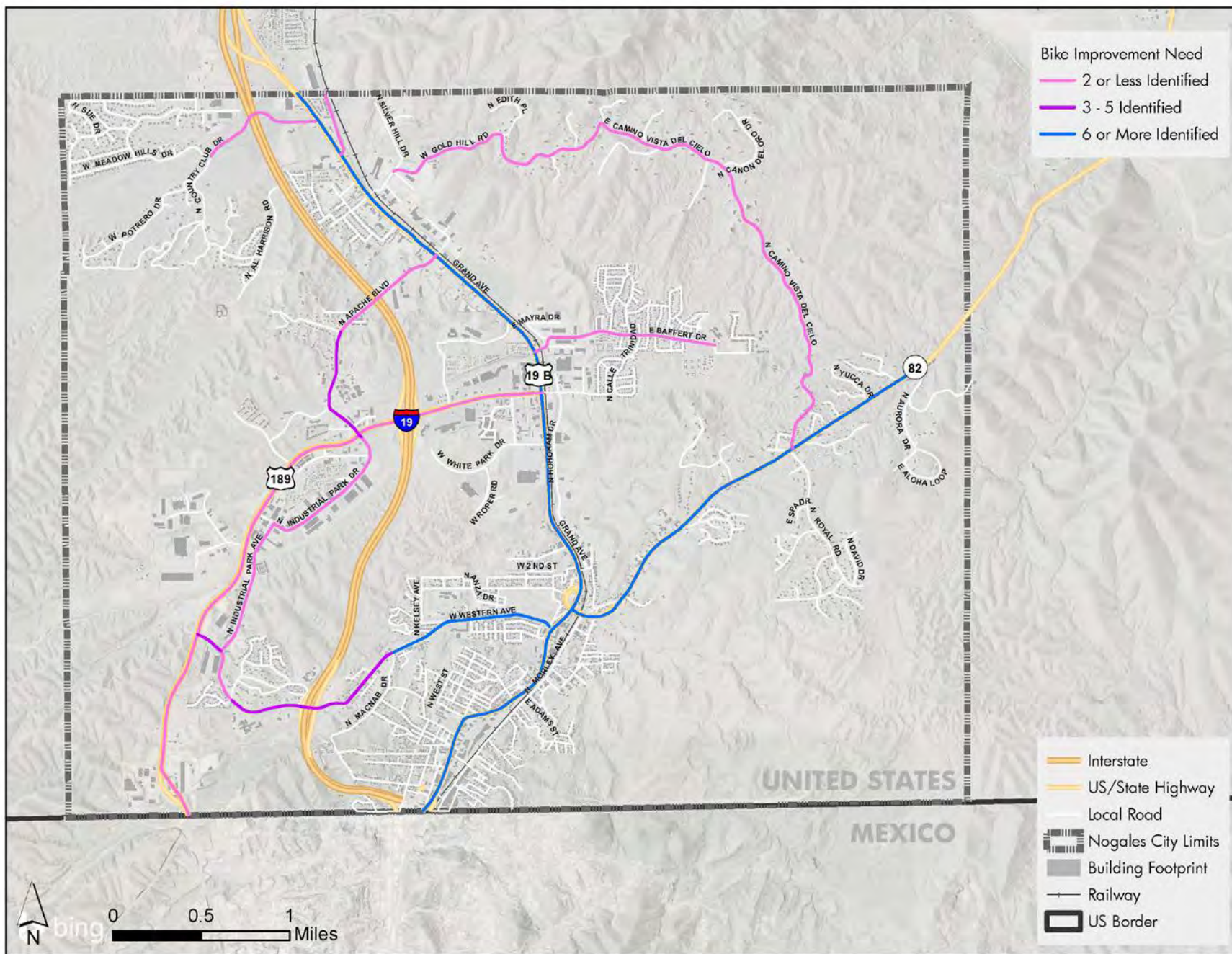


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Figure 4-20 | Amount of Stakeholders who Identified Bike Improvement Need

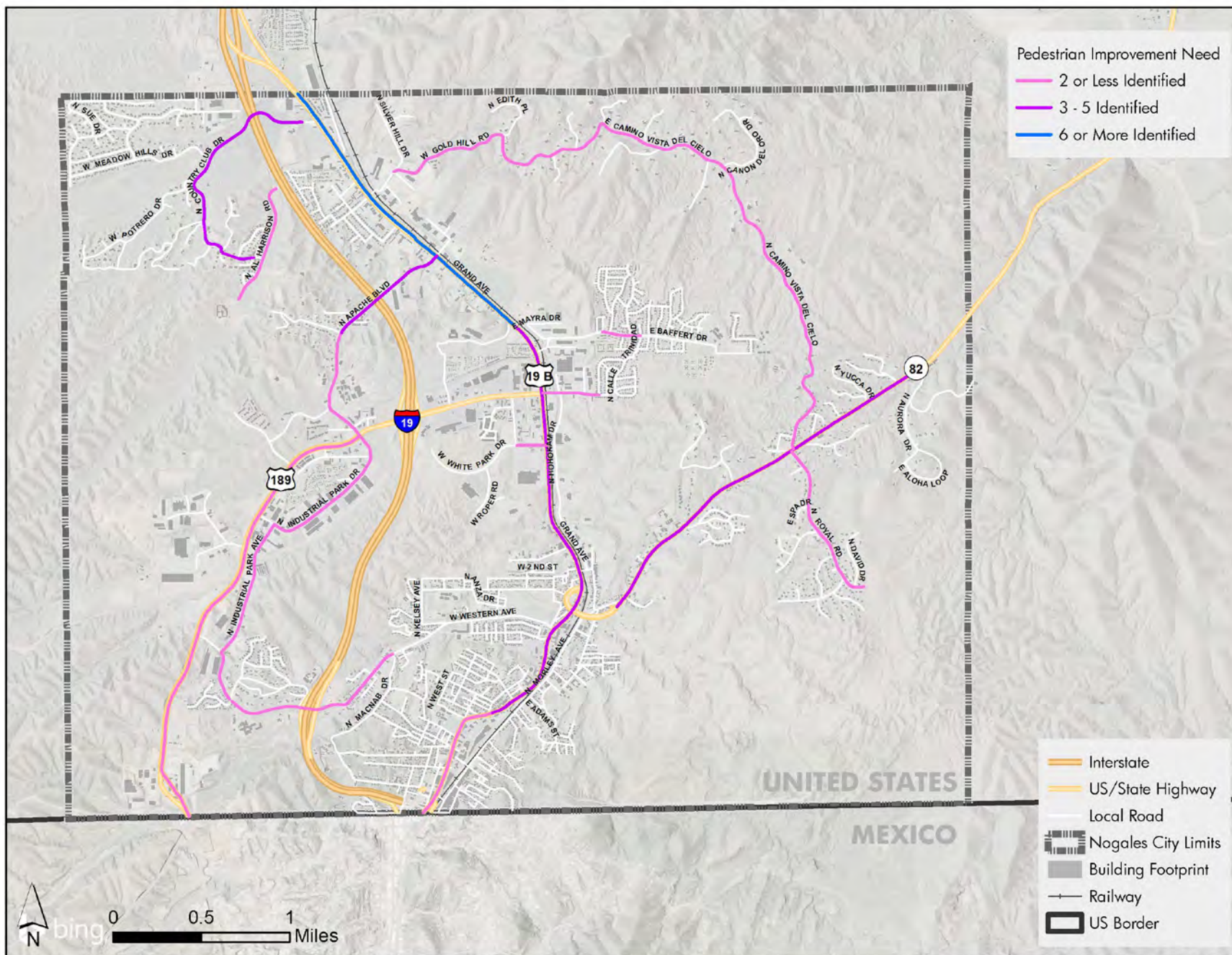


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Figure 4-21 | Amount of Stakeholders who Identified Pedestrian Improvement Need





4.6 | Crash Density

An important consideration to the safety of a roadway is the location of crashes. Table 4-4 depicts a summary of crashes in Nogales from 2012 till 2016. Overall, there were 1,210 crashes within the City of Nogales, with many occurring near the I-19/Mariposa Road interchange and the commercial node at Mariposa Road/Grand Avenue just to the east of the interchange. Out of all 1,210 crashes, nine resulted in fatalities, and thirteen resulted in a serious injury. Figure 4-22 displays the relative crash density of the 1,210 crashes from 2012 till 2016. Crashes tend to occur at the I-19 interchange at Mariposa Road, the intersection of Mariposa Road and Grand Avenue, and at various intersection locations along Grand Avenue.

4.6.1 | Severe Crashes

Overall, crash severity is fairly low, with only 2% of crashes resulting in a serious injury or a fatality. Figure 4-23 displays the density of these severe crashes and the locations of fatal crashes. Primarily, severe crashes have occurred along I-19, on Mariposa Road between I-19 and Grand Ave/US 19 B, and along Grand Avenue near the Patagonia Highway Interchange. Fatalities tend to occur on higher-speed and volume roadways, but are distributed across the city.

Table 4-4 | Nogales Crash Summary (2012-2016)

Total		Fatal Crashes		Serious Injury Crashes		Sub-Total (Fatal + Serious Injury)		Other Injury Crashes		Property Damage Only Crashes		Grand Total	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
		All Crash Totals	9	1%	13	1%	22	2%	223	18%	965	100%	1210

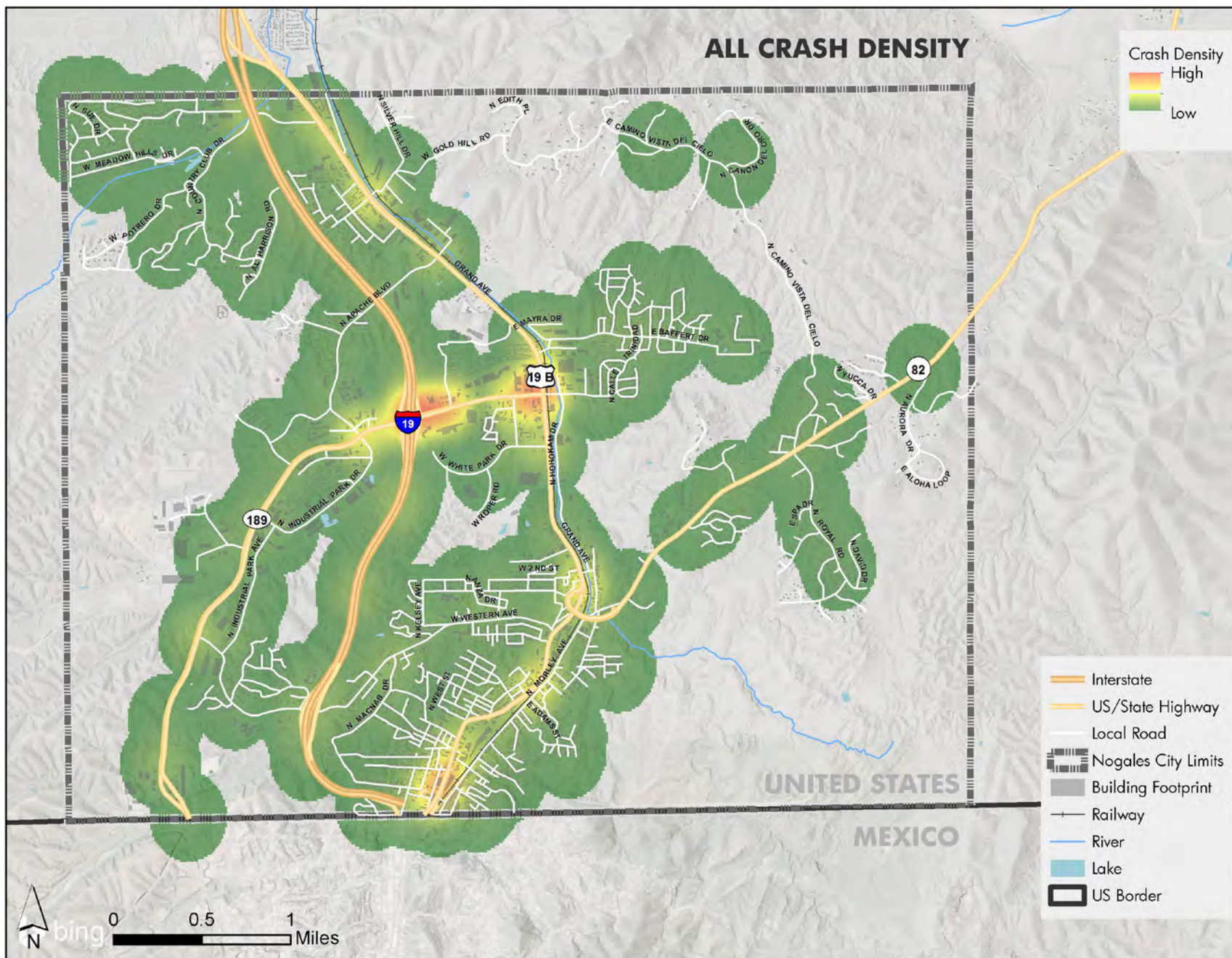
Harmful Event		Fatal Crashes		Serious Injury Crashes		Sub-Total (Fatal + Serious Injury)		Other Injury Crashes		Property Damage Only Crashes		Grand Total	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
		Pedestrian	2	16.7%	0	0.0%	2	16.7%	9	75.0%	1	8.3%	12
Bicycle	0	0.0%	0	0.0%	0	0.0%	3	75.0%	1	25.0%	4	100.0%	
Crash Totals	2	13%	0	0%	2	13%	12	75%	2	13%	16	100%	

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Figure 4-22 | All Crash Density (2012 - 2016 All Severity Crash Data)

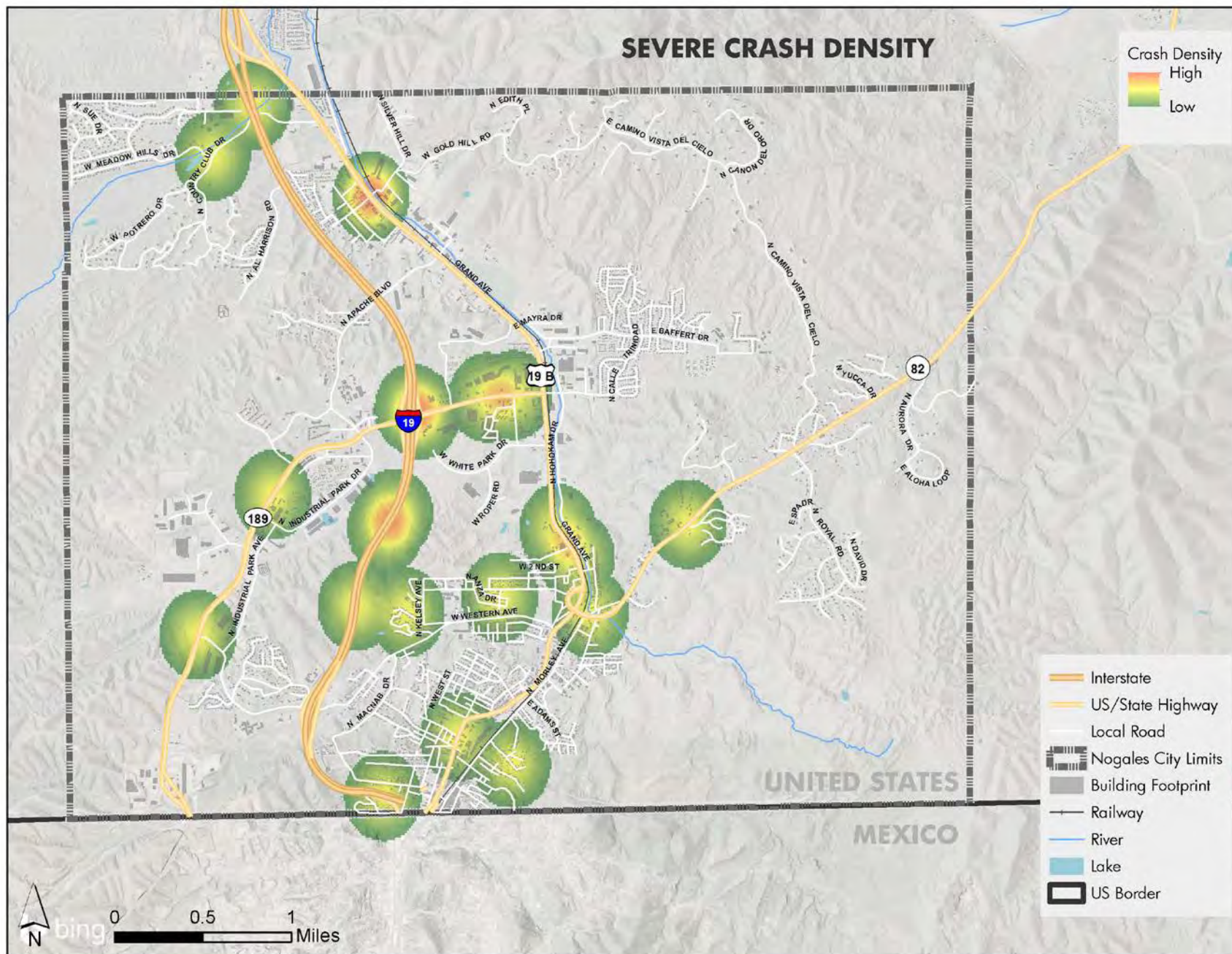


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Transportation Network



Figure 4-23 | Severe Crash Density (2012 - 2016 Fatal and Incapacitating Injury Crash Data)





4.6.2 | Pedestrian Crashes

Pedestrian crashes are of great importance due to the lack of protection pedestrians have when in a roadway. Additionally, the risk of a serious injury or fatality is much greater on higher speed roadways. As shown in Table 4-5, there have been two pedestrian fatalities and no pedestrian serious injuries in Nogales. There were twelve total pedestrian-involved crashes in Nogales, nine of which were classified as non-incapacitating injury or suspected injury. Figure 4-24 shows that the majority of all pedestrian crashes are occurring in the central commercial district. This area has a great number of pedestrian crossings and is an active commercial area.

4.6.3 | Bike Crashes

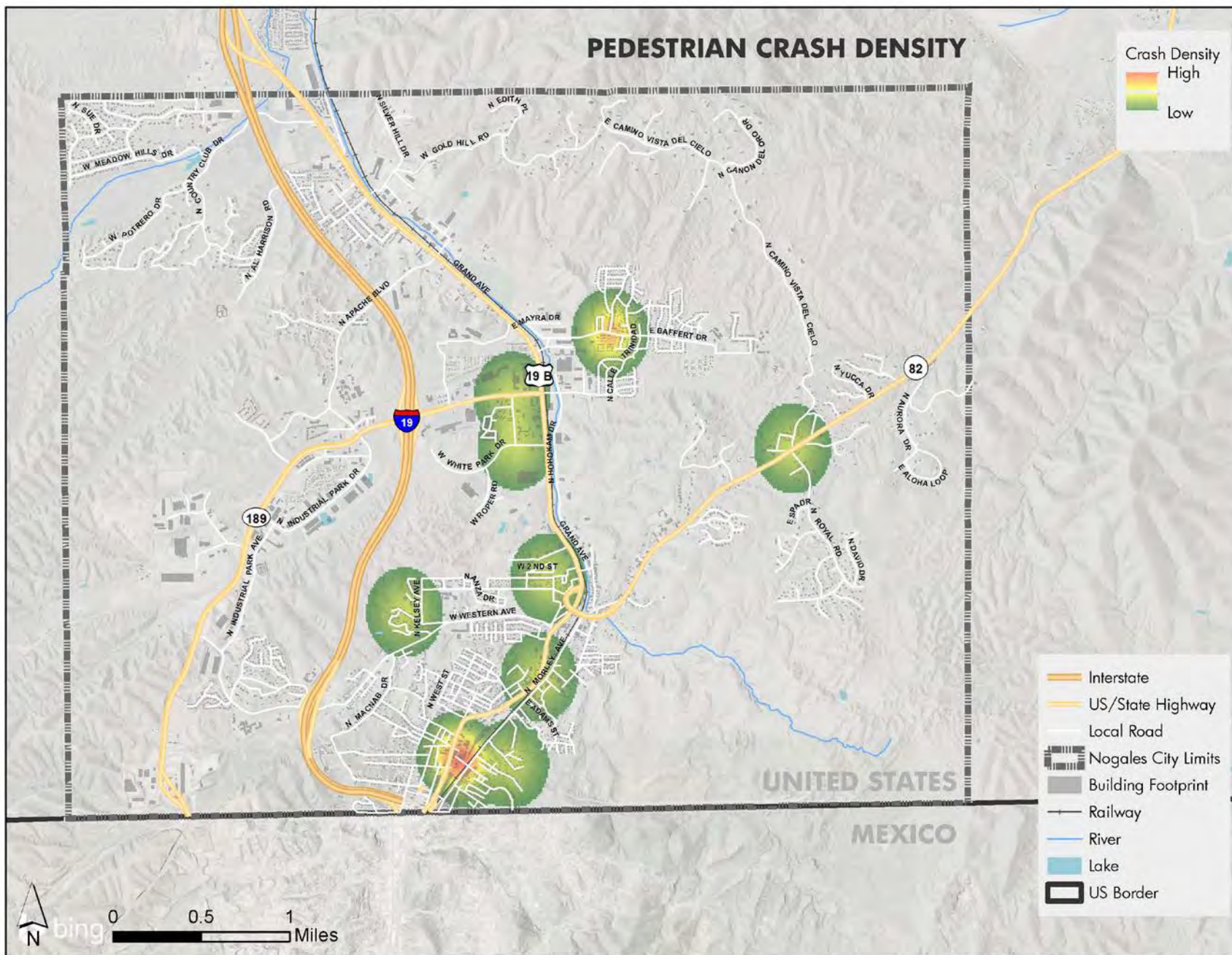
Bike crashes are fairly low in Nogales. As shown in Table 4-5, there have been four total bicycle-involved crashes in Nogales. Of these four crashes, none resulted in a fatality or a serious injury. As shown in Figure 4-25, the relative density of the four crashes tend to occur along Grand Avenue, with two of the crashes occurring in a similar location. It should be noted that the red “hot-spot” displayed in Figure 4-25 only represents two crashes.

4

Transportation Network



Figure 4-24 | Pedestrian Crash Density (2012 - 2016 All Severity Crash Data)

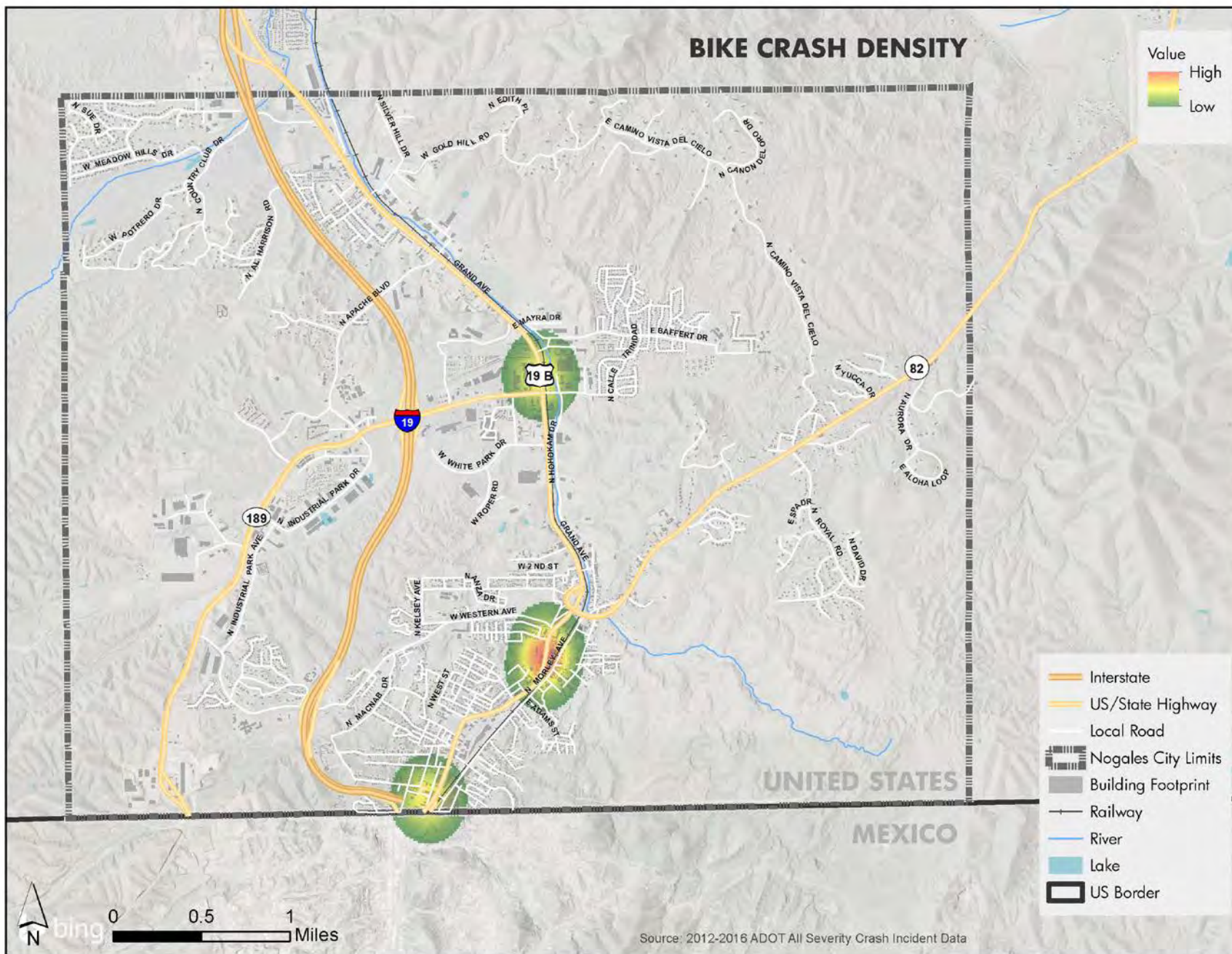


4

Transportation Network



Figure 4-25 | Bike Crash Density (2012 - 2016 All Severity Crash Data)





5.0 | Key Findings

The review of Nogales existing conditions resulted in several key findings which will help in developing context-specific solutions which increase the safety and mobility of pedestrians and cyclists.

5.1 | Critical Corridors

Six corridors identified by the City of Nogales were studied in detail throughout the existing conditions process. As shown in Table 5-1, four of these corridors were identified by a majority of stakeholders as needing improvement:

- Grand Avenue
- Patagonia Highway
- Frank Reed Road
- Target Range Road/ Western Avenue

Improvements to these corridors would increase safety, access and increase mobility for pedestrians.

Table 5-1 | Stakeholder input on Critical Corridors

Name	Location	Identified Bike Need	Identified Pedestrian Need
Grand Avenue	North of Baffert Drive	6 +	6 +
Patagonia Highway (SR-82)	East of existing sidewalks	6 +	3 - 5
Frank Reed Road	North of Nogales High School	3 - 5	3 - 5
Mariposa Road	From the existing Land Port of Entry (LPOE), to I-19	2	2
Target Range Road/Western Avenue	East of Mariposa Road to Grand Avenue	3 - 6	6 +
Royal Road	South of Patagonia Highway	0	1

5.2 | Live and Work Disconnect

With the exception of the central commercial district, residential areas are separated from working areas by edges. There are several edges that act as barriers to mobility in Nogales. The I-19 corridor and I-19 Business/Grand Avenue/Union Pacific corridor act as barriers to east-west travels, whereas the hilly-topography limits generally mobility in all directions. This has led to much of the commercial areas being developed in-between these edges along the north-south spine, and much of the residential development in pockets towards the outer extents of the city. This disconnect creates an great need for high volume corridors to facilitate all modes of travel, enabling residents to walk and bike to work.



5.3 | Schools

Many of the schools in Nogales lack adequate sidewalks connecting to residential areas. A Safe Routes to Schools (SRTS) program would help increase education and attention to students getting to school safely. A part of this process will be evaluating the main routes which students take to arrive to school. Several of the previously identified critical corridors such as Frank Reed Road and Target Range Road/Western Avenue, could be considered due to their proximity to residential and school areas. Often times, SRTS programs lead to built improvements to the physical environment, such as better sidewalks or crosswalks.

5.4 | Border Crossings

The Mariposa and DeConcini/Morley Gate LPOEs are vital connections for the regional economy and for border residents who travel through the gates daily. Work recently completed on the Mariposa LPOE to the west has increased the capacity of commercial vehicles along Mariposa Road/SR-182. These vehicles utilize the interchange at I-19, creating a great need for safety due to the high amount of traffic in this area. The DeConcini/Morley Gate LPOE allow personal automobiles, rail traffic, and pedestrians to cross the border. Understanding the several hundred feet wide entry that is the DeConcini/Morley Gate, is vital to planning pedestrian and cyclists routes that can facilitate daily travels over the border.

5.5 | 0S3 (Zero Stress)

Efforts by the cyclist advocacy group 0S3 have helped facilitate bike awareness and bike safety in the city. Their efforts help educate cyclists and non-cyclists alike, as well as offer a fun activity to residents. Utilizing their key insights throughout the planning process will be key in creating a functional multi-modal system in Nogales.

5.6 | Interstate Crossings

Due to the edge that I-19 presents, Interstate crossing locations in Nogales are key for getting cyclists and pedestrians past I-19. An evaluation of the vertical and horizontal geometry is key creating a safe and connected route for users who pass under the Interstate facility. The crossing at I-19 and Mariposa Road/SR-189 has a high level of traffic volume, traffic collisions, and is adjacent to a several key commercial and school locations.

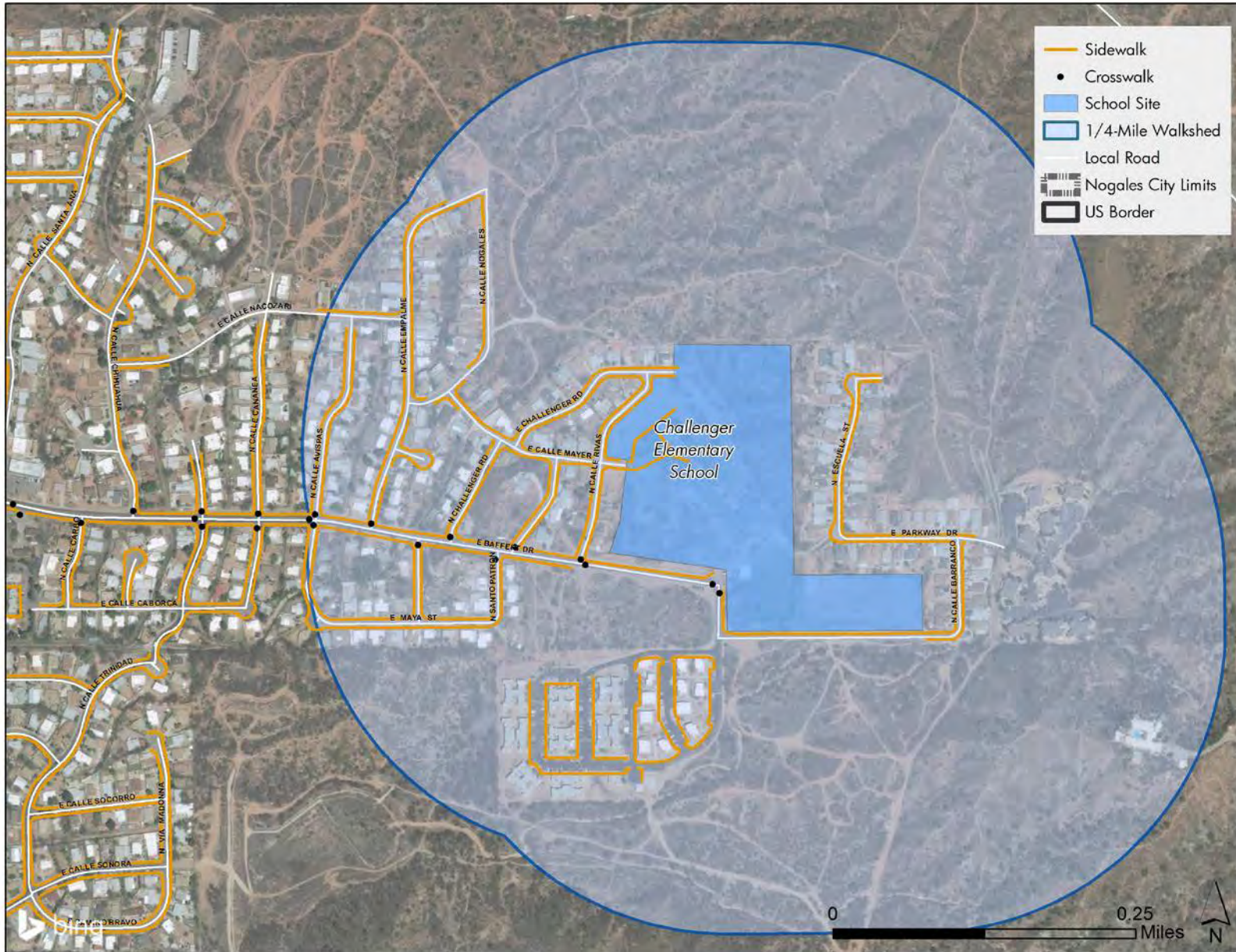
5.7 | Standard Cross Sections

As the community develops more of an understanding of how their overall transportation network can facilitate multimodal travel, a standard cross section for each roadway type would help in facilitating consistency across the network. This in turn will increase driver, cyclist, and pedestrian confidence with the road network.



Appendix A – Safe Routes to School

Bicycle & Pedestrian Master Plan



- Sidewalk
- Crosswalk
- School Site
- 1/4-Mile Walkshed
- Local Road
- ▨ Nogales City Limits
- ▭ US Border

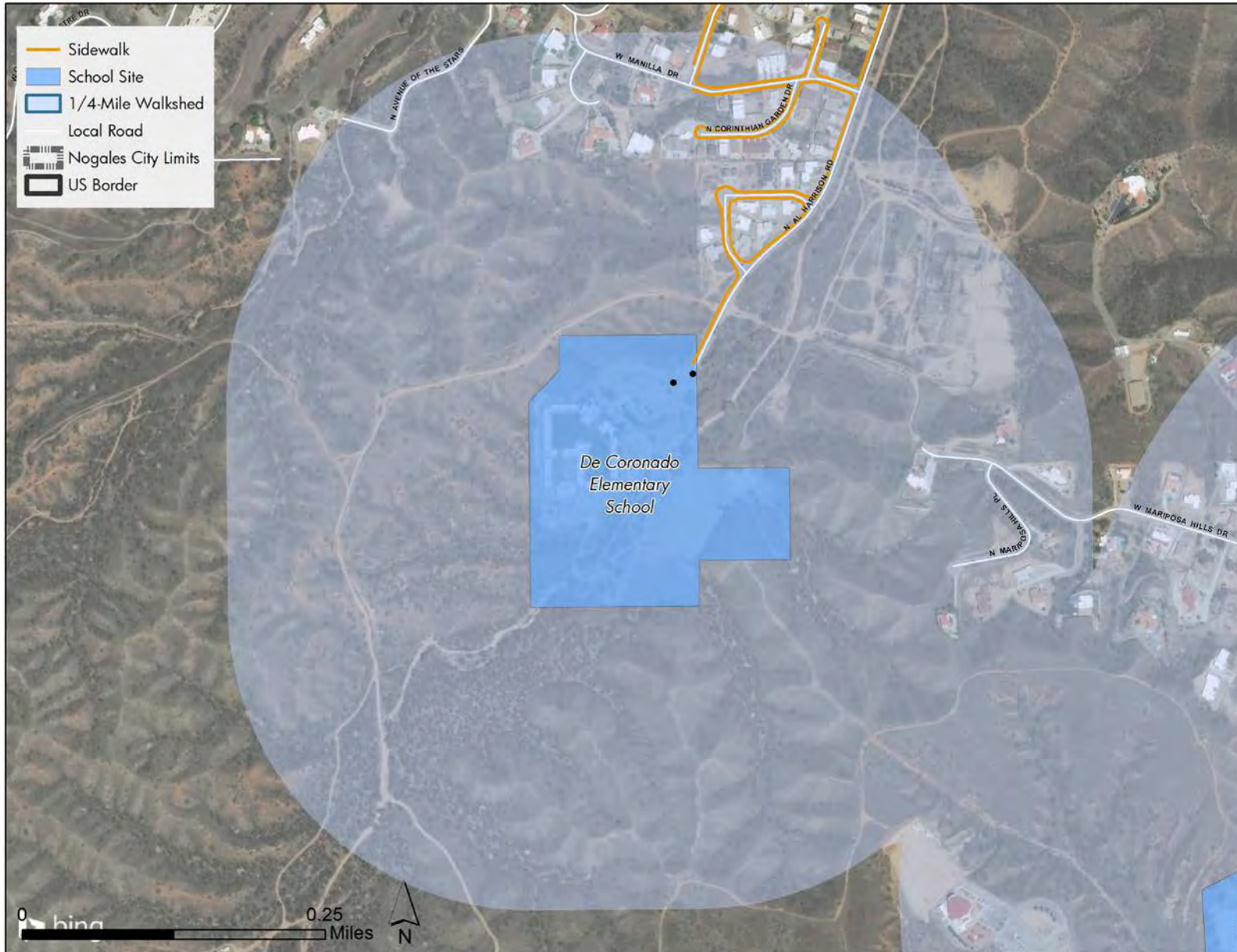
0 0.25 Miles



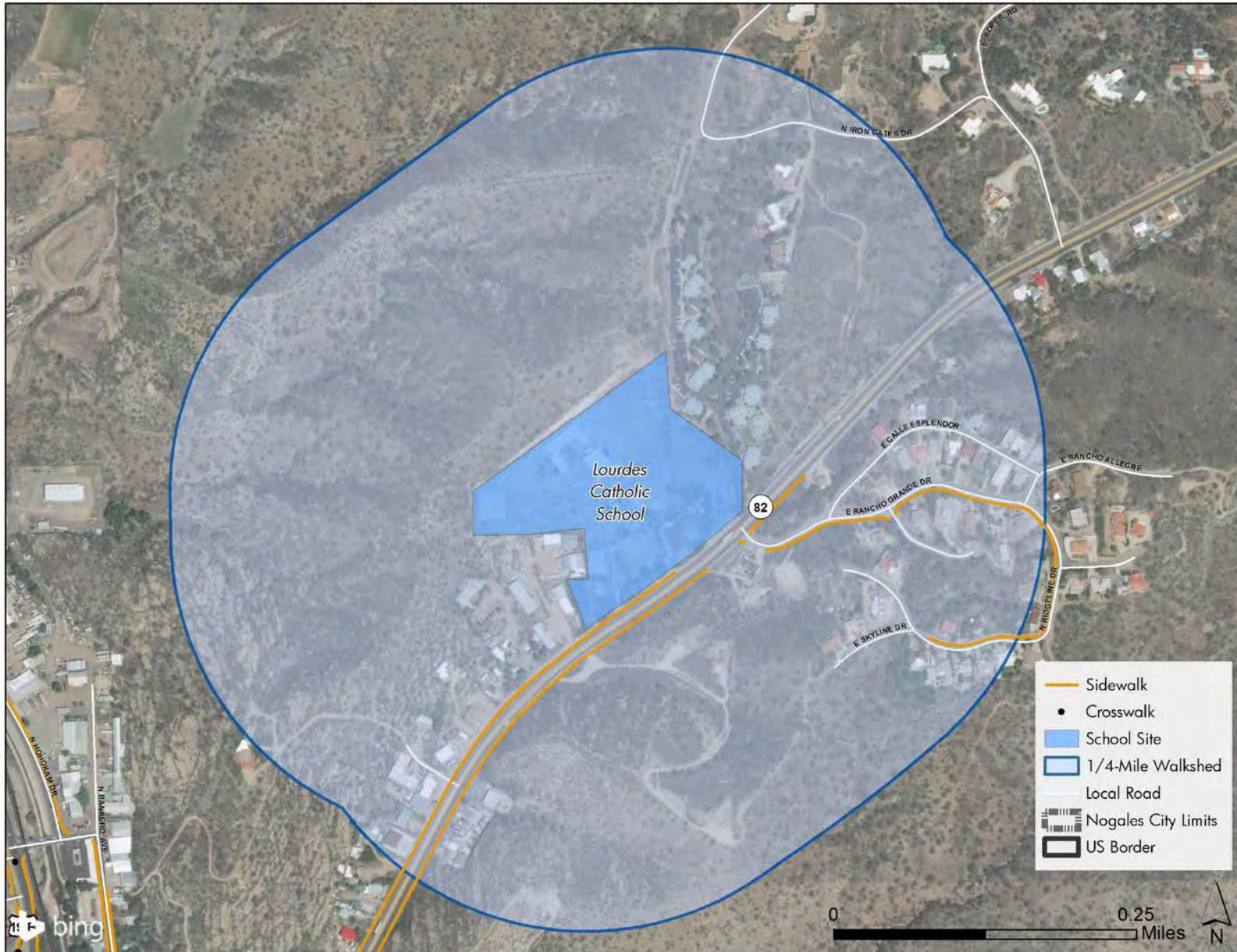
Bicycle & Pedestrian Master Plan



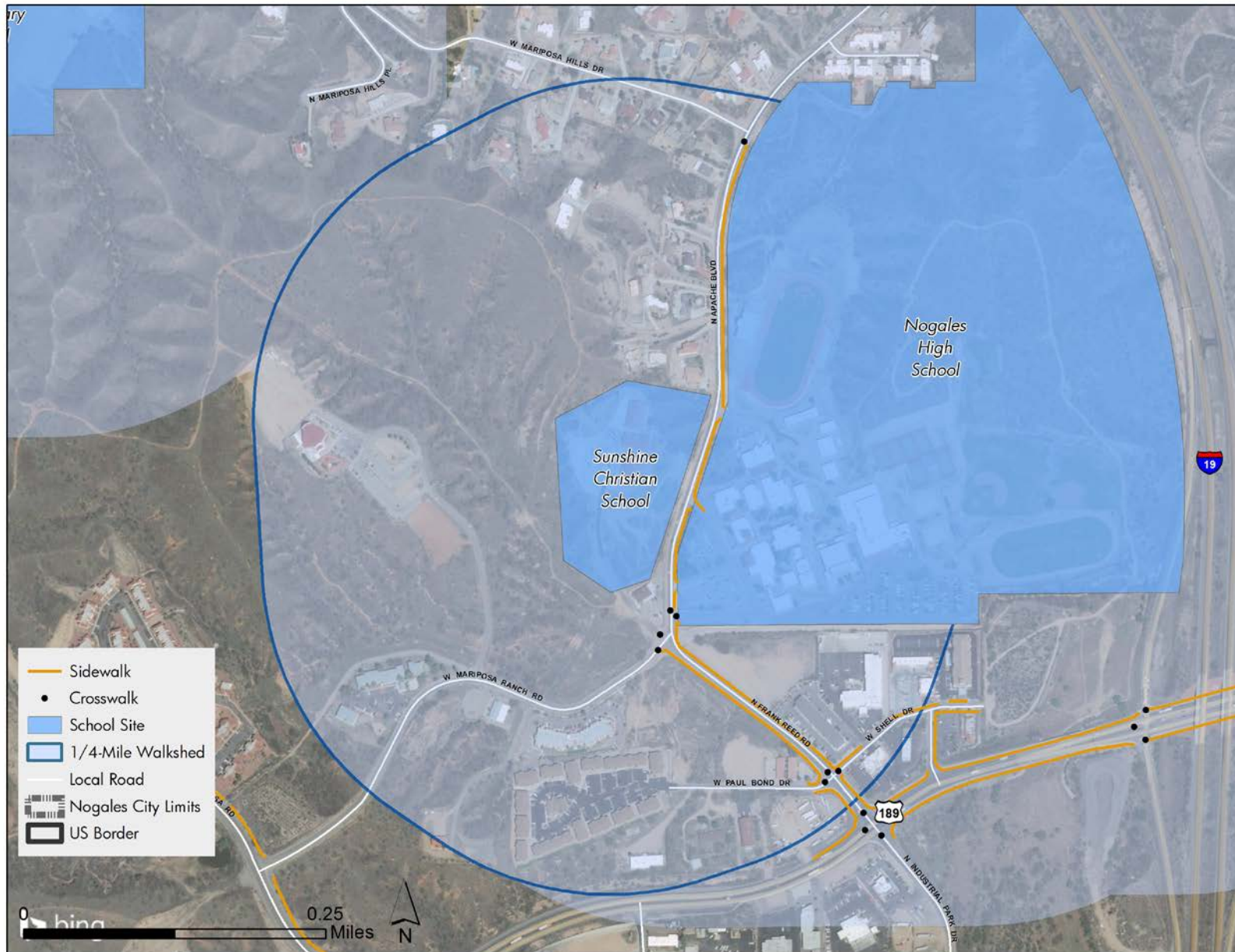
Bicycle & Pedestrian Master Plan



Bicycle & Pedestrian Master Plan



Bicycle & Pedestrian Master Plan



Bicycle & Pedestrian Master Plan

