CHAPTER 4

Affected Environment, Environmental Consequences, and Mitigation

BACKGROUND INFORMATION

This chapter presents pertinent information regarding the existing social, economic, and environmental setting of the proposed action. It also presents findings relative to the evaluation of potential environmental consequences of three action alternatives in the Western Section, one action alternative in the Eastern Section, and the No-Action Alternative (see Chapter 3, *Alternatives*, for information regarding the alternatives' design features). Where applicable, measures to avoid, reduce, or otherwise mitigate environmental impacts are described.

In accordance with National Environmental Policy Act (NEPA) provisions, substantial discussion is given to those elements of the environment most affected by the proposed action. Other elements of the environment are discussed to a lesser degree in the context of the chapter. Table 4–1 provides a summary of topics, content, and intended benefits to the reader.

Can the Impacts Change and, If So, How?

Findings relative to impacts presented in this chapter could change. The reasons for future changes, which would be presented in the Final Environmental Impact Statement (FEIS) and record of decision (ROD), are based on, but not limited to:

- refinement in design features through the design process
- updated aerial photography as it relates to growth in the Western Section of the Study Area
- communications with the City of Phoenix, the Gila River Indian Community (Community), and other stakeholders regarding measures to minimize harm to resources of the South Mountains afforded protection under Section 4(f)
- potential permission provided by the Community to develop action alternatives on Community land
- responses to public input
- potential changes to traffic forecasts as updated regularly by the Maricopa Association of Governments (MAG)
- potential changes regarding updated census data
- potential regulatory changes by local, State, or federal agencies

As design would progress, refinements would be made. Cost estimates for construction, right-of-way (R/W) acquisition, relocation, and mitigation would be updated on a regular basis.

Design enhancements would reduce impacts, enhance cost efficiencies, and/or accommodate other planning activities.

Even with these factors affecting findings, it is anticipated the effects would be roughly equivalent among the alternatives and, consequently, impacts would be comparatively the same. The assumption would be confirmed if and when such changes were to occur.

Consequently, mitigation measures presented in the chapter are considered by the Arizona Department of Transportation (ADOT) and Federal Highway Administration (FHWA) as possible future commitments to be implemented to avoid, reduce, or otherwise mitigate environmental impacts associated with the proposed action. The discussion of these mitigation measures in the Draft Environmental Impact Statement (DEIS) does not obligate ADOT to these specific measures. ADOT, along with FHWA, may choose to modify, delete, or add measures to mitigate impacts. If this were to occur, these modifications to the mitigation measures would be explained in detail in the FEIS or ROD, depending on when the modifications occur. Final commitment to mitigation measures would be made in the ROD.

Review of technical reports, predecisional reports, and memorandums

Technical reports, predecisional reports, and memorandums can be made available for review by appointment—with the exception of the cultural resources technical reports (because of the sensitive information they contain)—at ADOT Environmental Planning Group (EPG), 1611 W. Jackson St., Phoenix, AZ 85007. Special requests for portions of the cultural resources reports will be considered by ADOT on a case-by-case basis. These reports examine existing conditions and assess potential impacts on existing conditions.

Table 4-1 Affected Environment, Environmental Consequences, and Mitigation Content Summary, Chapter 4

Topic	Page	Highlights	Reader Benefit
Background Information	4-1	• Discussion of the changing nature of environmental assessments as the proposed action and No-Action alternatives progress through time and through the design process (if an action alternative were to become the Selected Alternative) • Reasons the environmental assessment could change over time and implications to the EIS[a] process	• Understanding of how assessments of social, economic, and environmental impacts fit into the EIS process • Understanding of how mitigation measures do not become full ADOT[b] commitments until issuance of a record of decision
Land Use	4-3	• Description of relevant aspects of the social, economic, and environmental context ("affected environment") of the three action alternatives in the Western Section, one action alternative in the Eastern Section, and the No-Action Alternative • Evaluation of the magnitude and intensity of the various alternatives on the resources of concern ("environmental consequences") • Description and explanation of appropriate measures that would be taken to avoid, reduce, or otherwise lessen the magnitude and intensity of the various alternatives' impacts ("mitigation measures") • A conclusion at the end of each section explains the relative context, intensity, and magnitude of the impacts on the resources of concern within the overall scope of the EIS analyses. Each conclusion is not intended to restate findings presented in each section but appropriately highlights noteworthy aspects of the information presented.	• Resource-by-resource understanding of the social, economic, and environmental impacts of the various action and No-Action alternatives • Resource-by-resource understanding of proposed mitigation measures
Social Conditions	4-20		
Title VI and Environmental Justice	4-29		
Displacements and Relocations	4-39		
Economic Impacts	4-46		
Air Quality	4-58		
Noise	4-80		
Water Resources	4-93		
Floodplains	4-102		
Waters of the United States	4-108		
Topography, Geology, and Soils	4-113		
Biological Resources	4-117		
Cultural Resources	4-128		
Prime and Unique Farmlands	4-149		
Hazardous Materials	4-152		
Visual Resources	4-155		
Energy	4-160		
Temporary Construction Impacts	4-161		
Material Sources and Waste Material	4-164		
Irreversible and Irretrievable Commitment of Resources	4-165		
Relationship between Short-term Uses of the Environment and Long-term Productivity	4-166		
Secondary and Cumulative Impacts	4-167		
Conclusions	4-178	• Action alternatives differentiated by the impacts each would cause • Overall chapter conclusions do not summarize data already presented; rather, they highlight noteworthy observations and conclusions drawn from observations of the data.	• Integrated summary of the scientific and analytical basis for comparison of the social, economic, and environmental impacts associated with the various alternatives

[a] environmental impact statement [b] Arizona Department of Transportation

LAND USE

This section describes the existing land use, zoning, development plans, future land use plans, and land ownership for the Study Area. Land use planning and transportation planning are intrinsically tied. In the Phoenix metropolitan area, the construction of the proposed action has been accommodated in past planning and is part of affected jurisdictions' ongoing general planning processes. Typically, the construction of a project like the proposed action follows on the heels of planned residential areas, employment centers, and commercial developments.

AFFECTED ENVIRONMENT

Existing Land Use, Land Use Trends, and Ownership

The entire Study Area falls within Maricopa County. Figures 4-1 and 4-2 illustrate the jurisdictional boundaries and land ownership, respectively. Within the Study Area, each jurisdiction's planning area may include incorporated areas and unincorporated areas likely to be annexed in the future. These planning areas are regulated by the respective jurisdiction's general plan, which guides future growth, and by the zoning ordinance, the principal tool in the implementation of the general plan. The largest land area included in the Study Area is in the Phoenix planning area. Tolleson follows, with the Study Area covering its entire incorporated area.

The Phoenix metropolitan area has historically and nationally been fast-growing, and projected growth in the Study Area and its surroundings is in line with the growth of the region (see the sections, *Need Based on Socioeconomic Factors*, beginning on page 1-11, and *Social Conditions*, beginning on page 4-20, to learn more about the fast growth rates in population, employment, and housing in the Study Area). Overall population growth in the Phoenix metropolitan area has affected the pattern of land use and infrastructure needs through the growth of residential, commercial, and employment land uses (land used for office, industrial, or retail uses is referred to as *employment* land uses) and through necessary public services such as provision of police and fire protection. The areas of greatest population growth are anticipated at the fringe of the metropolitan area (for example, the town of Buckeye, the city of Peoria, and the town of Gilbert). Of the Phoenix planning areas within the Study Area, Laveen and Estrella villages are expected to have population growth rates approximately equal to those of the rapidly expanding communities on the fringes of the metropolitan area, where population is expected to increase as much as 600 percent from 2000 to 2025 (MAG 2003).

The area is primarily characterized by single-family residential and agricultural land (31 percent and 21 percent of the Study Area, respectively). Approximately 56 percent of the Study Area is developed, with residential (31 percent single-family and 2 percent multifamily), commercial (4 percent), industrial (14 percent), transportation (2 percent), or public/quasi-public land uses (3 percent). The remaining 44 percent of the Study Area consists of agricultural land (21 percent), undeveloped land (12 percent), and open space (11 percent).

Data in Table 4-2 convey that much of the Study Area in 2009 was developed. As conveyed in Figure 4-3, the most intensely developed portion of the Study Area is along Interstate 10 (I-10) (Papago Freeway). Moving south, the Study Area is characterized by less dense development. At the southwestern extent, land uses are predominantly rural agrarian. Southeast of Phoenix South Mountain Park/Preserve (SMPP), adjacent to I-10 (Maricopa Freeway), Ahwatukee Foothills Village—

Existing versus planned land use

Vacant and agricultural land is quickly being converted in the Phoenix metropolitan area (the section, *Land Development Plans*, beginning on page 4-17, describes the ongoing development activity contributing to this conversion). Of three major land use types, residential land use was predominant in 2009. As depicted in the table below, large-scale land conversion, supported by existing zoning, will continue.

Land Use	Existing (%)	Zoned (%)
Agricultural	21	12
Residential	33	51
Commercial/ Industrial	18	25

Table 4-2 Existing Land Use, by Study Area Jurisdiction

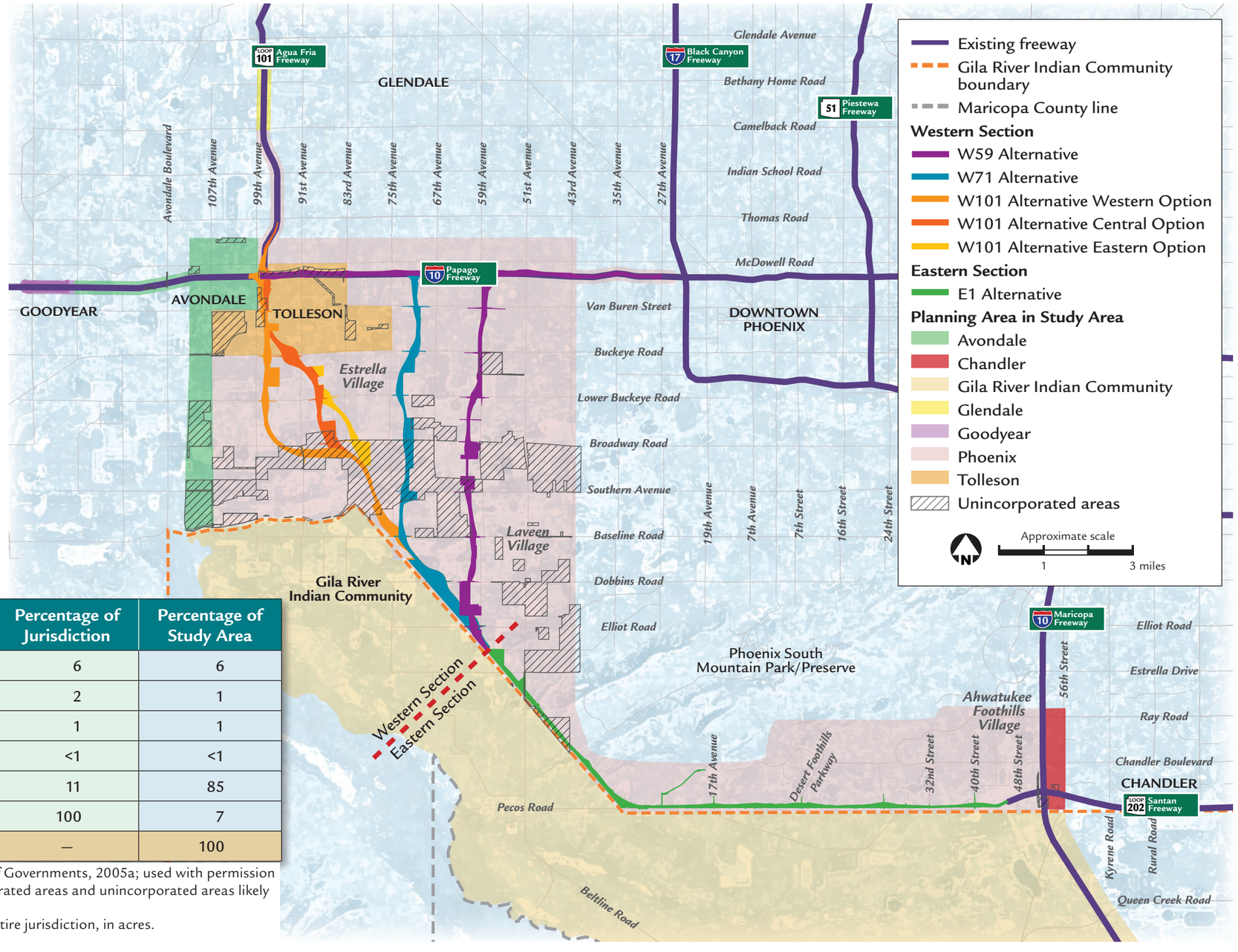
	Avondale		Chandler		Glendale		Goodyear		Phoenix		Tolleson		Study Area	
Land Use	Acreage	%[a]	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%
Agricultural	1,260	35	—[b]	—	138	46	5	3	9,567	20	976	26	11,946	21
Commercial	403	11	247	32	17	5	25	13	1,355	3	152	4	2,199	4
Industrial	73	2	298	38	—	—	—	—	6,019	12	1,521	40	7,911	14
Open Space	304	9	—	—	11	4	—	—	6,032	13	38	1	6,385	11
Public/Quasi-public	53	2	—	—	—	—	7	4	1,590	3	125	3	1,775	3
Residential (MF[c])	35	1	20	3	—	—	14	7	959	2	34	1	1,062	2
Residential (SF[d])	916	26	—	—	—	—	—	—	16,028	33	462	12	17,406	31
Transportation	210	6	113	15	94	31	64	33	749	2	148	4	1,378	2
Undeveloped	296	8	95	12	41	14	77	40	5,764	12	353	9	6,626	12
Total	3,550	100	773	100	301	100	192	100	48,063	100	3,809	100	56,688	100

[a] percentage of jurisdiction's total land use in the Study Area [b] not applicable [c] multifamily [d] single-family

The Gila River Indian Community and impacts

The Community Council has not allowed development of alternatives on Community land (Chapter 2, *Gila River Indian Community Coordination*, provides more information). The Natural Resources Standing Committee (NRSC) granted an extension of a right-of-entry permit in December 2007 for the project team to examine impacts related to construction and operation of the E1 Alternative. Therefore, impacts on the Community from the proposed action as presented in this document are based on data available to the general public and on field observation as appropriate and discussions are limited to only those areas where impacts would occur.

Figure 4-1 Jurisdictions



Land Area, by Study Area Jurisdiction

Affected Jurisdiction[a]	Acreage in Study Area	Percentage of Jurisdiction	Percentage of Study Area
Avondale (60,437)	3,550	6	6
Chandler (45,697)	773	2	1
Glendale (58,810)	301	1	1
Goodyear (96,407)	192	<1	<1
Phoenix (423,341)	48,063	11	85
Tolleson (3,809)	3,809	100	7
Study Area	56,688	—	100

Source: Maricopa Association of Governments, 2005a; used with permission

Note: A jurisdiction's planning area includes incorporated areas and unincorporated areas likely to be annexed in the future.

[a] Number in parentheses is the existing size of the entire jurisdiction, in acres.

The majority of land in the Study Area is located in incorporated municipalities. Some of the unincorporated areas may be subject to annexation.

located between Community land and SMPP—is nearly built-out with single-family residential, multifamily residential, and commercial land uses.

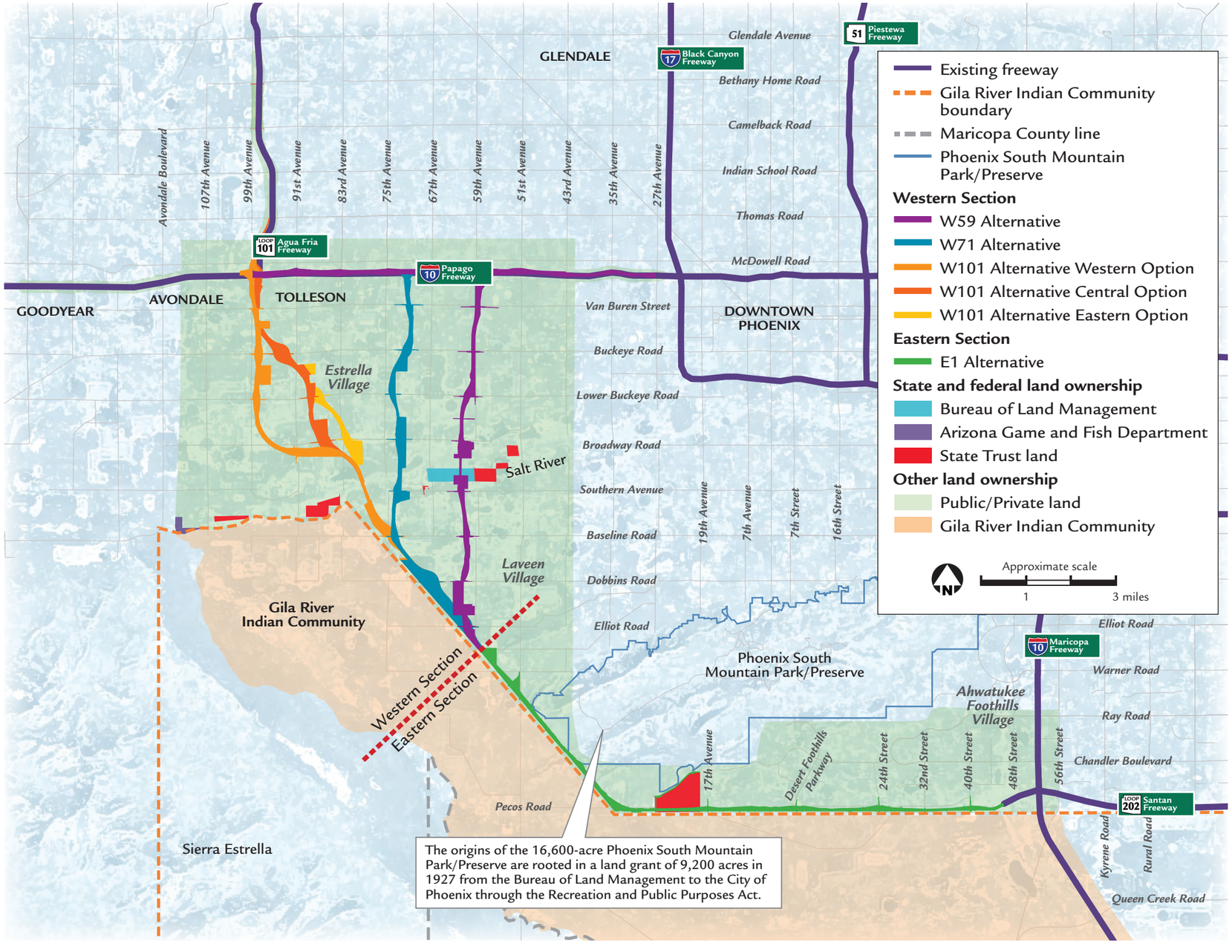
Notable land use characteristics and trends for each of the affected jurisdictions in the Study Area are:

- Avondale's rapid growth from 1990 to 2008 has influenced the city's transformation from a rural farming community with a population of just over 16,000 in 1990 to a suburban community with a population of over 76,650 in 2008 (Arizona Department of Commerce 2008). While agricultural remains Avondale's primary land use in the Study Area, the suburbanization trend will continue.
- Phoenix's Laveen Village planning area is changing, and residential subdivisions are replacing farmland. Laveen's existing population of almost 25,000 is expected to increase four-fold by 2030 (MAG 2007a).

Looking north into Estrella Village from approximately the Salt River and 63rd Avenue

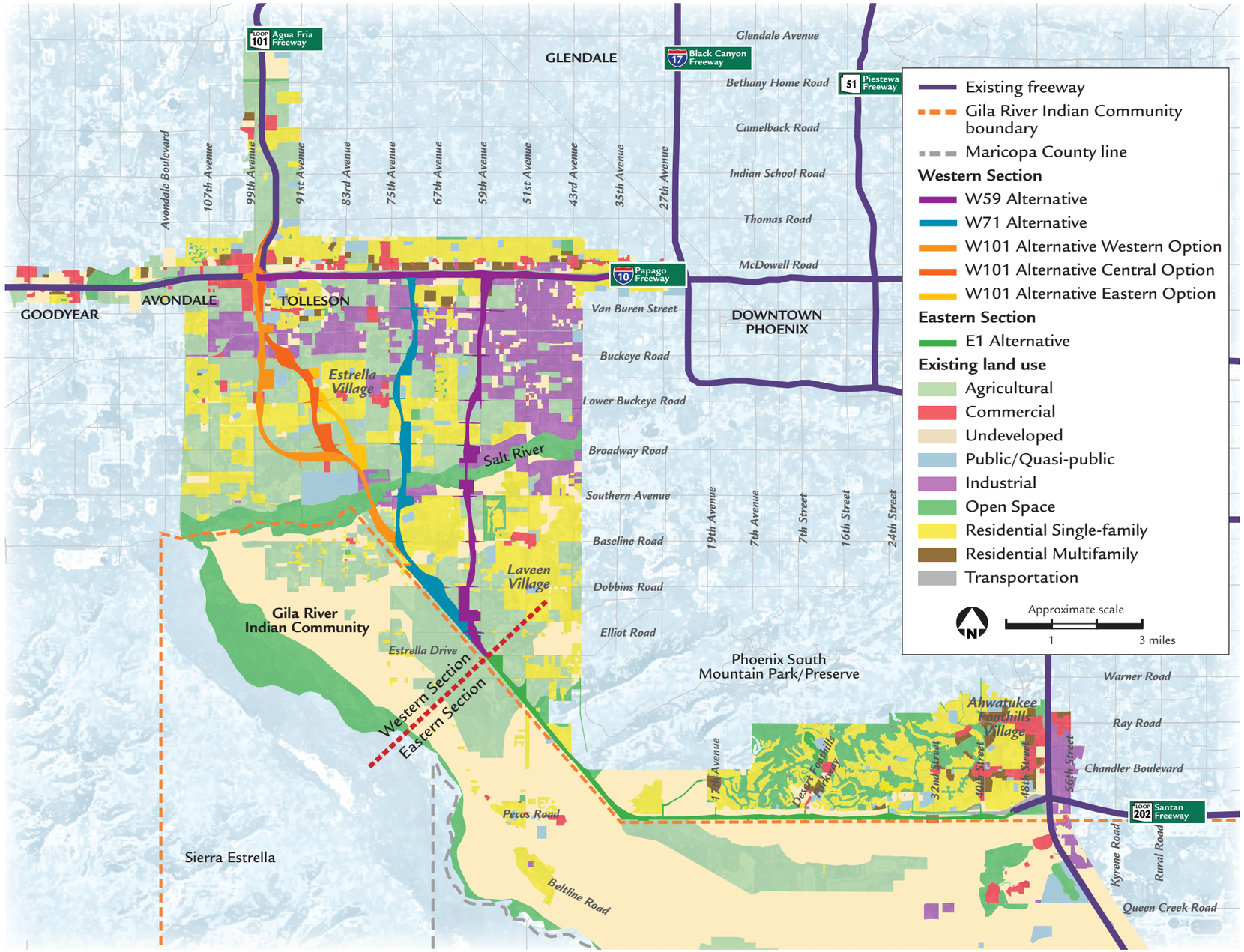
- In Phoenix's Estrella Village planning area, numerous industrial sites near the Salt River are located east of 91st Avenue. The density of industrial development increases from the Salt River to I-10. Large manufacturing and processing concerns make up the industrial land use between Buckeye Road and I-10. North of I-10, residential is the predominant land use.
- All 6 square miles of Tolleson lie completely within the Western Section of the Study Area. Originally an agricultural community, approximately

Figure 4-2 Land Ownership



The majority of land outside of the Gila River Indian Community is in private ownership.

Figure 4-3 Existing Land Uses



The agricultural uses once prevalent in the Western Section have been subject to conversion to more urban-based development.

Looking north at Laveen Village from approximately Dobbins Road and 63rd Avenue

26 percent of its land area remained in agricultural use in 2008. Tolleson's proximity to I-10 and State Route (SR) 101L have made the city a distribution hub for companies delivering products throughout the Southwest—hence the city's large amount of industrial land use (40 percent, or 1,521 acres). The city's residential district is in the center of the city, bounded by the Union Pacific Railroad (UPRR) to the south, I-10 to the north, 99th Avenue to the west, and 83rd Avenue to the east. These geographic and physical boundaries have constrained the city's residential development.

- The Eastern Section of the Study Area encompasses the Ahwatukee Foothills Village planning area. The established community is largely built-out with master-planned communities, protected open space areas, and several public schools and parks. Specific

Looking southwest into Tolleson at approximately Van Buren Street

Looking north into Ahwatukee Foothills Village at approximately Pecos Road and 36th Street

impacts to SMPP, a major recreational land use, are presented in Chapter 5, *Section 4(f) Evaluation*.

- Small portions of Chandler, Glendale, and Goodyear are within the Study Area, but effects of the proposed action on these areas would be limited.
- Versions of the proposed action most closely aligned with the W59 and E1 Alternatives have been accounted for in long-range planning by municipalities (most notably, the City of Phoenix).

Since the late 1980s, land has been set aside for the alignment. (For example, land along Pecos Road, land through SMPP, and a strip of land through a development north of Broadway Road have been left undeveloped in anticipation of the freeway project.) However, some development has been allowed to encroach into these areas.

The South Mountains as seen from the Estrella Village planning area

Most of the land potentially affected by the action alternatives is privately owned, with the exception of three parcels (one in the Eastern Section and two in the Western Section) (Table 4-3). Federal, State, and locally owned public land makes up a small portion of the Study Area (Figure 4-2, on page 4-5).

Development Plans

In March 2009, potentially affected municipalities were contacted for information on existing development plans. Nearly 144 planned developments, encompassing approximately 10,987 acres, were identified in the Study Area (see Figure 4-4). While each of these developments may be in different stages of planning, each has been approved by a municipality; the zoning each has received represents an "entitled right" to development.

Zoning

Arizona Revised Statutes (A.R.S.) § 9-462.01 allows the legislative body of any municipality to institute zoning for the purposes of conserving and promoting the public health, safety, and general welfare. Each of the jurisdictions in the Study Area has enacted zoning ordinances. The zoning ordinance is the principal tool in implementing a community's adopted general plan and defines the site plan and subdivision requirements for each land use.

To compare the amount and type of zoning, specific municipal zoning categories were grouped into eight broad zoning categories: agricultural, commercial, industrial, open space, planned area development (PAD), public/quasi-public, residential (multifamily), and residential (single-family). Table 4-4 summarizes the zoning for the Study Area, by jurisdiction.

In the Western Section, zoning north of Buckeye Road is largely industrial. South of Buckeye Road, land is zoned either to reflect the existing rural character of the landscape (Rural-43, Maricopa County's zoning designation for rural residential, with densities no greater than one dwelling unit per acre; S-1, Phoenix's Ranch or Farm Residence District, with low-density farm or residential uses to protect and preserve low-density areas in their present character) or is

Table 4-3 State and Federal Land Ownership, Study Area

Owner[a]	Acreage
Bureau of Land Management	192
Arizona Game and Fish Department	57
Arizona State Land Department	781

Source: Arizona Land Resource Information System, 2009

[a] Each acreage amount listed in this table amounts to less than 1 percent of the Study Area.

Table 4-4 Zoning, by Study Area Jurisdiction

	Avondale		Chandler		Glendale		Goodyear		Maricopa County		Phoenix		Tolleson		Study Area	
Zoning	Acreage	%[a]	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%	Acreage	%
Agricultural	143	6	—[b]	—	—	—	116	67	45	1	6,113	15	31	1	6,448	12
Commercial	43	2	5	1	16	6	10	6	23	<1	1,987	5	562	15	2,646	5
Industrial	21	1	322	50	260	91	—	—	572	7	7,797	20	2,333	61	11,305	20
Unzoned	—	—	—	—	—	—	—	—	742	9	186	1	252	7	1,180	2
Open space	—	—	—	—	—	—	—	—	—	—	173	<1	—	—	173	<1
PAD[c]	1,999	81	316	49	8	3	47	27	—	—	3,365	8	—	—	5,735	10
Public/Quasi-public	—	—	1	<1	—	—	—	—	—	—	—	—	116	3	117	<1
Residential (MF[d])	—	—	—	—	—	—	—	—	—	—	—	—	204	5	204	1
Residential (SF[e])	248	10	—	—	—	—	—	—	7,036	83	20,308	51	293	8	27,885	50
Total	2,454	100	644	100	284	100	173	100	8,418	100	39,929	100	3,791	100	55,693	100

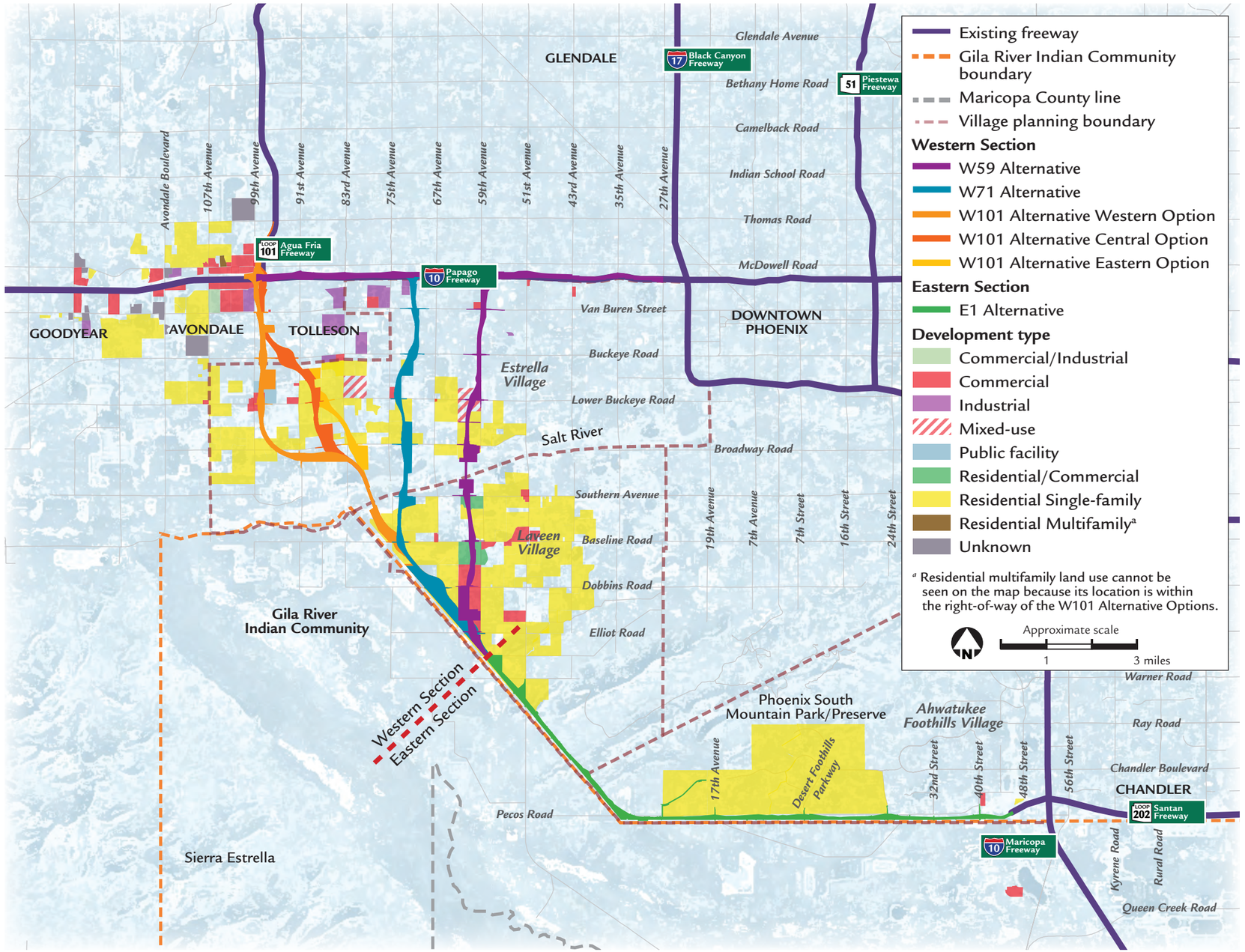
Sources: Cities of Avondale, Chandler, Glendale, Goodyear, Phoenix, and Tolleson, and Maricopa County (see Table 4-5, on page 4-9)

Note: Transportation right-of-way and other areas may not be zoned, so acreages do not equal jurisdiction's area. Information was current as of November 2009.

[a] percentage of total zoned acreage [b] not applicable [c] planned area development [d] multifamily [e] single-family

4

Figure 4-4 Planned Developments, 2009



The southwestern portion of the Phoenix metropolitan area is projected to be one of the fastest-growing areas in the state. This figure shows areas with a record of planned development by March 2009 (not areas that were already developed or had no record of a planned development by March 2009). Land in the area is typically zoned to reflect the existing rural character of the landscape or is zoned for suburban residential development in advance of anticipated development.

zoned for suburban residential development in advance of anticipated development.

Zoning in the Eastern Section west and north of SMPP is largely low-density residential (approximately one dwelling unit per acre), reflecting the rural agricultural character of this area. In Phoenix's Ahwatukee Foothills Village planning area to the east, the zoning is primarily higher-density single-family and multifamily residential and planned community district (PCD, the City of Phoenix's zoning designation that allows flexibility for planning large areas and is typically used for master-planned communities completed over several years' time). The Chandler portion of the Study Area is zoned industrial and commercial.

Land Use Plans

A general plan is an expression of long-term community intentions regarding a community's future development and physical form. A general plan commonly contains a community vision and the process necessary to make it a reality. This process is represented by maps, goals, objectives, and policies used to coordinate and implement land use decisions. In addition to transportation infrastructure, policies, impacts, and plans, other areas of the general plan address such issues as infrastructure, parks, recreation and open space, city services, housing supply and affordability, commercial and industrial locations, and public resources such as air and water. The general plan addresses each jurisdiction's planning area, which includes incorporated areas as well as unincorporated areas likely to be annexed in the future.

All of the affected municipalities in the Study Area have developed comprehensive plans or general plans in accordance with A.R.S. § 9-461. This statute calls for the creation and implementation of a general plan for each municipality in Arizona. The plans are implemented through zoning ordinances and other policies. The general and comprehensive plans assist officials and residents alike in land development issues. General and comprehensive plans are required to include maps of planned land use and circulation systems. Table 4-5 summarizes the status of general plans for all of the affected jurisdictions.

The jurisdictions with authority for land use designations in the Study Area have used approximately 50 general plan land use categories. To better understand the regional distribution of densities and intensities of land uses for the affected jurisdictions, the land use categories for each municipality have been grouped into eight broad land uses: transportation, commercial, industrial, mixed use, open space, public/quasi-public, single-family residential, and multifamily residential. Figure 4-5 shows the distribution of these land uses based on municipalities' general plans.

ENVIRONMENTAL CONSEQUENCES

This section discusses the environmental consequences of the action alternatives and No-Action Alternative by analyzing 1) the conversion of existing land uses to the proposed action and 2) the compatibility of adjacent land uses with the proposed action. Other impacts relating to land use include displacements and relocations of residential, commercial, and industrial uses; community character and cohesion impacts; visual impacts; impacts on noise levels; and air quality impacts (see the appropriate sections in Chapter 4 for detailed discussions regarding these impacts).

Land Use Conversion

The conversion of land uses resulting from the action alternatives was determined by measuring the number, type, and acreage of existing land uses within the proposed R/W. Land use conversion would occur in the cities of Avondale, Phoenix, and Tolleson. Detailed results are presented in Table 4-6 and summarized in Table 4-7 (no direct land use conversions would occur in the cities of Chandler, Glendale, or Goodyear).

The conversion acreages presented should not be considered final. Design of each action alternative, while completed to an equivalent level, is still preliminary and subject to change as designs would be further refined. This process would continue after the ROD into the final design phases for the Selected Alternative, assuming the Selected Alternative were an action alternative. Conversion of land under the No-Action Alternative would occur as land set aside for the proposed action were released from ADOT ownership and as land zoned by local jurisdictions to protect it as a transportation use were rezoned. Additionally, because much of the Western Section of the Study Area continues to be converted from primarily agricultural use to residential suburban uses, these acreages and associated percentages are subject to slight changes.

Table 4-5 Status of Affected Jurisdictions' General Plans and Plan Updates

Jurisdiction	Existing Adopted Plan (Adoption Date)	Update Status
Avondale	*Avondale General Plan 2030* (2012)	Ratified by voters on August 28, 2012
Chandler	*Chandler General Plan* (2008)	Ratified by voters on November 14, 2008
Glendale	*General Plan 2025: The Next Step* (2002)	Ratified by voters on November 5, 2002
Goodyear	*Goodyear General Plan 2003–2013* (2003)	Ratified by voters on November 4, 2003
Maricopa County	*Eye to the Future – Maricopa County Comprehensive Plan* (1997)	Updated to conform with State law
Phoenix	*Phoenix General Plan* (2001)	Ratified by voters on March 12, 2002
Tolleson	*Tolleson General Plan* (2005)	Ratified by voters on December 13, 2005

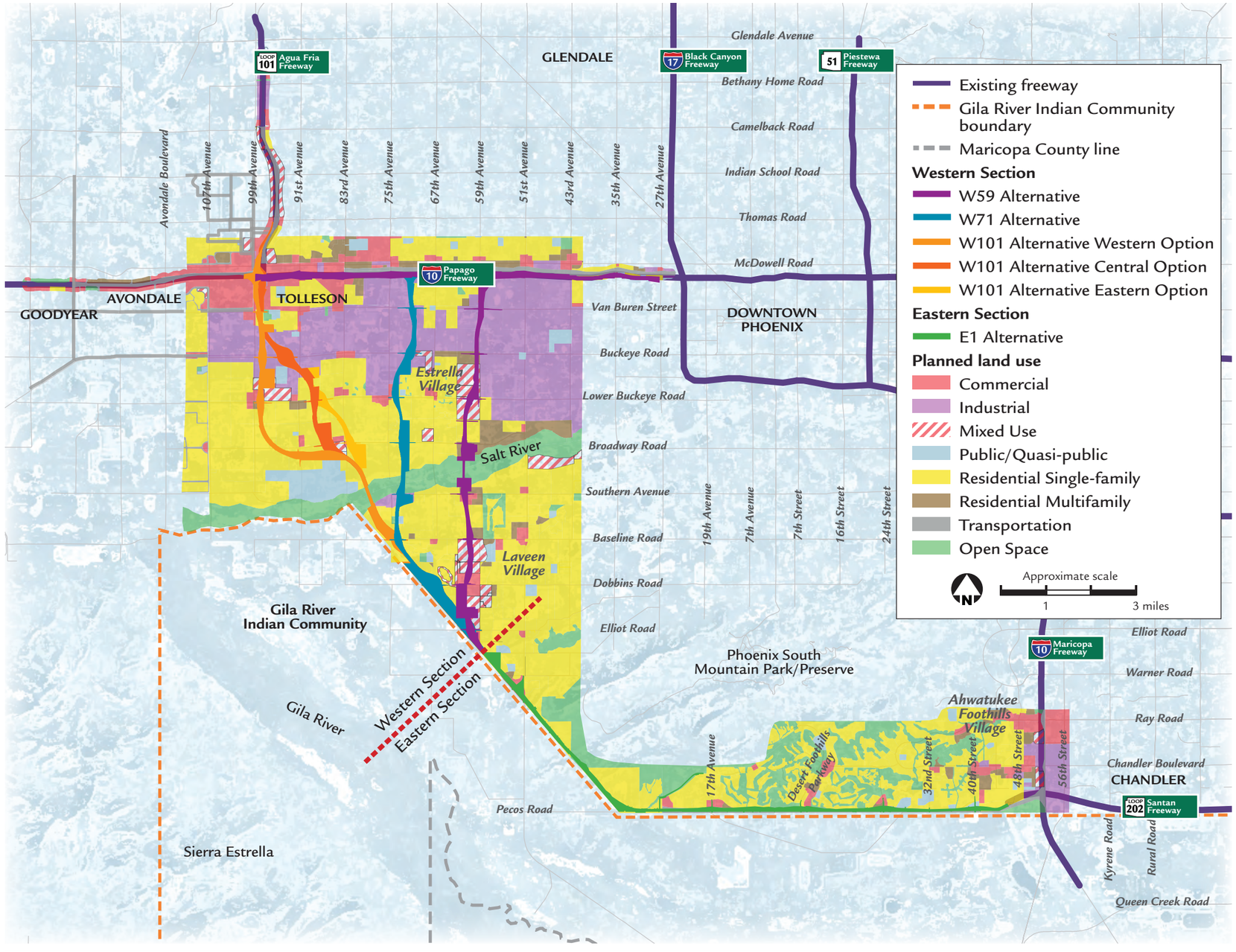
Action Alternatives, Western Section

All of the W101 Alternative Options would convert the most land because they are longer alignments than are the W59 (Preferred) and W71 Alternatives. Action alternatives contributing to the largest amount of land conversion would be those—such as the W101 Alternative—having the greatest amount of land in agricultural use in 2009. As previously noted, much of this land is undergoing rapid conversion to residential and commercial uses as planned by the local municipalities. The W71 Alternative would convert the greatest amount of industrial land. The W59 and W101 Alternatives would involve a lesser impact on industrial land.

Action Alternative, Eastern Section

Of the land uses in the Eastern Section, agricultural and undeveloped land would be subject to the most conversion. This is primarily a function of the E1 (Preferred) Alternative being located along the Pecos Road alignment and through SMPP, where previous versions of the proposed action have been accommodated

Figure 4-5 General Plan Land Use Designations



Growth trends in the southwestern portion of the Phoenix metropolitan area are supported by general plan land use designations.

in long-range planning by local municipalities [most notably, the City of Phoenix; see Chapter 5, *Section 4(f) Evaluation*, regarding the Phoenix Mountain Preserve Act]. Efforts were made to preserve the corridor by preventing development from occurring. Residential and public/quasi-public land uses have, however, encroached onto the corridor originally intended to be preserved for a future freeway (see text box on pages 4-12 and 4-13 regarding freeway awareness and related topics).

No-Action Alternative

The No-Action Alternative is assumed to include *Regional Transportation Plan* (RTP)-related improvements (e.g., arterial street widening, SR 30, Avenida Rio Salado [ARS]) and normal maintenance and minor improvements to the transportation system. No major project-related influences on land use in the Study Area would occur and no land would be acquired for R/W purposes. Existing residential land use patterns and trends would be maintained. Other existing trends and economic forces may, however, exert some influence for change. Freeway conditions in 2035 would be substantially worse than the limited areas of stop-and-go driving experienced in 2012. The existing freeways and arterial streets will not operate efficiently with the population, housing, and employment increases forecast for 2035. Combined, these increases will translate into higher demand for use of the existing freeway and arterial street systems. This increase in demand correlates to a need for 55 additional lanes of arterial street capacity in the Study Area. Without the proposed action, the region will suffer even greater congestion, travel delays, and limited options for moving people and goods safely through the Phoenix metropolitan area (see the section, *Historical Context of the Proposed Action*, beginning on page 1-5). Implications of identification of the No-Action Alternative as the Selected Alternative related to the system linkage with the proposed SR 30 and ARS projects are discussed on page 3-35. The No-Action Alternative would not preclude future attempts to construct a project similar to the proposed action at some future time.

Table 4-6 Existing Land Uses within Proposed Right-of-way, Action Alternatives

Land Use	Total Acreage in Study Area	Alternatives					
		Western Section					Eastern Section
		W59	W71	W101 Western Option	W101 Central Option	W101 Eastern Option	E1
		Acreage	Acreage	Acreage	Acreage	Acreage	Acreage
Avondale							
Agricultural	1,260	—[a]	—	—	—	—	—
Commercial	403	—	—	0–4	0–4	0–4	—
Industrial	73	—	—	—	—	—	—
Open space	304	—	—	—	—	—	—
Public/Quasi-public	53	—	—	—	—	—	—
Residential (MF[b])	35	—	—	—	—	—	—
Residential (SF[c])	916	—	—	—	—	—	—
Transportation	210	—	—	0–12	0–12	0–12	—
Undeveloped	296	—	—	—	—	—	—
Avondale subtotal	**3,550**	**—**	**—**	**0–16**	**0–16**	**0–16**	**—**
Phoenix							
Agricultural	9,567	548	535	612–618	469–476	495–502	163
Commercial	1,355	8	1	26–27	0–1	0–1	1
Industrial	6,019	157	181	25	25	25	10
Open space	6,032	40	20	21–22	23–24	23–24	92
Public/Quasi-public	1,590	1	1	—	—	—	12
Residential (MF)	959	20	—	—	—	—	—
Residential (SF)	16,028	42	277	291	386–387	351	104
Transportation	749	1	1	0–3	0–3	0–3	39
Undeveloped	5,764	118	45	106–107	118–121	143–145	462
Phoenix subtotal	**48,063**	**935**	**1,061**	**1,084–1,090**	**1,026–1,032**	**1,041–1,047**	**883**
Tolleson							
Agricultural	976	—	—	67–81	85–99	85–99	—
Commercial	152	—	—	0–1	0–1	0–1	—
Industrial	1,521	—	—	100–107	80–87	80–87	—
Open space	38	—	—	—	—	—	—
Public/Quasi-public	125	—	—	0–1	1	1	—
Residential (MF)	34	—	—	—	—	—	—
Residential (SF)	462	—	—	—	—	—	—
Transportation	148	—	—	23–27	23–27	23–27	—
Undeveloped	353	—	—	6–15	43–52	43–52	—
Tolleson subtotal	**3,809**	**—**	**—**	**207–221**	**242–257**	**242–257**	**—**
Total		**935**	**1,061**	**1,307–1,311**	**1,284–1,289**	**1,299–1,304**	**883**

Source: Arizona Department of Transportation aerial photography (2009, 2010); land use designations as of September 2009

Note: W101 Alternative and Options include ranges because of design options; subtotals don't equal a simple summing of the land use acreages because the Partial and Full Reconstruction Options would affect land uses differently.

[a] not applicable [b] multifamily [c] single-family

Impacts in the context of the proposed action

Points to be considered regarding impacts presented in this chapter:

- The screening process undertaken (see the section, *Alternatives Development and Screening*, beginning on page 3-1) eliminated action alternatives from further study because of, in part, undesirable impacts on the natural and built environments. As an indirect result, the action alternatives discussed in this chapter represent actions to avoid, reduce, or otherwise mitigate impacts on the environment. By this measure, the magnitude of impacts presented in this chapter has been, to some degree, already reduced through the screening process.
- Some design features to reduce impacts have already been incorporated into the action alternatives presented in this chapter. For example, R/W needs of the E1 Alternative through SMPP have been minimized to reduce land use conversion impacts.
- *Impacts*, by definition, have a negative connotation and often are implicitly associated with having adverse effects. Projects like the proposed action, however, can also provide benefits for the environment. Where appropriate, benefits that would result from the proposed action are presented.

Freeway Awareness

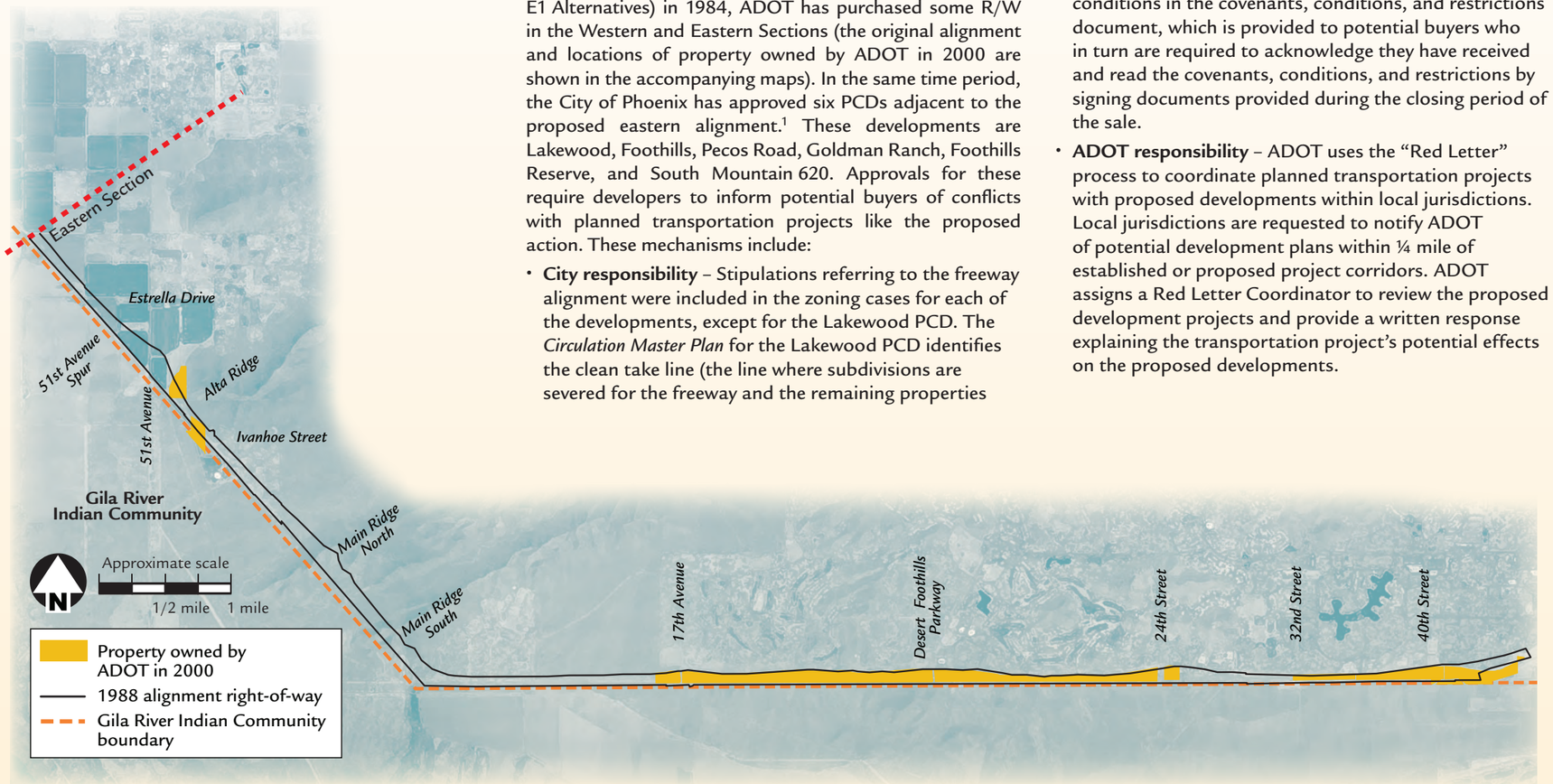
History of South Mountain Freeway Disclosure

Author	Year	Document	Reference
City of Phoenix	1980	*Annexation Implications in the Area South of South Mountain Park*	Map 5: Proposed *Street Plan for Planning Area B* includes proposed action
MAG[a]	1985	*Central Area Transportation Study*	Recommends adding reference to a freeway along 59th Avenue and Pecos Road to the *Transportation System Plan*
MAG	1985	*Regional Transportation Plan*	Proposes alignment along 55th Avenue[b] and Pecos Road
MAG	1985	*Long-Range Transportation Plan*	Proposes alignment along 55th Avenue[b] and Pecos Road
City of Phoenix	1985	*General Plan*	*General Plan* map includes proposed action
City of Phoenix	1985	Letter from City of Phoenix to Continental Homes regarding the Lakewood PCD[c]	Discloses the proposed freeway designation along Pecos Road and recommends R/W[d] widths
City of Phoenix	1985	Lakewood Development Zoning Case No. Z-301-84	*Lakewood PCD Circulation Master Pl*an shows "clean take line" (see next page) for the proposed freeway along Pecos Road
ADOT[e]	1988	*Southwest Loop Highway (SR 218) Final Environmental Assessment*	Alignment to begin approximately ½ mile east of the I-10[f] (Papago Freeway)/59th Avenue traffic interchange, go southwest to cross 59th Avenue south of Buckeye Road, continue south to the Community[g] boundary, and continue east along the northern side of the boundary to I-10 (Maricopa Freeway)
ADOT	1988	State Transportation Board Approval	Approves alignment running along Pecos Road and turning north to connect to I-10 (Papago Freeway) near 55th Avenue
ADOT	1989	ADOT Status Report MAG Freeway/Expressway System	Proposes alignment along 55th Avenue[b] and Pecos Road
City of Phoenix	1989	Goldman Ranch Development Zoning Case No. Z-5-89-8	Includes one stipulation requiring the developer to add a clean take line for the future proposed action
City of Phoenix	1993	State Land 620 Zoning Case No. Z-87-92-6	Includes one stipulation requiring the developer to coordinate completion of Pecos Road with the proposed action
City of Phoenix	1993	Foothills Reserve Zoning Case No. Z-77-93-6	Includes one stipulation requiring the developer to include a clean take line for the future proposed action
City of Phoenix	1993	Foothills Development Zoning Case No. Z-289-84	Includes one stipulation requiring the developer to add future freeway R/W and easements on *Master Street Plan*
MAG	1995	*Long-Range Transportation Plan Summary* and *1995 Update*	Proposes alignment along 55th Avenue[b] and Pecos Road
City of Phoenix	1997	Pecos Road Development Zoning Case No. Z-8-83	Includes three stipulations requiring the developer to revise plans based on the proposed freeway R/W
MAG	1999	*Long-Range Transportation Plan*	Proposes alignment along 55th Avenue[b] and Pecos Road
MAG	2000	*Long-Range Transportation Plan Summary* and *2000 Update*	Proposes alignment along 55th Avenue[b] and Pecos Road
FHWA[h]	2001	Notice of Intent, *Federal Register* Volume 66, Number 77	Proposed project would involve construction of a new multilane freeway extending approximately 25 miles from I-10 west of Phoenix to I-10 southeast of Phoenix to form a southwest loop
MAG	2003	*Regional Transportation Plan*	Proposes alignment along 55th Avenue[b] and Pecos Road
MAG	2005	*Regional Transportation Plan 2004* and *Draft 2005 Update*	Proposes alignment along 55th Avenue[b] and Pecos Road

[a] Maricopa Association of Governments [b] alignment most similar to the W59 Alternative [c] planned community district [d] right-of-way
[e] Arizona Department of Transportation [f] Interstate 10 [g] Gila River Indian Community [h] Federal Highway Administration

Freeway Awareness (continued)

Phoenix first documented a future major transportation facility to serve the southwestern part of the city in a 1980 planning report, *Annexation Implications in the Area South of South Mountain Park*. The City recommended constructing a six-lane freeway interchange on Pecos Road and a six-lane street from I-10 (Maricopa Freeway) west on Pecos Road and continuing northwest to 51st Avenue (City of Phoenix 1980). In 1985, MAG modified the proposal by proposing a future six-lane freeway on a similar alignment (instead of the six-lane street). The MAG proposal was included in the 1985 *Long-Range Transportation Plan* (LRTP), and the evolved South Mountain Freeway has been included in adopted long-range plans ever since.



With the Study Area subject to continued land development projects, the proposed action would require acquisition of developed properties and relocation of property owners for R/W where there was once mostly vacant land. Public comments received from potentially affected property owners as part of the environmental impact statement (EIS) process suggest the City, land developers, and ADOT did not disclose the future freeway project. Review of previously published ADOT, City, MAG, and developer documents confirms freeway project and alignment disclosure has occurred since 1980, when the Study Area was still primarily vacant land (see accompanying table).

Since original adoption of the South Mountain Freeway alignment (an alignment similar to the W59 and E1 Alternatives) in 1984, ADOT has purchased some R/W in the Western and Eastern Sections (the original alignment and locations of property owned by ADOT in 2000 are shown in the accompanying maps). In the same time period, the City of Phoenix has approved six PCDs adjacent to the proposed eastern alignment.[1] These developments are Lakewood, Foothills, Pecos Road, Goldman Ranch, Foothills Reserve, and South Mountain 620. Approvals for these require developers to inform potential buyers of conflicts with planned transportation projects like the proposed action. These mechanisms include:

- **City responsibility** – Stipulations referring to the freeway alignment were included in the zoning cases for each of the developments, except for the Lakewood PCD. The *Circulation Master Plan* for the Lakewood PCD identifies the clean take line (the line where subdivisions are severed for the freeway and the remaining properties continue to function as intended) for the future freeway. The City makes available a published media guide disclosing the freeway awareness stipulations or plan reference for each PCD.
- **Developer responsibility** – Arizona real estate law requires developers to disclose adverse conditions such as construction of a future freeway in a public document [5 Arizona Administrative Register § 650, R4-28-A1203]. Additionally, Arizona State Law states that subsequent purchasers have the right to "receive a copy of the public report and any contract, agreement or lease which fails to make disclosures . . . shall not be enforceable against the purchaser" (5 Arizona Administrative Register § 650, 32-2185.06). Developers typically disclose adverse conditions in the covenants, conditions, and restrictions document, which is provided to potential buyers who in turn are required to acknowledge they have received and read the covenants, conditions, and restrictions by signing documents provided during the closing period of the sale.
- **ADOT responsibility** – ADOT uses the "Red Letter" process to coordinate planned transportation projects with proposed developments within local jurisdictions. Local jurisdictions are requested to notify ADOT of potential development plans within ¼ mile of established or proposed project corridors. ADOT assigns a Red Letter Coordinator to review the proposed development projects and provide a written response explaining the transportation project's potential effects on the proposed developments.

[1] see endnotes, beginning on page 4-179

Table 4-7 Land Use Conversion Acreage

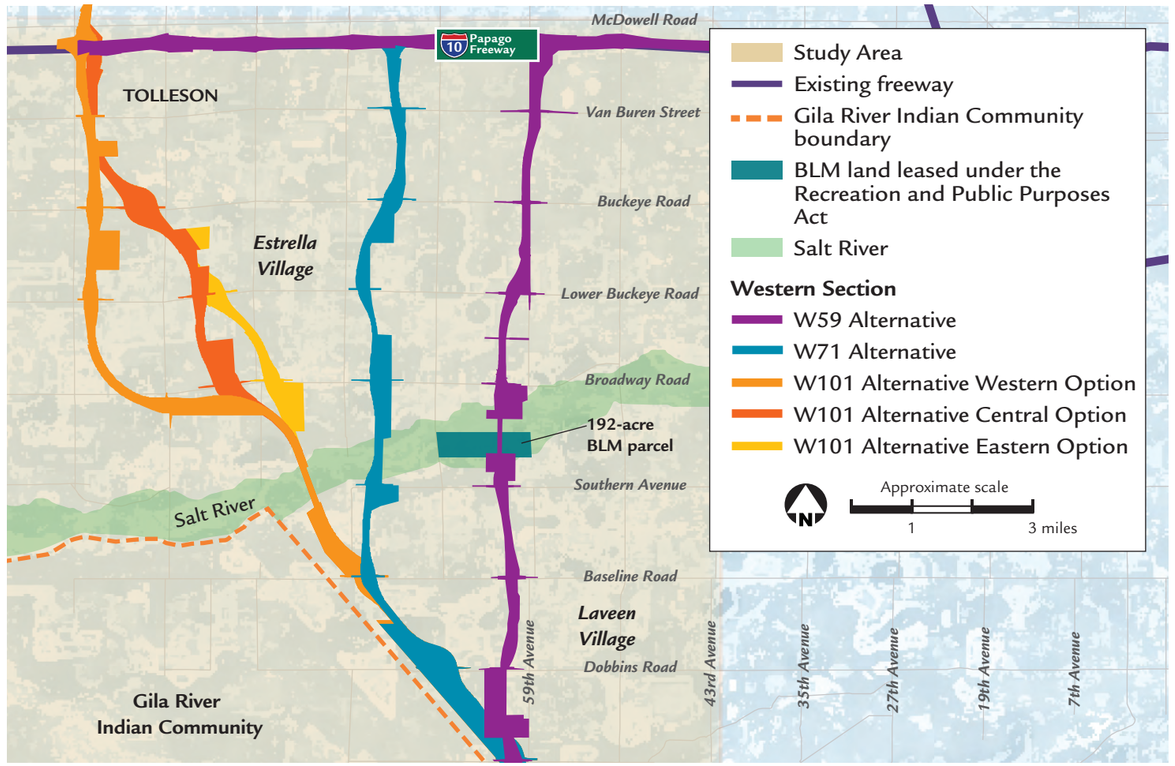
Land Use	Western Section			Eastern Section
	W59	W71	W101	E1
Agricultural	548[a]	535	554–699	163
Residential[b]	62	277	291–387	104
Commercial/Industrial	165	182	111–158	11
Open space/Undeveloped	158	65	129–221	554
Public/Quasi-public	1	1	0–1	12

Note: W101 Alternative and Options include ranges because of design options.
[a] in acres [b] includes multifamily and single-family residential

In the recent past, rapid development has occurred through much of the Western Section of the Study Area. The Laveen Village area alone is anticipated to have a built-out population of over 105,000. This development places increasing demand on the street network. The Phoenix *General Plan* for Laveen Village has designated areas for commercial development that cannot support the projected densities without implementation of the proposed action. The Salt and Gila rivers interrupt the street network in the Study Area, creating a discontinuous grid that limits east–west and north–south mobility. Maricopa County added more people between 2000 and 2006 than did any other county in the nation. In the 15 years from 1990 to 2005, the county's population grew by nearly 92 percent (U.S. Census Bureau 2007). Without the proposed action, the conversion of land from undeveloped and agricultural uses to residential, commercial, and industrial land uses would likely continue, placing a greater demand on the surface streets.

ADOT has preserved portions of the proposed R/W that could be applied to the E1 Alternative as a result of earlier studies and through strategic purchases to forestall development in anticipation of the construction of a transportation facility. If the No-Action Alternative were identified as the Selected Alternative, these parcels could be released, either through sale or other means, for future development. In such an instance, the existing zoning or the jurisdictions' general plans would provide guidance for future land uses on these properties.

Figure 4-6 Land Leased for Rio Salado Oeste Restoration Project from Bureau of Land Management



Land under Bureau of Land Management (BLM) ownership has been conveyed through a lease agreement and the Recreation and Public Purposes Act to the City of Phoenix to support the eventual development of the Rio Salado Oeste restoration project of the Salt River riverbed.

Public Lands

Action Alternatives, Western Section

The W59 (Preferred) Alternative would cross the Salt River through the eastern half of a 192-acre Bureau of Land Management (BLM) parcel (Figure 4-6). Piers for the proposed freeway bridge structure would be constructed within the BLM parcel area. The BLM parcel includes a number of easements and R/W, including R/W for ditches and canals constructed by the authority of the Bureau of Reclamation (Reclamation), rights for a 12-inch water pipeline granted to the City of Phoenix, and a 150-foot-wide road easement granted to the Maricopa County Department of Transportation (MCDOT). In addition, the City of Phoenix has a lease on this parcel under the provisions of the Recreation and Public Purposes Act for inclusion in the proposed Rio Salado Oeste project, a flood control and habitat restoration project cosponsored by the U.S. Army Corps of Engineers (USACE) (see text box on page 4-125). ADOT, FHWA, the City of Phoenix, BLM, and USACE would have to determine how to appropriate a portion of the land leased to the City for a federally funded transportation use. This situation would pertain only to the W59 Alternative, not the W71 Alternative or W101 Alternative and Options.

FHWA and ADOT met with the City of Phoenix and BLM on July 11, 2005 to discuss the lease and the build alternative that would pass through the leased property (the W55 Alternative—now the W59 Alternative).

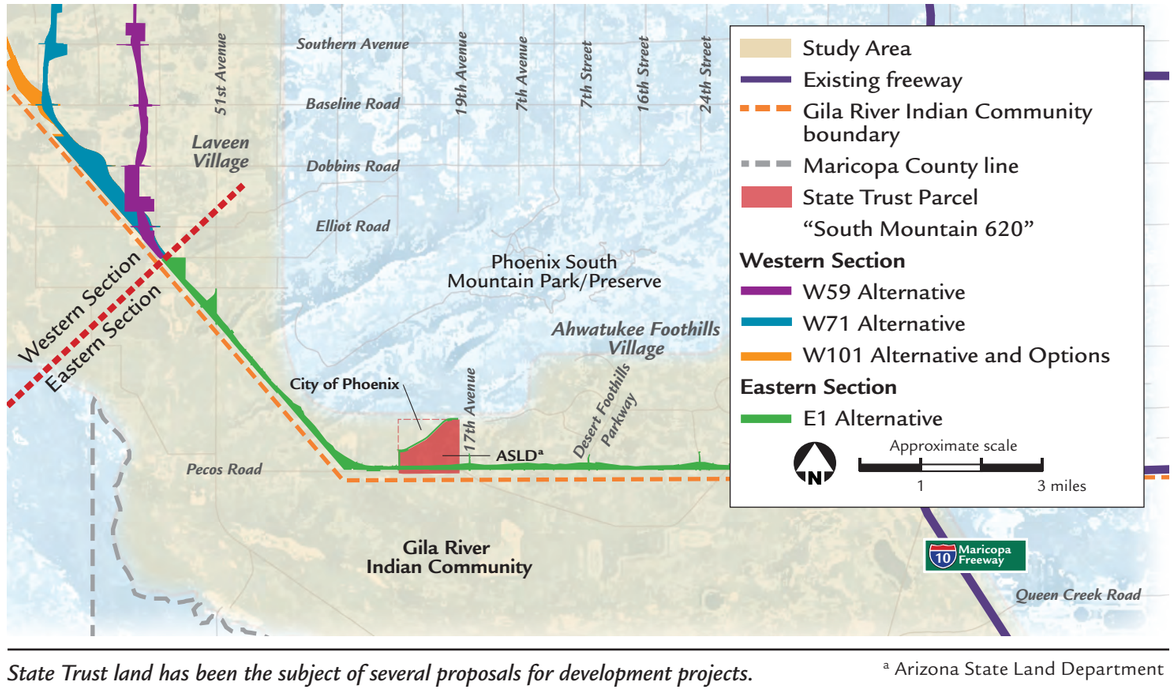
The City of Phoenix (lessee) was aware of, planned for, and had incorporated the proposed South Mountain Freeway in the City of Phoenix General Plan and in the conceptual plans for the Rio Salado Oeste project (see Project Features Map in Appendix 4-6). It was further agreed that although the lease did not include a reference to the proposed freeway, the BLM (lesser) would support working in concert with the City of Phoenix to take the steps necessary to amend the lease in a manner that would allow the proposed freeway to pass through the property, if the W55 Alternative (currently the W59 Alternative) were identified as the selected alternative in the EIS and ROD. Both parties concurred with this approach in August 2005 (see Appendix 1-1). The study team would continue to consult with BLM, USACE, and the City of Phoenix to coordinate design efforts to minimize impacts on the proposed uses of this land.

According to the USACE, the Rio Salado Oeste project lacks funding to proceed. As a result, the proposed construction of the South Mountain Freeway in this area would precede the habitat restoration project. Although traffic noise could impact some species, any wildlife that would inhabit the area after habitat improvements would experience the freeway as an existing condition and become habituated to traffic noise. The City of Phoenix and USACE view the South Mountain Freeway crossing as an opportunity to direct stormwater runoff from the proposed freeway to "irrigate" the river habitat.

Action Alternative, Eastern Section

Within the city of Phoenix, the E1 (Preferred) Alternative would cross the southern end of a section of land owned by the Arizona State Trust and referred to as South Mountain 620 (Figure 4-7). The City of Phoenix purchased the northern 247 acres in 2009 for expansion of SMPP, including a trailhead, active parkland, and public facilities. The parcel is zoned PCD, and the development plans proposed for the parcel have been consistent with single-family residential development occurring in the city to the east and west. Five easements for public utilities with the City of Phoenix and Salt River Project (SRP) pass through the parcel. ADOT would have to coordinate with the Arizona State Land Department (ASLD) for the conversion of State land to a transportation use.

Figure 4-7 State Trust Land, Eastern Section



State Trust land has been the subject of several proposals for development projects.

[a] Arizona State Land Department

The E1 Alternative would cross the western edge of SMPP. The land is owned by the City of Phoenix through a land grant provided to the City under the provisions of the Recreation and Public Purposes Act. Chapter 5, *Section 4(f) Evaluation*, further addresses the impacts and actions needed to reduce impacts from the E1 Alternative crossing the western edge of SMPP.

No-Action Alternative

The No-Action Alternative would have no adverse effect on public land ownership in the Study Area. If a freeway were not built along the E1 Alternative, other uses of land through the southern portion of South Mountain 620, which was identified for potential use by a freeway, may occur. If a freeway were not built, this parcel may still undergo conversion because the property is zoned for residential and neighborhood commercial development.

Land Use Compatibility

Land use impacts caused by all the action alternatives may extend beyond the proposed R/W and would include issues of access, community cohesion, economics, air quality, noise, cultural resources, visual impacts, and farmlands. These land use-related impacts are discussed in the sections, *Social Conditions, Economic Impacts, Air Quality, Noise, Cultural Resources, Visual Resources,* and *Prime and Unique Farmlands,* found elsewhere in this chapter.

The compatibility of land uses with the action alternatives and the No-Action Alternative was assessed by considering land uses within a ¼-mile buffer of the action alternatives' proposed R/W. The compatibility of a major transportation facility with existing land uses may have positive and negative consequences. Factors affecting land use compatibility of the proposed action would be:

- **Agricultural uses** – generally incompatible because the action alternatives:
  - would hasten planned conversion to urban uses (residential, industrial, or commercial land uses) as a result of the improved access (this issue is addressed in the section, *Secondary and Cumulative Impacts*, beginning on page 4-167)

Agricultural is a predominant land use in the Study Area, but that status is changing.

- may fragment agricultural parcels, making the parcels unsuitable for agriculture

➤ **Regional and community commercial uses** – generally perceived as compatible because the action alternatives:
- would improve access and exposure to a larger market with likely benefits from proximity to a freeway corridor
- may not require substantial mitigation (e.g., noise barriers) and can provide a buffer between a major transportation corridor and less intensive uses and/or more sensitive uses, such as multifamily and single-family residential

➤ **Neighborhood commercial uses** – generally perceived as incompatible because the action alternatives may divide service areas, potentially resulting in limited local access and negatively affecting the market share necessary for their sustainability. Generally, neighborhood businesses rely on a local customer base; however, the proposed action may provide additional access to some neighborhood businesses.

➤ **Industrial uses** – generally perceived as compatible because the action alternatives:
- would improve access to regional transportation routes as primary factors necessary for industry; the Study Area and its surroundings are characterized by a large amount of industrial development (see text box on page 3-64 regarding the Phoenix metropolitan area as a major distribution hub)
- may not require substantial mitigation (e.g., noise barriers) and can provide a suitable buffer between a major transportation corridor and less intensive uses such as commercial and residential development

➤ **Open space uses** – near a transportation corridor may or may not be compatible; the degree of compatibility depends on a number of factors, including the scale and purpose of the facility:
- Open space generally is perceived as not compatible because the action alternatives:
  - —may adversely affect open space set aside for habitat preservation if they were to provide unwanted access to the open space area or if noise from the facility were to disturb wildlife
  - —may fragment an open space area and make the area a less suitable habitat for plants and animals
  - —may limit direct access to the open space serving a local community
- Open space generally is perceived as compatible because the action alternatives:
  - —would beneficially enhance access to a regional park
  - —may be buffered from incompatible uses such as residential development by the open space
  - —may effectively limit access to a sensitive open space area, to the area's benefit

➤ **Public/Quasi-public uses** – near a transportation corridor may or may not be compatible and largely depend on the type of use:
- Public/Quasi-public uses generally are perceived as compatible because the action alternatives:
  - —would provide enhanced access to regional facilities such as colleges and special event venues
  - —may provide enhanced access to emergency response services
- Public/Quasi-public uses generally are perceived as not compatible because the action alternatives:
  - —may introduce undesirable noise or other secondary impacts on outdoor amphitheaters or other outside venues
  - —may bisect service areas for facilities (e.g., churches, schools) serving local communities and, therefore, limit user access

➤ **Multifamily residential uses** – while generally not perceived as compatible, a transportation corridor may be compatible because the action alternatives:
- help to mitigate the effect of increased land use intensity and increased traffic generated (when compared with single-family residential uses) by facilitating access to the regional freeway system, thereby improving residents' mobility and alleviating congestion on the local street network
- may require less mitigation for noise, air quality, and visual intrusion because of fewer exterior walls per dwelling unit in a multifamily development than in a single-family residential development

➤ **Single-family residential uses** – generally not compatible with transportation corridors because the action alternatives:
- would introduce visual, air quality, noise, and other intensive impacts on a comparatively sensitive land use
- may isolate portions of planned communities, limiting access to infrastructure and services
- would, however, provide easy access to the regional freeway system for commuting purposes (for those residing close to a freeway)

➤ **Undeveloped land** – near a transportation corridor may or may not be compatible and would largely depend on the type of use. Regarding the Study Area, undeveloped land is generally privately owned; compatibility would be a function of its planned land use, determined by zoning and the jurisdiction's adopted general plan.

Following these guidelines, the W59 Alternative would generally be the most compatible with existing land uses in the Western Section, although it would affect two apartment complexes and single-family residences as a result of R/W requirements for the system traffic interchange with I-10 (Papago Freeway). The W71 and W101 Alternatives would traverse larger areas of existing, developing, and planned residential development than would the W59 Alternative and would present greater areas of incompatible land use.

In the Eastern Section, the E1 Alternative would pass through both largely undeveloped land and open space along an alignment planned since the late 1980s in its western end, and through an area of intense urban/suburban residential development in its eastern end. While its compatibility would be subject to the scale and purposes of

the open space (SMPP) and the undeveloped land (either set aside for a transportation corridor or for residential development), the E1 Alternative through the western areas generally would be incompatible. While some benefits would be derived (e.g., ability to control access to open space), adverse effects would outweigh those beneficial effects because the action alternative would introduce an intensive use into an otherwise passive setting.

The E1 Alternative would also be adjacent to largely residential areas of Ahwatukee Foothills Village (to the north) and agricultural land to the south, on Community land. While a freeway has been planned in this location for many years, it is recognized that the intensive transportation use would generally be incompatible with residential uses. Recently approved planned development for commercial uses on Community land adjacent to the E1 Alternative suggests the Community anticipates the construction of the proposed action immediately adjacent to Community land.

Land use compatibility impacts caused by the No-Action Alternative are incorporated by reference to the section, *Land Use Conversion*, beginning on page 4-9. In addition, the compatibility of land uses in the Study Area would be a function of planned land use as determined by zoning, the jurisdictions' adopted general plans, and the land development approval processes as established by those jurisdictions.

Land Development Plans

The proposed action may affect implementation of the 144 planned developments previously referenced. The effects of implementation of the action alternatives on development plans could include:

- converting portions of the development to project-related uses
- fragmenting land uses, rendering portions unsuitable for their approved purpose
- locating incompatible land uses adjacent to the action alternative
- disrupting local road networks and affecting access

Table 4-8 Planned Developments Potentially Affected by Action Alternatives

Status	Western Section					Eastern Section
	W59	W71	W101 Western Option	W101 Central Option	W101 Eastern Option	E1
Active[a]	0	4	3–4	4–5	5–6	0
Planned	11	5	8	4	4	2
Total	11	9	11–12	8–9	9–10	2

Sources: Cities of Avondale, Glendale, Goodyear, Phoenix, and Tolleson

Note: W101 Alternative and Options include ranges because of design options.
[a] Active developments are projects under construction as of February 1, 2008.

Of the action alternatives in the Western Section (Table 4-8), the W101 Alternative Western Option would potentially affect the greatest number of developments (11–12). The 8–9 developments potentially affected by the W101 Alternative Central Option would be the least of all action alternatives.

To provide a detailed assessment of impacts on these planned developments is premature because of the dynamic nature of development site plans up until the time of construction. Where possible, ADOT has been working with developers to apprise them of the proposed project. In some cases, impacts have been assessed based on available development plans. For example, impacts on planned housing were assessed using the zoned number of residences in the development.

In the Eastern Section, the E1 Alternative would affect two planned developments. The low number reflects the fact that a large portion of the action alternative would pass through open space and already-developed lands.

The No-Action Alternative would affect planned developments in the vicinity of the W59 and E1 Alternatives. These developments were planned with the assumption of a freeway adjacent to the development. Many factors play into the planning and locating of major land development projects (e.g., subdivisions, planned communities, commercial centers). The relationship of the planned project to the location of a major transportation facility would be a factor. In some instances, the development would be purposely planned away from the transportation facility (e.g., a planned community) to ensure that the proposed freeway would not bisect it. In other instances, the development may be located adjacent to or immediately around the proposed freeway. The development plan for the approximately 480 acres in the Laveen Village urban core is one such example. This area is planned for the "Laveen Core," a mixed-use commercial development, based on proximity to the freeway alignment shown on the City of Phoenix's adopted *General Plan* land use map.

Zoning

Comparison of agriculturally zoned land (Table 4-4 on page 4-7) with existing agricultural land uses (Table 4-2 on page 4-3) illustrates that much of the zoning necessary to convert agricultural and undeveloped land to more urbanized uses has already been put in place (see sidebar on page 4-3). Industrial land uses account for approximately 7,911 acres of existing land use in the Study Area, whereas industrial zoning for the Study Area accounts for a total of 11,305 acres. While the development of urbanized uses may be hastened by implementation of an action alternative, review of the in-place zoning indicates that the process of conversion is already underway (see the section, *Historical Context of the Proposed Action*, beginning on page 1-5, to learn more about factors affecting regional growth).

Would the location of the proposed action affect the RTP?

Public comments have been received suggesting the selection of any location other than near the W59 Alternative alignment (or the selection of the No-Action Alternative) would require modifications to the RTP. The RTP included an alignment for the South Mountain Freeway that closely followed the W59 Alternative. A footnote to Figure 1-2, on page 1-6, indicates that the EIS/design concept report (DCR) study process is underway and is considering multiple location options. If any major modifications to the RTP are necessary because of the findings of the study process, MAG would need to follow the process outlined in A.R.S. § 28-6353.

The No-Action Alternative would not affect existing zoning, except in the instance of planned development where zoning is in place. Zoning in the Study Area would be a function of planned land use as determined by the jurisdictions' adopted general plans and the land development approval processes as established by those jurisdictions.

Rural areas, such as those zoned agricultural or very low-density residential (such as Maricopa County's R-43 Rural Zoning District, which allows one dwelling unit per acre, or the City of Phoenix's S1 Ranch or Farm Residence District, which is meant to preserve low-density areas of farm or residential uses), would continue to be rezoned as the areas become more suburban—consistent with the affected communities' long-range plans.

Long-range Plan Compatibility

Action Alternatives, Western Section

Avondale

The City of Avondale's adopted *General Plan* (2012) does not specifically call out the South Mountain Freeway. The plan's land use map does, however, designate land adjacent to and near I-10 (Papago Freeway) for commercial and employment uses. The W101 Alternative would provide improved transportation access to this area and, therefore, would be compatible with certain goals of the City's *General Plan*. The *General Plan* designation for the affected undeveloped land is industrial (considered compatible with a freeway use like the proposed action).

Phoenix

The City of Phoenix's adopted *General Plan* (updated 2002) divides the municipality into 15 planning areas referred to as villages. The Western Section includes portions of Estrella, Laveen, and a small portion of Maryvale (north of I-10 [Papago Freeway]) villages. The Estrella and Laveen planning areas are identified as "growth areas" to enable the planning areas to provide cost-efficient public facilities and expanded city services to anticipated housing and employment development.

The City's *General Plan* land use map shows the freeway alignment as "Future Transportation" (land use category), generally matching the W59 (Preferred) Alternative alignment. The City of Phoenix's plans for both Laveen and Estrella villages identify "cores" along the W59 Alternative, surrounded by commercial/mixed-commercial uses for each planning area clearly intended to benefit from proximity to the proposed freeway. In addition to the "called-out" commercial cores, the land uses north of the Salt River near the W59 Alternative are largely industrial (considered compatible with a freeway use). The alignment of the South Mountain Freeway as reflected in either the W71 or W101 Alternative is not identified or described in the City's *General Plan*. The plan and related maps would have to be amended accordingly.

Tolleson

The majority of Tolleson is planned for industrial uses (61 percent of the planning area). Residential areas are located in the area surrounding the 91st Avenue/Van Buren Street intersection. The City plans to retain what it refers to as its "compact, neighborhood-oriented land use form." Its *General Plan* (2005) promotes economic development and community character.

The W101 Alternative would bisect a portion of the western side of the city and affect an area of future residential, industrial, and commercial land uses. Community, land use fragmentation, and economic impacts would occur (see the sections, *Social Conditions* and *Economic Impacts*, beginning on pages 4-20 and 4-46, respectively, for further detail). The vision of the City's *General Plan*, to create economic development areas and community character, would become more difficult to achieve under the W101 Alternative. The City would have to amend its *General Plan* and adopted land use maps.

Adjacent to the city, the W71 Alternative would provide access to its commercial and industrial areas, and the footprint of the action alternative would not reduce the amount of land available for development. The alternative would aid in providing access to a planned employment corridor in Tolleson. Neither the W71 nor W59 Alternative would adversely affect the City of Tolleson's long-range planning efforts.

Glendale and Goodyear

Long-range planning for the cities of Glendale and Goodyear are excluded from the future land use discussion because no direct impacts would occur beyond approximately a mile from the action alternatives.

Action Alternative, Eastern Section

Chandler

A small portion (773 acres) of the city of Chandler is within the Study Area. The area is designated by the City's adopted *General Plan* (2008) for employment, defined as "proposed or existing industrial parks or developments as well as industrial support uses designated to house the City's industrial base." The City of Chandler's land use plan includes the proposed action along the Pecos Road alignment. Existing and planned industrial uses near the E1 (Preferred) Alternative and its interchange with I-10 (Maricopa Freeway) are industrial and would be compatible with a transportation facility connecting to the existing SR 202L (Santan Freeway).

Phoenix

The E1 Alternative would run along the southern edge of the Ahwatukee Foothills Village planning area (and would border Community land, to the south) as established in the City of Phoenix's adopted *General Plan*. The planning area includes an area designated as the village "core," located north of and away from the E1 Alternative at the 48th Street/Ray Road intersection. The City's adopted land use map shows a freeway alignment as "Future Transportation" (land use category), generally following the E1 Alternative alignment. The action alternative would be consistent with the City's adopted *General Plan*.

No-Action Alternative

The No-Action Alternative would adversely affect the City of Phoenix's long-range plan, which identifies village cores for the Laveen and Estrella planning areas.

The land use plan designations associated with these cores are predicated, in part, on proximity to the freeway corridor, as shown on the City's adopted *General Plan* land use map (which approximates the W59 Alternative). For example, commercial and industrial land use plan designations are often geographically located near major transportation corridors to promote efficient movement of goods and delivery of services. By not locating such a corridor where originally planned, the planning logic of land use distribution is altered. In this example, specifically, the local jurisdiction may choose to redistribute land use plan designations, which in turn could create conflict with existing land uses. Regardless of any decision associated with such an action, the plan and related maps would have to be amended accordingly. Ahwatukee Foothills Village has no planning area plan; therefore, there is no incompatibility under a No-Action Alternative.

MITIGATION

Mitigation for land use-related impacts (e.g., visual and audible intrusions) are discussed in the sections, *Social Conditions* (beginning on page 4-20), *Displacements and Relocations* (beginning on page 4-39), *Economic Impacts* (beginning on page 4-46), *Air Quality* (beginning on page 4-58), *Noise* (beginning on page 4-80), *Cultural Resources* (beginning on page 4-128), *Prime and Unique Farmlands* (beginning on page 4-149), and *Visual Resources* (beginning on page 4-155), and in Chapter 5, *Section 4(f) Evaluation*. Parties responsible for implementing the measures are identified in those sections.

ADOT Design Responsibilities

For the W59 and E1 Alternatives, ADOT and FHWA would coordinate with the entities (BLM and ASLD) managing affected public land and the various leaseholders to accommodate the proposed action.

CONCLUSIONS

Implementation of any of the action alternatives would convert existing land uses to a transportation use. In the Western Section, implementation of the W101 Alternative would convert the most land because its alignment is longer than other action alternatives in that section. The E1 (Preferred) Alternative, in the Eastern Section, would also convert existing land uses to a transportation use, although some land conversion would be associated with the transformation of Pecos Road from a major arterial street to a freeway use.

In the Western Section, implementation of the W101 Alternative would convert between 1,284 and 1,311 acres; the W71 Alternative would convert 1,061 acres; and the W59 (Preferred) Alternative would convert 935 acres. In the Eastern Section, the E1 Alternative would convert 883 acres (some of which are associated with Pecos Road). The locations and types of existing and planned land uses would vary by action alternative and option. Regardless of which specific action alternative may be implemented—if any—the total conversion of existing land use to a transportation use would be negligible when placed in the context of the amount of land in the region. Therefore, impacts on the availability of existing and planned land uses would be minimal.

Furthermore, vacant and agricultural land is rapidly being converted in the Phoenix metropolitan area, and this trend would be expected to continue despite proposed action implementation; Study Area land uses will look different in years to come. In 2000, much of the Western Section was agrarian and rural in character; by 2035, Study Area land uses are expected to reflect a more urbanized setting, with single-family residential communities, commercial cores, and industrial corridors, regardless of which or whether any action alternative were to be implemented.

Of the action alternatives in the Western Section, the W59 Alternative would be most compatible with adjacent industrial land uses; the W71 and W101 Alternatives would, by contrast, traverse large areas of planned residential development. The E1 Alternative, in the Eastern Section, would generally be incompatible with the natural land and primarily residential areas immediately north of the alignment. Regardless of which specific action alternatives may be implemented—if any—the types of adjacent land uses would be comparable to those found along much of the region's freeway system.

The proposed transportation facility has been planned through local and regional long-range planning efforts. Of the action alternatives, the W59 and E1 Alternatives would be most consistent with regional and local long-range planning efforts ongoing since the mid-1980s. The W101 Alternative and its Options would be the least consistent of the action alternatives; of the three action alternatives in the Western Section, it would have the greatest impact on the City of Tolleson's land uses and long-range planning efforts.

4

How communities change

With the growth in the region, communities and their neighborhoods are created and evolve. Patterns of life develop within these communities, contributing to a sense of place for its residents. Issues such as mobility, continuity, character, inclusion, and maintenance of a sense of place become important aspects to the individuals who reside in these communities.

The proposed action has the potential to alter conditions important to communities' residents. Consequences could be both adverse and beneficial to those aspects important to communities, neighborhoods, and their residents. Determining impacts on social conditions involves individuals' opinions and preferences as to what is important to them and their behavior in a community. It involves the community itself and what makes it unique or gives it its character. Often, with this matter, communities—particularly those in the Phoenix metropolitan area—are changing; communities in 2013 may look quite different in 2035.

Phoenix: The nation's fifth-largest city

The 2005 census conducted by the U.S. Census Bureau identified Phoenix as the country's fifth-largest city. The mid-decade census also showed that Phoenix had increased in population by 12 percent in just 5 years, attesting to Phoenix's rapid growth in the early 2000s. Maricopa County grew even faster—by 26 percent in the 7 years since the 2000 Census—to 3.9 million people. (The Phoenix metropolitan area still ranks as the nation's thirteenth-largest.)

(*Note:* The main text uses the decennial census data because they contain demographic elements not collected for the mid-decade census.)

SOCIAL CONDITIONS

Social conditions are the results of interactions of humans with one another, over time, and of observable patterns and characteristics that they create in their surroundings. Social conditions include demographic characteristics, community character, and public facilities related to societal activities. Economic conditions, displacements and relocations, and matters relating to environmental justice and Title VI of the Civil Rights Act of 1964 (Title VI) are treated in stand-alone sections in this chapter.

AFFECTED ENVIRONMENT

Demographic Characteristics

Key demographic characteristics of the Study Area include race, income, employment, housing, and population growth. Population growth is an important socioeconomic factor because of its direct influence on housing and employment growth and on existing and planned transportation facilities and infrastructure. Population growth influences the demand for all modes of transportation and catalyzes construction of highway facilities, provision of mass transit services, and construction and installation of bicycle and pedestrian infrastructure.

Regional Demographic Context

By 1950, the city of Phoenix had grown to a population of 107,000 in an area of 17 square miles. This growth was an indicator of the city's potential to become a regional population and economic center. By 2009, Phoenix was the nation's fifth-most populous city, with 1,575,423 residents and an area of 519 square miles (Arizona Department of Commerce 2010; City of Phoenix 2009a); see the section, *Historical Context of the Proposed Action*, beginning on page 1-5, for additional information regarding population, housing, and employment growth.

Population growth experienced between 1990 and 2000, a product of both in-migration and natural increase, changed the racial composition of the city of Phoenix. During this time, the White population, as a percentage of the total population, decreased from nearly 82 percent to just over 71 percent. Hispanics marked the greatest percentage increase, growing from 20 percent to 34 percent. Because Hispanics may self-identify on the census form as being White (racially) and as being Hispanic (as an ethnicity), the above percentages may not be directly comparable, i.e., some percentages of census respondents may consider themselves to be in both groups. The percentages should be taken only as rough measures of demographic change. The second-largest increase was in the "other race/two or more races" classification, increasing from less than 10 percent to nearly 20 percent. Other racial classifications—Black/African American, American Indian/Alaskan Native, and Asian—remained at nearly the same percentages in both census years. (This discussion uses U.S. Census Bureau classifications for race and ethnicity.)

Population and Employment

Between 2000 and 2010, population within census blocks in the Study Area increased by more than 72 percent. By comparison, the population of Arizona increased by 25 percent, Maricopa County increased by 24 percent, and the population of the city of Phoenix increased by 10 percent.

Between 1990 and 2000 the highest population increase in the Study Area occurred in and around the Ahwatukee Foothills Village planning area, which increasing by over 400 percent (the planning area is currently near buildout). Between 2000 and 2010, the Laveen planning area experienced even greater growth, increasing by 665 percent. Other more populated areas, such as the Estrella planning area, north of the Salt River, grew by 256 percent between 2000 and 2010.

Maricopa County's population is projected to increase by three-fourths between 2005 and 2035, from 3.7 million to over 6.5 million (MAG 2009b). The number of housing units is projected to increase by 81 percent by 2035 to accommodate the expected growth in population.

Employment is also expected to more than double, increasing from approximately 1.7 million jobs in 2005 to 3.6 million in 2035. A portion of this growth would occur in and around the Study Area. The total population in the Study Area is expected to grow at a slightly slower rate than the county, increasing from 264,630 in 2005 to 453,748 in 2035 (see the section, *Need Based on Socioeconomic Factors*, beginning on page 1-11, to learn more about the region's growth). Employment in the Study Area is expected to increase by approximately 114 percent, from 116,629 jobs in 2005 to 249,568 in 2035. As with population, the greatest increase in employment is expected to occur in the Western Section of the Study Area in the city of Tolleson and in Laveen and Estrella villages.

Housing Stock and Valuation

Over 327,395 housing units (94 percent of them occupied) in 2010 were within the census block groups in the Study Area. Of the owner-occupied housing units, 43 percent (4 percentage points below the Maricopa County average) were valued below $125,000.

Relative to the rest of the Study Area, median housing values are highest in Ahwatukee Foothills Village. The area north of Southern Avenue has a variety of housing types, with most census block groups having median home values ranging from $85,000 to $130,000. To keep pace with anticipated population growth, a range of housing proposals is in various stages of development in the Study Area (see the section, *Development Plans*, on page 4-7). Because of the recent economic downturn, median single-family housing prices in 2009 were comparable to the housing prices of 2000 (Arizona State University 2009).

Community Character

In recent years, most of the Study Area has changed from rural and agricultural to moderate-density, homogenous single-family residential (the southwestern portion of the Phoenix metropolitan area has been one of the fastest-growing areas in the state). Generally, with

the exception of a few distinct locations, the area can be characterized as transitional.

In the Western Section, agricultural and open-desert land is rapidly changing to residential uses, with concentrations of residential and mixed commercial/light industrial uses. The trend toward urbanization is evident in the form of newly constructed and proposed residential subdivisions, warehouse and distribution facilities, and office and light industrial parks, as well as large master-planned residential developments that often include commercial as well as recreational components.

From 2000 through 2007, the changing character of the area was evident from the numerous posted notices of zoning change requests. Road and infrastructure improvements and new school construction were other signs of local area governments responding to this growth activity. New commercial centers at formerly remote intersections (e.g., the northeastern corner of 83rd Avenue and Lower Buckeye Road) also indicate that new residential development triggered retail development activity. In some areas, new growth during this period led to a mix of new master-planned, suburban-density subdivisions and commercial establishments amid scattered, older rural homesteads and open fields. Since 2007, because of the worldwide economic downturn, growth in the region has essentially halted. This state of flux, however, remains evident, which makes community character difficult to define. A few communities, however, do exhibit distinct characteristics (see Figure 4-8).

Community Facilities and Services

Figure 4-9 illustrates the location of public facilities in the Study Area. With continued planned development in this area, more community facilities in the form of schools, public complex facilities, churches, and parks will appear.

ENVIRONMENTAL CONSEQUENCES

All Action Alternatives, Western and Eastern Sections

For all action alternatives, increased road capacity would improve overall circulation and accessibility in both the Study Area and the greater Phoenix metropolitan area, benefiting existing and future residents, employees, and employers (see Chapter 1, *Purpose and Need*, which further addresses traffic performance). Overall, the local arterial street network would experience a reduction in traffic when compared with the No-Action Alternative (some traffic would shift to a freeway from the local street system). Local travel times through a given area would improve. This would also make local roads more attractive and safer for pedestrian and bicycle circulation.

Some localized impacts would be experienced where the movement of traffic between a freeway and the local street network would lead to peak-hour congestion at service traffic interchanges. This would lead to delays in the vicinity, potentially affecting nearby commercial and neighborhood areas (the effects would be offset by optimizing service traffic interchange operation through design and by the RTP-planned arterial street improvements where applicable).

The southwestern segment of SR 202L (South Mountain Freeway), as represented by the proposed action, has been part of the region's adopted long-range transportation planning efforts to accommodate regional mobility needs since 1985 and is reflected in the planning goals established for the next 20 years (see Chapter 1, *Purpose and Need*, and Chapter 3, *Alternatives*, regarding past and ongoing regional planning efforts). Land use planning and transportation planning are intrinsically tied. In the Phoenix metropolitan area, the proposal to construct the proposed action (and other transportation projects of similar magnitude) is coordinated by MAG and is a result of affected municipalities' general planning processes. As typical in the region, the construction of a project like the proposed action is the direct result of planned land use development of residential areas, employment centers, and commercial developments. These factors are based to a large extent on past growth trends and projections for population, housing, and employment. The actualization of long-range planning efforts depends, in part, on the planned Regional Freeway and Highway System being in place.

The action alternatives would not adversely affect access from area neighborhoods to schools through the use of major arterial streets. Existing and planned bus routes may be altered, but travel times would not be adversely affected. Most existing and planned schools would be near one or more of the action alternatives on or near major arterial streets. The action alternatives would also improve access for residents to school facilities and community centers that are used for after-school day care and recreational and educational activities.

Response times for police, fire, and medical emergency services would be faster when compared with response times under the No-Action Alternative. Circulation on major arterial streets would be improved through better distribution of traffic onto the overall transportation network, the provision of alternative routes, and through localized operational improvements such as grade separations and planned interchanges.

The action alternatives would substantially reduce the number of vehicles that pass through Community land on 51st Avenue and Beltline Road. Impacts on community character and cohesion are described in Table 4-9. As evident in the table, primary adverse impacts from action alternatives would occur on those Study Area communities with distinct characteristics (see Figure 4-8 for descriptions of the communities).

No-Action Alternative

No project-related impacts on community character and the cohesiveness of neighborhoods—existing or now undergoing development—or on commercial/industrial areas would occur as a result of identification of the No-Action Alternative as the Selected Alternative. Increasing congestion identification the local street network would, however, be expected, especially in the most rapidly urbanizing portions of the Study Area if a controlled-access, high-speed travel option were not available to area residents, businesses, and visitors. During the next 25 years, daily traffic volumes in the Study Area are expected to increase by approximately 46 percent on freeways and arterial streets. This 46 percent increase in daily traffic correlates to a need for 55 additional lanes

Cohesion and character of communities

A neighborhood's cohesiveness is considered to be adversely affected when the proposed action would:

- **eliminate or adversely change existing circulation within the neighborhood**
- **eliminate neighborhood access to commercial areas, schools, parks, or other community amenities**
- **create a physical barrier to movement within the community**

The character of a community is considered to be adversely affected when the proposed action would:

- **substantially reduce the physical size of a distinct community**
- **introduce an intensive land use within passive land uses such as agricultural or open space that are within a distinct community**
- **introduce freeway-generated intrusions such as unmitigated substantial noise, traffic congestion, or visual blight**

Freeways and crime

In 2005, the City of Phoenix Police Department staff met with the South Mountain Citizens Advisory Team (SMCAT) (see page 6-7) to discuss the relationship of crime and freeways. The following are highlights from the meeting:

- **Crime changes are influenced by a wide variety of factors and it would be difficult to determine whether a new freeway had any effect.**
- **Based on experience, there did not appear to be any correlation between crime rates and freeways.**
- **The City of Phoenix Police Department does not have any statistics specific to crime adjacent to freeways.**
- **Crime suspects who use freeways to get away are typically the easiest to catch.**
- **Crime seems to be more related to what is built adjacent to freeways.**

Figure 4-8 Distinct Communities

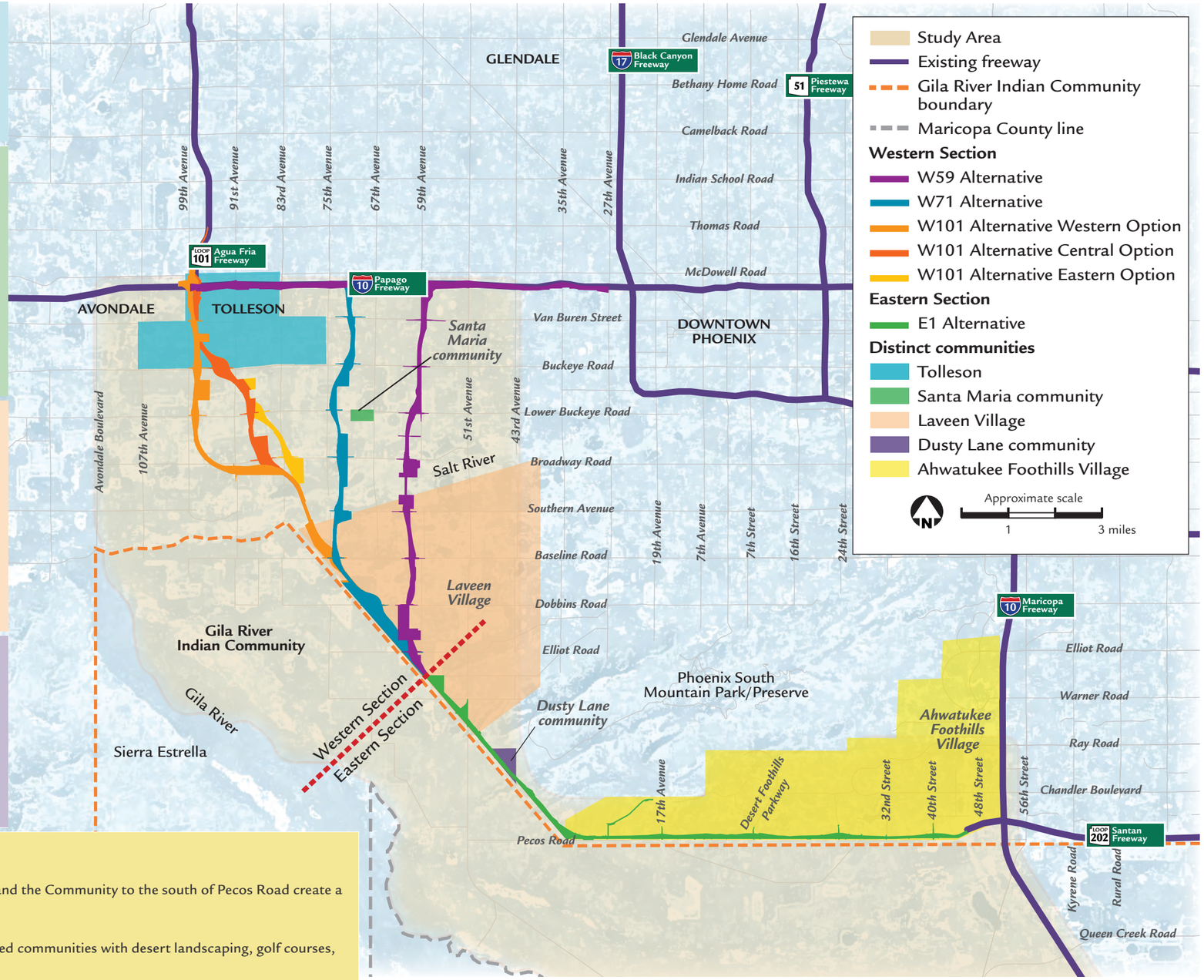
Tolleson
- approximately 10 miles west of downtown Phoenix
- founded in 1912
- 6 square miles in size—much smaller than other incorporated cities in the region
- a distinct downtown area with a family-oriented, small-town atmosphere
- near I-10[a]; supports several highway-dependent uses such as warehouses

Santa Maria community (historically, Santa Marie Townsite)
- an 80-acre unincorporated townsite "island" established in the early 1900s
- an original homestead was issued in January 1916
- in the early 1940s, Mexican immigrants working on farms in the area established a fairly substantial makeshift tent community on the land. In August 1944, the property owner conducted a land survey for subdivision into 62 parcels for the immigrants to purchase
- the townsite became official in 1945 when immigrants were allowed to purchase lots
- the community retains a strong sense of its rural character with its collage of predominantly vernacular architecture, narrow streets built flush to grade (no sidewalks), and aboveground utilities (see page 5-7, for more information about this NRHP-eligible[b] community)

Laveen Village
- an area between the South Mountains and the Salt River
- founded in an agricultural heritage
- valued by farmers, equestrians, and those looking for mountain access
- homesteaded in the late 19th century
- a strong farming community identity; cotton and alfalfa fields bordered by canals and country roads give Laveen Village a rural character
- to the west and south is Community[c] land, characterized by open space that includes views of the Sierra Estrella
- in recent years, a budding suburbanization trend has been slowed by worldwide economic downturn

Dusty Lane community
- an isolated area of residences on the southwestern side of the South Mountains
- retains a sense of separation from the larger metropolitan area
- single-family dwellings and manufactured homes are scattered along mostly unpaved roads, giving the area a rural feel
- horses are kept at some of the homesites
- accessible from Dusty Lane, off of 51st Avenue
- the Community to the south and the South Mountains to the east and north create a boundary that fosters a sense of isolation from the rest of Phoenix

Ahwatukee Foothills Village
- well-established, with new residential development
- I-10 (Maricopa Freeway) to the east, the South Mountains to the north and west, and the Community to the south of Pecos Road create a boundary that fosters a sense of separation from the rest of Phoenix
- vacant, undeveloped land is relatively rare
- distinct in its character in that it is composed of more contemporary master-planned communities with desert landscaping, golf courses, and lakes
- adjacent mountains provide outdoor recreational opportunities
- character is modern, protected, unified, and "upscale"



The Study Area has communities with distinct characteristics and cohesion.

[a] Interstate 10 [b] National Register of Historic Places [c] Gila River Indian Community

of arterial street capacity in the Study Area. Without the proposed action, the region will suffer even greater congestion, travel delays, and limited options for moving people and goods safely through the Phoenix metropolitan region. This, in turn, could affect the character of the individual villages and distinct subareas in the Study Area. The area's growth prospects as envisioned by the municipalities' long-range plans, as well as their contributions to regional economic growth, could also be adversely affected by both the perception and reality of traffic congestion and travel delays.

MITIGATION

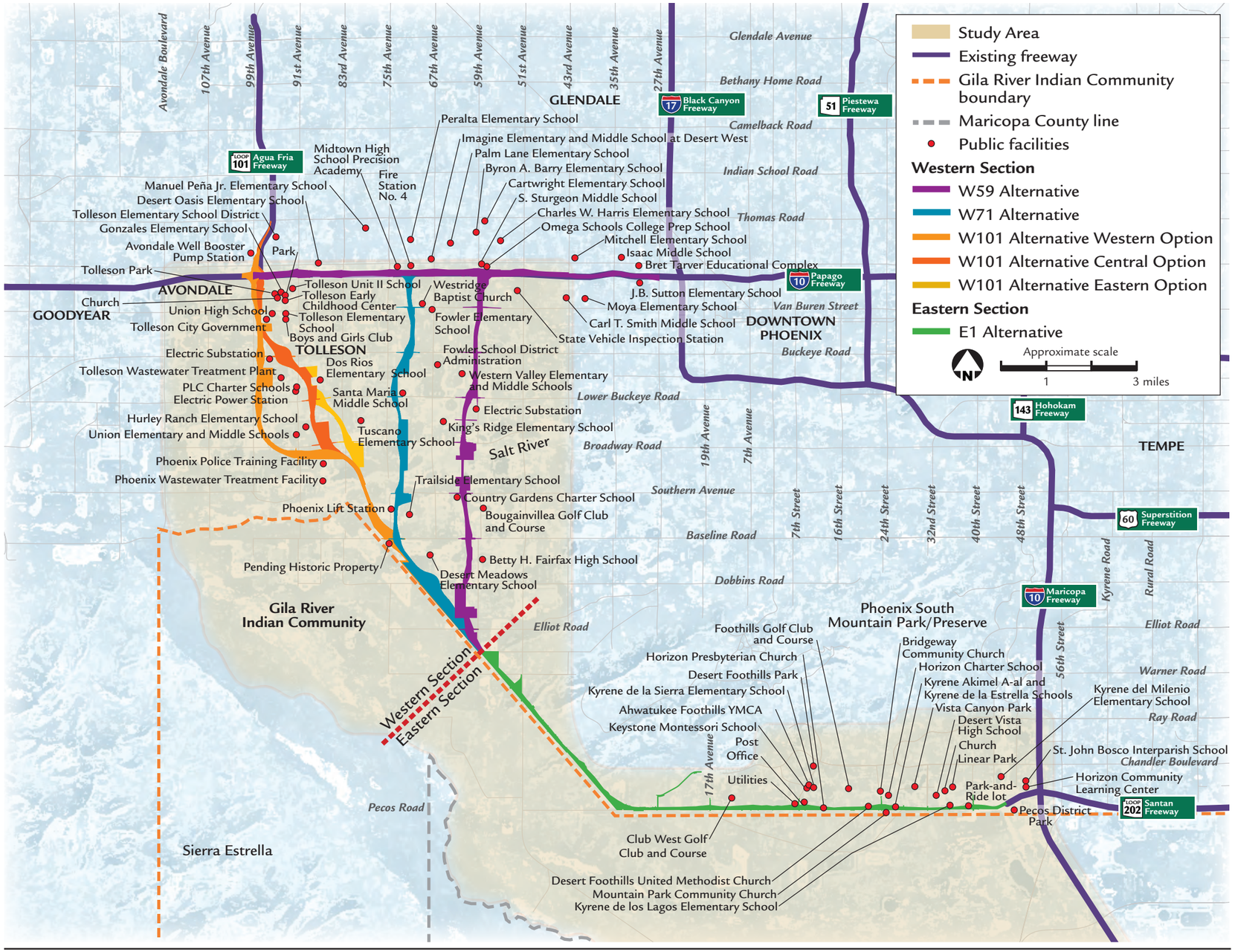
Potential mitigation measures for social conditions-related impacts (e.g., visual and audible intrusions) are discussed in the sections, *Land Use* (beginning on page 4-3), *Displacements and Relocations* (beginning on page 4-39), *Economic Impacts* (beginning on page 4-46), *Air Quality* (beginning on page 4-58), *Noise* (beginning on page 4-80), *Cultural Resources* (beginning on page 4-128), *Prime and Unique Farmlands* (beginning on page 4-149, *Visual Resources* (beginning on page 4-155), and *Temporary Construction Impacts* (beginning on page 4-161), and in Chapter 5, *Section 4(f) Evaluation*. Parties responsible for implementing the potential mitigation measures are identified in those sections.

The following mitigation measures for the social effects of the proposed action are applicable to all action alternatives.

ADOT Design Responsibilities

To reduce community intrusions caused by the action alternatives and reduce impacts on the character of surrounding communities, mitigation measures considered by ADOT during the design phase would include reducing the amount of R/W required; providing alternative access to the local road network to satisfy emergency services access requirements; and using noise barriers, aesthetic treatments of structures, and landscaping to reduce community intrusions (see the sections, *Noise* and *Visual Resources*, beginning on pages 4-80 and 4-155, respectively, to learn more about mitigation).

Figure 4-9 Public Facilities and Services



Numerous public facilities are primarily in locations where development has intensified in recent years.

Table 4-9 Impacts on Community Character and Cohesion, Action Alternatives

Alternative	Location	Land Use/ Community Characteristics	Effect on Characteristics	Effect on Community Cohesion	Comments
Western Section					
W59 Alternative	• Western portion of Laveen Village south of the Salt River	• North of South Mountain Avenue, remains in agricultural use, in contrast to areas farther east and west that have largely been converted to single-family residential	• Would visually and audibly intrude on the less-intensive, passive residential character of the area	• No adverse effects; circulation on arterial street network would be maintained through planned interchanges at Southern Avenue and Elliot, Dobbins, and Baseline roads	• W59 Alternative would pass through the Laveen Village core in the Dobbins Road vicinity using a similar alignment planned for previous versions of the South Mountain Freeway
	• Through Estrella Village, between the Salt River and Roosevelt Canal	• Primarily agricultural areas with the exception of an area just north of Broadway Road where the action alternative would pass between two housing developments on land set aside to accommodate previous versions of the South Mountain Freeway		• No adverse effects; circulation on arterial street network would be maintained through planned interchanges at Broadway, Lower Buckeye, and Buckeye roads	• W59 Alternative would cross the Rio Del Rey subdivision, immediately north of Broadway Road; while the subdivision was designed to accommodate the freeway corridor, the needed right-of-way would affect a number of homes and disrupt the local street network; none of the subdivision's loop or cul-de-sac streets are intended to be connected across the potential freeway expanse • Service traffic interchange at Broadway Road would disrupt the edge of adjacent neighborhood streets but would not alter any of the main ingress/ egress points
	• North of the Roosevelt Canal between Buckeye Road and Van Buren Street	• Primarily industrial, with agricultural land and a mix of business park, light industrial, and heavier industrial uses (toward Van Buren Street)	• Would not alter the existing character	• Internal site circulation and parking/ storage areas would be disrupted where the action alternative would bisect developed properties • No adverse effects on circulation in arterial street network, which would be maintained through planned interchanges at Lower Buckeye Road and Van Buren Street	• W59 Alternative would pass through the Estrella Village core in the Lower Buckeye Road vicinity using a similar alignment planned for previous proposals for a South Mountain Freeway • Internal residential road network would be reconfigured
	• North of Van Buren Street to I-10[a] (Papago Freeway)	• Industrial uses and single-family and multifamily residential uses	• Would visually and audibly intrude on the less-intensive, passive, single-family residential character of the area west of the alternative and would displace residents of apartment complexes to the east	• Would displace residents from the Liberty Cove and Southwest Village apartments	• W59 Alternative would pass over Roosevelt Street
W71 Alternative	• Elliot Road to just north of Dobbins Road (Laveen Conveyance Channel)	• Area is split between portions that are primarily in agricultural use or largely undeveloped	• Would visually and audibly intrude on the less-intensive, passive residential character of the area not yet rapidly urbanizing	• No adverse effects; circulation on arterial street network would be maintained through planned interchanges at Southern Avenue and Elliot, Dobbins, and Baseline roads	• Because the general area is in transition, W71 Alternative would be a part of the evolving land use plan

Note: Other societal impacts regarding air quality, noise, displacements, and community economics are presented in later sections of this chapter.

(continued on next page)

[a] Interstate 10

Table 4-9 Impacts on Community Character and Cohesion, Action Alternatives (continued)

Alternative	Location	Land Use/ Community Characteristics	Effect on Characteristics	Effect on Community Cohesion	Comments
Western Section					
W71 Alternative	• North of Dobbins Road to the Salt River	• Land largely developed with homogeneous residential and industrial uses along the Salt River	• Would visually and audibly intrude on the less-intensive, passive residential character of the area not yet rapidly urbanizing	• Would affect the established Laveen Meadows and Laveen Ranch subdivisions, resulting in displacements; remaining homes west of the alternative would be separated from the larger subdivision • No adverse effects to circulation on arterial street network, which would be maintained through planned interchanges at Southern Avenue and Elliot, Dobbins, and Baseline roads	• Internal residential road network would be reconfigured
	• North of the Salt River to Buckeye Road in Estrella Village	• Land transitioning from primarily agricultural uses to homogeneous residential developments		• Would displace residents in the rural, low-density Western Heritage Estates subdivision; would divide the Sienna Vista Manor subdivision, resulting in displacements; would cause displacements in neighboring Estrella Village subdivision • No adverse effects on circulation in arterial street network, which would be maintained through planned interchanges at Broadway, Lower Buckeye, and Buckeye roads • W71 Alternative was adjusted to avoid passing through the Santa Maria community just south of Buckeye Road	
	• North of Buckeye Road to I-10 (Papago Freeway) in Estrella Village	• Primarily industrial uses with "pockets" of agricultural uses; established residential uses north of Van Buren Street	• Would not alter the existing community character but would visually and audibly intrude on the established residential use	• No adverse effects on circulation in arterial street network, which would be maintained through planned interchanges at Buckeye Road and Van Buren Street	
W101 Alternative	• Elliot Road to just north of Dobbins Road (Laveen Conveyance Channel)	Same as described for the W71 Alternative			
	• North of Dobbins Road to the Salt River	• Land developing with homogeneous residential uses and existing low-density residential uses along the Salt River	• Would visually and audibly intrude on the less-intensive, passive residential character of the area	• Would cause displacements in the developing Laveen Farms subdivision • No adverse effects on circulation on arterial street network, which would be maintained through planned interchanges at Southern Avenue and Elliot, Dobbins, and Baseline roads	• Internal residential road network would be reconfigured

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Table 4-9 Impacts on Community Character and Cohesion, Action Alternatives (continued)

Alternative	Location	Land Use/ Community Characteristics	Effect on Characteristics	Effect on Community Cohesion	Comments
Western Section					
W101 Alternative	• Salt River to Lower Buckeye Road (western area of Estrella Village)	• Land transitioning from primarily agricultural uses to homogeneous residential developments	• Would visually and audibly intrude on the less-intensive, passive residential character of the area	• Eastern Option would cause displacements in the developing Tuscano subdivision and divide the existing Volterra subdivision • Central Option would affect existing agricultural and dairy operations south of Broadway Road and the developing Hurley Ranch subdivision • Western Option would affect existing agricultural and dairy operations south of Broadway Road and the existing Country Place subdivision • No adverse effects on circulation in arterial street network, which would be maintained through planned interchange at or near Broadway Road	• Dairy operations are spread along Broadway Road between 83rd and 99th avenues. The Eastern Option would avoid the dairy area. The Western Option would pass through several such properties. The Central Option would go through the center of this dairy cluster. The dairy operations have been at this location for many years; a W101 Alternative would introduce a barrier amid this cluster of common economic and agricultural activity. • Internal residential road network would be reconfigured
	• Lower Buckeye Road to Buckeye Road	• Land transitioning from primarily agricultural uses to homogeneous residential developments and retail businesses	• Would visually and audibly intrude on the less-intensive, passive, developing residential character of the area	• Eastern Option would cause displacements in the Heritage Point and Farmington Park subdivisions • Central Option would cause displacements in the Farmington Park subdivision • Western Option would disrupt the large retail plaza at northeastern corner of Lower Buckeye Road and 99th Avenue • No adverse effects on circulation in arterial street network, which would be maintained through planned interchanges at Lower Buckeye and Buckeye roads	• Internal residential road network would be reconfigured • Central and Eastern Options would affect access to Dos Rios Elementary School and a planned public neighborhood park located along 87th Avenue; however, access would not be entirely eliminated for these properties
	• Buckeye Road to I-10 (Papago Freeway)	• Primarily industrial and warehouse/ distribution north of Buckeye Road to Van Buren Street • Van Buren Street to I-10 (Papago Freeway), primarily agricultural use transitioning to commercial (e.g., automobile sales and truck stop/ convenience centers)	• Would not alter the existing character	• No adverse effects; circulation on arterial street network would be maintained through planned interchanges at Buckeye Road and Van Buren Street	• Tolleson's downtown core, older established neighborhoods, and main civic and educational facilities would be east of the W101 Alternative and Options. All options would avoid the city's core area. The community's character would, however, still be adversely affected by the introduction of a freeway nearby.

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Table 4-9 Impacts on Community Character and Cohesion, Action Alternatives (continued)

Alternative	Location	Land Use/ Community Characteristics	Effect on Characteristics	Effect on Community Cohesion	Comments
Eastern Section					

E1 Alternative	• I-10 (Maricopa Freeway) to approximately 35th Avenue alignment along the nearly built-out Ahwatukee Foothills Village	• Established community to the north characterized by homogeneous residential communities with scattered commercial and public/quasi-public uses
		• Vacant and agricultural uses on Community[b] land to the south
			• Would visually and audibly intrude on the less-intensive, passive, residential character of the area. The magnitude of impact would be offset by the fact the alternative would replace the existing four-lane Pecos Road. Pecos Road, although to a lesser degree than would occur with the action alternative, now visually and audibly intrudes on the village. Further, the impact would not be "new" to the village, considering that I-10 and the I-10/SR 202L[c]/Pecos Road system traffic interchange border the village on the east and that either or both are used regularly by village residents.
			• The alternative would be on the village's outskirts by replacing Pecos Road as planned and approved since the late 1980s. By staying on the community's perimeter, village residents' internal mobility, established sense of place, feeling of inclusion, and internal continuity would not be substantially altered (Figure 4-8). The E1 Alternative would eliminate access to Pecos Road (which would itself be eliminated). New traffic patterns would, thus, evolve for local traffic, disrupting existing networks that use Pecos Road as an arterial street.
				• No adverse effects on circulation in arterial street network, which would be maintained through planned interchanges at 17th Avenue, Desert Foothills Parkway, and 24th and 40th streets
				• The E1 Alternative would alter existing access to the Valley Metro 40th Street/Pecos Road Park-and-Ride facility; however, the facility was:
				  • designed to accommodate access modification if necessary for freeway construction and/or operation
				  • placed at its location specifically to facilitate access to the proposed freeway, once in operation
					• Pecos Park, a regional park south of Pecos Road and north of the Community boundary, would be compatible with the action alternative
					• Pecos Park uses are neither noise- nor visually sensitive
					• Park is adjacent to an existing freeway segment [see Chapter 5, *Section 4(f) Evaluation*, for more information]
					• Kyrene de los Lagos Elementary School, located between 40th and 32nd streets, has access directly onto Pecos Road; that access would be eliminated as a result of the action alternative. However, the school's main access point is off Liberty Lane. Further, school siting records indicate district officials preferred the school's existing location because of the future access that would eventually be provided by the proposed freeway.
					• Mountain Park Community Church would be displaced
					• Internal residential road network would be reconfigured
					• Proposed extension of Chandler Boulevard from 27th Avenue alignment east 1 mile to the road's current western terminus would provide residents of Foothills Reserve subdivision a second point of access/egress

	• 35th Avenue alignment to Elliot Road	• Primarily natural land with pockets of single-family residential uses (the Dusty Lane community) • Primarily vacant and agricultural uses on Community land to the south and west and a casino, a commercial land use	• Would visually and audibly intrude on the comparatively less-intensive, passive, natural, and sparsely developed residential character of the area	• No adverse effects on circulation in arterial street network, which would be maintained through access to the Dusty Lane community from Dusty Lane and an interchange at 51st Avenue • Action alternative would impede access to the South Mountains from the Community (see the section, *Cultural Resources*, beginning on page 4-128, regarding the importance of the South Mountains to the Community)	• Chapter 5, *Section 4(f) Evaluation*, presents a detailed discussion of the interaction between the proposed action and the South Mountains.

[b] Gila River Indian Community [c] State Route 202L (Loop 202)

The following are examples of design mitigation:

- encasement of existing facilities for the Sprint fiber-optic line
- a structure over Lower Buckeye Road (to reduce impacts on the Sprint fiber-optic line)
- a longer structure over the Roosevelt Canal (to alleviate impacts on the AT&T fiber-optic line)

The ADOT Right-of-Way Group would coordinate during the design phase to designate necessary utility corridors for relocations where appropriate (see the section, *Temporary Construction Impacts*, beginning on page 4-159, to learn more about utility-related mitigation).

ADOT would coordinate with all local agencies and private facility owners to minimize the effects of utility relocations and adjustments. Coordination would include, when possible, developing construction schedules to coincide with scheduled maintenance periods and off-peak loads.

During the design phase, ADOT would coordinate with municipalities and affected communities to address and resolve impacts on internal road networks. Each action alternative would affect the configuration of the existing local street network. Reconfiguration would be subject to modification as design of the project is refined in future project development phases. An example of how the local street network could be reconfigured is shown in Figures 3-32 and 3-33 (see pages 3-56 and 3-57) using the W59 and E1 Alternatives.

ADOT would develop and implement a public involvement plan for the design and construction phases of the proposed action. Objectives of continued public involvement may include, but would not be limited to, a level of involvement in:

- architectural design treatment of structures
- measures to minimize harm to Section 4(f) resources
- the acquisition and relocation process
- modification to the local roadway network
- construction activity monitoring

During the design and construction phases of the selected action alternative, ADOT would coordinate with all appropriate emergency services, and efforts would be made to minimize effects on response routes and times for all service areas.

ADOT District Responsibilities

Mitigation for societal impacts would include continuous public communication efforts during the design and construction phases as well as implementation of an acquisition and relocation program (see the section, *Displacements and Relocations*, beginning on page 4-39).

ADOT would coordinate with all local agencies and private facility owners to minimize the effects of utility relocations and adjustments. Coordination would include, when possible, developing construction schedules to coincide with scheduled maintenance periods and off-peak loads.

During construction, ADOT would coordinate with the affected utilities to minimize disruption of service.

CONCLUSIONS

The action alternatives would introduce an intensive transportation use adjacent to less-intensive, less-compatible uses. Primarily, the existing character of neighboring communities would be adversely affected by the physical presence of the proposed freeway and its associated visual and noise intrusions into nearby neighborhoods.

In the Western Section, the largely transitional character from agricultural to homogeneous residential and commercial uses has been planned for several years (see the section, *Zoning*, on page 4-17); land use types and distribution as envisioned by municipalities' general plans have remained relatively unchanged since the early 1980s. Implementation of any of the action alternatives would be only one of several factors that could alter the rate of the ongoing transition, and none would induce alteration of the ultimate land use types from those envisioned in the respective general plans. Considering construction time frames, it is more likely that much of the area in the Western Section already will have transitioned before the entire proposed freeway would become operational. Of the three action alternatives in the Western Section, implementation of the W59 (Preferred) Alternative would least affect social conditions, as defined in this section.

In the Eastern Section, the E1 (Preferred) Alternative would not substantially alter the character of nearly built-out Ahwatukee Foothills Village for reasons presented in Table 4-9. Because the proposed freeway would be on the village "outskirts" and would replace the existing four-lane Pecos Road (an action planned and approved since the late 1980s), effects on Ahwatukee Foothills Village's internal mobility, established sense of place, feeling of inclusion, and internal continuity would be negligible. Mitigation measures would aid in reducing intrusion impacts caused by implementation of the action alternative. The E1 Alternative would introduce an intensive transportation use adjacent to a "serene" setting in a remote, peripheral portion of SMPP. Visual and noise intrusions on SMPP would be more severe than those encountered by village residents because of the park/preserve's passive, pleasant, and natural setting.

While identification of the No-Action Alternative as the Selected Alternative would not affect community character and cohesion in the manner the action alternatives would, increased congestion on the local street network resulting from continued urbanization would lead to reduced efficiency in the delivery of services and in the movement of goods and people. The ability to complete the planned and approved Regional Freeway and Highway System is arguably being outpaced by growth in the region. This condition would likely continue to lead to substantial congestion on the local arterial street network as well as on the Regional Freeway and Highway System.

TITLE VI AND ENVIRONMENTAL JUSTICE

The U.S. Environmental Protection Agency (EPA) and FHWA define environmental justice as "fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies." Environmental justice principles and procedures are followed to improve all levels of transportation decision making. Title VI prohibits discrimination on the basis of race, color, or national origin. The 1994 Executive Order 12898 on environmental justice addresses minority and low-income populations. The rights of women, the elderly, and the disabled are protected under related statutes. This Presidential Executive Order and other related statutes fall under the umbrella of Title VI. The U.S. Department of Transportation Order 5610.2(a) requires that environmental justice principles be considered in all the Department's programs, policies, and activities.

Three fundamental environmental justice principles apply to the transportation project development process:

- to avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations
- to ensure the full and fair participation by all potentially affected communities in the transportation decision-making process
- to prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

Effective transportation decision making depends on understanding and properly addressing the unique needs of different socioeconomic groups. Properly implemented, environmental justice principles and procedures improve all levels of transportation decision making. The approach will:

- make better transportation decisions that meet the needs of all people
- design transportation facilities that fit more harmoniously into neighborhoods
- provide opportunities for neighborhood input in the process, including identifying potential effects and mitigation measures in consultation with affected neighborhoods and improving accessibility to public meetings, official documents, and notices to affected neighborhoods
- improve data collection, monitoring, and analysis tools that assess the needs of, and analyze the potential impacts on, minority and low-income populations
- avoid disproportionately high and adverse impacts on minority and low-income populations
- minimize and/or mitigate unavoidable impacts by identifying concerns early in the planning phase and providing offsetting initiatives and enhancement measures to benefit affected neighborhoods

The minority groups addressed by Title VI are:

- Black (a person having origins in any of the black racial groups of Africa)
- Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)
- Asian American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands)
- American Indian and Alaska Native (a person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition)
- some other race (a person who does not identify with one of the previously listed four races) or persons of more than one race

Environmental justice populations include concentrations of low-income, elderly, disabled, and female head of household populations. A member of a low-income population is defined as "a person whose household income is at or below the Department of Health and Human Services poverty guidelines." The U.S. Department of Health and Human Services poverty guidelines state that the poverty income level for a family of four in 2009 was $22,050. A geographic area is considered to have a minority or low-income population if more than 50 percent of its population meets the above minority or low-income definitions or if its minority or low-income population percentage is meaningfully greater in the affected area than is that for the general population.

DATA ASSUMPTIONS

To establish whether the proposed action would disproportionately affect environmental justice populations, a basis for comparison was established. Because the proposed action would affect multiple jurisdictions, all within Maricopa County, the county was identified as the area of comparison.

Environmental justice populations were identified as those populations in census geographies where the percentage of the environmental justice population is known to exceed the percentage of an "identifiable group," in accordance with FHWA guidance. This study used a lower threshold for the identifiable group by determining the lesser of either 1½ times the area of comparison (Maricopa County) or 50 percent of the total population in the census geography.

The demographic information used in this analysis is from the 2010 U.S. Census, with the exception of disabled, which is based on data from the 2000 U.S. Census.

To focus on potentially affected neighborhoods, the smallest unit of analysis for each of the studied populations was identified. Census block-level data were used to identify minority, elderly, and female head of household populations. Census block group-level data were used to identify low-income and disabled populations.

AFFECTED ENVIRONMENT

Affected Populations

The percentages of Title VI and environmental justice populations for the Study Area, affected jurisdictions, Maricopa County, and the state of Arizona are shown in Table 4-10.

Data in Table 4-10 illustrate the social diversity in the Study Area. Compared with Maricopa County as a whole, the Study Area has a greater percentage of all of the sensitive populations discussed, except for disabled and elderly populations. The portion of minorities in the Study Area is 68.1 percent, 64 percent greater than the county percentage of 41.4 percent. The percentage of the Study Area population that is low-income (13.9 percent) is 10 percent larger than the percentage for the county (15.3 percent). The percentage of female heads of household with children (11.6 percent) is 59 percent higher than that of the county (7.3 percent). Figures 4-10 through 4-14 illustrate the geographic distribution in the Study Area of Title VI and environmental justice populations.

Census blocks containing a percentage of minorities at or above 50 percent are distributed throughout the Study Area. Within the Study Area, the blocks with the greatest percentage of minority populations are located within ½ mile of I-10 (Papago Freeway) and within the Community. While minority populations are widely distributed in the Study Area, two communities, Santa Maria and Tolleson, bear further discussion (see Figure 4-8, on page 4-22, for community descriptions).

- Census blocks that make up the Santa Maria community have populations of between 76 and 100 percent minorities, mostly Hispanic. Additionally, a strong sense of community exists, as evidenced in the percentage of area residents who have lived in the same home since before 1995 (72 percent)—almost twice the corresponding figure for Maricopa County (37 percent) (U.S. Census Bureau 2010c).
- Overall, the city of Tolleson is 89 percent minority. In this largely Hispanic community (80 percent), Spanish is spoken in 70 percent of households, compared with Maricopa County, where 21 percent of households speak Spanish in the home (American Community Survey 2007–2011).

Low-income populations are less widely distributed in the Study Area than minority populations. The census block groups with the greatest percentage of people living in poverty are located in the northern portion of the Study Area, concentrated around I-10 (Papago Freeway), east of 83rd Avenue. Many factors contribute to this concentration of low-income households, not the least of which is the availability of affordable housing in the Study Area. Within the Study Area, there is a higher percentage of multifamily housing units in the area immediately surrounding I-10, east of Tolleson. Most of the elementary school districts in the Western Section of the Study Area reported in 2009 that most students are eligible for free lunch, an indicator of lower incomes (the Arizona Department of Education National School Lunch Program determines eligibility for

Table 4-10 Title VI and Environmental Justice Population Percentages, Affected Study Area Jurisdictions

Population	State of Arizona	Maricopa County	Gila River Indian Community	City of Avondale	City of Chandler	City of Glendale	City of Goodyear	City of Phoenix	City of Tolleson	Study Area
Title VI										
Minority	42.1	41.4	98.8	65.9	38.3	48.4	41.7	53.4	89.2	68.1
Hispanic or Latino[a]	29.6	29.6	15.3	50.3	21.9	35.5	27.8	40.8	80.1	51.3
Black or African American	3.7	4.6	0.3	8.7	4.5	5.6	6.3	6.0	5.8	8.4
American Indian or Alaska Native	4.0	1.6	81.4	1.0	1.1	1.2	1.0	1.6	1.0	2.2
Asian	2.7	3.4	0	3.3	8.1	3.8	4.2	3.0	0.8	4.0
Native Hawaiian or Other Pacific Islander	0.2	0.2	0.1	0.3	0.2	0.2	0.1	0.1	0.2	0.2
Some other race	0.1	0.1	0	0.2	0.2	0.1	0.1	0.2	0.2	0.2
More than one race	1.8	1.9	1.7	2.1	2.3	2.0	2.2	1.7	1.1	1.8
Environmental Justice										
Low-income[b]	15.3	13.9	47.8	13.6	7.1	16.3	7.8	18.8	18.0	15.5
Disabled[c]	19.3	18.0	25.7	16.3	13.3	18.3	14.8	19.1	22.5	17.2
Elderly[d]	19.3	17.1	9.0	8.8	12.2	13.9	16.4	12.8	12.5	7.7
Female head of household[e]	7.1	7.3	18.3	10.9	7.2	9.6	6.4	9.0	18.5	11.6

Note: Evaluations for all cities and Maricopa County were calculated by summing all the tracts with centroids in each municipal planning area and then calculating the percentage.

Sources: State, county, city, tribal, and Study Area figures are based on data from the U.S. Census Bureau (2010), with the exception of disabled, which is based on data from U.S Census Bureau (2000), and low-income, which is based on the 5-year American Community Survey (2006–2010).

[a] based on U.S. Census Table P5: Hispanic or Latino, and Not Hispanic or Latino by Race

[b] based on U.S. Census, American Community Survey: Poverty Status in the Past 12 Months

[c] based on U.S. Census 2000: Civilian Noninstitutionalized Persons Age of 5 and Over with Sensory, Physical, Mental, and/or Self-care Disabilities

[d] based on U.S. Census: Sex by Age

[e] based on U.S. Census: Household Size By Household Type By Presence of Own Children

free lunches). Additionally, the U.S. Census Bureau's Small Area Income and Poverty Estimates (2009) for school districts was considered.

Existing Trends Affecting Populations

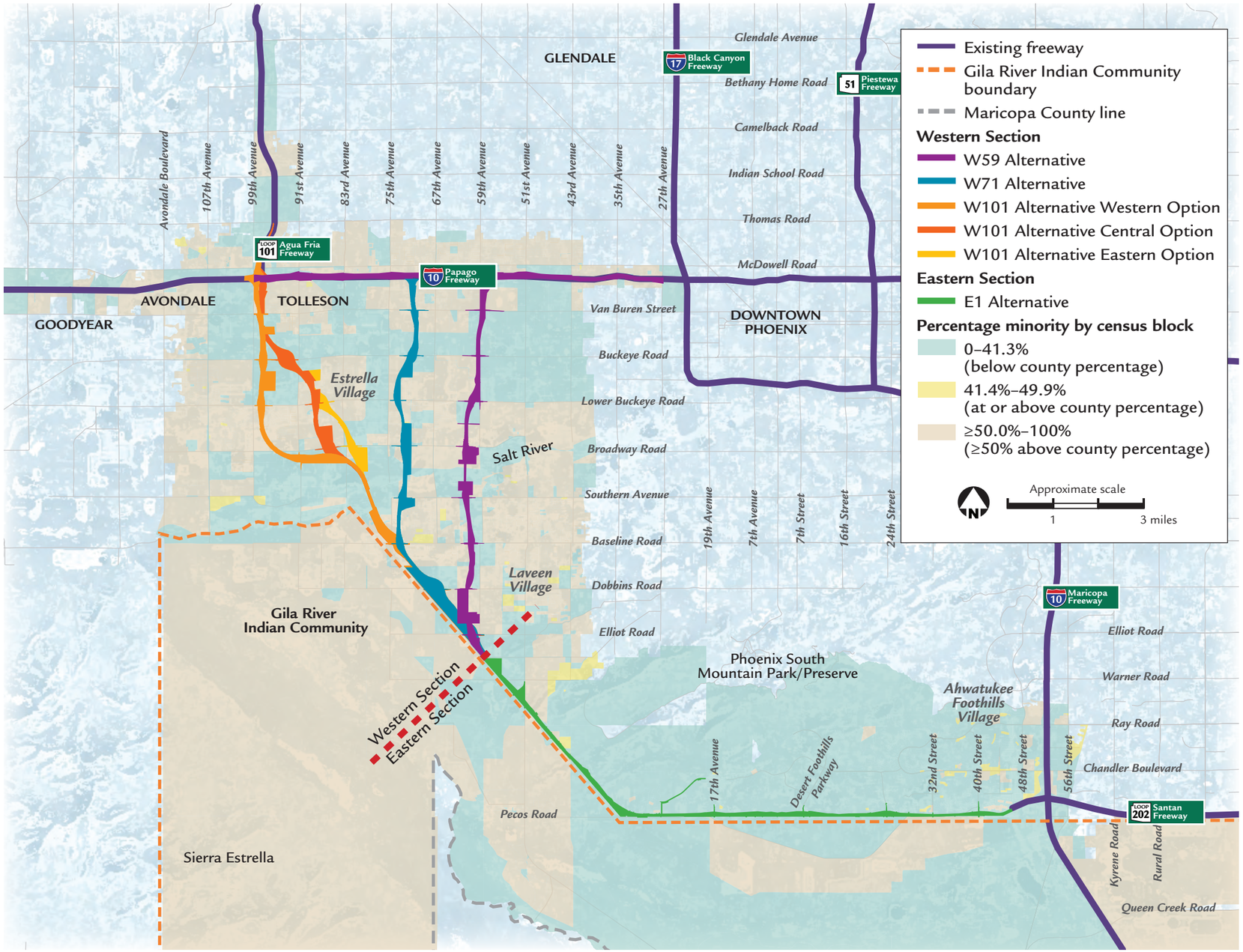
The rural character of the Western Section of the Study Area is changing. Low-density residential and agricultural land uses are being supplanted by medium-density residential subdivisions. This planned change in land use presents challenges to minority and low-income populations:

- Agricultural uses have provided jobs for many minority farm workers.
- The growth is resulting in increased land values, making homes less affordable.

For most of the last decade, low-income residents faced rapidly increasing home prices. Because of the recent economic downturn, however, median single-family home prices in 2009 were comparable to home prices in 2000 (Arizona State University 2009). In 2004, areas such as South Phoenix and Tolleson, which at that time had median home prices below $150,000, saw the biggest jumps in sales and prices. Rental prices also increased, although not as much during this period. The U.S. Department of Housing and Urban Development (HUD) reported that fair market rents for the Phoenix metropolitan area increased by 31 percent between 2000 and 2011 (HUD 2011).

Because of the greater percentage of low-income and minority populations in the Study Area relative to Maricopa County, local school districts, social outreach agencies, and aid organizations in the area were contacted to determine the social services provided to the area and the effects a major transportation corridor in the area might have. Social service agencies, such as shelters for the homeless, addiction treatment and recovery centers, soup kitchens, and public schools providing free meals, reported that most clients arrive in cars or by taxi or bus, or, in the case of low-income children receiving free meals at school, by school bus.

Figure 4-10 Minority Populations Distribution



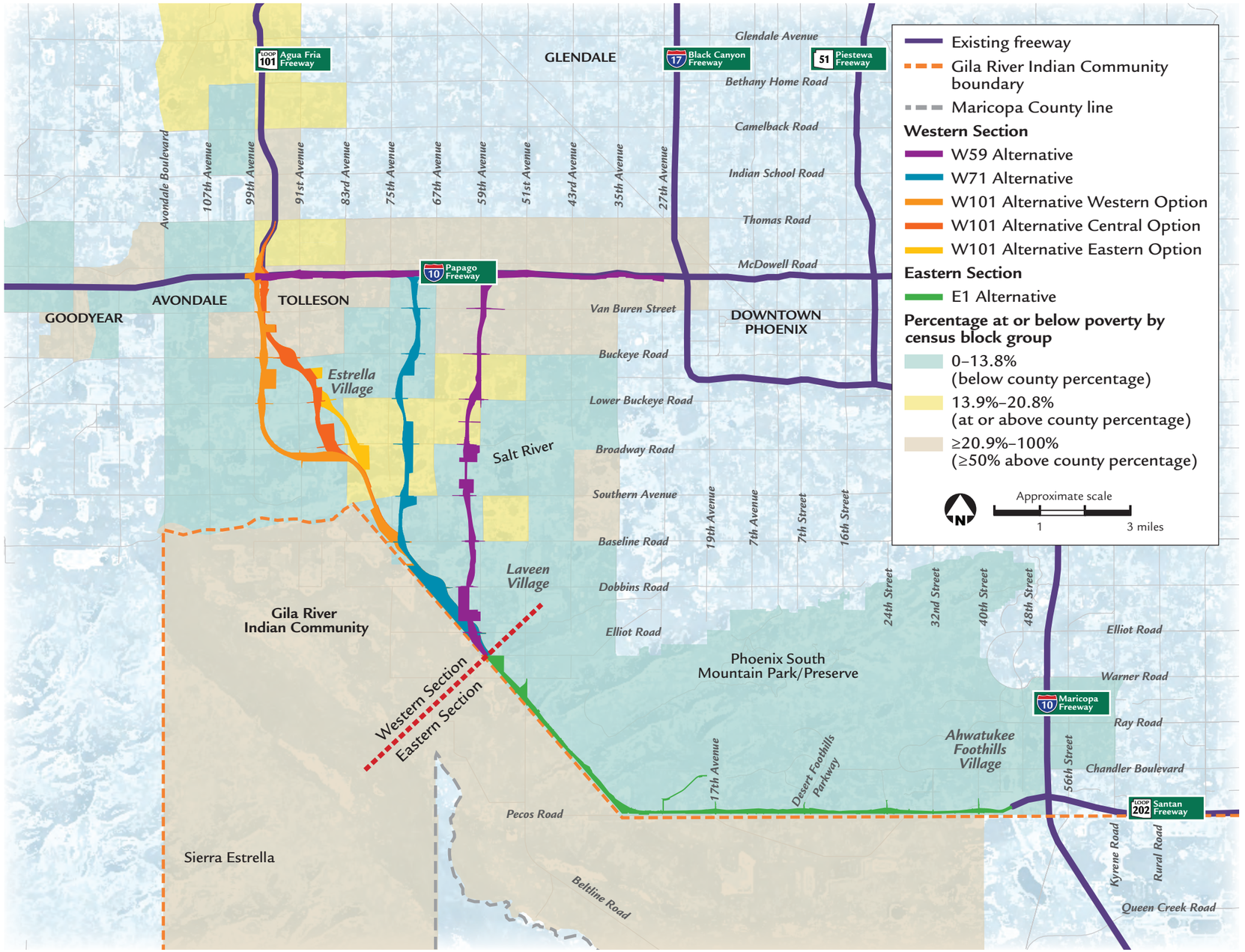
Minority populations, as identified through the use of census data, are prevalent throughout much of the Study Area. The U.S. Census Bureau uses geographic areas that do not correspond with the boundaries of Phoenix South Mountain Park/Preserve (SMPP). While the map colors may suggest that people live in SMPP, in fact, the data are depicting adjacent areas.

Engaging all populations in the EIS process for the proposed action

Public scoping is an integral part of identifying and analyzing Title VI and environmental justice impacts. Throughout the EIS process, early and continued communication with potentially affected neighborhoods ensured that neighborhood impacts would be identified and persons would not be overlooked or excluded from the process. Title VI and environmental justice concerns have been addressed continuously since the start of the EIS process for the proposed action.

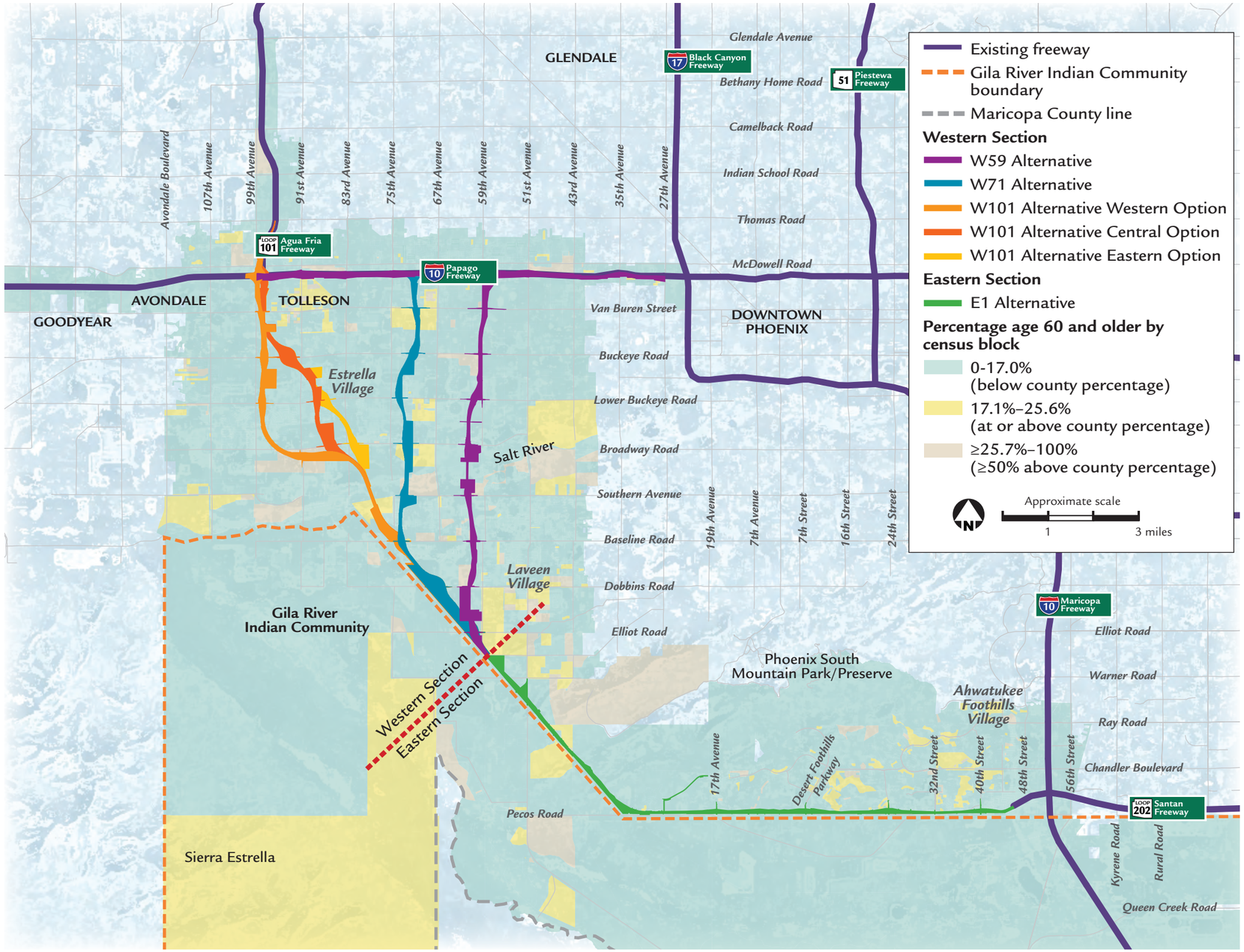
Specific strategies to ensure participation by the Hispanic, Native American, and low-income populations were established at the outset. Specific activities to engage these populations in the process included multiple-language newsletters (Spanish and Native American), other printed materials available in Spanish, the availability of Spanish translators and team members at public meetings to facilitate comments, and direct and ongoing communication with Community members and tribal leaders. The SMCAT, with representation of minorities and both sexes, was convened early and met continuously through the completion of the impact analyses to provide input and guidance on the process. Chapter 2, *Gila River Indian Community Coordination*, and Chapter 6, *Comments and Coordination*, discuss specifics regarding the extent of engagement of all affected populations in the process.

Figure 4-11 Low-income Populations Distribution



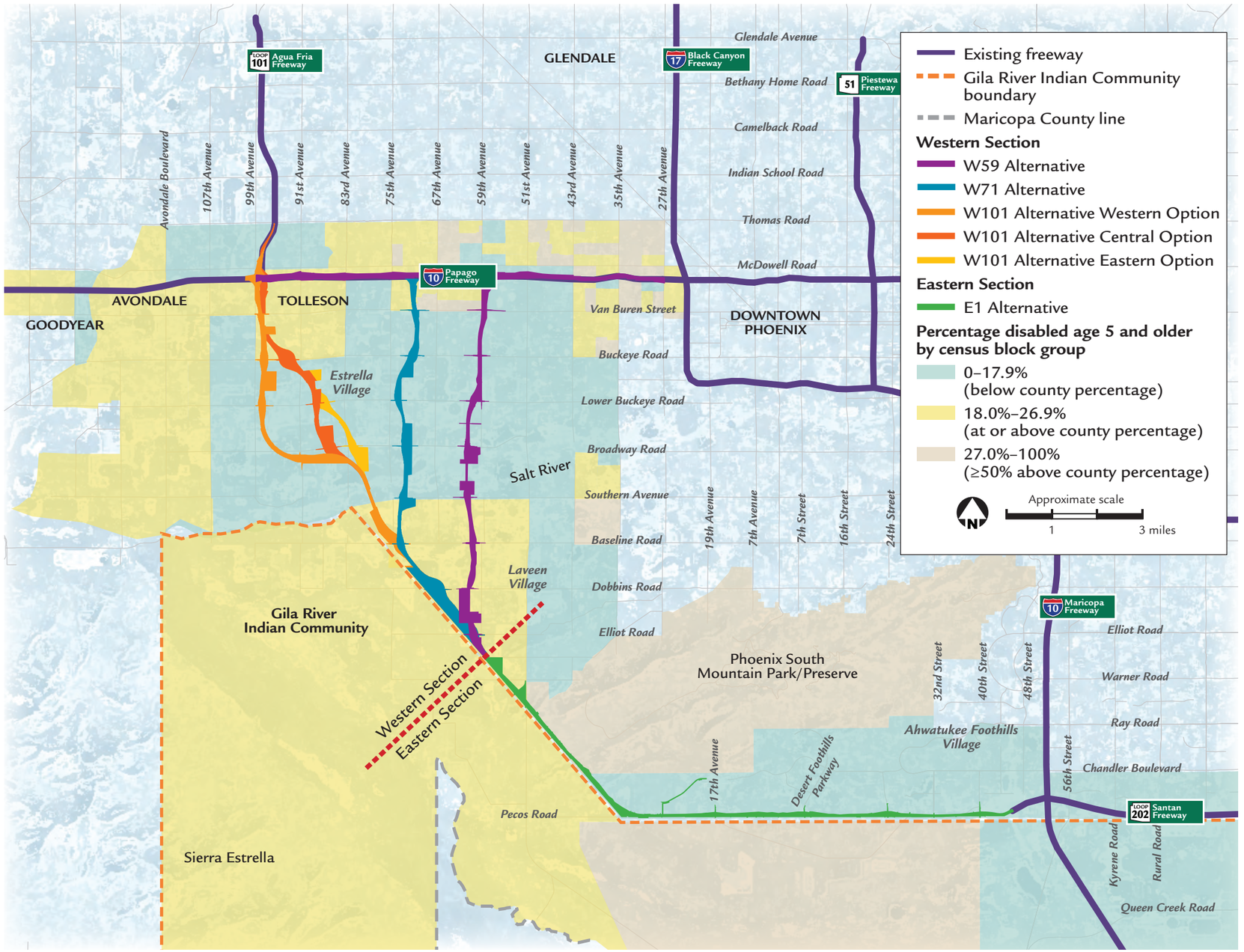
Low-income populations, as identified through the use of census block groups, are prevalent throughout much of the northern and northwestern portions of the Study Area. The U.S. Census Bureau uses geographic areas that do not correspond with the boundaries of Phoenix South Mountain Park/Preserve (SMPP). While the map colors may suggest that people live in SMPP, in fact, the data are depicting adjacent areas.

Figure 4-12 Elderly Populations Distribution



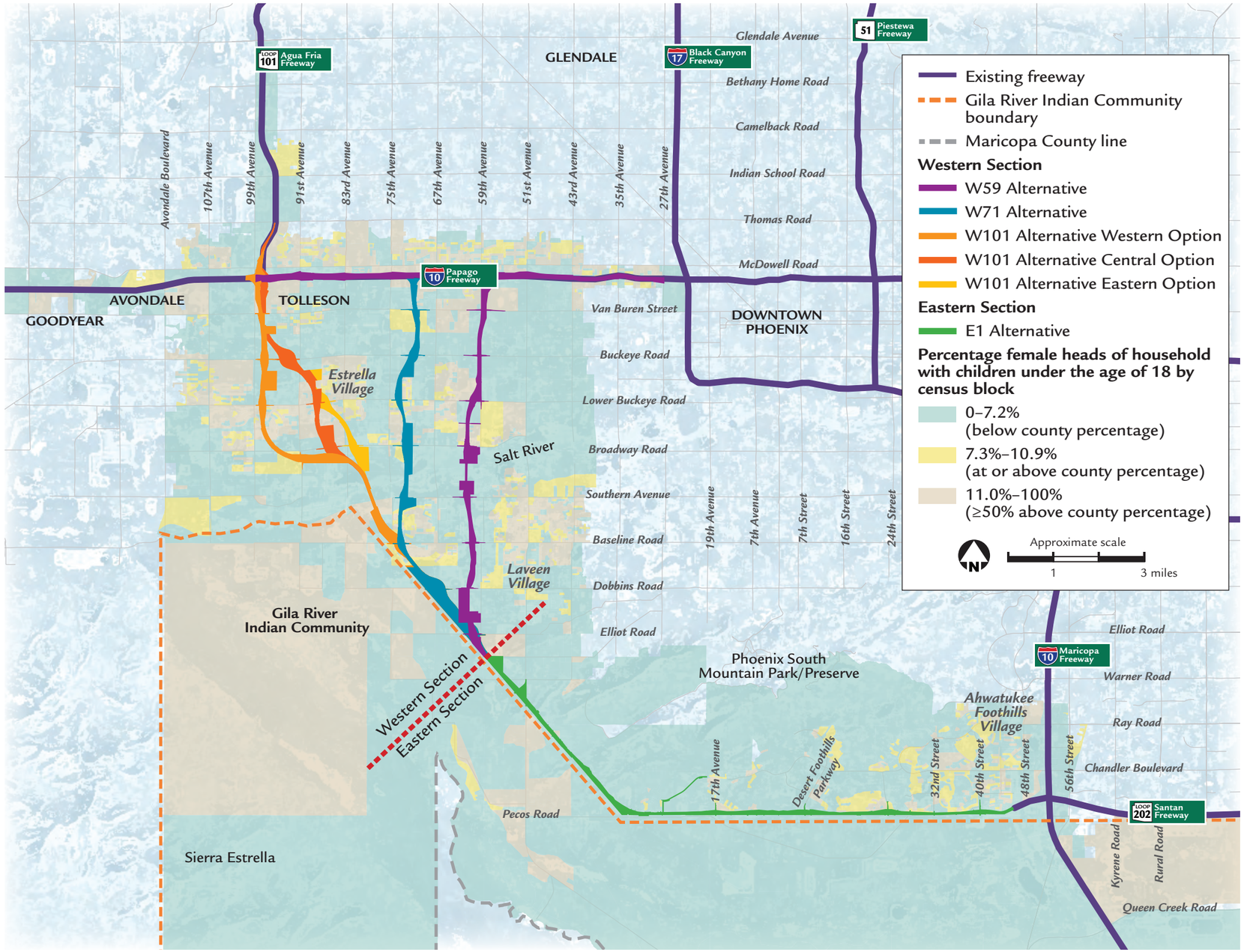
The majority of population segments in the Study Area fall below the overall county percentage of populations of people 65 years old and older. The U.S. Census Bureau uses geographic areas that do not correspond with the boundaries of Phoenix South Mountain Park/Preserve (SMPP). While the map colors may suggest that people live in SMPP, in fact, the data are depicting adjacent areas.

Figure 4-13 Disabled Populations Distribution



The U.S. Census Bureau uses geographic areas that do not correspond with the boundaries of Phoenix South Mountain Park/Preserve (SMPP). While the map colors may suggest that people live in SMPP, in fact, the data are depicting adjacent areas.

Figure 4-14 Female Heads of Household Populations Distribution



Populations with comparatively high percentages of female heads of household are found throughout the Study Area. The U.S. Census Bureau uses geographic areas that do not correspond with the boundaries of Phoenix South Mountain Park/Preserve (SMPP). While the map colors may suggest that people live in SMPP, in fact, the data are depicting adjacent areas.

ENVIRONMENTAL CONSEQUENCES

The environmental justice analysis focused on areas where there would be adverse environmental impacts, which includes all areas within the R/W footprint. Populations within census blocks or census block groups that would be affected by the action alternatives are shown in Table 4-11. This analysis identified environmental justice populations as those census blocks or block groups where the percentage of these groups is equal to or greater than 50 percent or 150 percent of the county percentage, whichever is less (in the case of minorities, the threshold is equal to or greater than 50 percent).

All action alternatives and options would affect residences using Section 8 housing vouchers. The HUD Section 8 housing assistance program is a rent subsidy program for eligible low-income families. (In general, the family's income may not exceed 50 percent of the median income for the county or metropolitan area in which the family chooses to live.) The subsidies make up the difference between what a family can afford (usually 30 percent of household income) and the market rent for suitable housing (HUD 2000).

Specific impacts are described under the action alternatives, Western Section and Eastern Section. All action alternatives and options would affect census blocks with minority populations greater than 50 percent because of displacements and relocations associated with the additional R/W needs. Replacement housing policy and guidance are addressed in the section, *Displacements and Relocations*, beginning on page 4-39.

Figures 4-10 through 4-14 support the findings presented in the discussion of impacts. Table 4-12 in the section, *Displacements and Relocations*, also supports the discussion.

All action alternatives would entail construction impacts that would affect all populations—environmental justice and otherwise. Such impacts would be temporary and would not cause undue hardship on any one population.

Action Alternatives, Western Section

W59 (Preferred) Alternative

Nine of the 12 census blocks with residential displacements under the W59 Alternative contain 50 percent or greater minority populations. Of these 9 census blocks, impacts on 1 are common to all of the Western Section action alternatives. Six of the

Table 4-11 Protected Populations Affected by Action Alternatives

Population	Western Section					Eastern Section
	W59	W71	W101 Western Option	W101 Central Option	W101 Eastern Option	E1
Census Block-level Data						
Census blocks affected	99	104	105	115	131–132	52
With no population[a]	53	27	55	59–60	59–60	23
With impacts	12	56	37	44	52–53	10
With minority populations ≥50%[b]	9	51	32	39	47	2
With elderly populations ≥25.7%[c]	2	0	1	0	0	1
With female head of household populations ≥11.0%[d]	6	22	14	23	24	2
Census Block Group-level Data						
2000 Census block groups affected	5	5	7–9	9	9	15
With impacts	4	5	2	2	3	5
With disabled ≥27%[e]	1	1	0	0	0	1
Census Tract-level Data						
2010 Census tracts affected	9	7	10–11	11	11	10
With impacts	5	5	3	5	6	4
With low-income ≥20.9%[f]	2	0	0	0	0	0

Sources: State, county, city, tribal, and Study Area figures are based on data from the U.S. Census Bureau (2010), with the exception of disabled, which is based on data from U.S Census Bureau (2000), and low-income which is based on the 5-year American Community Survey (2006-2010).

[a] No population is those census blocks where the 2010 U.S. Census reported the population to be zero.

[b] based on U.S. Census Table P5: Hispanic or Latino, and Not Hispanic or Latino by Race

[c] based on U.S. Census Table P12: Sex by Age

[d] based on U.S. Census Table P19: Household Size By Household Type By Presence of Own Children

[e] based on U.S. Census Table P41: Civilian Noninstitutionalized Persons Age of 5 and Over with Sensory, Physical, Mental, and/or Self-care Disabilities

[f] based on American Community Survey Table S1701: Poverty Status in the Past 12 Months

9 minority population census blocks also contain a percentage of female head of household populations above the established threshold.

Of the single-family residential displacements that would occur under the W59 Alternative, 28 displacements would occur in an established subdivision immediately adjacent to I-10, and 9 displacements would occur in the Rio Del Rey subdivision at Broadway Road and 63rd Avenue. Rio Del Rey is in the Riverside Elementary School District, which reported that a majority of its students are minorities, and 18 percent are low-income. The remaining 9 displacements caused by the W59 Alternative would be rural residential properties, primarily located south of the Salt River.

In addition to the single-family residential displacements, the W59 Alternative would displace two apartment complexes totaling up to 680 units. These apartments fall within a census block where greater than 50 percent of the population is minority. Most of the apartment units have "market-rate" rents; however, one apartment complex accepts Section 8 housing vouchers (of the 264 units in the complex, 16 currently use Section 8 vouchers).

W71 Alternative

Of the 56 census blocks with residential displacements that would be caused by the W71 Alternative, 51 contain minority populations of 50 percent or greater than the census blocks' total population. Twenty-two of these 56 blocks are also identified as having a percentage of female head of household populations above the established threshold.

Nearly half of the 705 single-family homes that would be affected by the W71 Alternative are within the Laveen Meadows, Laveen Ranch, and Laveen Farms subdivisions. These subdivisions are within the Laveen Elementary School District, where the local elementary school (Desert Meadows Elementary) reported that a majority of the students are minorities and 16 percent are low-income.

Another 252 single-family homes that would be affected by the W71 Alternativeare homes within the Sienna Vista and Windsong and Estrella Village subdivisions. These subdivisions are comprised largely of census blocks with greater than 50 percent minority populations and female head of households with 11 percent or greater of the census blocks' total population.

The W71 Alternative would purposefully avoid affecting the community of Santa Maria and Santa Maria Middle School, located along Lower Buckeye Road.

None of the five census tracts with residential displacements under the W71 Alternative would affect low-income populations. A census block group containing a disabled population would have 17 single-family residential displacements. This census block group is located between Van Buren Street and I-10. In addition, seven of the single-family residences within the W71 Alternative currently accept Section 8 housing vouchers.

W101 Alternative

The options of the W101 Alternative would result in varying impacts on census blocks with minority populations representing 50 percent or greater of the census blocks' total population. A number of these census blocks are common to all three options, while the W101 Alternative Eastern Option would affect the most census blocks with minority populations, and the Western Option would affect the fewest census blocks with minority populations. The options of the W101 Alternative would also result in varying effects on census blocks with female head of household populations with 11 percent or greater of the census blocks' total population. Several of these census blocks are common to all three options, while the W101 Alternative Eastern Option would affect the most census blocks with female head of household populations and the Western Option would affect the fewest census blocks with female head of household populations.

The W101 Alternative Western Options would affect one census block with elderly populations greater than 150 percent of the County percentage, located within the Country Place subdivision.

Western Option

The W101 Alternative Western Option would displace an additional 171 single-family homes in the Country Place subdivision. This subdivision consists of census blocks with greater than 50 percent minority populations. An additional 3 residences using Section 8 housing vouchers would be affected.

Central Option

The W101 Alternative Central Option would displace an additional 344 single-family homes in the 91st Avenue and Lower Buckeye Road and Hurley Ranch subdivisions, consisting almost entirely of census blocks with greater than 50 percent minority populations and female head of household populations with 11 percent or greater of the census blocks' total population . An additional 9 residences using Section 8 housing vouchers would be affected by this option.

Eastern Option

The W101 Alternative Eastern Option would displace an additional 430 single-family homes in the 91st Avenue and Lower Buckeye Road, Ryland at Heritage Point, 83rd Avenue and Lower Buckeye Road, and Hurley Ranch subdivisions, consisting almost entirely of census blocks with greater than 50 percent minority populations and female head of household populations with 11 percent or greater of the census blocks' total population. These subdivisions are within the Union Elementary School District, which reported that a majority of students are minorities and 16 percent are low-income. An additional 11 residences using Section 8 housing vouchers would be affected by this option.

No residential displacements would occur in Tolleson as a result of the proposed action. Project-related disruptions in Tolleson would chiefly occur in industrial areas and would not adversely affect environmental justice populations in residential neighborhoods. The proposed action would not cut off access or restrict the mobility of environmental justice populations. Access to the high school would not be impaired.

Environmental justice and impacts

All alternatives (including the No-Action Alternative) would have the potential to create adverse impacts on, as well as benefits for, all population segments in the Study Area and its surroundings. Impacts include community disruption and fragmentation; relocations and displacements; and air, noise, and visual quality intrusions from the proposed action. These impacts are directly addressed in the sections, *Land Use, Social Conditions, Displacements and Relocations, Economic Impacts, Air Quality, Noise, Cultural Resources, Visual Resources, Prime and Unique Farmlands,* and *Temporary Construction Impacts*, found elsewhere in this chapter. In addressing environmental justice, it is important to understand whether the proposed action would have disproportionately high and adverse impacts on the protected population.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The E1 Alternative would result in 121 residential displacements. Two of the ten census blocks with residential displacements contain minority populations. Two affected census blocks contain female heads of household populations greater than the threshold value; one of these census blocks is also identified as a minority block. One census block with residential impacts contains greater than the threshold for age 60 and over populations. Residential displacements would occur in one census block group containing an environmental justice population of people with disabilities. Environmental justice concerns with regard to the Community are presented in the section, *Context of Coordination in Relation to Environmental Justice Executive Order*, on page 2-11.

No-Action Alternative

Socioeconomic conditions under the No-Action Alternative would be similar to existing conditions. As discussed previously, rural land uses are being converted to urban uses throughout the Western Section of the Study Area. These changes have been planned; agricultural land uses are not shown on any of the Study Area's affected municipalities' future land use maps.

Congestion would increase with the No-Action Alternative, and accessibility to employment and housing might be impeded by increased congestion. As congestion on surface streets increases, all neighborhoods would be affected equally. The No-Action Alternative would result in no property acquisitions and no household relocations. Therefore, environmental justice populations would not be affected by R/W acquisitions.

MITIGATION

No undue hardship or disproportionate adverse impacts on populations afforded protection under Title VI, Executive Order 12898, the U.S. Department of Transportation Order 5610.2(a), and other related statutes would occur and, therefore, no mitigation would be required. Mitigation measures as presented in the sections, *Land Use* (beginning on page 4-3), *Social Conditions* (beginning on page 4-20), *Displacements and Relocations* (beginning on page 4-39), *Economic Impacts* (beginning on page 4-46), *Air Quality* (beginning on page 4-58), *Noise* (beginning on page 4-80), *Cultural Resources* (beginning on page 4-128), *Prime and Unique Farmlands* (beginning on page 4-149), *Visual Resources* (beginning on page 4-155), and *Temporary Construction Impacts* (beginning on page 4-161), would result in reduction, minimization, and avoidance of impacts as well as overall benefits to all populations in the Study Area.

CONCLUSIONS

ADOT and FHWA have engaged all population segments to ensure access to the EIS study process. Assisted by this involvement, analytical results indicate the proposed action would benefit all populations in the Study Area in general by reducing traffic congestion, enhancing accessibility, and supporting local economic development plans

- As part of the approved RTP—which includes planned improvements to the Regional Freeway and Highway System, arterial street network, transit, and other aspects of the region's freeway system (see the text box, *What is the Regional Transportation Plan?*, on page 1-5)—environmental justice populations would benefit from the RTP at approximately the same level or, in some cases, at a higher level than would populations in areas not considered to have environmental justice populations (MAG 2003). In connecting the eastern, southeastern, and southwestern regions of the Phoenix metropolitan area, the proposed action would provide improved access for all area residents to key employment areas to the north, south, and east along the I-10 corridor, and in central Phoenix.
- The proposed action would reduce congestion and improve the area transportation system. Improvements would be especially important given the projected growth and development in the southwestern Phoenix metropolitan area. Along with the general population, Title VI and environmental justice populations would benefit from these improvements. Accessibility to regional public and private facilities and services would be improved. Under the No-Action Alternative, accessibility to employment and housing might be impeded by increased congestion.

Households using Section 8 vouchers would be affected by all of the Western Section action alternatives. Housing units that participate in the program are not limited, except by the availability of vouchers; therefore, the availability of replacement housing is not easily quantified. Based on discussions with the City of Phoenix Housing Department, there is currently replacement housing in the area.

All action alternatives and options would have an adverse effect on environmental justice populations, primarily during construction, but impacts would be temporary and would not create undue hardship or be disproportionately high compared with projected impacts on all populations in the Study Area. Mitigation presented throughout this chapter (see sidebar on this page for specific topics) would reduce many of the adverse impacts. All populations would benefit from the proposed action's implementation through improved regional mobility and reduced local arterial street traffic.

Therefore, because the proposed action would not cause disproportionately high and adverse effects on any environmental justice populations, no environmental justice or Title VI mitigation would be required.

DISPLACEMENTS AND RELOCATIONS

AFFECTED ENVIRONMENT

Construction of the new freeway facility would cause displacement of households, businesses, and public facilities. In addition to displacements, changes in accessibility along the new facility could also affect properties adjacent to the freeway by altering travel patterns. The resulting displacement impacts would primarily involve residential properties, but commercial establishments would also be affected.

ENVIRONMENTAL CONSEQUENCES

Impact Overview, Western and Eastern Sections

The action alternatives would predominantly displace residents of single-family homes, as shown in Table 4-12. Displacements under each action alternative would primarily be concentrated in the northwestern and southeastern portions of the Study Area, areas undergoing rapid development and containing numerous single-family residential neighborhoods, and a warehouse/distribution area for many Phoenix-area businesses.

A number of existing undeveloped tracts of land are also located near or within the action alternatives' proposed R/W. Single-family subdivisions have been developed or have been proposed for a large portion of the Western Section of the Study Area (see the section, *Development Plans*, on page 4-7, to learn about development activity in the Study Area). Impacts on undeveloped single-family residential lots have also been considered in the displacement and relocation analysis. Table 4-12 shows the potential displacement impacts, by action alternative.

Action Alternatives, Western Section

As shown in Table 4-12, the W59 (Preferred) Alternative would result in the most business displacements, while the W101 Alternative Eastern Option would result in the most residential displacements. The W101 Alternative Eastern Option would also affect the most platted lots and, therefore, would potentially result in additional residential displacements.

Table 4-12 Potential Displacements, Action Alternatives

Action Alternative/Option[a]	Businesses[b]	Residential					Community Facilities[c]	Utilities[d]
		SF[e]	Lots[f]	MH[g]	MF[h]	Total		
Western Section								
W59	41	53	0	0	680	733	0	1
W71	22	705	120	0	0	825	0	0
W101 Western Option	14–30[i]	598–599	326–327	2	0	926–928	3	3
W101 Central Option	14–29	769	350	0	0	1,119	3	2
W101 Eastern Option	14–28	857	447	0	0	1,304	3	2
Eastern Section								
E1	0	112	17	9	0	138	1	2

Source: aerial photography flown in 2010

[a] Displacements were estimated using aerial photographs, supplemented by field observations in February 2010.

[b] includes businesses whose buildings are directly affected; does not include businesses whose parking and outdoor storage areas would be affected by an action alternative; count reflects the number of structures involved in business activities, not the number of actual businesses; counts have not been reconciled with the counts shown in Table 4-13, which derive from a Maricopa Association of Governments database, because the number of businesses could change as frequently as weekly or monthly

[c] includes schools

[d] includes electric substations, communication facilities, well stations, etc.

[e] single-family

[f] includes an estimate of the number of lots platted without homes being built

[g] manufactured homes

[h] multifamily, represents number of units potentially affected

[i] W101 Alternative and Options include ranges because of design options.

Action Alternative, Eastern Section

Displacements associated with the E1 (Preferred) Alternative would occur primarily along Pecos Road in Ahwatukee Foothills Village. In addition, a number of lots platted for new single-family home construction would be affected. The Mountain Park Community Church would be displaced under this action alternative. Coordination with the City of Phoenix regarding the 32nd Street and 25th Avenue interchanges resulted in both being removed from the proposed action. These interchanges would have affected additional residences, had they been included. No displacements would occur on Community land.

No-Action Alternative

No property would need to be acquired if the No-Action Alternative were identified as the Selected Alternative. Therefore, no displacements or relocations would occur. The No-Action Alternative would not preclude proposal of a project similar to the proposed action in the future that could, in turn, result in displacements and relocations. As additional development in the area occurs, an even greater number of displacements and relocations would likely be required if such a project were constructed in the future.

Residential Relocation Potential, Western and Eastern Sections

The majority of the single-family residences that would be displaced by the action alternatives in the Western Section are primarily located between Baseline and Buckeye roads. Housing in the Study Area is predominantly single-family, with a range of older housing built in the 1950s through 1970s to new housing recently constructed.

According to the 2000 Census, the single-family residency vacancy rate in the Study Area was 7 percent and the overall rental vacancy rate was 9 percent for the census block groups that make up the Study Area. More recent data indicate a higher rental vacancy rate—the Phoenix-Mesa-Scottsdale metropolitan statistical area's rental vacancy rate during the fourth quarter of 2009 was 17.9 percent (U.S. Census Bureau 2010). Subdivisions containing single-family homes of similar size and style to those that would potentially be displaced have been developed in the Study Area during recent years. In addition, there are several platted subdivisions that have not yet been developed.

For the purposes of this analysis, it is assumed that residents displaced by action alternatives would most likely relocate in the Study Area and farther into the developing suburbs to the east and west. This area allows for the same proximity to existing services and facilities, such as schools, parks, medical offices, retail shopping areas, and freeway access.

Interim population and land use projections from MAG indicate that the Study Area will continue to grow substantially in the future (see Chapter 1, *Purpose and Need*, for further discussion regarding growth). To summarize, the entire Study Area's population will grow by a projected 118 percent between 2000 and 2020, and the number of dwelling units in the Study Area is projected to grow by 123 percent during the same period. Single-family residential development would continue to replace vacant land and spread west and south. The population growth rate in the Eastern Section would be expected to be slower (the area is nearly built-out) and will increase by only 15 percent, while the number of dwelling units will increase by 10 percent between 2000 and 2020.

Data from the Maricopa County Assessor's office on recent sales and comparable prices indicate potentially displaced residences located within the action alternatives in the Western Section generally range in value from the low $100,000s for some of the older housing up to the low $300,000s for newly constructed housing. Applicable housing located in the Eastern Section generally ranges in value from the upper $200,000s to the low $600,000s.

A survey of real estate sales listings in September 2006 was conducted to determine the availability and prices of existing homes similar to those that would be displaced. Real estate listings for four ZIP Codes in southwestern Phoenix (85323, 85353, 85043, and 85048) were examined for similar-size homes. The data indicated that comparable single-family dwellings would exist for replacement housing, particularly in the area of the action alternatives in the Western Section, which includes ZIP Codes 85323, 85353, and 85043. Approximately 1,185 single-family homes were listed for these areas, at an average price of $271,000. Real estate availability in the Eastern Section of the Study Area was not as prevalent, although the existing listings showed approximately 319 comparable homes for sale at an average price of $430,000. The economic downturn that began in 2007 has depressed home prices throughout the region. As of the second quarter of 2009, average home prices across the United States are at levels similar to what they were in early 2003 and will likely remain lower until the real estate market recovers (Standard and Poor's and Fiserv 2009).

As population in the Phoenix metropolitan area increases, demand for housing in the Study Area would also increase. Newly constructed housing would most likely provide some of the replacement housing required as a result of construction of any of the action alternatives and options in the Western Section. It is likely, however, that the supply would be tighter and the accompanying demand higher in and near Ahwatukee Foothills Village because it is much more densely developed and has fewer opportunities for new single-family home construction. Tempe has available housing, and the communities of Chandler and Gilbert are projected to grow in the next 20 years and would provide other options for relocation of displaced residents from this area. A combination of available housing and newly built homes projected and/or planned for development would accommodate the expected number of relocations, especially if R/W acquisition were to occur over an extended period of time.

Businesses Relocation Potential, Western and Eastern Sections

The action alternatives would cause economic impacts on businesses that would range from beneficial (resulting from improved highway access for transportation companies) to highly adverse (such as displacement). For those remaining businesses, impacts would be temporary (such as accessibility problems during project construction) or permanent (such as lack of visibility or accessibility from the new freeway). Displacement impacts would be mitigated through relocation or site purchase at a fair market price. Business revenue impacts, however, would not be mitigated. The following sections focus initially on business displacements and then identify potential impacts on remaining businesses.

Although displacement could be an adverse impact on a given business, it is not necessarily an adverse impact on the economy. As previously stated, these impacts would be mitigated through relocation or outright purchase of the business site. If demand for the types of services provided by the businesses remains, activity should continue at the new location, especially when it is reasonably near the existing location.

Such is the case with most types of businesses in the Western Section. Some businesses in the corridor, however, are characterized by very high levels of capital investment and serve a regional demand for their products. Some businesses also require rail access. Displacing these businesses and relocating or rebuilding their capital equipment would be very expensive, may result in relocation out of the region, or may cause them to close. These businesses will be discussed in the context of the action alternative in which each business is located.

Businesses potentially displaced by each action alternative are shown in Figures 4-15 through 4-17, which use aerial photography to show the specific location of each displaced business with respect to the proposed action alternatives. Table 4-13 summarizes the business displacements, by action alternative, according to the nature of the business.

Figure 4-15 Potential Business Relocations, W101 Alternative and Options

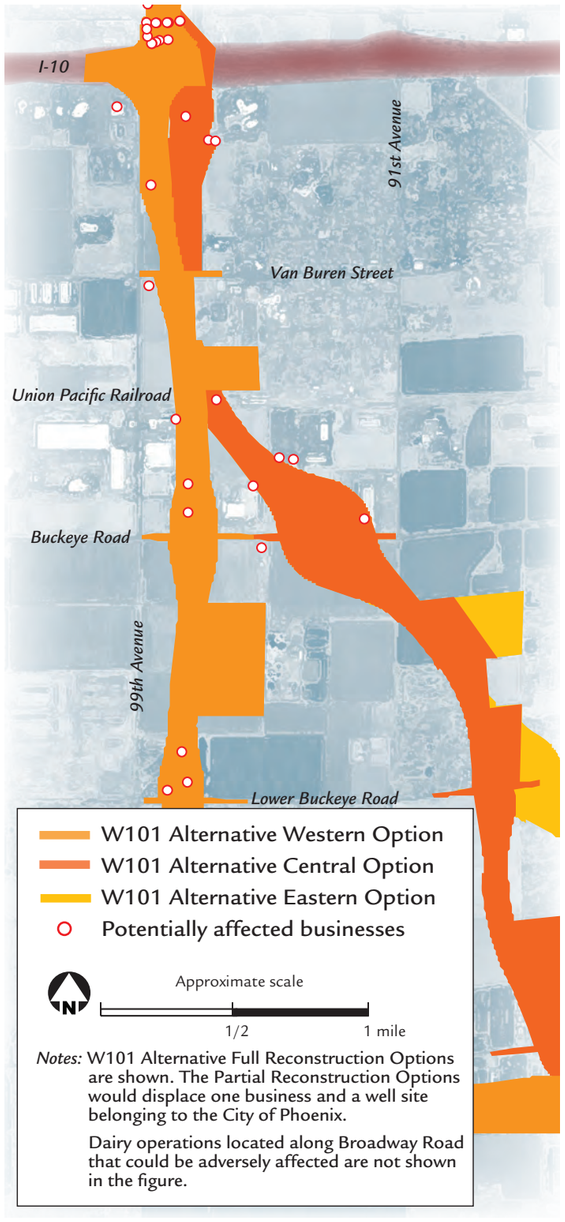


Figure 4-16 Potential Business Relocations, W71 Alternative

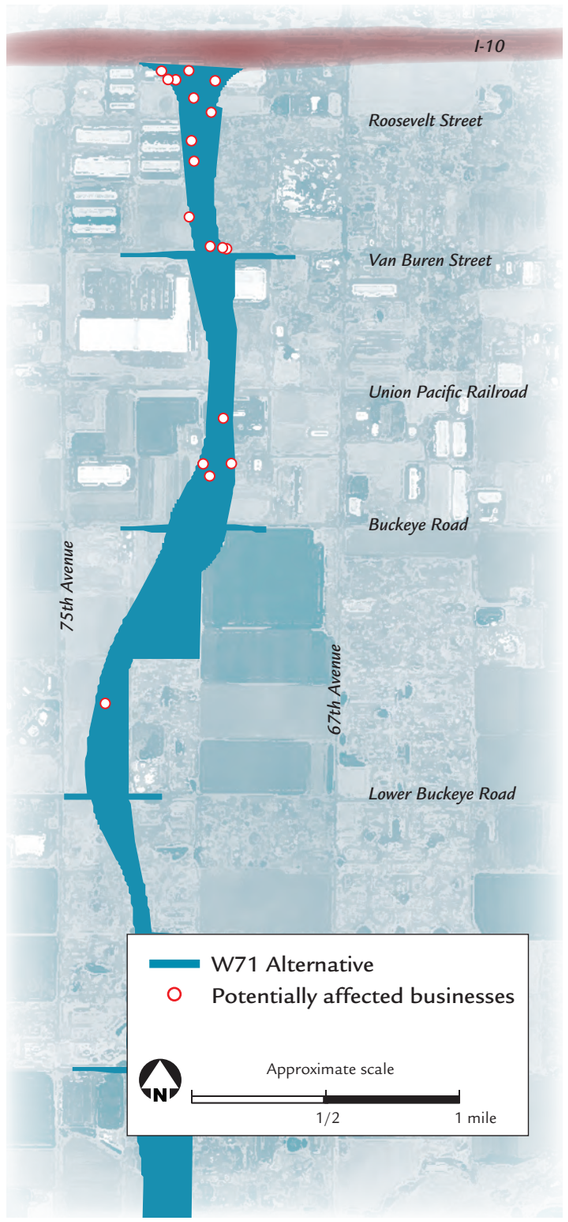
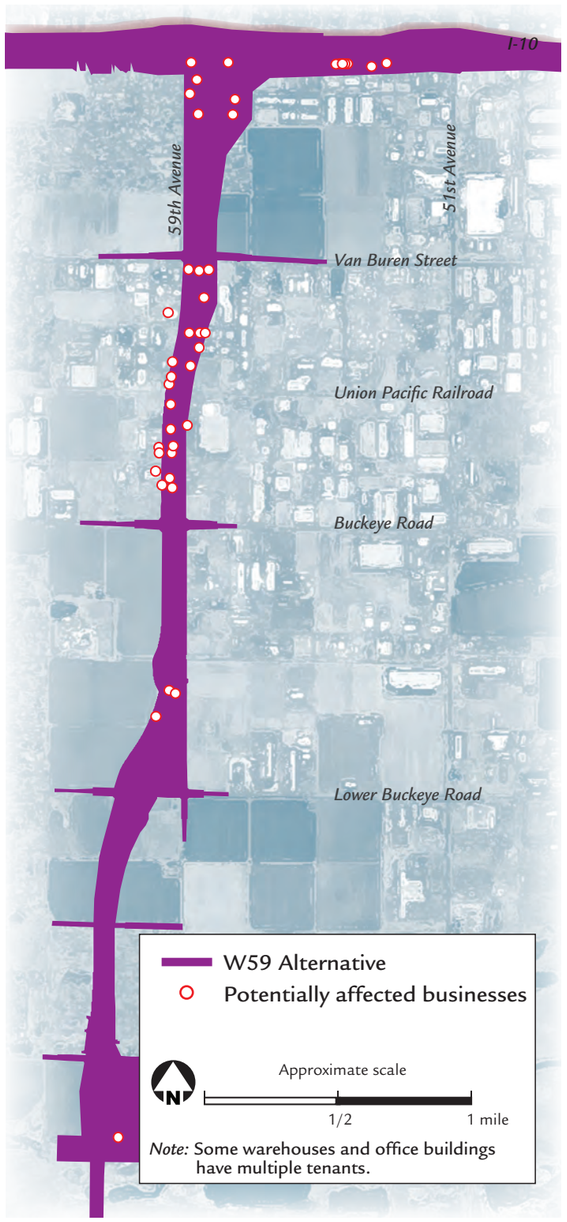


Figure 4-17 Potential Business Relocations, W59 Alternative



The number of business displacements would be greatest with the W59 Alternative. Many business owners chose locations in the area in part because of the expectation of the proposed freeway being constructed nearby. Please see Tables 4-12 and 4-13 for more detail regarding potential business relocations.

Table 4-13 Summary of Business Displacements, Action Alternatives

Action Alternative/Option	Business													
	Accommodation and Food Services	Administrative and Support and Waste Management and Remediation Services	Agriculture, Forestry, Fishing, and Hunting	Construction	Manufacturing	Other Services (except Public Administration)	Professional, Scientific, and Technical Services	Public Administration	Retail Trade	Transportation and Warehousing	Utilities	Wholesale Trade	Unclassified	Total
Western Section														
W59	3	2	0	3	7	3	3	2	6	6	0	6	1	42
W71	1	0	0	2	2	0	0	0	1	2	0	1	0	9
W101 Western Option	0–2[a]	0	2–3	0	2	0–2	0	0	1–6	1	0	3	0–13	9–32
W101 Central Option	0–1	0	3	0	4	0–1	0	0	0–2	1	0	1	0–13	9–26
W101 Eastern Option	0–1	0	1	0	4	0–1	0	0	0–2	1	0	1	0–13	7–24
Eastern Section														
E1	0	0	0	1	0	2	1	0	0	1	0	0	4	9

Sources: Maricopa Association of Governments 2007 Business Database; Maricopa County Assessor, 2009

Notes: The Maricopa Association of Governments 2007 Business Database may indicate numerous businesses within one location (address). The "other services" category includes health care and social assistance. "Professional, scientific, and technical services" include educational services, finance and insurance, real estate, and rental and leasing.

[a] W101 Alternative and Options include ranges because of design options.

Action Alternatives, Western Section

W59 (Preferred) Alternative

Manufacturing, retail trade, transportation and warehousing, and wholesale trade would account for over half the total number of displaced businesses. The largest employers are in the retail fields. Retail businesses tend to be relatively easier to relocate because their equipment and workforce are generally more mobile than industrial and manufacturing enterprises, with less site-specific capital investment. Several machinist facilities manufacture metal products. These processes tend to have large, heavy equipment fixed in place. Removal and reinstallation would result in high costs and business disruption. These businesses would, however, likely remain viable within the region if relocated (with the project sponsor assuming the comparatively high costs of relocation).

Most businesses could be relocated within the region; because of limited information available during data-gathering efforts, however, there are three businesses whose operations are unclassified. The known types of businesses are not so site-specific that displacement by the proposed action may cause them to leave the region. Therefore, the relocations of these businesses should not cause an adverse economic impact on the region.

W71 Alternative

Of the displaced businesses, there would be two each in the construction, manufacturing, and transportation and warehousing industries. One of the manufacturing businesses, Daystar, would be difficult to relocate. It is a plastics product manufacturer with a high level of capital investment specially invented by the company for production. The equipment would be difficult to move and would be difficult to replace without prefabrication.

Similar to the nature of the businesses along the W59 Alternative, with the exception of Daystar, it appears that the displacement or relocation of businesses along the W71 Alternative would not cause regional economic impacts because the demand for these goods and services would likely continue into the future.

W101 Alternative and Options

The options of the W101 Alternative would displace businesses, mostly in Tolleson. In contrast to the W59 and W71 Alternatives, professional or administrative businesses or construction businesses would not be in the proposed R/W. In contrast to the other action alternatives, only one transportation and warehousing business would be displaced. Large businesses with substantial employment, however, would be adversely affected. Similar to the other action alternatives, many of the businesses along the W101 Alternative could be relocated with minimal impact on the regional economy. Adverse impacts on the regional economy resulting from the W101 Alternative and Options would result from impacts on a limited number of businesses:

- The W101 Alternative Central and Eastern Options would displace two major Tolleson employers: Atrium Door & Window Company and Holsum Bakery. Atrium Door & Window Company, employing nearly 300 people, serves a large market throughout the Southwest and could continue business in a range of locations inside or outside of the Phoenix region. Holsum Bakery, which employs about 180 people, is one of the few flour milling businesses in the region. Because of the nature of its operations, this business would require a similar location with rail and truck access. Both businesses would likely be very expensive to relocate because of high levels of capital investment in their plants.

In addition, Holsum Bakery has expressed concerns about the feasibility of relocating without major interruptions in its business.[2] If relocated within the region, the regional economic impacts of these business displacements would be minimal.

- The W101 Alternative Western Option would also displace Bay State Milling Company, which has a substantial investment in equipment at its existing site. Bay State Milling Company is a large flour mill serving more than 80 percent of the bakeries, tortilla factories, and food-service providers in Arizona. The mill requires a site with both truck and rail access for operations. Interruption of operations at the flour mill for possible relocation would have a detrimental effect on this business as well as on the local and regional economies.[3]
- The W101 Alternative Western and Central Options would displace dairy operations on West Broadway Road and 99th Avenue. It is not now known whether the sites could be reconfigured to allow the dairies to remain in operation. Similar to milling companies, these businesses have a high level of capital investment in equipment. Because of the biological nature of the operations, no interruption in operations could be tolerated if relocated. If totally displaced, the dairy operations would be difficult to relocate within the region because of urbanization in surrounding areas. These potential displacements would continue a trend of dairy production moving farther away from the Phoenix metropolitan area.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The E1 Alternative would displace nine businesses: one in construction; two in the "other services" category; one in professional, scientific, and technical services; one in transportation and warehousing; and four that are unclassified.

No-Action Alternative

Under the No-Action Alternative, no businesses would be displaced or otherwise affected. Over time, however, it is possible that roadway improvements later initiated by local jurisdictions may adversely affect businesses. In addition, increasing future traffic congestion may adversely affect trucking and other transportation-related businesses in the Study Area. The No-Action Alternative would not preclude proposal of a project similar to the proposed action in the future that could, in turn, result in displacements and relocations.

If My Property Would Be Affected, Can ADOT Purchase the Land in Advance?

Concerns have been raised by people whose properties are known to be in the alignment of one of the action alternatives or may abut the proposed new freeway. Owners of several properties located adjacent to the R/W boundary have claimed that the new freeway would cause hardships, such as increased noise, degraded visual quality, decreased property values, inability of owners to sell their property because of the location of the new freeway, or structural damage from project construction activities.

ADOT has a process in place to evaluate hardship claims on a case-by-case basis and determine whether compensation is required. Additionally, the Arizona Department of Administration Risk Management Section has a process in place to evaluate compensation for structural damages.

Hardship Acquisitions

The hardship acquisition process is similar to the regular acquisition process, except properties must meet strict criteria outlined in Chapter 7 of the current ADOT *Right-of-Way Procedures Manual* to be eligible for hardship acquisitions. The property owner must provide a written request to the ADOT Project Management Coordinator that describes the nature of the hardship. To be eligible for hardship acquisition, property owners must meet one of the criteria and provide supporting documentation generally outlined in the accompanying table. The property owner documents an inability to sell the property because of the impending project at fair market value within a time frame that is typical of properties not affected by the impending project. It is the responsibility of the applicant to understand the specifics of the supporting documentation.

After receiving all required documentation, the Project Management Coordinator would investigate the property owner's request and prepare a memorandum outlining the results of the investigation and providing a recommendation to the Chief Right-of-Way Agent. The memorandum would also include a cost estimate for property acquisition. The Chief Right-of-Way Agent would make the final decision regarding the approval or denial of the property acquisition. If approved, the Project Management Coordinator would provide a copy of the complete documentation package and letter of approval to the property owner. In the event that the request is not approved, the Project Management Coordinator would provide a letter disclosing the reasons for denial. Generally, few claims have met ADOT's eligibility criteria for hardship acquisitions; therefore, ADOT has generally provided no compensation for such claims.

Hardship Acquisition Criteria and Documentation

Hardship Situation	Supporting Documentation
Disability	Doctor's statement
Deprived health, safety, and welfare conditions	Legal records
Mandatory transfer of employment	Certified letter from employer
Loss of employment	Certified letter from employer
Insufficient funding for estate debt	Financial statement
Extreme reduction in income	Income tax returns
Foreclosure or bankruptcy	Financial statement
Inability to sell property/loss in property value due to vicinity of corridor	Broker's certification

Damages

Claims for structural damages are evaluated on a case-by-case basis through the Arizona Department of Administration Risk Management Section. The property owner would initiate the process by immediately reporting property damages to the Risk Management Section in Phoenix. The property owner would then complete and submit form RMO15, "Notice of Claim Against the State of Arizona," to the Risk Management Section and the Office of the Attorney General. The form must be completed with contact information; the date, time, and circumstances of the situation; and the amount of the claim.

After receiving the claim, the Risk Management Section would notify the property owner of the claim number and the adjuster who would be assigned to evaluate the claim. The adjuster would then determine whether the claim would be eligible for compensation and notify the property owner of the claim status.

Proximity Impacts on Businesses

In general, the proposed action would benefit nearby businesses by providing improved highway access and would benefit regional businesses by improving regional traffic conditions. Offsetting these benefits would be short-term adverse impacts during construction (see the section, *Temporary Construction Impacts*, beginning on page 4-161) and, for some types of businesses, reduced

Table 4-14 Summary of Businesses within 300 Feet of Action Alternatives

Action Alternative/ Option	Business													
	Accommodation and Food Services	Administrative and Support and Waste Management and Remediation Services	Agriculture, Forestry, Fishing, and Hunting	Construction	Manufacturing	Other Services (except Public Administration)	Professional, Scientific, and Technical Services	Public Administration	Retail Trade	Transportation and Warehousing	Utilities	Wholesale Trade	Unclassified	Total
Western Section														
W59	5	4	1	6	14	10	5	0	7	15	0	15	1	83
W71	0	0	0	0	1	0	1	0	2	2	0	5	0	11
W101 Western Option	0	0–1[a]	0–1	0	0–1	0–3	0–4	0–1	0–2	0–7	0–1	0–2	0	9–14
W101 Central Option	0–1	1	0	1	0	0–1	0	1	1–2	0	1	3	0–13	9–23
W101 Eastern Option	0–1	1	1	1	0	0–1	0	1	1–2	0	1	3	0–13	10–24
Eastern Section														
E1	0	0	0	0	0	3	3	0	0	1	0	0	0	7

Sources: Maricopa Association of Governments 2007 Business Database; Maricopa County Assessor, 2008

Notes: This table includes businesses within 300 feet of the action alternatives but outside of each respective action alternative's right-of-way. The Maricopa Association of Governments 2007 Business Database may indicate numerous businesses within one location (address). The "other services" category includes health care and social assistance. The "professional, scientific, and technical services" category includes educational services, finance and insurance, real estate, and rental and leasing.

[a] W101 Alternative and Options include ranges because of design options; totals don't equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

visibility to the traveling public possibly leading to reduced business revenues.

Retail businesses, restaurants, and some service industries are types of businesses most dependent on visibility. Other types of businesses, particularly those located in the Study Area, are less dependent on "drive-by" customers and tend to be sought out by customers; these are sometimes termed "destination businesses." For instance, customers of trucking companies, warehouses, wholesale traders, and manufacturers do not frequent these businesses on an impulse—visibility is still important, but less important than it may be to retail trade.

Table 4-14 summarizes those businesses within 300 feet (but outside of the R/W) of the respective action alternatives by business type and number.

Action Alternatives, Western Section

W59 (Preferred) Alternative

As long as access to businesses would remain uninterrupted during the construction period, adverse impacts on the local or regional economies would be minimal. Most businesses are located on relatively well-used arterial and collector streets, and it is reasonable to assume that access would always be provided during the construction period.

Because of the nature of the businesses—predominantly wholesale trade, trucking, and manufacturing—temporary construction impacts from dust, noise, and access changes would be disruptive in the near term, but unlikely to adversely affect the economic viability of the business or industry in the long term. It is also likely that most of these businesses would benefit from the proposed freeway through improved highway access.

W71 Alternative

Because of the nature of businesses within 300 feet of the W71 Alternative, they would not be affected by the W71 Alternative. It is likely that these businesses would benefit from the proposed freeway through improved highway access; therefore, any permanent effects would likely be beneficial.

W101 Alternative and Options

As long as access to the businesses within 300 feet of the W101 Alternative and Options would remain uninterrupted during the construction period, local and regional economies would experience minimal adverse impacts. Because most of these businesses are located on relatively well-used arterial and collector streets, it is reasonable to assume that access would always be provided. In addition, with the exception of a drive-in type business, it does not appear that any business revenues would be reduced by temporary dust and noise impacts associated with project construction.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The businesses within 300 feet of the E1 Alternative are relatively small and would potentially benefit from improved highway access and visibility. The businesses on Community land, although larger, would also benefit from improved highway access and visibility.

MITIGATION

ADOT Right-of-Way Group Responsibilities

An acquisition and relocation assistance program would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 Code of Federal Regulations [C.F.R.] § 24), which identifies the process, procedures, and time frame for R/W acquisition and relocation of affected residents or businesses. Relocation resources would be available to all residential and business relocatees, without discrimination. All replacement housing would be decent, safe, and sanitary. Replacement housing is available in the general area; last-resort housing would, however, be provided if it were found that sufficient, comparable housing were not available within monetary limits of owners and tenants. The *ADOT Relocation Assistance Program* is included as Appendix 4-1, beginning on page A497. If necessary, specific relocation plans would be developed to assist displaced residents of mobile homes in finding new locations for their mobile homes. All acquisitions and relocations resulting from the proposed freeway would comply with Title VI and with 49 C.F.R. § 24.

Private property owners would be compensated at fair market value for land and may be eligible for additional benefits. As for renters, HUD considers anything under a 6 percent rental vacancy rate as a "tight" rental market (i.e., replacement rental housing may be difficult to locate). The Rental Supplement is based on a calculation between the current rental plus utilities and the determined available comparable rental unit plus utilities times 42 months. This payment would be made available to assist with the difference in rent if the cost of replacement housing were to exceed the rental cost at that time (with conditions).

In the final determination of potential relocation impacts during the acquisition process, ADOT would provide, where possible, alternative access to properties losing access to the local road network. In the event that alternative access could not be provided, ADOT would compensate affected property owners in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 C.F.R. § 24).

Prior to the ROD, ADOT would consider protective and hardship acquisition on a case-by-case basis in accordance with criteria outlined in the ADOT *Right-of-Way Procedures Manual* (2009a). After the ROD, ADOT would consider protective and hardship acquisition of properties in those freeway sections not planned for immediate construction. Protective acquisition would aid in reducing the number of needed acquisitions closer to the time of construction.

ADOT would coordinate with the local jurisdictions, MAG, and the Regional Public Transportation Authority (RPTA) to identify opportunities to use excess R/W, whenever possible, for future park-and-ride lots and related public facilities. Costs associated with these facilities would be the responsibility of the City of Phoenix, MAG, and/or the RPTA.

CONCLUSIONS

Displacements resulting from implementation of any of the action alternatives would involve, predominantly, single-family homes. In the Western Section, implementation of the W59 (Preferred) Alternative would displace substantially fewer single-family residential properties than would implementation of the W71 and W101 Alternatives, in part because local jurisdictions have accommodated the proposed action along the alignment of the W59 Alternative in their planning (53 displaced existing single-family residences when compared with 705 and between 598 and 857 displaced existing single-family residences for the W71 Alternative and W101 Alternative and Options, respectively). However, when including multifamily housing unit displacements, the number of displacements with the W59 Alternative increases to 733 units (lower than any other action alternative in the Western Section). The E1 (Preferred) Alternative in the Eastern Section would displace an estimated 112 existing single-family homes. Through the EIS process, alignment identification and concept design of the action alternatives have been modified to reduce freeway footprint-related impacts. The number of displacements reflected in this document, while consistent with a project the magnitude of the proposed action located in a growing region, is subject to change as ADOT continues to refine the proposed freeway design to enhance freeway operation and to reduce impacts and costs.

Any of the action alternatives would cause economic impacts on businesses, ranging from beneficial (a result of improved freeway access for transportation companies, for example) to adverse (displacements). Projected business displacements would vary by action alternative, and while implementation of the W59 Alternative would displace a greater number of businesses than would the other action alternatives in the Western Section (41 businesses compared with only 14 to 30 businesses), more employees could be adversely affected by implementation of the W101 Alternative than by the W59 Alternative. With the W59 Alternative, manufacturing, retail trade, transportation and warehousing, and wholesale trade businesses would account for over one-half of the displacements. Nine businesses would be displaced by the E1 Alternative. Although displacement could be an adverse impact on a given business, it would not necessarily be an adverse impact on the economy. Assuming demand persists for the types of services provided by displaced businesses, activity should continue at new locations, especially when reasonably near existing locations. Because of the size of the Phoenix regional economy and because of the availability of business sites nearby, business displacements should be able to be reasonably mitigated and the regional economy unaffected.

In the region, ADOT and FHWA have regularly used and consistently applied the required acquisition and relocation assistance program afforded to affected residents. The program would effectively mitigate relocation impacts.

ECONOMIC IMPACTS

EXISTING CONDITIONS

Because of the growing economic intensification of the region, local governments are concerned about the volume of developable land that could be removed from the tax base as a result of implementation of one of the action alternatives. (A 2004 City of Phoenix report demonstrated that the levels of tax revenue impacts and other revenue impacts can be measured in the millions of dollars.) Consideration of major tax revenue impacts that would result from the action alternatives was used in a manner similar to that applied in the City of Phoenix report and is discussed in this section.

Table 4-15 summarizes the acreage of land uses that would be affected by the action alternatives and that would be expected to generate measurable tax revenues. The table was generated assuming the following land uses would not generate substantial tax revenues:

- *Institutional* lands are generally for public purposes, are not subject to property taxes, and do not generate sales tax revenues.
- *Park* lands are generally public lands and are consequently not in the tax base.
- *Transportation* land accounts for existing public R/W for streets, roads, and highways, which are not included in the tax base.
- *Water surface or riverbed* accounts for the channel and immediate floodplain of the Salt River.

Of the affected municipalities, the City of Phoenix would have the most acreage of taxable land at stake with respect to the proposed action. In the Western Section, the W59 Alternative would need the least amount of taxable land.

Most of the impact on the City of Tolleson's taxable land base would stem from the W101 Alternative and Options, where primarily agricultural, industrial, and vacant land would be affected.

Impacts on taxable land in Avondale would occur with the W101 Alternative and Options. The impacts would be approximately double in Avondale if full reconstruction

Table 4-15 Acreage of Taxable Land Uses by Jurisdiction, Action Alternatives

Action Alternative/Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	548	8	157	42	20	118	893
W71	535	1	181	277	—[a]	45	1,039
W101 Western Option	612–618[b]	26–27	25	291	—	106–107	1,062–1,066
W101 Central Option	469–476	0–1	25	386–387	—	118–121	1,002–1,006
W101 Eastern Option	495–502	0–1	25	351	—	143–145	1,017–1,021
Eastern Section							
E1	163	1	10	104	—	462	740
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	67–81	0–1	100–107	—	—	6–15	183–194
W101 Central Option	85–99	0–1	80–87	—	—	43–52	218–229
W101 Eastern Option	85–99	0–1	80–87	—	—	43–52	218–229
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	0–4	—	—	—	—	0–4
W101 Central Option	—	0–4	—	—	—	—	0–4
W101 Eastern Option	—	0–4	—	—	—	—	0–4
Eastern Section							
E1	—	—	—	—	—	—	—

Source: analysis of aerial imagery (2009, 2010)
[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

of the I-10 (Papago Freeway)/SR 101L (Agua Fria Freeway) system traffic interchange were to occur.

ENVIRONMENTAL CONSEQUENCES

Fiscal Impact Economic Assumptions

The primary source of tax generation data used in the analysis was from the Maricopa County Assessor's database. The analysis employed full cash values and limited cash values because those values are used directly in property tax calculations and are readily available from the County Assessor. Market values were used to calculate the full and limited cash values, but the formulas are complex and market values are not available in the Assessor's database.

The average full and limited cash values were determined by using a sample set of each property type from parcels within each of the action alternatives. Commercial land was assumed to include 50 percent retail and 50 percent office. Industrial land was assumed to be 50 percent manufacturing and 50 percent warehouse/distribution.

For each type of land use considered, ten samples of representative property values (land and improvement) were randomly drawn from the interactive map and database using a "point-and-click" method. Because these samples were randomly[4] selected, they represent businesses from all parts of the county. The average values of properties originally identified in 2005 in Maricopa County were escalated at the rate of increase in the value of single-family residential property.

The assessment ratio for each property type was updated with 2009 ratios, as shown in Table 4-16. Assessment ratios for commercial properties were assumed to be 20 percent, the ratio for 2011, because the project would not be built prior to that year and the long-term assessment ratio beyond 2011 is scheduled to be 20 percent. Vacant land was valued to reflect its zoning.

The tax levy applied to calculate property tax impacts was updated with the 2008 levy and broken into the primary and secondary levies. Because each action alternative overlaps multiple tax districts, the most common tax district in each alignment was used to

Table 4-16 Land Valuation Assumptions Used to Estimate Property Tax Impacts Resulting from Right-of-way Acquisition

Assumption	Land Use					
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant
Land valuation assumptions for estimating property tax impacts						
Market value						
Full cash value for tax purposes (80% of market value, $)	6,080	364,430	695,620	841,010	990,560	501,960
Limited value (95% of full cash value, $)	5,240	300,650	520,270	762,330	897,880	415,850
Assessment ratio	0.16	0.20	0.20	0.10	0.10	0.16
Assessed valuation for primary tax levies ($)	838	60,130	104,054	76,233	89,788	66,536
Assessed valuation for secondary tax levies ($)	973	72,886	139,124	84,101	99,056	80,314
Primary tax levy ($ per $100 of assessed value)						
Phoenix	5.85	5.85	5.85	5.85	5.85	5.85
Avondale	5.44	5.44	5.44	5.44	5.44	5.44
Tolleson	6.06	6.06	6.06	6.06	6.06	6.06
Secondary tax levy ($ per $100 of assessed value)						
Phoenix	3.84	3.84	3.84	3.84	3.84	3.84
Avondale	3.53	3.53	3.53	3.53	3.53	3.53
Tolleson	4.31	4.31	4.31	4.31	4.31	4.31
Primary taxes per acre						
Phoenix	49	3,516	6,084	4,457	5,250	3,890
Avondale	46	3,274	5,665	4,150	4,888	3,622
Tolleson	51	3,646	6,309	4,622	5,444	4,034
Secondary taxes per acre						
Phoenix	37	2,800	5,345	3,231	3,806	3,086
Avondale	34	2,571	4,908	2,967	3,495	2,834
Tolleson	42	3,142	5,997	3,626	4,270	3,462
Total real and personal property taxes ($/acre)						
Phoenix	86	6,316	11,429	7,689	9,056	6,976
Avondale	80	5,845	10,573	7,117	8,383	6,456
Tolleson	93	6,788	12,306	8,247	9,714	7,496

Table 4-17 Reductions in Local Annual Property Tax Revenues Resulting from Right-of-way Acquisition, Existing Land Uses, Action Alternatives

Action Alternative/ Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	$47,300	$50,500	$1,794,400	$322,900	$181,100	$823,200	$3,219,400
W71	46,200	6,300	2,068,700	2,129,700	—[a]	313,900	4,564,800
W101 Western Option	52,900–53,400[b]	164,200–170,500	285,700	2,237,400	—	739,500–746,400	3,480,200–3,493,000
W101 Central Option	40,500–41,000	0–6,300	285,700	2,967,800–2,975,481	—	823,200–844,100	4,125,500–4,144,500
W101 Eastern Option	42,800–43,400	0–6,300	285,700	2,698,700	—	997,600–1,011,500	4,025,400–4,045,000
Eastern Section							
E1	$14,000	$6,300	$114,300	$800,000	—	$3,222,900	$4,157,500
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	$6,200–7,500	$0–6,800	$1,230,600–1,316,800	—	—	$45,000–112,400	$1,356,100–1,369,300
W101 Central Option	7,900–9,200	0–6,800	984,500–1,070,600	—	—	322,300–389,800	1,389,000–1,402,200
W101 Eastern Option	7,900–9,200	0–6,800	984,500–1,070,600	—	—	322,300–389,800	1,389,000–1,402,000
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$0–23,400	—	—	—	—	$0–23,400
W101 Central Option	—	0–23,400	—	—	—	—	0–23,400
W101 Eastern Option	—	0–23,400	—	—	—	—	0–23,400
Eastern Section							
E1	—	—	—	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

determine the average primary and secondary levies to be applied to calculate primary and secondary taxes per acre. Note that the most common tax district for each alignment included a City of Phoenix levy, even on the W71 and W101 Alternatives. For illustration purposes, the average levy was calculated for Avondale and Tolleson and included their respective City levies. The calculations show the impact on Avondale and Tolleson if all the properties falling within their respective city boundaries included a City levy from one of these cities.

Property Taxes, Existing Conditions

Table 4-17 presents estimates of reductions (in 2009 dollars) in property tax revenues by type of land use that could be expected by each jurisdiction as a result of each of the action alternatives and options. The estimates are based on existing land uses, land values, and tax rates. Thus, the extent of existing taxable land uses identified in Table 4-15 were both valued and then assessed at the rates shown in Table 4-16 to calculate the loss in tax revenues (Table 4-17) that would reflect the loss of taxable land from tax rolls as a result of acquisition of R/W for the proposed action.

For Phoenix, under existing conditions, the W71 Alternative would create the greatest adverse impact on annual property tax revenues, followed by the W101 Alternative and Options. It should be noted, however, that any impacts on property tax revenues from any of the action alternatives would account for approximately 1 percent of the overall primary and secondary property tax revenues accruing to the City of Phoenix (City of Phoenix 2009b).

Although existing conditions reflect a less developed area surrounding the W101 Alternative, the City of Phoenix anticipates that future development would be as intense around the W101 Alternative as it would be along the W59 and W71 Alternatives. The City of Phoenix's reduction in annual property tax revenues under the E1 Alternative, based on existing land uses, is estimated to be $4.2 million.

The City of Tolleson would experience reductions in property tax revenues from the W101 Alternative and Options, which would create adverse impacts. These

impacts would range from about $1.3 million to about $1.4 million per year, depending on the option of the W101 Alternative considered. The impacts would account for approximately 28 percent of Tolleson's existing annual primary property tax revenues (City of Tolleson 2009), a substantial loss for the small community. It should be noted that these percentages apply to the City's General Fund discretionary revenues. Some additional property tax revenues are dedicated for existing debt service.

The impact on the City of Avondale's property tax revenues would depend on whether the W101 Alternative and Options have the I-10 (Papago Freeway)/SR 101L system traffic interchange partially reconstructed or fully reconstructed. With partial reconstruction, there would be no impacts on Avondale's tax revenues. With full reconstruction, the property tax revenue impacts would account for less than 1 percent of Avondale's existing annual property tax revenues (City of Avondale 2009).

Sales Taxes on Retail Sales, Existing Conditions

Retail sales are primarily generated from enterprises in commercial and industrial land uses. Table 4-18 shows assumptions regarding retail sales. Along with the local option sales tax rate of 2 percent in Avondale and Tolleson, these assumptions were used to calculate retail sales tax revenue on a per acre basis. Table 4-19 shows estimates of reductions (in 2009 dollars) in annual sales tax revenues that could be expected with the purchase of the roadway R/W, assuming existing land use and tax rates, for each action alternative, by jurisdiction.

For Phoenix, the W59 (Preferred) and W71 Alternatives would have the highest level of annual impact. Overall, the potential impacts on Phoenix's existing retail sales tax revenues would be relatively small compared with the City's total sales tax revenues, accounting for less than 0.5 percent regardless of the action alternative considered.

For Tolleson, the W101 Alternative and Options would result in substantial adverse impacts on retail sales tax revenues, ranging from about $1 million to $1.3 million per year, depending on the option considered. That level of impact would account for about 14 to 17 percent of the City's existing total annual revenues from retail sales taxes, depending on the action alternative considered (City of Tolleson 2009).

The adverse impacts on Avondale associated with the W101 Alternative and Options would be approximately $250,500 per year. As a fraction of the City's existing total annual revenue from retail sales taxes, that level of impact would account for less than 1 percent (City of Avondale 2009).

Table 4-18 Assumptions Used to Estimate Retail Sales Tax Impacts Resulting from Right-of-way Acquisition

Assumption	Land Use					
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant
Retail sales tax assumptions						
Retail sales generation ($ per building square foot)	—[a]	250	35	—	—	—
Floor area ratio	—	0.23	0.31	—	—	—
Retail sales generation ($ per acre)	—	2,504,700	472,600	—	—	—
Local tax rate[b]						
Phoenix	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Avondale	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Tolleson	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Retail sales tax generation ($/acre)						
Phoenix	—	$50,100	$9,500	—	—	—
Avondale	—	62,600	11,800	—	—	—
Tolleson	—	62,600	11,800	—	—	—

[a] not applicable [b] Rate represents the local option sales tax, whose revenues are allocated directly to the municipality.

Tax Revenue Impacts, Future Land Uses

Although the current economic downturn has created a slow-growth development context, historic and projected long-term growth rates in the region invite consideration of how tax revenue impacts might change under future land use conditions. Indeed, this was the center of the City of Phoenix's concerns regarding the proposed action alternatives.

Tables 4-20 and 4-21 show future land use estimates and taxable acreage for the three jurisdictions, respectively. For analysis purposes, these estimates are assumed to reflect built-out conditions as they might exist from 2025 through 2035. The tables reveal a shift from agricultural and other low-intensity land uses to commercial, industrial, and residential development. Overall, no substantial changes in the taxable land base are anticipated between the current period and future conditions. The increasing intensity of land use, however, creates greater tax revenue impacts.

Property Tax Revenues, Future Land Uses

Table 4-22 shows projected impacts on annual property tax revenues (in 2009 dollars) for land within the action alternatives' R/W, assuming future land use and the tax generation coefficients shown in Table 4-16. The impacts would be several times the magnitude of those under existing land uses.

Table 4-19 Reductions in Annual Retail Sales Tax Revenues Resulting from Right-of-way Acquisition, Existing Land Uses, Action Alternatives

Action Alternative/Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	—[a]	$400,800	$1,484,000	—	—	—	$1,884,800
W71	—	50,100	1,711,000	—	—	—	1,761,100
W101 Western Option	—	1,302,400–1,352,500[b]	236,300	—	—	—	1,538,800–1,588,900
W101 Central Option	—	0–50,100	236,300	—	—	—	236,300–286,400
W101 Eastern Option	—	0–50,100	236,300	—	—	—	236,300–286,400
Eastern Section							
E1	—	$50,100	$94,500	—	—	—	$144,600
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$0–62,600	$1,181,600–1,264,300	—	—	—	$1,244,200–1,264,300
W101 Central Option	—	0–62,600	945,300–1,028,000	—	—	—	1,007,900–1,028,000
W101 Eastern Option	—	0–62,600	945,300–1,028,000	—	—	—	1,007,900–1,028,000
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$0–250,500	—	—	—	—	$0–250,500
W101 Central Option	—	0–250,500	—	—	—	—	0–250,500
W101 Eastern Option	—	0–250,500	—	—	—	—	0–250,500
Eastern Section							
E1	—	—	—	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

Table 4-20 Estimated Acreage of Future Study Area Land Uses, Action Alternatives

Action Alternative/ Option	Land Use										Total
	Agricultural	Commercial	Industrial	Public	Single-family Residential	Multifamily Residential	Open Space	Transportation	Vacant	Water Surface or River Bed	
Phoenix											
Western Section											
W59	—[a]	372	190	—	120	181	72	—	—	—	935
W71	—	147	223	—	650	—	41	—	—	—	1,061
W101 Western Option	—	214	103–108[b]	—	742	3	19	3–4	—	—	1,084–1,090
W101 Central Option	—	141	77–82	—	786	—	19	3–4	—	—	1,026–1,032
W101 Eastern Option	—	141	76–81	—	802	—	19	3–4	—	—	1,041–1,047
Eastern Section											
E1	—	70	11	2	373	15	32	380	—	—	883
Tolleson											
Western Section											
W59	—	—	—	—	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—	—	—	—	—
W101 Western Option	—	62–69	91–98	—	54	—	—	—	—	—	207–221
W101 Central Option	—	62–69	128–136	—	52	—	—	—	—	—	242–257
W101 Eastern Option	—	62–69	128–136	—	52	—	—	—	—	—	242–257
Eastern Section											
E1	—	—	—	—	—	—	—	—	—	—	—
Avondale											
Western Section											
W59	—	—	—	—	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—	—	—	—	—
W101 Western Option	—	0–6	—	—	—	—	—	0–10	—	—	0–16
W101 Central Option	—	0–6	—	—	—	—	—	0–10	—	—	0–16
W101 Eastern Option	—	0–6	—	—	—	—	—	0–10	—	—	0–16
Eastern Section											
E1	—	—	—	—	—	—	—	—	—	—	—

Sources: City of Tolleson, 2005; City of Phoenix, 2001; City of Avondale, 2002; Maricopa County, 1997

[a] not applicable [b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

Table 4-21 Acreage of Future Taxable Land Uses, Action Alternatives

Action Alternative/ Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	—[a]	372	190	120	181	—	863
W71	—	147	223	650	—	—	1,020
W101 Western Option	—	214	103–108[b]	742	3	—	1,062–1,067
W101 Central Option	—	141	77–82	786	—	—	1,004–1,009
W101 Eastern Option	—	141	76–81	802	—	—	1,019–1,024
Eastern Section							
E1	—	70	11	373	15	—	469
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	62–69	91–98	54	—	—	207–221
W101 Central Option	—	62–69	128–136	52	—	—	242–257
W101 Eastern Option	—	62–69	128–136	52	—	—	242–257
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	0–6	—	—	—	—	0–6
W101 Central Option	—	0–6	—	—	—	—	0–6
W101 Eastern Option	—	0–6	—	—	—	—	0–6
Eastern Section							
E1	—	—	—	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

Table 4-22 Reductions in Local Annual Property Tax Revenues Resulting from Right-of-way Acquisition, Future Land Uses, Action Alternatives

Action Alternative/Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	—[a]	$2,349,600	$2,171,600	$922,600	$1,639,100	—	$7,082,900
W71	—	928,500	2,548,700	4,997,600	—	—	8,474,800
W101 Western Option	—	1,351,700	1,177,200–1,234,400[b]	5,704,900	27,200	—	8,261,000–8,318,100
W101 Central Option	—	890,600	880,200–937,200	6,043,200	—	—	7,813,900–7,871,000
W101 Eastern Option	—	890,600	868,600–925,800	6,166,200	—	—	7,925,400–7,982,600
Eastern Section							
E1	—	$442,100	$125,700	$2,867,800	$135,800	—	$3,571,400
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$420,800–468,300	$1,119,900–1,206,000	$445,400	—	—	$1,986,000–2,119,700
W101 Central Option	—	420,800–468,300	1,575,200–1,673,600	428,900	—	—	2,424,900–2,570,900
W101 Eastern Option	—	420,800–468,300	1,575,200–1,673,600	428,900	—	—	2,424,900–2,570,900
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$0–35,100	—	—	—	—	$0–35,100
W101 Central Option	—	0–35,100	—	—	—	—	0–35,100
W101 Eastern Option	—	0–35,100	—	—	—	—	0–35,100
Eastern Section							
E1	—	—	—	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

Table 4-23 Reductions in Annual Sales Tax Revenues Resulting from Right-of-way Acquisition, Future Land Uses, Action Alternatives

Action Alternative/Option	Land Use						Total
	Agricultural	Commercial	Industrial	Single-family Residential	Multifamily Residential	Vacant	
Phoenix							
Western Section							
W59	—[a]	$18,635,000	$1,796,000	—	—	—	$20,431,000
W71	—	7,363,800	2,107,900	—	—	—	9,471,700
W101 Western Option	—	10,720,100	973,600–1,020,900[b]	—	—	—	11,693,700–11,741,000
W101 Central Option	—	7,063,300	727,800–775,100	—	—	—	7,791,100–7,863,400
W101 Eastern Option	—	7,063,300	718,400–765,700	—	—	—	7,781,600–7,828,900
Eastern Section							
E1	—	$3,506,600	$104,000	—	—	—	$3,610,600
Tolleson							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$3,882,300–4,320,600	$1,075,200–1,158,000	—	—	—	$4,957,500–5,478,500
W101 Central Option	—	3,882,300–4,320,600	1,512,400–1,606,900	—	—	—	5,394,700–5,927,500
W101 Eastern Option	—	3,882,300–4,320,600	1,512,400–1,606,900	—	—	—	5,394,700–5,927,500
Eastern Section							
E1	—	—	—	—	—	—	—
Avondale							
Western Section							
W59	—	—	—	—	—	—	—
W71	—	—	—	—	—	—	—
W101 Western Option	—	$0–375,700	—	—	—	—	$0–375,700
W101 Central Option	—	0–375,700	—	—	—	—	0–375,700
W101 Eastern Option	—	0–375,700	—	—	—	—	0–375,700
Eastern Section							
E1	—	—	—	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options; totals do not equal a simple summing of the impacts because the Partial and Full Reconstruction Options would affect land uses differently.

For the City of Phoenix, the W71 Alternative would create the greatest adverse impact, although there do not appear to be large differences among any of the Western Section action alternatives. In the Eastern Section, the E1 Alternative's projected reduction in property tax revenues for the City of Phoenix would, in the context of all tax revenues that the City of Phoenix would likely collect annually, be nearly inconsequential. For the Cities of Tolleson and Avondale, future property tax revenue impacts would be driven by commercial and industrial land uses.

Sales Tax Revenues, Future Land Uses

Similar to property taxes, impacts on local retail sales tax revenues under future land uses would be many times the magnitude of those under existing land uses (Table 4-23). For Phoenix, future sales tax impacts would range from approximately 5 to about 33 times those reported under current conditions. (The higher multiplier is related more to small initial conditions than to an extreme impact.) Of all the action alternatives, the W59 Alternative would cause the greatest loss—by a large margin—in annual sales tax revenues. These reduced revenues would be attributable to the loss of annual tax collections from land that would be lost to R/W acquisition for this alternative. The City of Phoenix's reductions in sales tax revenues under the E1 Alternative, based on future land uses, are estimated to be about $3.6 million.

For Tolleson, the increase in retail sales tax impact would be striking for the W101 Alternative and Options. Impacts would change from approximately $1 million per year to a range of $4.9 million to $5.9 million. Implementation of any of these options would preclude considerable commercial development and collection of corresponding retail sales tax revenues. Similarly, for Avondale, estimated annual sales tax impacts would jump from $250,500 under existing land uses to approximately $375,500 under future conditions. In terms of relative impact on municipal government revenues, the percentage share of the sales tax impact on the smaller jurisdictions would be greater than would be the impacts on the City of Phoenix.

Other Types of Fiscal Impacts

Other types of fiscal impacts were considered in this analysis, but were not estimated because they represent a relatively small portion of total revenues to the communities. Not considered, for example, were capital expenditure reductions and other efficiencies for emergency response teams, reduced maintenance expenses for street repair because of reduced traffic congestion, or the costs of financing and providing additional infrastructure and social services to support community needs on an accelerated time scale.

Combined Property and Sales Tax Impacts, Existing and Future Conditions

Table 4-24 summarizes the combined property tax and retail sales tax impacts on the communities for existing and future land uses. The following text discusses the data presented, by municipality.

Phoenix

For the City of Phoenix, under existing land uses, the W71 Alternative would create substantially greater impact compared with the W59 Alternative and W101 Alternative and Options. This is as expected for the W101 Alternative and Options because they cover less developed land. Under future land uses, the combined impacts would increase substantially and the W59 Alternative would cause the highest adverse impact. Overall, the W101 Alternative Central and Eastern Options and the W71 Alternative would create substantially less impact on the City of Phoenix under future conditions. The E1 Alternative would result in a relatively small reduction in overall tax revenues that would be nearly inconsequential when considered in the context of total tax revenues the City of Phoenix now collects and anticipates collecting in the future.

Tolleson

For the City of Tolleson, under existing and future conditions, the W101 Alternative and Options would have the greatest impacts because considerably more of this community's land would be needed for R/W (the community would not be affected under the W59 and W71 Alternatives). Impacts on the City of Tolleson under future land uses would be adverse because of the removal of developable land from the tax base. The City's total tax revenues would be reduced by 14 to 17 percent under the W101 Alternative and Options, potentially affecting the City's ability to provide public services.

Avondale

The City of Avondale would be affected by only the W101 Alternative and Options. Existing impacts are estimated to be small in relation to total City revenues, although under future land uses the impacts would likely become relatively greater. Again, this would be because of removal of developable land from the tax base.

No-Action Alternative

The No-Action Alternative would conflict with local jurisdictions' land use plans that have incorporated a freeway. Not building a freeway in the Study Area would mean that land set aside for the freeway would become available for taxable uses, if the jurisdictions were to change their zoning plans. The communities would have to amend their existing land use plans to identify new uses for land that has been owned by ADOT or that has otherwise been protected for a future freeway use. It is difficult to make projections of fiscal impacts on these communities that would result from expanding their tax base without knowing the specific zoning changes that would occur and the rate of conversion of the land to new and possibly taxable uses.

Table 4-24 Estimates of Total Tax Revenue Impacts, Property and Sales Tax Combined, Dollars per Year, Action Alternatives

Action Alternative/Option	Phoenix		Tolleson		Avondale	
	Land Use Condition		Land Use Condition		Land Use Condition	
	Existing	Future	Existing	Future	Existing	Future
Western Section						
W59	$5,104,300	$27,513,800	—[a]	—	—	—
W71	6,325,900	17,946,500	—	—	—	—
W101 Western Option	5,018,900–5,081,800[b]	19,954,700–20,059,100	$2,600,200–2,633,500	$6,943,600–7,598,300	$0–273,900	$0–410,800
W101 Central Option	4,361,800–4,430,900	15,605,000–15,709,400	2,396,800–2,430,100	7,819,600–8,498,400	0–273,900	0–410,800
W101 Eastern Option	4,261,700–4,331,400	15,707,100–15,811,500	2,396,800–2,430,100	7,819,600–8,498,400	0–273,900	0–410,800
Eastern Section						
E1	$4,302,100	$7,182,000	—	—	—	—

[a] not applicable
[b] W101 Alternative and Options include ranges because of design options.

Impacts on the Traveling Public

A major objective of the proposed action is to improve travel conditions in and around the Phoenix metropolitan area (see Chapter 1, *Purpose and Need*, for detailed discussion regarding the purpose of the proposed action). Alternatively stated, the proposed freeway would reduce automobile and truck travel times throughout the region. The projected time savings, as described in the analysis in this section, would be valuable to the traveling public and are estimated to be worth approximately $18.65 per hour (see Table 4-25). This dollar-per-hour figure was multiplied by an estimate of the overall annual travel time reductions per action alternative and option in the region, as measured in the MAG travel demand model, for 2020–2035. The present value[5] of the future time savings that would accrue to the traveling public is an estimate of the monetized benefits resulting from implementation of the proposed project.

Table 4-25 Estimated Value of Motorists' Travel Time

Type of Travel	Person-hours in Traffic[a] (%)	Travel Share[b] (%)		Total Hours		Percentage Value of Travel Time		Local Earnings/ Hour Rate		Value of Travel Time		Weighted Average Local Travel Time Value
		Personal	Business	Personal[c]	Business[d]	Personal[e]	Business	Personal[f]	Business[g]	Personal	Business	
Local travel	35	94	6	0.33	0.02	50	100	$27.30	$29.40	$13.65	$29.40	$14.53[h]
Intercity travel	55	87	13	0.48	0.07	70	100	27.30	29.40	19.11	29.40	20.46
Truck travel[i]	10	—	100	—	0.10	—	100	—	23.08[j]	—	23.08	23.08
Total weighted average time value ($ per person-hour)[k]												$18.65

[a] The percentage of person-hours in congested traffic for travel on the proposed action is assumed to be 35% for local travel, 55% for intercity travel, and 10% for trucks.
[b] Travel distribution shares, from the U.S. Department of Transportation, derive from on-line analysis of person miles of travel data from the 1995 Nationwide Personal Transportation Survey.
[c] Derived from 94.4% of the time in local traffic being devoted to personal travel: thus, 33% of the total travel hours are devoted to personal local travel (94.4% x 35%).
[d] Derived from 5.6% of the time in local traffic being devoted to business travel: thus, 2% of the total travel hours are devoted to business local travel (5.6% x 35%).
[e] The value of local personal travel is considered to be 50% of that of business travel; for intercity travel, the value is considered to be 70% of that of business travel.
[f] Personal local and intercity earnings/hour rates: The 2008 median household income for Maricopa County ($56,197) was obtained from the U.S. Census Bureau American Community Survey.
[g] The business local and intercity earnings/hour rates were retrieved from the U.S. Bureau of Labor Statistics Employer Cost for Employee Compensation for U.S. Mountain Region workers in private industry. The most recent per hour data were used (third quarter 2009).
[h] If one assumes a nominal 1,000 hours, 330 hours would be devoted to local personal travel at a valuation of $13.65 and 20 hours would be devoted to local business travel at a valuation of $29.40. Adding these together yields a weighted average of $14.55 ($4,504.50 and $588.00 ÷ 350 hours [i.e., 35% of the nominal 1,000 hours] = $14.53).
[i] The percentage of person-hours in traffic for trucks on the roadway is from MAG 2001 traffic counts on freeways in the Study Area.
[j] Earnings per hour rates for truck drivers were retrieved from the U.S. Bureau of Labor Statistics Employer Cost for Employee Compensation for the U.S. Transportation and Material Moving sector. The most recent per hour data were used (third quarter 2009).
[k] Using a nominal 1,000 hours: 350 hours @ $14.53 plus 550 hours @ $20.46 plus 100 hours @ $23.08 = $18,646.5. Dividing this by 1,000 hours gives a weighted average of $18.65.

Differences in travel time impacts are primarily between the No-Action Alternative and the action alternatives because, from a traffic modeling standpoint, all action alternatives are designed to accomplish the same objectives in the region: reduce congestion and reduce travel time. In 2035, travel time savings for the action alternatives would be approximately 15 million hours annually (see Table 4-26).

There would be some adverse impact on the traveling public during the construction phase of the proposed action alternative because modifications would be made to I-10 (Papago Freeway) at the freeway's western terminus and because surface arterial streets would be crossed. These impacts would, however, be temporary and, because the roadway would be constructed in a relatively undeveloped area, these impacts are not anticipated to be severe compared with impacts in a developed corridor. Therefore, travel time impacts during construction are not accounted for in this analysis.

The following discussion develops the dollar per hour figure in more detail and presents the calculations for determining the economic impacts.

Estimating the Value of Motorists' Time

The value of time spent in traffic congestion can amount to millions of dollars annually. Real monetary costs can be associated with additional productivity costs, worker availability, freight inventory, logistics, just-in-time production, and market access (Weisbrod et al. 2001).

Factors to be considered when estimating the value of motorists' time include:

- average household income levels
- amount of local and intercity truck travel
- distribution of personal and business travel

Consistent with U.S. Department of Transportation (USDOT) guidelines, the analysis determined the value of time for regional personal, business, and truck travel (USDOT 1997). These values were then weighted by the relative volume of each on the road, as estimated at a national level by USDOT (1997). Results are in Table 4-25.

Overall Value of Motorists' Time Weighted by Type of Travel

Table 4-25 summarizes the calculations used to estimate the overall value of motorists' travel time in the Phoenix region. A weighted average local travel time value and a weighted average intercity travel time value were calculated using the percentages of personal and business travel to weight the value of earnings per hour for local travel and for intercity travel, respectively. The weighted average local travel time value is $14.53 per person-hour. The weighted average intercity travel time value is $20.46 per person-hour. Truck drivers use 100 percent of earnings-per-hour rates for travel because all truck travel is considered for business purposes. The value of time for trucks spent in congestion is $23.08 per person-hour. An overall weighted value of travel time was then computed based on the relative share of person-hours spent in congestion for local travel, intercity travel, and truck travel; these are assumed to be 35 percent, 55 percent, and 10 percent, respectively. For Maricopa County, the total weighted average time value of congestion is $18.65 per person-hour. This value was used to estimate the total value of time savings achievable through relieved congestion for each action alternative and option.

Net Travel Delay Reductions Attributable to the Proposed Action

Table 4-26 shows the reduction in delay compared with the No-Action Alternative for each of the action alternatives and options from 2020 to 2035. It is assumed that benefits would begin upon project completion, in approximately 2020. Any benefits achieved from partial opening of the proposed freeway were not counted. It was assumed that there are 270 days of congestion per year. In 2035, travel time savings for the action alternatives are expected to be approximately 15 million hours annually.

Table 4-26 Economic Benefit of Reduced Regional Traffic Congestion, Action Alternatives

Year	Reduction in Delay Compared with No-Action Alternative (hours/year)			Economic Benefit Associated with Reduction in Traffic Congestion ($ million/year)		
	W59/E1	W71/E1	W101/E1	W59/E1	W71/E1	W101/E1
2020	5,639,220	5,713,470	6,660,630	$105	$107	$124
2021	6,243,894	6,318,144	7,265,304	116	118	135
2022	6,848,568	6,922,818	7,869,978	128	129	147
2023	7,453,242	7,527,492	8,474,652	139	140	158
2024	8,057,916	8,132,166	9,079,326	150	152	169
2025	8,662,590	8,736,840	9,684,000	162	163	181
2026	9,267,264	9,341,514	10,288,674	173	174	192
2027	9,871,938	9,946,188	10,893,348	184	185	203
2028	10,476,612	10,550,862	11,498,022	195	197	214
2029	11,081,286	11,155,536	12,102,696	207	208	226
2030	11,685,960	11,760,210	12,707,370	218	219	237
2031	12,290,634	12,364,884	13,312,044	229	231	248
2032	12,895,308	12,969,558	13,916,718	240	242	260
2033	13,499,982	13,574,232	14,521,392	252	253	271
2034	14,104,656	14,178,906	15,126,066	263	264	282
2035	14,709,330	14,966,100	14,911,020	274	279	278
			Total	$3,036	$3,062	$3,326

Source: Maricopa Association of Governments, 2010b; extrapolated analysis
Note: The value of motorists' time caught in congestion is $18.65 per hour (Table 4-25), the number of days per year with congested traffic conditions is 270, and all monetary figures are in 2010 dollars.

Findings Regarding Travel Time Costs and Effects on Traveling Public

Using the weighted average travel time value of congestion ($18.65 per person-hour) and a present value based on a discount rate of 3 percent, the total value of travel time savings was calculated for each action alternative, as shown in Table 4-26. By using the present value of the economic benefits that would accrue from reducing congestion and delays once an action alternative were to become operational, the benefits of constructing an action alternative as compared with the No-Action Alternative were estimated. The present value of travel time savings for each action alternative between 2020 and 2035 would be between $3 billion and $3.3 billion. These benefits compare favorably with the estimated total project cost of $2.43 billion (for the Preferred Alternative). (All valuations in this paragraph are in 2010 dollars.)

MITIGATION

The mitigation discussion in the section, *Displacements and Relocations*, beginning on page 4-39, presents compensation policies and procedures for displaced residences and businesses.

ADOT District Responsibilities

During construction, the ADOT District office would coordinate with local businesses to ensure reasonable access to businesses would be maintained during regular operating hours.

CONCLUSIONS

Implementation of any of the action alternatives would result in conversion of a taxable land base to a nontaxable land base. The Cities of Phoenix, Tolleson, and Avondale would experience reductions in sales tax and property tax revenues. Reductions experienced by the Cities of Phoenix and Avondale would be inconsequential.

The City of Tolleson would experience a 14 to 17 percent reduction under the W101 Alternative. This, in turn, would have a potentially adverse effect on the City's ability to effectively provide public services. Implementation of the W101 Alternative would also transfer a higher percentage of developable land in Tolleson to a transportation use than would be the comparable cases in Phoenix and Avondale.

The action alternatives would substantially benefit the region through travel time savings and enhanced movement of goods and delivery of services. Depending on which action alternative might be implemented—if any—travel time savings estimated through 2035 would range from $3 billion to $3.3 billion (in 2010 dollars); furthermore, approximately 15 million hours of travel time would be saved annually. Conversely, under the No-Action Alternative, substantial travel time savings in hours and dollars would not be realized.

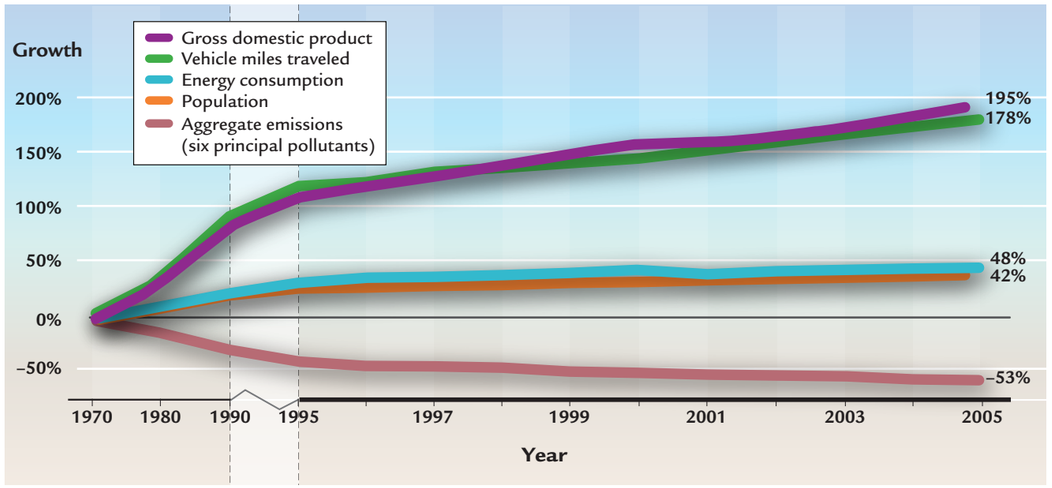
AIR QUALITY

The creation of the Clean Air Act (CAA) in 1963 implemented a national effort to maintain healthy air quality by controlling air pollution. The CAA provides the principal framework for national, State, and local efforts to protect air quality. The 1970, 1977, and 1990 CAA amendments renewed and intensified national efforts to reduce air pollution in the United States.

Air pollution comes from many different sources:

- stationary sources
  - factories
  - power plants
  - dry cleaners
- mobile sources
  - motor vehicles
  - construction equipment
  - planes
  - trains
- natural sources
  - windblown dust
  - wildfires

Figure 4-18 Comparison of National Economic and Demographic Growth Indicators and Air Emissions, 1970–2005



Source: U.S. Environmental Protection Agency, 2006

As major indicators of economic or demographic growth increased over the past 35 years, emissions of six principal air pollutants have been halved.

The wide variety of pollutants from these sources can affect local and regional air quality. For additional information regarding the provisions of the CAA, refer to the EPA Web site, <www.epa.gov>. This section addresses the effects of the proposed action and alternatives, including the No-Action Alternative, on air quality pursuant to the provisions set forth in the CAA, as amended, and related guidance.

REGULATORY OVERVIEW

The environmental awakening of the United States in the middle of the last century launched a series of air pollution control laws, starting with the Air Pollution Control Act of 1955, which identified air pollution as a national problem and recognized the need for research and further action. Eight years later, the 1963 CAA focused on regulating air pollution from stationary sources such as power plants or steel mills. The CAA of 1965 and the Air Quality Act of 1967 set standards for automobile emissions and began to move authority for enforcement of air pollution regulations to the local level. To protect public health, and based on scientific research and analysis of potential health impacts, the 1970 CAA established acceptable concentrations for six criteria air pollutants:[6]

- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- ozone (O_3)
- particulate matter (PM)
- sulfur dioxide (SO_2)
- lead

Protecting public health continues to be the driving force for modifications and additions to air pollution regulations today. Between 1970 and 2005, emissions of criteria pollutants were cut by more than half, from 273 million metric tons of annual emissions to 133 million metric tons (Figure 4-18). During this period, emissions of CO decreased 54 percent, nitrogen oxides 24 percent, volatile organic compounds (VOCs) (contributors to O_3 formation) 54 percent, SO_2 (a by-product of diesel combustion) 49 percent, and lead 98 percent (Holmstead 2005). These reductions in air pollution occurred during a period of robust economic growth. Between 1970 and 2005, the U.S. economy grew by more than 195 percent, vehicle miles traveled (VMT) increased by 178 percent, and energy consumption grew by 48 percent.

In 1997, the Arizona Legislature passed House Bill 2307, which required reformulated fuels in Area A May 1 through September 30 each year, beginning in 1999. In addition, in 1999, the Arizona Legislature passed House Bill 2347, which requires winter fuel reformulation with 3.5 percent oxygen content in Area A (portions of Maricopa, Yavapai, and Pinal counties) November 1 through March 31 each year, beginning in 2000 (Arizona Administrative Code [A.A.C.] Title 20, Chapter 2, Article 7). EPA's approval notice of the Arizona Clean Burning Gasoline Program was published in the *Federal Register* on March 4, 2004 (MAG 2009f).

CRITERIA POLLUTANTS

While EPA regulates many air pollutants, certain pollutants are known as "criteria" air pollutants because EPA uses health-related criteria for permissible exposure levels. The permissible levels are known as the National Ambient Air Quality Standards (NAAQS). One set of limits (primary standards) protects health; another set (secondary standards) is intended to minimize environmental and property damage (Table 4-27). These pollutants are monitored by State and local agencies. In Maricopa County, the Maricopa County Air Quality Department (MCAQD) and the Arizona Department of Environmental Quality (ADEQ) maintain a network of air quality monitoring sites, most of which are located in Phoenix and surrounding communities. Observations as well as atmospheric measurements (see text box on the next page) are collected for research and analysis. A geographic area in which concentrations of criteria pollutants are less than the primary standard is called an attainment area. A geographic area where the concentration of a criteria pollutant exceeds the primary standard is called a nonattainment area.[7]

Table 4-27 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary	Secondary
Carbon monoxide	1-hour	35 ppm[a]	no standard
	8-hour	9 ppm	no standard
Nitrogen dioxide	Annual	0.053 ppm	0.053 ppm
	1-hour	0.1 ppm	no standard
Ozone	8-hour	0.075 ppm	0.075 ppm
Particulate matter ($PM_{2.5}$)[c]	24-hour	35 µg/m^3[b]	35 µg/m^3
	Annual	12 µg/m^3	15 µg/m^3
Particulate matter (PM_{10})[d]	24-hour	150 µg/m^3	150 µg/m^3
Lead	rolling 3-month	0.15 µg/m^3	0.15 µg/m^3
Sulfur dioxide (SO_2)	1-hour	75 ppb[e]	NA[f]
	3-hour	NA	0.5 ppm

Source: 40 Code of Federal Regulations Part 50
[a] parts per million [b] micrograms per cubic meter [c] for particles less than or equal to 2.5 microns (2.5 millionths of a meter) in diameter [d] for particles less than or equal to 10 microns (10 millionths of a meter) in diameter [e] parts per billion
[f] not applicable

The six criteria pollutants listed previously in the section *Regulatory Overview* were first regulated by the 1970 CAA. In the Phoenix area, three of the six criteria pollutants have been historically measured at concentrations higher than the NAAQS (i.e., nonattainment). Local actions were required to reduce concentrations of CO, O_3, and PM_{10}. The Study Area currently lies in a nonattainment area for O_3 and PM_{10}. The Maricopa County area was redesignated to attainment for CO in 2005. Discussion of each of the criteria pollutants follows.

Characteristics of Criteria Pollutants

Lead

Lead is a heavy metal that, at certain exposure levels, can harm the kidneys, liver, nervous system and other organs. It may cause neurological impairments, such as seizures, mental retardation, and behavioral and learning disorders. Recent studies also show that lead may be a factor in high blood pressure and subsequent heart disease. Motor vehicles were the main source of lead air pollution in the past. Lead was an "antiknock" additive used in gasoline. EPA set regulations during the 1980s to gradually reduce the amount of lead added to gasoline. A 1996 CAA amendment banned the sale and use of leaded gasoline in the United States. Since then, lead emissions from vehicles have decreased by about 98 percent nationally.[8] The Phoenix area is in attainment for lead.

Nitrogen Dioxide

NO_2 is a reddish-brown gas belonging to the highly reactive family of gases called nitrogen oxides. Prolonged exposure to NO_2 irritates the lungs and may decrease resistance to respiratory infections, especially in people with existing respiratory illnesses such as asthma. NO_2 is a precursor compound in the photochemical formation of O_3 and, also, in the formation of $PM_{2.5}$, a component of the "brown cloud" frequently observed during fall and winter (see text box on this page). Sources of NO_2 in the Phoenix area include on-road vehicles (58 percent), off-road vehicles (27 percent), and other sources (15 percent), such as power-generating stations, naturally occurring soil processes, and manufacturing plants. NO_2 emissions have declined because of the use of reformulated fuels.

Ambient concentrations of NO_2 are well below the annual standard in the Phoenix metropolitan area. During 2009, MCAQD operated five NO_2 monitoring sites, and none recorded an exceedance of either the 1-hour or the annual standard. On February 9, 2010, EPA finalized a new primary 1-hour NO_2 NAAQS of 0.1 part per million (ppm). This level is intended to protect against adverse health effects associated with short-term exposure to NO_2. New networks of near-road NO_2 monitors for the hourly standard are required to be operational between January 1, 2014, and January 1, 2017. The Phoenix area is in attainment for NO_2.

Sulfur Dioxide

SO_2 is a colorless gas that has a pungent odor at higher concentrations. Prolonged exposure to SO_2 irritates the lungs and may reduce airflow through nasal passages and airways, especially in people who have asthma and are exposed to high concentrations and in those exposed to high concentrations through outdoor exercise. Like NO_2, SO_2 is also a precursor compound in the formation of $PM_{2.5}$, a component of the "brown cloud" that forms frequently during the fall and winter.

Sources of SO_2 in the Phoenix area include point sources, such as industry and mining (32 percent); area sources, such as small industry or household activities (26 percent); off-road vehicles (23 percent); and on-road vehicles (19 percent). Major control technology installed in Arizona's copper smelters during the 1980s reduced SO_2 emissions substantially. SO_2 emissions are expected to decline in the future with the introduction of reformulated fuels. Ambient concentrations of SO_2 were measured at two sites during 2009. On June 22, 2010, EPA finalized a new primary 1-hour SO_2 standard and revoked the 24-hour and annual standards. The 3-hour standard remains a secondary standard for SO_2. No exceedances of these standards have been recorded in the region. The Phoenix area is in attainment for SO_2.

Carbon Monoxide

CO is a colorless and odorless gas produced by incomplete combustion of hydrocarbon fuels. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health risks are most serious for those who suffer from cardiovascular disease, particularly those with angina or peripheral vascular disease. Because CO is a gas, it tends to disperse relatively quickly from its source.

Nationwide, 77 percent of CO emissions are from transportation sources, with more than 65 percent of that from on-road sources. In Arizona's metropolitan areas, about 47 percent of CO emissions come from on-road motor vehicles, 50 percent from off-road vehicles or equipment such as construction vehicles and lawn or garden equipment, and 3 percent from fuel combustion from commercial and residential heating. The highest levels of CO are found in the winter months, when thermal inversions tend to trap pollutants near the ground.

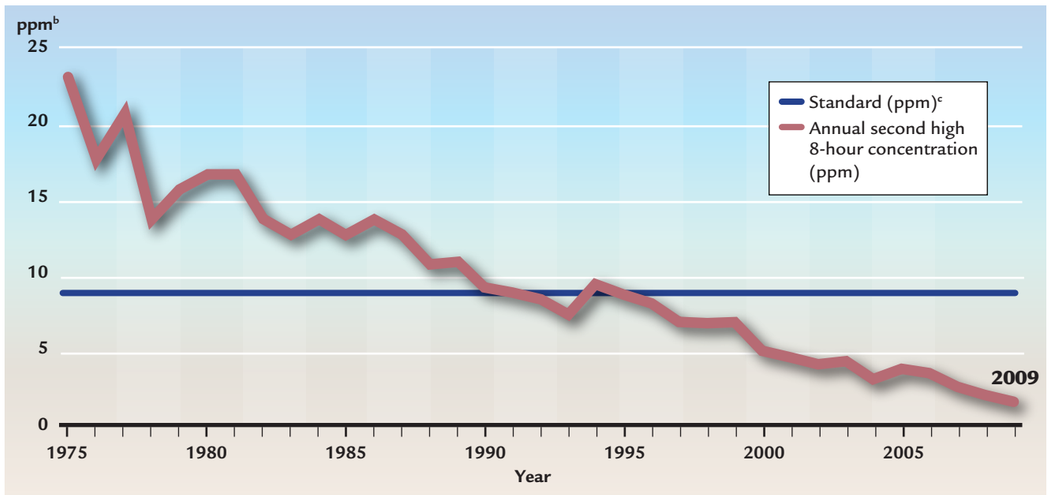
The Maricopa County Carbon Monoxide Maintenance Area was originally classified as a "moderate" nonattainment area in November 1990, and EPA required

A Word about the Brown Cloud

Phoenix's brown cloud is a hazy condition caused by the accumulation in the atmosphere of $PM_{2.5}$, SO_2, and NO_2, with $PM_{2.5}$ being the predominant contributor. In the Phoenix metropolitan area, about 31 percent of $PM_{2.5}$ emissions are attributed to on-road mobile sources. Other $PM_{2.5}$ sources include construction dust and equipment, agriculture, industry, leaf blowers, diesel generators, and fireplaces. In the region, the brown cloud tends to be worse and more frequent in the winter, when temperature inversions tend to trap pollutants near the ground.

The brown cloud is a regional problem that has worsened as the region's population has increased. Source emission standards are expected to dramatically reduce the on-road mobile source contribution to brown cloud pollutants. These standards, phased in between 2006 and 2010, have reduced sulfur content, nitrogen oxides, and $PM_{2.5}$ in heavy-duty diesel truck engines. New engine and gasoline standards for cars and light trucks are also expected to result in substantial reductions in sulfur and nitrogen oxides over the next two decades. However, even with these reductions in on-road mobile source emissions, rapid population growth projected for the region and the many off-road sources of brown cloud precursors likely mean that the brown cloud will continue to be a concern.

Figure 4-19 Annual Second High 8-hour Carbon Monoxide Concentrations, Phoenix,[a] 1980–2009



Source: Maricopa County Air Quality Department, 2010

[a] based on monitoring data from the Central Phoenix monitoring site
[b] concentration in parts per million
[c] National Ambient Air Quality Standard for carbon monoxide, 8-hour concentration

The 8-hour CO concentrations in Phoenix have declined dramatically and generally steadily since the mid-1970s.

attainment by December 1995. The Maricopa County area did not attain the CO standard by this date, and EPA reclassified the area as a "serious" nonattainment area in June 1996. EPA required that MAG prepare a strategy to address the CO problem, and the strategy was included in the State's air quality plan (State Implementation Plan, or SIP). In September 2003, EPA concluded that the Maricopa County area had attained the CO standard. On March 9, 2005, EPA redesignated the Maricopa County area as attainment for CO and approved a maintenance plan for the area. The maintenance plan requires many of the same control measures as the nonattainment SIP; these measures will remain in place through 2015. MAG submitted a second maintenance plan in April 2013 that demonstrated maintenance of the CO standard through 2025 with existing control measures.

CO concentrations have declined in the Maricopa County area by as much as two-thirds since the mid- to late-1970s. The number of days that the 8-hour CO standard was exceeded declined steadily and dramatically from 86 in 1984 to 4 in 1990. There have been no violations of the 8-hour standard in the area since 1996. Most of this improvement can be attributed to federal standards for new-vehicle emissions, augmented by emission reductions from Arizona's Vehicle Emissions Inspection Program (begun in 1976), and the use of oxygenated fuels in the winter (initiated in 1989). During 2009, MCAQD operated 13 CO monitoring sites, and none reported an exceedance of either the 1-hour or the 8-hour standard. Figure 4-19 shows the decrease in concentrations for 8-hour CO exposures at the Central Phoenix monitoring site.[9]

Ozone

Although O_3 in the upper atmosphere is critical to life because it shields the earth from high levels of harmful ultraviolet radiation from the sun, high concentrations of O_3 at ground level can affect plant and animal health. In humans, O_3 has the potential to damage lung tissue, reduce lung function, and sensitize the lungs to other irritants. Exposure to high concentrations of O_3 for as little as several hours has been found to reduce lung function and induce respiratory inflammation.[10]

O_3 is not emitted directly as a tailpipe pollutant, but is formed through complex atmospheric photochemical reactions with other pollutants, primarily VOCs and nitrogen oxides. For this reason, O_3 is considered a regional pollutant. Federal requirements dictate that emissions of compounds that contribute to O_3 formation (known as O_3 precursors) cannot exceed certain limits. In general, on-road vehicle emissions account for nearly one third of the VOC emissions and nearly 60 percent of the nitrogen oxides from the greater Phoenix area (ADEQ 2010). Sunlight and high temperatures accelerate the photochemical reactions that form O_3, so peak O_3 levels in Arizona occur during the summer. MAG conducts regional O_3 studies and analyses. EPA promulgated two health-based regulations: one limited the 1-hour O_3 average concentration and one set an 8-hour average O_3 concentration. The Maricopa Ozone Nonattainment Area, including the Phoenix metropolitan area, was originally designated a nonattainment area in 1991 for not meeting the 1-hour O_3 NAAQS. EPA reclassified the Maricopa area to "serious" nonattainment in 1998 for failing to attain the 1-hour O_3 standard. The State of Arizona requested attainment redesignation in December 2000 as a result of 3 years with no O_3 violations. In May 2001, EPA determined that the Maricopa area had attained the 1-hour O_3 standard. A maintenance plan with a redesignation request was submitted to EPA in April 2004. The 1-hour O_3 maintenance plan and redesignation request were approved by EPA in June 2005, but EPA revoked the 1-hour standard in June 2005 in Arizona.

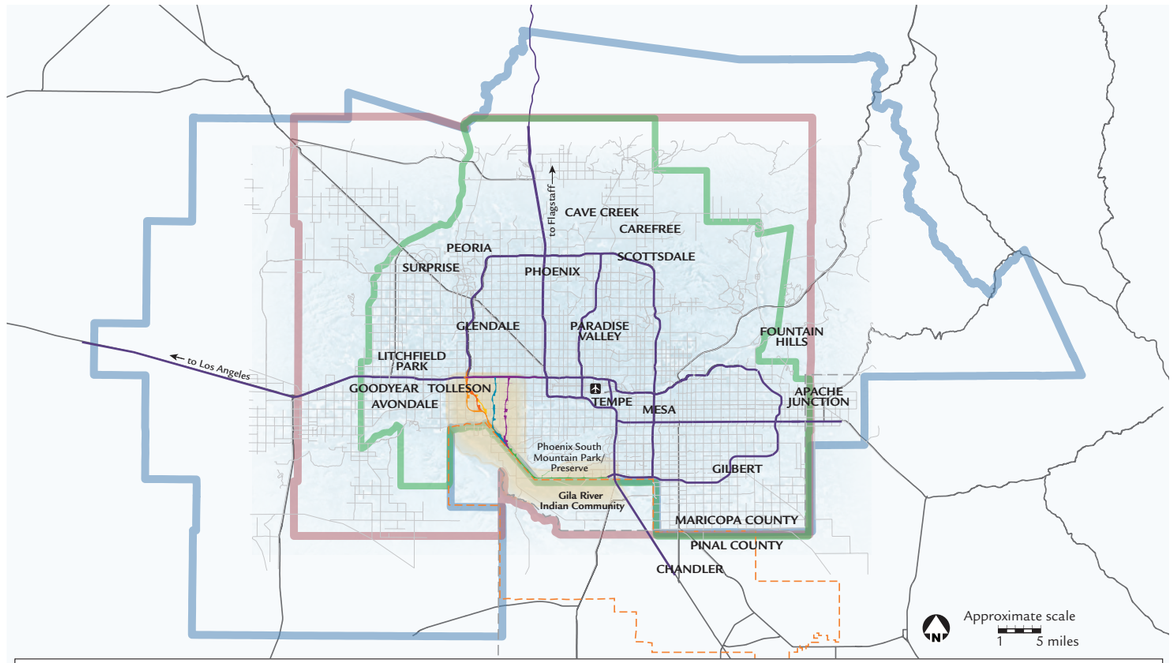
The 8-hour O_3 standard, as adopted by EPA in 1997 and revised in 2008, is expressed as the 3-year average of the annual fourth-highest concentration. In 2004, the Maricopa area was designated a Basic nonattainment area for the 1997 8-hour O_3 standard. The Maricopa 8-hour Ozone Nonattainment Area covers a large area of eastern Maricopa County, including the Phoenix metropolitan area and Apache Junction in Pinal County, as shown on Figure 4-20.

MAG submitted a nonattainment area plan for the 1997 8-hour O_3 standard to EPA in 2007. Based upon monitoring data, there have been no violations of the 1997 8-hour O_3 standard at any monitor since 2004. In 2009, MAG submitted a redesignation request and maintenance plan to EPA for the 1997 8-hour standard. On June 13, 2012, EPA approved the MAG nonattainment area plan for the 1997 8-hour ozone standard.

In 2008, EPA reduced the 8-hour O_3 standard from 0.08 ppm to 0.075 ppm. In May 2012,EPA designated the Maricopa area as a Marginal nonattainment area for the 2008 8-hour O_3 standard. The nonattainment area for the 2008 8-hour O_3 standard is slightly larger than the 1997 8-hour O_3 nonattainment area, expanding farther south and west of Maricopa County to encompass existing power plants.

Long-term trends in 8-hour concentrations of O_3 can be detected by examining data from six sites in the Phoenix area that have been in operation since 1990 (Figure 4-21). The six sites are Central Phoenix, Glendale, North Phoenix, Pinnacle Peak, South Scottsdale, and West Phoenix. In addition to the 3-year average of the annual fourth-highest concentration, the minimum and maximum values are also shown to demonstrate any spatial variability that may exist across the Phoenix area. In general, there is a decrease in 8-hour concentrations from 1990 to 2009, with

Figure 4-20 Nonattainment Areas for Particulate Matter,[a] Carbon Monoxide, and Ozone,[b] Maricopa County



Source: Arizona Department of Transportation, 2010, *Air Quality Assessment South Mountain Freeway 202L Draft Report*

[a] particulate matter greater than or equal to 10 microns (10 millionths of a meter) in diameter
[b] In 2012, the U.S. Environmental Protection Agency finalized the boundary for the 8-hour standard nonattainment area, expanding it slightly to the south and west within Maricopa County to encompass existing power plants.

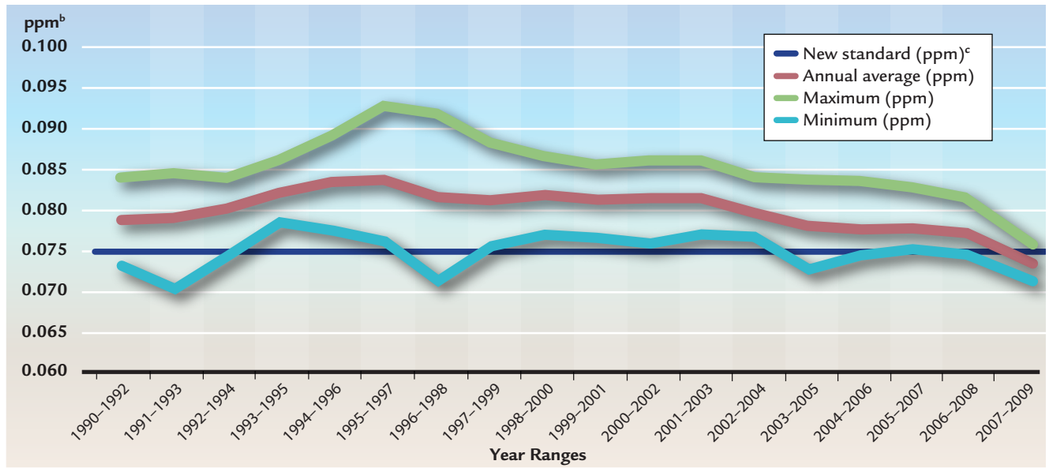
Air quality issues may be regional in nature.

the majority of the decrease occurring from the mid- to late-1990s to 2008 (ADEQ 2010).

Particulate Matter

Particulates are small particles suspended in the atmosphere and may cause irritation and damage to the respiratory system. Exposure to particulates may aggravate existing lung disease, such as asthma or bronchitis, and may increase susceptibility to respiratory infections. Initially, the CAA set standards for all airborne PM. This was referred to as Total Suspended Particulates. In 1987, using additional information on potential health effects, however, EPA began using a new indicator, PM_{10}, which includes only those particles with a diameter less than or equal to 10 microns (micrometers). Ten microns is approximately one-seventh the diameter of a human hair. The PM_{10} fraction of Total Suspended Particulates was considered more important in adversely affecting human health. EPA adopted an annual and a 24-hour standard for PM_{10}. EPA revoked the annual PM_{10} standard, however, in late 2006.

Figure 4-21 Exceedances of Maximum 8-hour Ozone Concentrations, Phoenix,[a] 1990–2009



Source: Arizona Department of Environmental Quality, 2009

[a] based on monitoring data from six sites: Central, North, and West Phoenix; Glendale; Pinnacle Peak; and South Scottsdale
[b] concentration in parts per million
[c] National Ambient Air Quality Standard for ozone, 8-hour concentration

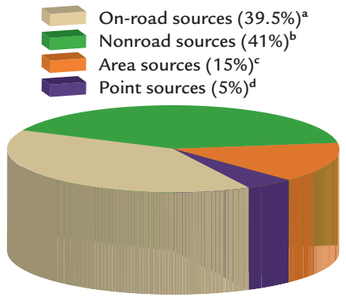
Although the average values at six monitoring sites have generally declined over time, values at some locations exceed the 8-hour ozone standard of 0.075 ppm based on the 2010 to 2012 monitoring data.

Because of its many sources and broad size range, particulate pollution does not have a specific season when it is most troublesome; its effects, however, are aggravated by dry conditions and high winds. On-road travel accounts for 39.5 percent of PM_{10} emissions in Maricopa County, as shown in Figure 4-22.

Air quality in the Maricopa County area does not currently meet the 24-hour PM_{10} NAAQS. The Maricopa County Particulate Matter Nonattainment Area was originally classified in November 1990 as "moderate." The area was reclassified in June 1996 to "serious" nonattainment status, requiring attainment by 2001, as shown on Figure 4-20. The State of Arizona submitted a revised plan to achieve attainment and requested a 5-year extension of the attainment deadline for the 24-hour and annual PM_{10} standards for the Maricopa County area. In July 2002, EPA announced approval of the plan and granted the extension to December 2006.

However, there were numerous exceedances of the 24-hour PM_{10} standard in 2005 and 2006. On June 6, 2007, EPA published a final notice stating that the

Figure 4-22 Regional PM_{10} Emissions Sources, Phoenix, 2008



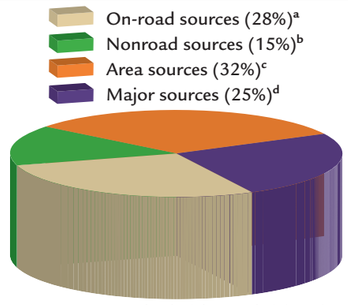
Source: Maricopa Association of Governments, 2009f

Note: Because of rounding, numbers do not add up to 100.

[a] mobile sources
[b] mobile sources including aircraft, locomotives, construction equipment, agriculture
[c] small industrial sources such as dry cleaners, gasoline stations
[d] stationary sources such as power plants and industrial facilities

These relative shares of airborne particulate matter (10 microns in diameter or less) from various emissions sources reflect use of in-place, committed control measures.

Figure 4-23 Sources of the 188 Hazardous Air Pollutants Regulated by the Environmental Protection Agency



Source: Federal Highway Administration, 2006c

[a] mobile sources
[b] mobile sources including aircraft, locomotives, construction equipment
[c] small industrial sources such as dry cleaners, gasoline stations, natural sources (wildfires)
[d] large industrial sources

Nationally, large industrial sources and numerous small businesses and natural sources account for the majority of the 188 hazardous air pollutants regulated by the U.S. Environmental Protection Agency.

nonattainment area had failed to attain the standard by December 31, 2006, triggering the CAA requirement to prepare a Five Percent Plan for PM_{10}. The MAG 2007 Five Percent Plan for PM_{10} was submitted to EPA in December 2007. The plan's committed measures demonstrated at least a 5 percent reduction in PM_{10} emissions per year and attainment of the PM_{10} standard in 2010. On September 9, 2010, EPA proposed a partial approval and disapproval of the MAG 2007 Five Percent Plan. The two major reasons for the proposed disapproval were 1) the 2005 baseline emissions inventory was inaccurate since it overestimated construction and other emissions and 2) the EPA non-concurrence with four high-wind exceptional events at the West 43rd Avenue monitor in 2008 that resulted in a violation of the 24-hour PM_{10} standard. On January 25, 2011, ADEQ withdrew the MAG 2007 Five Percent Plan to address technical approvability issues identified by EPA and include new information. Although the plan was withdrawn, the measures in the plan continue to be implemented. In May 2012, ADEQ submitted to EPA the MAG 2012 Five Percent Plan for PM_{10} as a replacement for the withdrawn MAG 2007 Five Percent Plan. The new MAG 2012 Five Percent Plan contains a wide variety of existing control measures and projects that have been implemented to reduce PM_{10} and a new measure designed to reduce PM_{10} during high-risk conditions, including high winds. The new plan's committed measures demonstrated at least a 5 percent reduction in PM_{10} emissions per year and attainment of the PM_{10} standard in 2012.

Three years of clean monitoring data (an average of no more than one exceedance a year per monitor, averaged over a 3-year period) is needed for the region to attain the PM_{10} standard. Only one exceedance of the PM_{10} standard occurred in 2010. However, in 2011 and 2012, numerous high-wind PM_{10} exceptional event exceedances were recorded as a result of haboobs and dust storms. EPA concurrence with exceptional event documentation prepared by ADEQ would give the region the 3 years of clean data needed for attainment of the PM_{10} standard

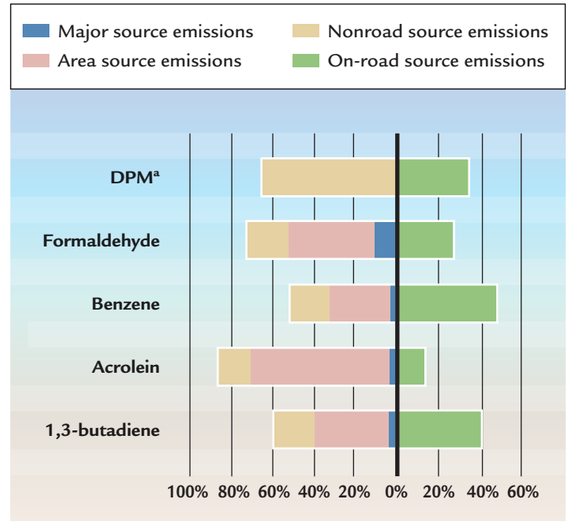
EPA has modified the health standards for particulates. Data suggest that particles 2.5 microns or smaller in diameter ($PM_{2.5}$), may pose the greater threat to human health because they more readily attach to toxic and carcinogenic compounds and penetrate more deeply into the lungs. In December 2012, EPA updated the NAAQS for $PM_{2.5}$, setting the primary annual standard at 12 $\mu g/m^3$ and keeping the 24-hour $PM_{2.5}$ standard at 35 $\mu g/m^3$. Monitoring for $PM_{2.5}$ in the Phoenix metropolitan area indicates $PM_{2.5}$ is below these health standards. According to the Maricopa County 2008 Periodic Emissions Inventory, approximately 34 percent of the total $PM_{2.5}$ emissions are from on-road mobile sources in the Phoenix metropolitan area. Nonroad mobile, area, and point sources are responsible for about 66 percent of total $PM_{2.5}$ emissions.

MOBILE SOURCE AIR TOXICS

In addition to the criteria pollutants, EPA regulates hazardous air pollutants (HAPs), which are a range of compounds known for or suspected of having serious health or environmental impacts. Under the CAA, EPA regulates 188 HAPs. Figure 4-23 shows that most HAPs originate from human-made sources, including indoor sources such as fumes from cooking, home supplies, or building materials, and outdoor sources such as refineries, chemical plants, gasoline stations, and vehicle emissions. Some HAPs are also released from natural sources such as forest fires (FHWA 2006c).

Twenty-eight percent of overall HAPs emissions plus diesel particulate matter (DPM) and diesel organic gases have been classified as on-road mobile source air toxics (MSATs). In March 2001, EPA issued a final rule on *Control of Emissions of Hazardous Air Pollutants from Mobile Sources*, which developed a list of 21 MSATs and then refined it further, compiling a subset of seven pollutants identified as having the greatest influence on health: acrolein, benzene, 1,3-butadiene, DPM, formaldehyde, naphthalene, and polycyclic organic matter (POM). EPA has already placed requirements into law that will limit future emissions of these contaminants from motor vehicles. Unlike the criteria pollutants, however, no NAAQS have yet been established for MSATs. Figure 4-24 summarizes information from 1999 for five of the seven MSATs individually and shows the percentages of emissions from on-road vehicle exhaust as compared with other sources. This figure shows that nationwide emissions of acrolein, formaldehyde, and DPM are predominantly from nonroad and area emissions, while nearly half of the 1,3-butadiene and benzene emissions are from on-road sources (FHWA 2006c).

Figure 4-24 Priority Mobile Source Air Toxics Emissions, 1999, On-road Versus Other Sources



Source: Federal Highway Administration, 2006c

[a] diesel particulate matter

Nationally, emissions from on-road sources are the largest contributors (by weight) to two of the seven priority mobile source air toxics—benzene and 1,3-butadiene.

Discussion of Pollutants

The following sections contain general information about sources, exposures, reactivity, and health risks for the seven MSATs. In general, all these pollutants derive from multiple sources in any urban environment. The most prevalent form of exposure is inhalation.

Acrolein

Acrolein is released into the air as a result of manufacturing acrylic acid, which is used in plastics, coatings, floor polishes, and paints. It can be also formed

from the breakdown of certain pollutants in outdoor air or from burning tobacco or gasoline.[11] Fuel combustion represents the major source of emissions of acrolein to the atmosphere (EPA 2003). According to the Integrated Risk Information System, acrolein's potential carcinogenicity cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure. Short-term inhalation exposure may result in upper respiratory tract irritation and congestion. No information is available on its reproductive and developmental effects in humans. Acrolein is highly reactive and remains in the atmosphere for only a short time, making it difficult to detect ambient atmospheric concentrations. Acrolein is rapidly metabolized by organisms and does not bioaccumulate.[12]

Benzene

Benzene is a known human carcinogen and a natural component of petroleum. It is added to gasoline as an antiknock agent at concentrations of between 1 and 2 percent. Benzene may be emitted by evaporation of gasoline or from the incomplete combustion of fuel. Benzene is emitted to the air from many different sources. According to EPA's *Toxicity and Exposure Assessments for Children's Health*, benzene concentrations in indoor air are also significant contributors to children's exposures, particularly in homes where people smoke.[13] Benzene levels in homes are usually higher than outdoor levels, often because of venting of gasoline vapors from attached garages. For example, a study in Michigan found that the average concentration of benzene in residential garages was 36.6 $\mu g/m^3$, compared with 0.4 $\mu g/m^3$ outdoors.[14] Other common household sources of benzene are stored gasoline, glues, paints, furniture wax, detergents, and other consumer products. Cigarette smoke also contains high levels of benzene, and smokers have much higher levels of benzene in both their homes and their bodies than nonsmokers. The Stochastic Human Exposure and Dose Simulation – Air Toxics study also indicated that 15 percent of the average annual exposure to benzene occurred inside vehicles while driving and about 15 percent of the exposure occurred during vehicle refueling. The remaining inhalation exposure is from ambient outdoor air. Benzene is widely used as an industrial solvent and as an intermediate in chemical syntheses (Environment Canada 1993). Workers who may be exposed to benzene because of their occupations include steel workers, printers, laboratory technicians, firefighters, gas station employees, and chemical plant workers. Chemical reactions limit the atmospheric residence time of benzene to only a few days, and possibly to only a few hours (Agency for Toxic Substances and Disease Registry 2005).

1,3-butadiene

Large amounts (about 3 billion pounds) of 1,3-butadiene are produced each year from petroleum gases. Over 60 percent of this is used to make components of automobile tires. Smaller percentages are used in the manufacture of nylon, copolymer latexes, neoprene rubber, resins, rocket propellants, specialty copolymer resins, latexes for paints, coatings, adhesives, and as an additive to oil lubricants. Exposure to 1,3-butadiene mainly occurs in the following industries: rubber and latex production, petroleum refining, secondary lead smelting, water treatment, agricultural fungicides, and production of raw material for nylon.[15] Small amounts of 1,3-butadiene are found in gasoline, automobile exhaust, cigarette smoke, and wood smoke. 1,3-butadiene is a colorless gas with a mild, aromatic, gasoline-like odor. It is noncorrosive but highly flammable. The vapor is heavier than air. Under EPA's *Guidelines for Carcinogen Risk Assessment* (2005), 1,3-butadiene is characterized as carcinogenic to humans by inhalation. 1,3-butadiene does not bioaccumulate.[16] Estimates for atmospheric residence time in several U.S. cities ranged from 0.4 hour under clear skies at night in the summer to several days under cloudy skies at night in the winter. Residence times during daylight hours are shorter and vary by season. Given the generally short daytime residence times, the net atmospheric lifetime of 1,3-butadiene is short and there is generally limited potential for long-range transport of this compound (Hughes et al. 2001). It should be noted, however, that 1,3-butadiene is transformed into acrolein and formaldehyde in the atmosphere.[17]

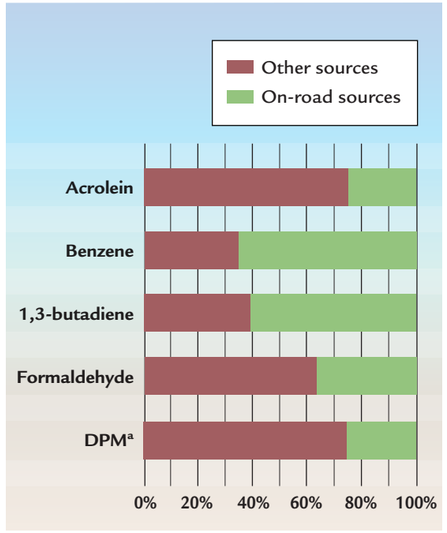
Formaldehyde

Formaldehyde is a colorless gas that is both naturally occurring and the result of human activity. It is one component of diesel exhaust and is a secondary pollutant produced by the atmospheric reactions of other pollutants, including 1,3-butadiene, a chemical found in automobile exhaust.[18] In general, indoor environments consistently have higher concentrations of formaldehyde than outdoor environments because many building materials, consumer products, and fabrics emit formaldehyde. Exposure most often occurs through inhalation of fumes, particularly indoors where concentrations can accumulate because of poor ventilation. Workers can be exposed during direct production, treatment of materials, and production of resins. Healthcare professionals, pathology and histology technicians, and teachers and students who handle preserved specimens may be potentially exposed. Exposure to formaldehyde may irritate the eyes, nose, and throat, and can cause skin and lung allergies.[19] In 1987, EPA classified formaldehyde as a probable human carcinogen under conditions of unusually high or prolonged exposure, according to the Integrated Risk Information System, based on limited evidence in humans, but on sufficient evidence in animals. In June 2004, the International Agency for Research on Cancer reclassified formaldehyde as a known human carcinogen. Formaldehyde breaks down quickly in the atmosphere and does not accumulate in the body.[20]

Diesel Particulate Matter

DPM is emitted by diesel automobiles, generators, light-duty and heavy-duty vehicles, railroad locomotives, and many off-road vehicles including construction equipment. In Maricopa County, heavy-duty trucks and buses account for approximately one-quarter of DPM emissions from all mobile sources.[21] When diesel fuel burns in an engine, the resulting exhaust includes gases and soot that may contain hundreds of different chemical substances. Contaminants emitted as gases condense to form a wide variety of small particles that compose DPM. These fine particles have a large surface area, which makes them an excellent medium for adsorbing organic compounds, including those that can cause health risks. Also, if inhaled, these small particles can reach deeper levels of the lungs. DPM disperses rapidly, but is nonreactive, and it can stay in the air for days or

Figure 4-25 Priority Mobile Source Air Toxics Emissions, Maricopa County



[a] diesel particulate matter

Source: U.S. Environmental Protection Agency, "National Air Toxics Assessment; Emissions Data Tables"

In Maricopa County in 1999, benzene and 1,3-butadiene are the predominant mobile source air toxics emissions (by weight) from on-road sources, the same as reported from national data (see Figure 4-24).

weeks. DPM can accumulate in the lungs over time if exposures continue (EPA 2002). People working near diesel engines in agriculture, construction, and railroads are potentially exposed to elevated levels. According to the Integrated Risk Information System, diesel exhaust is likely to be carcinogenic to humans by inhalation from environmental exposures. DPM as reviewed in this document is the combination of DPM and diesel exhaust organic gases. DPM exacerbates existing respiratory effects. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

Naphthalene

Naphthalene is a white crystalline, volatile solid that converts from a solid directly to a gas without an intermediate liquid phase at room temperature so that it exists as a gas in the atmosphere. Naphthalene is produced from petroleum refining and coal tar distillation. It is used in smokeless powder, cutting fluids, lubricants, synthetic resins, tanning product preservatives, and textile chemicals. Naphthalene is released to the air from the burning of coal and oil and from mothballs. Examples of human-made emission sources include paper mills, manufacturers of some wood products, and some combustion processes such as refuse combustion and coal tar pitch fumes. Naphthalene has also been detected in tobacco smoke and vehicle exhaust. Natural emission sources include crude oil and natural uncontrolled combustion. Acute exposure to naphthalene by inhalation, ingestion, and skin contact is associated with hemolytic anemia, liver damage, and, in infants, neurological damage. Symptoms include headache, nausea, vomiting, diarrhea, malaise, confusion, convulsion, and coma. Naphthalene vapors are highly irritating to the eyes, and cataracts have been reported in humans who experience acute exposure to naphthalene. EPA has classified naphthalene as a possible human carcinogen.

Table 4-28 Priority Mobile Source Air Toxics Emissions, Maricopa County, 2002

Pollutant	On-road Mobile Sources (% of total)	Other Sources (% of total)	Total (tons of emissions)
Acrolein	44	56	58
Benzene	54	46	2,008
1,3-butadiene	58	42	242
Formaldehyde	55	45	1,102
Napthalene	21	79	137

Source: U.S. Environmental Protection Agency, 2009

Polycyclic Organic Matter

POM is a broad class of over 100 organic compounds with more than one benzene ring. POM can be divided into two subgroups: polycyclic aromatic hydrocarbons (PAHs) and PAH-derivatives. PAHs are organic compounds that include only carbon and hydrogen; PAH-derivatives contain other elements in addition to carbon and hydrogen. In general, compounds with two rings, such as naphthalene, exist as a gas. Compounds with three to four rings, such as pyrene, exist either as a gas or a particle, depending on the temperature and pressure. Compounds with five rings, such as dibenzo[a,h]anthracen and benzo[a]pyrene, exist as particles in the atmosphere. POM is produced by the incomplete combustion of fossil fuels and vegetable matter and is generally present in the atmosphere in particulate form. Examples of human-made emission sources include cigarette smoke, grilling meat, home heating, fireplaces, vehicle exhaust, coal-fired power plants, petroleum refineries, paper mills, and roofing tar. POM can also be formed from any naturally occurring combustion, such as forest fires. Exposure to POM can occur through inhalation, ingestion, and skin contact. Epidemiological studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The exposure of skin to mixtures of carcinogenic PAHs can cause skin disorders; adverse skin effects have been reported following application of solutions containing benzo[a]pyrene.

Table 4-29 Annual Priority Mobile Source Air Toxics Concentrations, South Phoenix

Pollutant	South Phoenix Annual Mean ($\mu g/m^3$)[a]
Benzene	3.5
1,3-butadiene	0.5
Formaldehyde	4.2

Source: Joint Air Toxics Assessment Project Report, 2004 (November)

[a] micrograms per cubic meter

Local Emissions of Priority MSATs

It is possible to estimate the relative contributions (by weight of emissions) of the different local sources of priority MSATs using EPA-compiled information. In June 2009, EPA released the results of its National-Scale Air Toxics Assessment for 2002.[22] The purpose of the national-scale assessment was to identify and prioritize those HAPs that present the greatest potential concern in terms of adversely affecting human health. Table 4-28 and Figure 4-25 show that, in Maricopa County, priority pollutants come from on-road mobile sources (such as cars and trucks) and other sources (such as industrial emissions, dry cleaners, gas stations, construction equipment, and train diesel engines).[23]

Regional emissions can exhibit wide local variations. In the Phoenix area, some monitoring data include several priority MSATs. In 2003, a short-term study under the Joint Air Toxics Assessment Project measured ambient levels of benzene; 1,3-butadiene; and formaldehyde in the South Phoenix area (bounded on the north by Van Buren Street, on the south by Chandler Boulevard, on the east by 1st Street, and on the west by 55th Avenue). The annual mean concentrations for these compounds are presented in Table 4-29 (McCarthy et al. 2004).

Emissions data organized and displayed at the county level can mask wide local variations. For example, compare the emissions percentages of benzene, 1,3-butadiene and formaldehyde in Table 4-28 with the percentages shown

for South Phoenix in Table 4-30 (McCarthy et al. 2004; Sullivan et al. 2004). On-road mobile sources represent a smaller portion of these pollutants in South Phoenix compared with Maricopa County as whole.

ENVIRONMENTAL CONSEQUENCES

Criteria Pollutants

CO

FHWA regulations require a project-level quantitative analysis for CO emissions from motor vehicles on all major transportation projects in nonattainment or maintenance areas. This project-level CO analysis was performed for the existing condition (2010) and for the action and No-Action alternatives in the design year (2035). Two EPA-approved models are used to project local impacts of CO emissions. One model, MOBILE6.2, estimated CO emissions from vehicles operating on the proposed freeway in the design year. Consistent with 40 C.F.R. § 93.111(c), since this project-level CO analysis started before or during the grace period for MOVES2010, MOBILE6.2 was used to estimate CO emissions. The other, a dispersion model (CAL3QHC Version 2), projected ambient CO concentrations in that year.

To address the modeling results, it is important to understand the ambient concentrations of CO in the Study Area. Maricopa County operates a network of air quality monitoring sites in the region. Monitoring results at stations in the Study Area demonstrate that the 1-hour and 8-hour maximum concentrations of CO are well below the NAAQS (see Figure 4-19 on page 4-60 for the 8-hour levels).

For the project-level analysis, projected maximum 1-hour and 8-hour concentrations were calculated for receptors at various distances from the roadway centerline for existing traffic conditions and roadway configurations for I-10, for major arterial street intersections near the proposed action alternatives, and for receptors located at the proposed action alternatives' interchanges. Receptor placement met the criteria for selecting modeling locations as specified in 40 C.F.R. § 93.123(a). In all, over 700 receptor locations were modeled in the Study Area. Projected 8-hour concentrations of CO with the action alternatives were low, with most projected 8-hour concentrations being less than 5 ppm. (The NAAQS for the 8-hour CO concentration level is 9 ppm.) Projected 8-hour concentrations at receptors located at arterial street intersections near I-10 generally exhibited a small decrease from the existing conditions to the action alternatives' scenario. Those receptors located at the arterial street intersections and freeway interchanges south of I-10 exhibited small increases. These projected 8-hour increases associated with the action alternatives were less than 3 ppm.

Table 4-31 illustrates maximum projected 1-hour concentrations: the action alternatives would result in concentrations below the 35 ppm NAAQS for the 1-hour CO concentration level. Table 4-32 illustrates maximum projected 8-hour concentrations: the action alternatives would result in concentrations below the 9 ppm NAAQS for the 8-hour CO concentration level. The CO project-level air quality analysis demonstrated that none of the action alternatives would violate the NAAQS, based on projected 2035 traffic.

Ozone

Since O_3 is a regional pollutant, a meaningful evaluation at the project level is not possible. MAG is responsible for developing plans to reduce emissions of O_3 precursors in the Maricopa area. MAG submitted its Eight-Hour Ozone Plan to EPA in summer 2007 (MAG 2009f). The Preferred Alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

Particulate Matter

Transportation projects that are within nonattainment or maintenance areas and are not exempt require an analysis that "… must document that no new local PM_{10} violations will be created and the severity or number of existing violations will not be increased as a result of the project" (FHWA 2001a). In March 2006, EPA and FHWA issued a joint guidance document on performing qualitative hot-spot analyses in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. Projects that are of "air quality concern" as defined by 40 C.F.R. § 93.123(b)(1) require a hot-spot analysis. The proposed action is such a project.

Table 4-30 Priority Mobile Source Air Toxics Emissions, South Phoenix

Pollutant	On-Road Mobile Sources		Other Sources		Total
	Tons/year	% of total	Tons/year	% of total	Tons/year
Benzene	26.90	25	80.60	75	107.50
1,3-butadiene	4.40	9	43.46	91	47.86
Formaldehyde	18.90	40	28.62	60	47.52

Source: Joint Air Toxics Assessment Project Report, 2004 (December)

In December 2010, EPA established transportation conformity guidance for performing quantitative $PM_{2.5}$ and PM_{10} hot-spot analyses for transportation projects and established a 2-year grace period. EPA conformity guidance continues to allow qualitative PM_{10} hot-spot conformity analyses for analyses that were started before or during the grace period and if the final environmental document for the project is issued no more than 3 years after issuance of the draft environmental document [40 C.F.R § 93.111(c)]. Qualitative analyses may involve comparing the project area with an area possessing similar characteristics, reviewing findings from air quality studies that may have been performed, or employing other qualitative approaches. A PM_{10} qualitative analysis was performed for this project; it examined the areas that may be adversely affected by the proposed South Mountain Freeway. A $PM_{2.5}$ qualitative analysis was not required.

The qualitative analysis of the potential impacts associated with the proposed action began with a review of future traffic conditions on the Preferred Alternatives: the W59 and E1 Alternatives. The action alternatives' average daily traffic (ADT) levels, percentages of trucks, and level of service (LOS) were reviewed. Four service traffic interchanges were identified for detailed review based on LOS and/or high traffic volumes during the evening peak hour of travel. They were Van Buren Street, Southern Avenue, Desert Foothills Parkway, and 40th Street. The 83rd Avenue interchange was included with the W101 Alternative because no interchange is planned at Southern Avenue with the W101 Alternative. Under the 2020 action scenario, the ADT on arterial streets intersecting the W59

Table 4-31 Maximum Projected 1-hour Carbon Monoxide Concentrations[a] at Intersections/Interchanges

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Thomas Road	—[b]	—	—	—	—	—	—	—	—	—	3.8 3.7 3.8	—
McDowell Road	4.2[c] 3.8[d] 4.1[e]	—	4.0 3.9 3.7	4.2 4.1 4.3	—	4.8 4.7 4.8	—	—	5.2 4.6 3.9	—	2.9 3.5 3.5	—
Interstate 10	5.2 4.3 4.0	3.7 3.3 3.2	5.6 4.8 —[f]	5.6 4.8 4.9	3.4 2.9 3.4	4.6 4.4 4.7	—	—	7.0 6.1 4.8	—	7.2 4.6 3.9	—
Van Buren Street	—	5.1 3.5 3.7	4.3 3.8 —[g]	4.1 3.5 3.9	3.3 3.0 3.9	3.8 3.5 3.6	—	—	3.5 3.5 3.8	—	2.6 2.6 4.4	—
Buckeye Road	—	3.6 3.9 4.3	3.8 3.4 —[g]	3.8 3.3 3.4	2.5 2.3 3.2	3.5 3.3 3.2	—	3.7 3.6 5.0	3.5 3.6 3.6	—	3.1 3.2 4.4	3.4 3.4 4.8
Lower Buckeye Road	—	2.5 2.4 4.2	3.5 3.3 3.5	3.2 3.2 3.7	3.8 3.2 3.6	2.8 2.7 3.1	4.0 3.6 4.2	3.4 3.5 4.0	3.1 3.3 3.0	3.1 3.0 3.4	3.1 2.8 3.5	3.0 3.0 3.2
Broadway Road	—	2.0[h] 2.0[h] 3.8	2.0[h] 2.0[h] 2.0[h]	—	2.7 3.1 5.4	2.4 2.8 3.1	2.4 2.7 3.2	2.3 3.1 3.1	—	2.3 2.7 3.6	2.3 2.2 —[f]	—
91st Avenue	—	—	—	—	—	—	—	—	—	—	—	—[g] —[g] 2.9

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Southern Avenue	—	2.0[h] 2.0[h] 3.8	2.0[h] 2.0[h] 2.0[h]	—	—	—	—	—	—	—	—	—
Baseline Road	—	2.0[h] 2.0[h] 3.9	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 4.3	—	—	—	—	—	2.3 2.3 3.9	—
Dobbins Road	—	2.0[h] 2.0[h] 5.7	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 3.0	—	—	—	—	—	—	—
Elliot Road	—	2.0[h] 2.0[h] 4.4	2.0[h] 2.0[h] 2.0[h]	—	2.0[h] 2.0[h] 3.0	—	—	—	—	—	—	—
Free Flow	—	3.9 3.4 5.4	—	—	2.0[h] 2.0[h] 5.2	—	—	—	—	2.0[h] 2.0[h] 5.0	3.3[h] 2.9[h] 5.0[h]	2.0[h] 2.0[h] 4.1

Eastern Section						
	51st Avenue	17th Avenue	Desert Foothills Parkway	24th Street	40th Street	Free Flow
E1 Alternative	2.0[h] 2.0[h] 3.9	2.8 2.2 3.4	2.8 2.2 3.1	2.8 2.5 3.2	2.6 2.5 3.7	2.8 2.4 5.0

[a] all values are in parts per million (ppm); 1-hour standard = 35 ppm [b] not applicable [c] 4.2 – existing conditions
[d] 3.8 – No-Action Alternative [e] 4.1 – action alternatives [f] interchange removed [g] receptor within the right-of-way
[h] no existing roadway near receptor; background levels assumed

or E1 Alternatives would increase by as much as 10,000 vehicles. The largest increases are projected for those arterial streets intersecting the W101 Alternative. The largest of these is at 83rd Avenue, where the ADT would increase by approximately 30,000 vehicles. The percentage of trucks that are heavy trucks (diesel) is estimated at 2 to 7 percent. The 2020 LOS for the identified interchanges were not available, but because of the LOS projected for the same interchanges in 2035 (with higher traffic volumes), it may be assumed that none of these interchanges would operate at LOS E or F during 2020.

Under the 2035 action scenario, the percentage of trucks would remain at the 2020 level with ADT increasing by approximately 84 percent. The largest increases would be associated with the W101 Alternative. Increases of approximately 6 to 33 percent are projected for the W59 Alternative and approximately 23 to 42 percent for the W71 Alternative. With the action alternatives, two of the interchanges (at Van Buren Street and Southern Avenue) would operate at LOS C at both ramps. None of the interchanges would operate at a LOS E or F during 2035. Based on this information, both interchanges were considered as the worst-case traffic scenarios, but the Van Buren Street interchange had a higher ADT. Therefore, the Van Buren Street interchange with the W101 Alternative was analyzed.

The transportation conformity rule also requires that the analysis consider the year of expected peak emissions from the project.

The qualitative analysis compared ambient concentrations of PM_{10} at five MCAQD PM_{10} monitoring sites in the

Table 4-32 Maximum Projected 8-hour Carbon Monoxide Concentrations[a] at Intersections/Interchanges

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Thomas Road	—[b]	—	—	—	—	—	—	—	—	—	2.7 2.6 2.7	—
McDowell Road	2.9[c] 2.7[d] 2.9[e]	—	2.8 2.7 2.6	2.9 2.9 3.0	—	3.4 3.3 3.4	—	—	3.6 3.2 2.7	—	2.0 2.5 2.5	—
Interstate 10	3.6 3.0 2.8	2.6 2.3 2.2	3.9 3.4 —[f]	3.9 3.4 3.4	2.4 2.0 2.4	3.2 3.1 3.3	—	—	4.9 4.3 3.4	—	5.0 3.2 2.7	—
Van Buren Street	—	3.6 2.5 2.6	3.0 2.7 —[g]	2.9 2.5 2.7	2.3 2.1 2.7	2.7 2.5 2.5	—	—	2.5 2.5 2.7	—	1.8 1.8 3.1	—
Buckeye Road	—	2.7 2.7 3.3	2.7 2.4 —[g]	2.7 2.3 2.4	1.8 1.6 2.2	2.5 2.3 2.2	—	2.6 2.5 3.5	2.5 2.5 2.5	—	2.2 2.2 3.1	2.4 2.4 3.4
Lower Buckeye Road	—	1.8 1.7 2.9	2.5 2.3 2.5	2.2 2.2 2.6	2.7 2.2 2.5	2.0 1.9 2.2	2.8 2.5 2.9	2.4 2.5 2.8	2.2 2.3 2.1	2.2 2.1 2.4	2.2 2.0 2.5	2.1 2.1 2.2
Broadway Road	—	1.4[h] 1.4[h] 2.7	—	—	1.9 2.2 3.8	1.7 2.0 2.2	1.7 1.9 2.2	1.6 2.2 2.2	—	1.6 1.9 2.5	1.6 1.5 —[f]	—
91st Avenue	—	—	—	—	—	—	—	—	—	—	—	1.4[h] 1.4[h] 2.0

Western Section												
	51st Avenue	W59 Alternative	59th Avenue	67th Avenue	W71 Alternative	75th Avenue	83rd Avenue	91st Avenue	99th Avenue	W101 Alternative Eastern Option	W101 Alternative Central Option	W101 Alternative Western Option
Southern Avenue	—	1.4[h] 1.4[h] 2.7	—	—	—	—	—	—	—	—	—	—
Baseline Road	—	1.4[h] 1.4[h] 2.7	—	—	1.4[h] 1.4[h] 3.0	—	—	—	—	—	1.6 1.6 2.7	—
Dobbins Road	—	1.4[h] 1.4[h] 4.0	—	—	1.4[h] 1.4[h] 2.1	—	—	—	—	—	—	—
Elliot Road	—	1.4[h] 1.4[h] 3.1	—	—	1.4[h] 1.4[h] 2.1	—	—	—	—	—	—	—
Free Flow	—	2.7 2.4 3.8	—	—	1.4[h] 1.4[h] 3.6	—	—	—	—	1.4[h] 1.4[h] 3.5	2.3 2.0 3.5	1.4[h] 1.4[h] 2.9

Eastern Section						
	51st Avenue	17th Avenue	Desert Foothills Parkway	24th Street	40th Street	Free Flow
E1 Alternative	1.4[h] 1.4[h] 2.7	2.0 1.5 2.4	2.0 1.6 2.2	2.2 1.8 2.2	2.0 1.8 2.6	2.0 1.7 3.5

[a] all values are in parts per million (ppm); 8-hour standard = 9 ppm [b] not applicable [c] 2.9 – existing conditions [d] 2.7 – No-Action Alternative [e] 2.9 – action alternatives [f] interchange removed
[g] receptor within the right-of-way [h] no existing roadway near receptor; background levels assumed

Phoenix area. These sites represented urban areas near freeways, urban areas distant from freeways, and rural areas. The ambient concentrations included vehicle-related emissions such as tailpipe exhaust, brake-wear, tire-wear, reentrained road dust, and emissions from construction activities. The identified sites, ambient concentrations of PM_{10} measured during 2009, nearest road, and traffic volumes are presented in Table 4-33 (MCAQD 2010).

A review of the monitoring data suggests that industrial, mining, or agricultural areas have the highest ambient concentrations of PM_{10}. The sites near freeways typically have ambient concentrations below the NAAQS. For example, the Central Phoenix location (Table 4-33) has been in operation for over 40 years. Exceedances of the 24-hour PM_{10} standard have occurred at the Central Phoenix monitor, but most of these exceedances were caused by high-wind exceptional events. Likewise, the Greenwood site is within 200 feet of I-10 and is surrounded by a mix of residential, commercial, and light industrial facilities. This location had one exceedance of the 24-hour standard in 2009, which was noted by ADEQ as an "exceptional event." Exceptional events are adverse air quality events that may be caused by meteorological conditions (e.g., high winds, violent storms) or rare events (e.g., large structure fires or explosions, post-disaster clean-up activities). If such an event occurs and EPA agrees with the determination, data that

Table 4-33 PM_{10} Monitoring Locations, Results, and Nearby Road Characteristics, 2009

Site Name (Location)	Maximum 24-Hour PM_{10} Value ($\mu g/m^3$[a])	2nd Maximum 24-Hour PM_{10} Value ($\mu g/m^3$)	Number of Exceedances of PM_{10} Standard	Nearest Freeway	Distance from Freeway	2009 Traffic Volumes
Urban locations near freeways (<½ mile)						
Central Phoenix (16th Street/Roosevelt)	153	130	0	I-10[b] SR 51[c] SR 202L[d]	¼ mile ¾ mile ¾ mile	248,000 157,000 109,000
Greenwood (27th Avenue/I-10)	229	123	1[f]	I-10 I-17[e]	200 feet ½ mile	293,000 130,000
Urban locations distant from freeways (>½ mile)						
Durango Complex (27th Avenue/Durango Street)	277	161	3	I-17	¾ mile	110,000
West 43rd Avenue (43rd Avenue/Broadway Road)	317[f]	213	7	I-17	2½ miles	124,000
Rural locations						
Buckeye (Highway 85/Maricopa County 85)	439[f]	400	3	I-10	4 miles	37,500

[a] micrograms per cubic meter [b] Interstate 10 [c] State Route 51 [d] State Route 202 (Loop 202) [e] Interstate 17 [f] exceptional event

would have caused an exceedance of the NAAQS are not counted against an area's measure of air quality.

Of the monitoring locations reviewed, the site characteristics of the Central Phoenix and Greenwood monitoring sites would most closely resemble the characteristics of the Buckeye Road and Baseline Road interchanges in 2035. Based on the review of these sites and the projected characteristics of the two interchanges, it is unlikely that the proposed action alternatives would cause or contribute to an exceedance of the PM_{10} standards. This is based on the following factors:

- Fugitive dust sources in Maricopa County are the largest contributors to ambient concentrations of PM_{10}.
- Diesel exhaust is not a major contributor to ambient concentrations of PM_{10}.
- The proposed improvements would reduce travel time and congestion on the freeways and arterial streets in the area, thereby reducing exhaust emissions of PM_{10}.
- The emission factor for PM_{10} in 2035 is projected to be approximately 75 percent of the 2010 value based on the ratio of the PM_{10} emission factors (exhaust brake and tire) from MOBILE6.2.

This conformity determination meets applicable CAA Section 176(c) requirements for federally funded or approved transportation projects, specifically, the requirements for PM hot-spot analysis as codified at 40 C.F.R. §§ 93.116 and 93.123. By meeting these regulatory requirements as well as other requirements in the conformity regulations, this conformity determination demonstrates compliance with the requirements of CAA Section 176(c)(1).

Future Trends in Criteria Pollutants

EPA will continue its successful efforts to further reduce vehicle emissions. These programs include reformulated gasoline, the national low-emission vehicle program, Tier II motor vehicle emissions standards, gasoline sulfur control program, heavy-duty diesel engine program, and on-highway diesel sulfur control programs. Two examples follow.

Heavy-duty Diesel Emissions Standards

In December 2000, EPA issued its final rule in a two-part strategy to reduce diesel emissions from heavy-duty trucks and buses. The standards pertain to diesel engines found in such vehicles (weighing over 8,500 pounds), beginning in model year 2004. Additional standards and procedures were implemented in 2007. EPA required diesel fuel refiners to produce diesel fuels (for highway vehicle use) that have a sulfur content of no more than 15 ppm, effective October 2006, a 97 percent reduction from the previous 500 ppm level.

Tier II Emissions Standards

In December 1999, EPA announced what are known as Tier II new engine and gasoline standards designed to reduce emissions from new passenger cars and light trucks. Effective 2004, gasoline refiners and importers have been required to manufacture gasoline with sulfur levels not exceeding 300 ppm. By 2006, sulfur levels were to meet a 30 ppm average and were not to exceed 80 ppm. As a result of these regulations, nitrogen oxide emissions are predicted to decrease by 61 percent and VOC emissions by 24 percent between 2004 and 2030. Not only will the updated regulations reduce criteria pollutants, they will also reduce MSATs, which are discussed in the next section.

Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that EPA regulate 188 air toxics, also known as HAPs. EPA has assessed this expansive list in its latest rule on the *Control of Hazardous Air Pollutants from Mobile Sources* (Federal Register 72(37): 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are listed in its Integrated Risk Information System <www.epa.gov/iris/>. In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers from its 1999 National Air Toxics Assessment <www.epa.gov/ttn/atw/nata1999/>. These are acrolein; benzene; 1,3-butadiene; DPM plus diesel exhaust organic gases; formaldehyde; naphthalene; and POM. While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

Information Availability Constraints in Analyzing Project-Specific MSATs Impacts

This section includes a basic analysis of the likely MSATs emissions impacts of the proposed action and the No-Action Alternative. Available technical tools do not, however, enable the prediction of project-specific health impacts of the emissions changes associated with the action alternatives. Because of these limitations, the following discussion is included in accordance with Council on Environmental Quality (CEQ) regulations [40 C.F.R. § 1502.22(b)] regarding incomplete or unavailable information. 40 C.F.R. § 1502.22(b) addresses situations where analysis of an impact in a NEPA document is restricted by missing or incomplete information, and requires the NEPA document to 1) state that there is missing or incomplete information, 2) discuss the relevance of this information, 3) summarize what is known about the impact in question, and 4) in the face of what is known and not known, present the federal agency's evaluation of the likely impact.

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts attributable to changes in MSAT emissions associated with a proposed set of freeway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. EPA is the lead authority for administering the CAA and its amendments and has specific statutory obligations with respect to hazardous air pollutants and MSATs. EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. It maintains Integrated Risk Information System, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (<www.epa.gov/iris/>). Each report contains assessments of noncancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSATs, including the Health Effects Institute (HEI). Two HEI studies are summarized below. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious are the adverse human health effects of MSAT compounds at current environmental concentrations (<pubs.healtheffects.org/view.php?id=282>) or in the future as vehicle emissions substantially decrease (<pubs.healtheffects.org/view.php?id=306>).

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts, each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevent a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70-year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affect emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine a person's duration of actual exposure at a specific location; and to establish the extent of exposure attributable to a proposed action, especially given that some of the information needed is unavailable.

Considerable uncertainties are associated with existing estimates of toxicity of the various MSATs because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (<http://pubs.healtheffects.org/view.php?id=282>). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for DPM. The EPA (<www.epa.gov/risk/basicinformation.htm#g>) and HEI (<pubs.healtheffects.org/getfile.php?u=395>) have not established a basis for quantitative risk assessment of DPM in ambient settings.

A national consensus is also lacking on an acceptable level of risk. The current context is the process used by EPA as provided by the CAA to determine whether more stringent controls are needed to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk attributable to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million attributable to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.

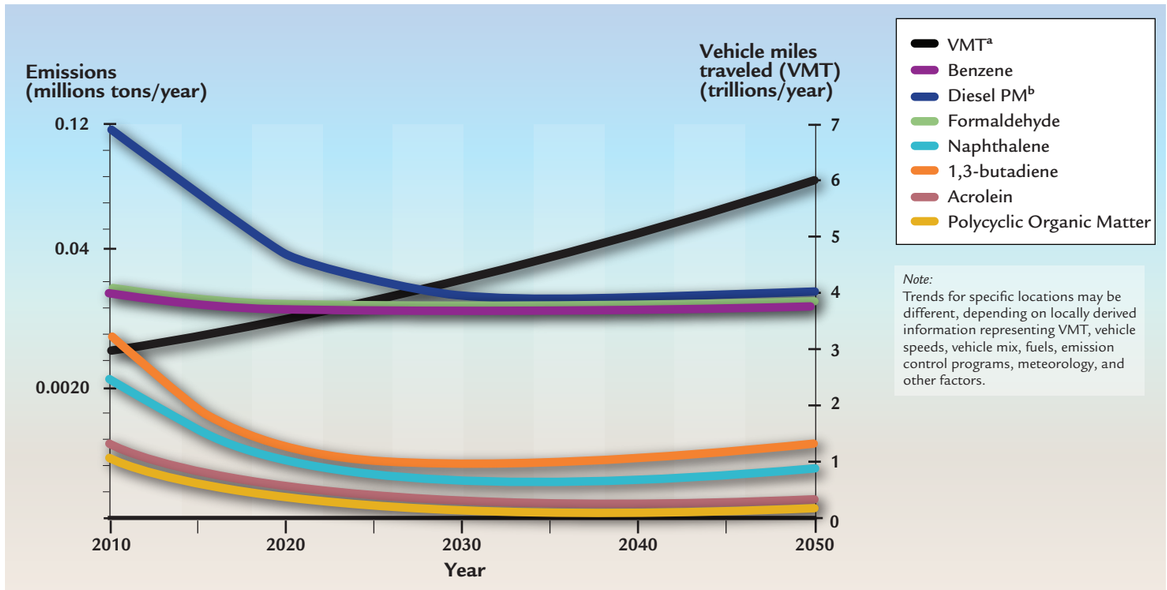
Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers,

who would need to weigh this information against project benefits, such as reducing traffic congestion, that are better suited for quantitative analysis

Emissions Model

The EPA emissions model MOBILE6.2 was used to project emissions at a regional level consistent with 40 C.F.R. § 93.111(c), since the MSAT analysis for the proposed action started before or during the grace period for using the MOVES2010 emissions model. According to EPA, MOVES improves upon the MOBILE model in several key aspects: MOVES is based on a vast amount of in-use vehicle data collected and analyzed since the latest release of MOBILE, including millions of emissions measurements from light-duty vehicles. Analysis of these data enhanced EPA's understanding of how mobile sources contribute to emissions inventories and the relative effectiveness of various control strategies. In addition, MOVES accounts for the significant effects that vehicle speed and temperature have on PM emissions estimates, whereas MOBILE did not. MOVES2010b includes all air toxic pollutants in the National Air Toxics Assessment that are emitted by mobile sources. EPA has incorporated more recent data into MOVES2010b to update and enhance the quality of MSAT emission estimates. These data reflect advanced emission control technology and modern fuels, plus additional data for older vehicles.

Figure 4-26 National MSAT Emission Trends, 1999–2050



Source: EPA MOVES2010b model runs conducted from May to June 2012 by FHWA.

[a] vehicle miles traveled
[b] diesel particulate matter

Regulatory initiatives have and will continue to result in reductions of mobile source air toxics (MSATs) emissions in the near term. As vehicle miles traveled steadily increase, MSAT emissions will rise only gradually.

Based on an FHWA analysis using EPA's MOVES2010b model, as shown in Figure 4-26, even if VMT increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSATs is projected for the same time period.

The implications of MOVES related to MSAT emissions estimates compared with MOBILE as used in this analysis are lower estimates of total MSAT emissions; and significantly lower benzene emissions; significantly higher DPM emissions, especially for lower speeds. Consequently, DPM is projected to be the dominant component of the emissions total.

Dispersion Model

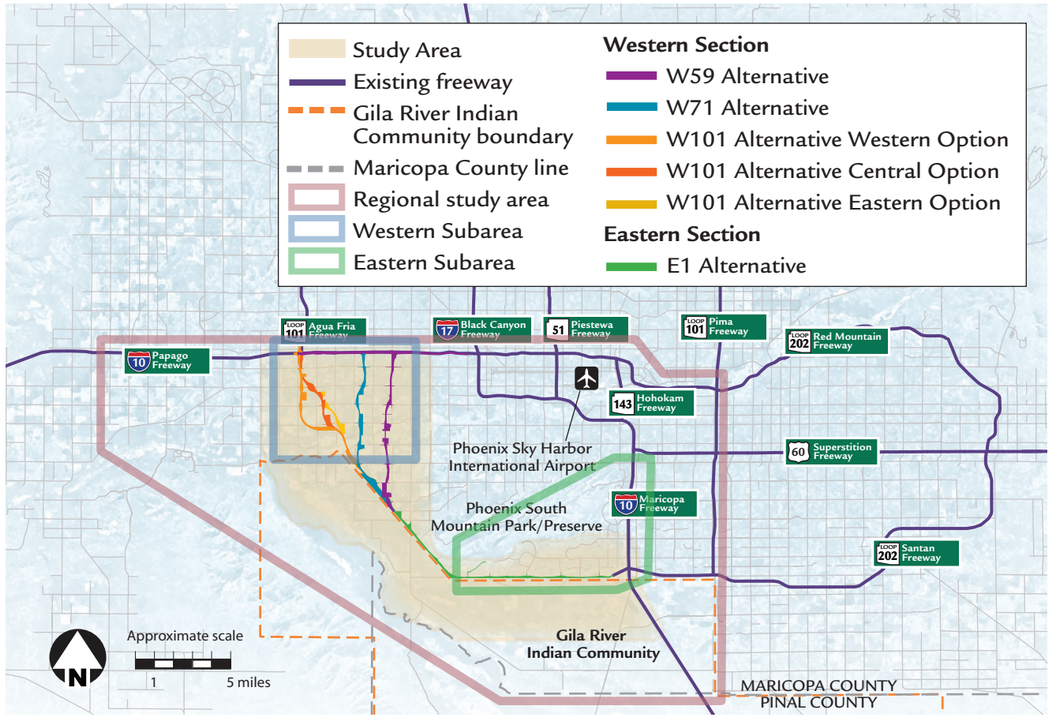
A dispersion model is used to evaluate how projected emissions will disperse into the environment and to estimate pollutant concentrations at specific times and locations. EPA's current dispersion models were developed and validated more than a decade ago for the purpose of projecting episodic concentrations of CO to determine compliance with the NAAQS.

MSAT Emissions Trends

Computer modeling was used to compare the projected emission trends of the action alternatives. The Study Area was divided into two geographic subareas, as shown in Figure 4-27, and emissions trends were modeled for the two subareas. The Eastern Subarea encompassed the general vicinity near Pecos Road, and the Western Subarea covered evaluations of emissions along each of the three Western Section action alternatives' proposed alignments. The No-Action Alternative was also modeled for both subareas. In addition, emissions trends were modeled for the entire Study Area. All modeling was performed for the proposed freeway's opening year (2020) and design year (2035).

This analysis was performed using EPA's MOBILE6.2 model. In accordance with FHWA interim guidance, the methodology employed was approved for use in estimating MSATs emission trends for regional areas and for relative comparisons of alternatives on large projects.

Figure 4-27 Modeled Assessment Areas, Mobile Source Air Toxics, Maricopa County



Source: Maricopa Association of Governments, 2006b; used with permission

Projected mobile source air toxics emissions trends for the action and No-Action alternatives were modeled using two geographic subareas to provide meaningful areas of comparison between 2010 and future conditions (2020 and 2035).

Tables 4-34 through 4-36 summarize the results of this modeling effort. Figure 4-28 shows MSATs emissions as a function of vehicle speed.

Subarea Emissions Impacts

The modeling results for the Western and Eastern Subareas show that future priority MSATs emissions for all of the proposed action alternatives would be substantially lower than the 2010 MSAT emissions even with increases in VMT of up to 70 percent. Reductions of up to 80 percent in MSATs emissions (DPM) are projected for the future years. These results generally agree with EPA's national projections. Results of the modeling are presented in Tables 4-34 and 4-35.

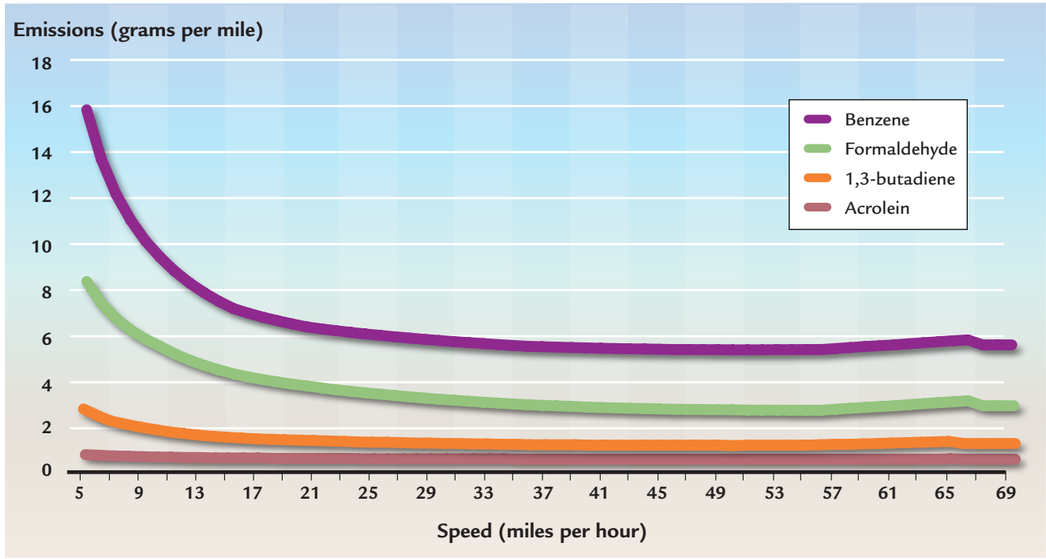
In the Western Subarea, the projected priority MSATs emissions for the proposed action alternatives during 2020 and 2035 would range from 23 to 77 percent lower and 17 to 81 percent lower than 2010 levels, respectively, depending on the action alternative and pollutant. The projected priority MSATs emissions for the No-Action Alternative during 2020 and 2035 would range from 28 to 78 percent lower and 20 to 83 percent lower than 2010 levels, respectively, depending on the pollutant. As shown in Table 4-34, the W59 (Preferred) Alternative shows the lowest MSATs emissions, followed by the W101 Alternative, with the W71 Alternative showing the highest MSATs emissions.

In the Eastern Subarea, the projected priority MSATs emissions for the E1 (Preferred) Alternative during 2020 and 2035 would range from 29 to 73 percent lower and a 1 percent increase to 77 percent lower than 2010 levels, respectively, depending on the pollutant. As shown in Table 4-35, formaldehyde emissions from the W101 Alternative would increase by 1 percent over the No-Action Alternative in 2035. The projected priority MSATs emissions for the No-Action Alternative during 2020 and 2035 would range from 31 to 79 percent lower and 14 to 82 percent lower than 2010 levels, respectively, depending on the pollutant.

Regional Emissions Impacts

The regional emissions modeling demonstrated that future priority MSATs emissions for the W59 (Preferred) Alternative would be substantially lower than the 2010 MSAT emissions, even with increases in VMT of over 50 percent (Table 4-36).

Figure 4-28 Priority Mobile Source Air Toxics Emissions as a Function of Vehicle Speed



Source: Federal Highway Administration, 2006c

Once the average speed of traffic exceeds about 20 miles per hour (mph), priority mobile source air toxics (MSATs) emissions are relatively constant, regardless of vehicle speed. In heavily congested conditions, where traffic speeds are likely below 20 mph, MSATs emissions increase with decreased speeds. More fuel—meaning more emissions—is also consumed because automotive engines do not operate optimally at low speeds.

Table 4-34 Modeled Mobile Source Air Toxics Emissions, Western Subarea Alternatives

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
W59 Alternative									
Daily VMT[c]	3,099,202	3,490,936	13	3,905,597	26	3,810,374	23	4,187,989	35
Acrolein	0.58	0.41	–29	0.44	–24	0.45	–22	0.44	–24
Benzene	25.89	14.95	–42	16.14	–38	16.51	–36	15.82	–39
1,3–butadiene	2.57	1.66	–35	1.78	–31	1.80	–30	1.76	–32
Diesel particulates	13.83	2.99	–78	3.35	–76	2.39	–83	2.62	–81
Formaldehyde	12.84	9.27	–28	9.87	–23	10.26	–20	10.08	–22
Naphthalene	1.64	0.71	–57	0.79	–52	0.69	–58	0.76	–54
POM[d]	1.88	0.81	–57	0.90	–52	0.79	–58	0.86	–54
W71 Alternative									
Daily VMT	3,099,202	3,490,936	13	3,779,856	22	3,810,374	23	4,201,674	36
Acrolein	0.58	0.41	–29	0.43	–26	0.45	–22	0.47	–19
Benzene	25.89	14.95	–42	15.68	–39	16.51	–36	17.04	–34
1,3–butadiene	2.57	1.66	–35	1.73	–33	1.80	–30	1.87	–27
Diesel particulates	13.83	2.99	–78	3.24	–77	2.39	–83	2.63	–81
Formaldehyde	12.84	9.27	–28	9.67	–25	10.26	–20	10.65	–17
Naphthalene	1.64	0.71	–57	0.76	–54	0.69	–58	0.76	–54
POM	1.88	0.81	–57	0.87	–54	0.79	–58	0.87	–54
W101 Alternative									
Daily VMT	3,099,202	3,490,936	13	3,668,498	18	3,810,374	23	4,275,331	38
Acrolein	0.58	0.41	–29	0.37	–36	0.45	–22	0.46	–21
Benzene	25.89	14.95	–42	12.68	–51	16.51	–36	16.14	–38
1,3–butadiene	2.57	1.66	–35	1.47	–43	1.80	–30	1.82	–29
Diesel particulates	13.83	2.99	–78	3.15	–77	2.39	–83	2.68	–81
Formaldehyde	12.84	9.27	–28	8.44	–34	10.26	–20	10.47	–18
Naphthalene	1.64	0.71	–57	0.74	–55	0.69	–58	0.77	–53
POM	1.88	0.81	–57	0.84	–55	0.79	–58	0.88	–53

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year); service traffic interchanges at Interstate 10 and Warner Road, Ray Road, and Chandler Boulevard [c] vehicles miles traveled
[d] polycyclic organic matter

Table 4-35 Modeled Mobile Source Air Toxics Emissions, Eastern Subarea Alternatives

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
W59 Alternative[c]									
Daily VMT[d]	2,329,369	2,533,214	9	3,258,767	40	2,921,031	25	3,866,231	66
Acrolein	0.45	0.30	–33	0.26	–42	0.38	–16	0.42	–7
Benzene	21.18	11.40	–46	8.34	–61	14.59	–31	14.95	–29
1,3–butadiene	2.02	1.23	–39	1.01	–50	1.53	–24	1.66	–18
Diesel particulates	10.40	2.17	–79	2.79	–73	1.83	–82	2.42	–77
Formaldehyde	9.95	6.83	–31	5.84	–41	8.56	–14	9.55	–4
Naphthalene	1.23	0.51	–59	0.66	–46	0.53	–57	0.70	–43
POM[e]	1.40	0.58	–59	0.75	–46	0.60	–57	0.80	–43
W71 Alternative									
Daily VMT	2,329,369	2,533,214	9	3,294,453	41	2,921,031	25	3,900,165	67
Acrolein	0.45	0.30	–33	0.30	–33	0.38	–16	0.43	–4
Benzene	21.18	11.40	–46	10.34	–51	14.59	–31	15.41	–27
1,3–butadiene	2.02	1.23	–39	1.19	–41	1.53	–24	1.70	–16
Diesel particulates	10.40	2.17	–79	2.82	–73	1.83	–82	2.44	–77
Formaldehyde	9.95	6.83	–31	6.80	–32	8.56	–14	9.78	–2
Naphthalene	1.23	0.51	–59	0.66	–46	0.53	–57	0.70	–43
POM	1.40	0.58	–59	0.76	–46	0.60	–57	0.80	–43
W101 Alternative									
Daily VMT	2,329,369	2,533,214	9	3,353,926	44	2,921,031	25	3,940,818	69
Acrolein	0.45	0.30	–33	0.31	–31	0.38	–16	0.44	–2
Benzene	21.18	11.40	–46	10.71	–49	14.59	–31	15.89	–25
1,3–butadiene	2.02	1.23	–39	1.24	–39	1.53	–24	1.75	–13
Diesel particulates	10.40	2.17	–79	2.88	–72	1.83	–82	2.47	–76
Formaldehyde	9.95	6.83	–31	7.04	–29	8.56	–14	10.06	1
Naphthalene	1.23	0.51	–59	0.68	–45	0.53	–57	0.71	–42
POM	1.40	0.58	–59	0.77	–45	0.60	–57	0.81	–42

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year) [c] assumes traffic volumes that would result from connecting the W59 Alternative with the E1 Alternative; a similar assumption applies to the other Western Section alternatives [d] vehicles miles traveled [e] polycyclic organic matter

Table 4-36 Modeled Mobile Source Air Toxics Emissions, Regional Area, Assuming W59 Alternative

MSATs[a] Compound	2010[b]	2020				2035			
		No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)	No-Action Alternative[b]	Change from 2010 (%)	Action Alternative[b]	Change from 2010 (%)
Daily VMT[c]	27,640,971	32,358,536	17	34,135,774	24	39,875,291	44	41,812,073	51
Acrolein	4.89	3.58	–27	3.52	–28	4.61	–6	4.54	–7
Benzene	219.60	128.80	–41	124.10	–43	168.30	–23	160.30	–27
1,3–butadiene	21.66	14.35	–34	14.04	–35	18.43	–15	17.93	–17
Diesel particulates	123.40	27.73	–78	29.28	–76	24.92	–80	26.23	–79
Formaldehyde	108.20	80.70	–25	79.40	–27	104.90	–3	103.20	–5
Naphthalene	14.59	6.53	–55	6.89	–53	7.21	–51	7.56	–48
POM[d]	16.55	7.45	–55	7.86	–53	8.23	–51	8.63	–48

[a] mobile source air toxics [b] calculated MSATs emissions (tons per year) [c] vehicles miles traveled [d] polycyclic organic matter

Reductions of up to 79 percent in MSATs emissions (DPM) are projected for future years.

For the regional area, constructing the proposed freeway would provide a small net benefit in reducing total MSAT emissions. The model results indicate that the priority MSATs emissions would be reduced by up to 2 percent in the opening and the design years if the freeway were constructed when compared with the No-Action Alternative. Although the W59 Alternative showed 6 percent and 5 percent higher DPM emissions than the No-Action Alternative in the opening and design years, respectively, the 2035 emissions of DPM would be 79 percent lower than 2010 emissions.

MSAT Information Status

What is known about MSATs is still evolving. FHWA is working with stakeholders, EPA, and others to better understand the strengths and weaknesses of developing analysis tools and the applicability on the project-level decision documentation process. Human epidemiology and animal toxicology experiments indicate that many chemicals or mixtures termed air toxics have the potential to affect human health. As toxicology, epidemiology, and air contaminant measurement techniques have improved over the decades, scientists and regulators have increased their focus on the levels of each chemical or material in the air in an effort to link potential exposures with potential health effects. EPA's list of 21 mobile source toxics represents its prioritization of these chemicals or materials for further study and evaluation. EPA's strategy for evaluating air toxic compounds effects is focused on both national trends and local impacts.

Air toxics emissions from mobile sources have the potential to affect human health and often represent a regulatory agency concern. FHWA has responded to this concern by developing an integrated research program to answer the most important transportation community questions related to air toxics, human health, and the NEPA process. To this end, FHWA has performed, funded, or is currently managing several research projects. Many of these projects are based on an Air Toxics Research Workplan that provides a roadmap for agency research efforts (<www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/workplan/index.cfm>). These efforts include the studies discussed in the following sections.

National Near Roadway MSAT Study

FHWA, in conjunction with EPA and a consortium of State departments of transportation, studied the concentration and physical behavior of MSATs and mobile source $PM_{2.5}$ in Las Vegas, Nevada and Detroit, Michigan. The study criteria dictated that the study site be open to traffic and have 150,000 annual average daily traffic or more. These studies were intended to provide knowledge about the dispersion of MSAT emissions, with the ultimate goal of enabling more informed transportation and environmental decisions at the project level. These studies are unique in that the monitored data were collected for an entire year. The Las Vegas report revealed there are a large number of influences in this urban setting, and researchers must look beyond the roadway to find all the sources in the near road environment. Additionally, in Las Vegas, meteorology played a large role in the concentrations measured in the near-road study area. More information is available at <www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/>.

Traffic-related Air Pollution

Going One Step Beyond: A Neighborhood Scale Air Toxics Assessment in North Denver (The Good Neighbor Project)

In 2007, the Denver Department of Environmental Health issued a technical report entitled *Going One Step Beyond: A Neighborhood Scale Air Toxics Assessment in North Denver (The Good Neighbor Project)*. This research project was funded by FHWA. In this study, the Denver Department of Environmental Health conducted a neighborhood-scale air toxics assessment in North Denver, which includes a portion of the proposed Interstate 70 East project area. Residents in this area have been very concerned about both existing health effects in their neighborhoods (from industrial activities, hazardous waste sites, and traffic) and potential health impacts from changes to Interate 70.

The study was designed to compare modeled levels of the six priority MSATs identified in FHWA's 2006 guidance with measurements at existing MSAT monitoring sites in the study area. MOBILE6.2 emissions factors and the ISC3ST dispersion model were used (some limited testing of the CALPUFF model was also performed). Key findings include: 1) modeled mean annual concentrations from highways

were well below estimated Integrated Risk Information System cancer and noncancerous risk values for all six MSATs, 2) modeled concentrations dropped off sharply within 50 meters of roadways, 3) modeled MSAT concentrations tended to be higher along highways near the Denver Central Business District than along the Interstate 70 East corridor (in some cases, they were higher within the business district itself, as were the monitored values), and 4) dispersion model results were generally lower than monitored concentrations but within a factor of two at all locations.

Mobile Source Air Toxic Hot Spot

Given concerns about the possibility of MSAT exposure in the near-road environment, The HEI dedicated a number of research efforts at trying to find an MSAT "hotspot." In 2011, three studies were published that tested this hypothesis. In general, the authors confirm that while highways are a source of air toxics, they were unable to find that highways were the only source of these pollutants. They determined that near road exposures were often no different or no higher than background or ambient levels of exposure and, hence, no true hot spots were identified. Additional information may be found at <pubs.healtheffects.org/getfile.php?u=659> page 137, <pubs.healtheffects.org/getfile.php?u=656> page 143, and <pubs.healtheffects.org/getfile.php?u=617> page 87, where monitored on-road emissions were higher than emission levels monitored at near-road residences, but the issue of hot spots was not ultimately discussed.

Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects

In January 2010, HEI released Special Report #17, investigating the health effects of traffic-related air pollution. The goal of the research was to synthesize available information on the effects of traffic on health. Researchers looked at linkages between 1) traffic emissions (at the tailpipe) with ambient air pollution in general, 2) concentrations of ambient pollutants with human exposure to pollutants from traffic, 3) exposure to pollutants from traffic with human-health effects and toxicologic data, and 4) toxicologic data with epidemiological associations. Challenges in making exposure assessments, such as quality and quantity of emissions data and models, were investigated, as was the appropriateness of the use of proximity as an exposure-assessment model. Overall, researchers felt that there was "sufficient" evidence for causality for the exacerbation of asthma. Evidence was "suggestive but not sufficient" for other health outcomes such as cardiovascular mortality and others. Study authors also note that past epidemiologic studies may not provide an appropriate assessment of future health associations because vehicle emissions are decreasing over time. The report is available at <http://www.healtheffects.org/>. FHWA provides financial support to HEI's research work.

Health Effects Institute Special Report #16

In November 2007, HEI published Special Report #16: Mobile-Source Air Toxics: A Critical Review of the Literature on Exposure and Health Effects. The purpose of this report was to accomplish the following tasks:

- Use information from the peer-reviewed literature to summarize the health effects of exposure to the 21 MSATs defined by EPA in 2001.
- Critically analyze the literature for a subset of priority MSATs.
- Identify and summarize key gaps in existing research and unresolved questions about the priority MSATs.

HEI chose to review literature for acetaldehyde; acrolein; benzene; 1,3-butadiene; formaldehyde; naphthalene; and POM. Diesel exhaust was included, but not reviewed in this study because it had been reviewed by HEI and EPA recently. In general, the report concluded that the cancer health effects attributable to mobile sources are difficult to discern because the majority of quantitative assessments are derived from occupational cohorts with high concentration exposures and because some cancer potency estimates are derived from animal models. The report suggested that substantial improvements in analytical sensitively and specificity of biomarkers would provide better linkages between exposure and health effects. Noncancer endpoints were not a central focus of most research and, therefore, require further investigation. Subpopulation susceptibility also requires additional evaluation. The study is available from HEI's website at <www.healtheffects.org/>.

Kansas City PM Characterization Study (Kansas City Study)

This study was initiated by EPA to conduct exhaust emissions testing on 480 light-duty, gasoline vehicles in the Kansas City Metropolitan Area. Major goals of the study included characterizing PM emissions distributions of a sample of gasoline vehicles in Kansas City, characterizing gaseous and PM toxics exhaust emissions, and characterizing the fraction of high emitters in the fleet. In the process, sampling methodologies were evaluated. Overall, results from the study were used to populate databases for the MOVES emissions model. FHWA was one of the research sponsors. This study is available on EPA's website at <www.epa.gov/otaq/emission-factors-research/420r08009.pdf>.

Estimating the Transportation Contribution to Particulate Matter Pollution (Air Toxics Supersite Study)

The purpose of this study was to improve understanding of the role of highway transportation sources in PM pollution. In particular, it was important to examine uncertainties, such as the effects of the spatial and temporal distribution of travel patterns, consequences of vehicle fleet mix and fuel type, the contribution of vehicle speed and operating characteristics, and influences of geography and weather. The fundamental methodology of the study was to combine EPA research-grade air quality monitoring data in a representative sample of metropolitan areas with traffic data collected by State departments of transportation and local governments.

Phase I of the study, the planning and data evaluation stage, assessed the characteristics of EPA's ambient PM monitoring initiatives and recruited State departments of transportatoin and local governments to participate in the research. After evaluating and selecting potential

metropolitan areas based on the quality of PM and traffic monitoring data, nine cities were selected to participate in Phase II. The goal of Phase II was to determine whether correlations could be observed between traffic on highway facilities and ambient PM concentrations. The Phase I report was published in September 2002. Phase II included the collection of traffic and air quality data and data analysis. Ultimately, six cities participated: New York City (Queens), Baltimore, Pittsburgh, Atlanta, Detroit and Los Angeles.

In Phase II, air quality and traffic data were collected. The air quality data were obtained from EPA's Aerometric Information Retrieval System Air Quality Subsystem, Supersite personnel, and North American Research Strategy for Tropospheric Ozone and Aerosols data archive site. Traffic data included intelligent transportation systems (roadway surveillance), coverage counts (routine traffic monitoring), and supplemental counts (specifically for the research project). Analyses resulted in the conclusion that only a weak correlation existed between $PM_{2.5}$ concentrations and traffic activity for several of the sites. The existence of general trends indicates a relationship, the assumption that, however, is primarily unquantifiable. Limitations of the study include the assumption that traffic sources are close enough to ambient monitors to provide sufficiently strong source strength, the assumption that vehicle activity is an appropriate surrogate for mobile emissions, and the lack of knowledge of other factors such as nontraffic sources of PM and its precursors. A paper documenting the work of Phase II was presented at the 2004 Emissions Inventory Conference and is available at <www.epa.gov/ttn/chief/conference/ei13/mobile/black.pdf>.

Conformity

The 1990 CAA amendments require transportation projects to conform to (be consistent with) air quality implementation plans. To be a conforming project, a project must be a part of an approved transportation plan (such as the RTP) and transportation improvement program (TIP). The proposed action is contained within the currently approved RTP (2010 Update). MAG's Fiscal Year 2011–2015 TIP contains several references to the South Mountain Freeway project. The 2010 RTP references the proposed action as containing three general purpose lanes and one high-occupancy vehicle (HOV) lane in each direction. Therefore, the proposed action would conform to the approved transportation plan and TIP.

Action Alternatives, Western Section

The CO project-level air quality analysis demonstrated that none of the Western Section action alternatives would violate the NAAQS, based on projected 2035 traffic. Although a meaningful evaluation of O_3 at the project level is not possible, the action alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

In the Western Subarea, the projected priority MSAT pollutant emissions for the action alternatives would be comparable to the No-Action Alternative and 24 to 77 percent lower than 2010 levels, depending on the year and pollutant. According to Table 4-34, the W59 (Preferred) Alternative shows the lowest MSATs emissions, followed by the W101 Alternative, with the W71 Alternative showing the highest MSATs emissions.

The proposed action would construct new interchanges at several locations along the Community boundary. As a result, the results of the CO project-level air quality analysis near the proposed interchanges could be applied to the Community. This analysis demonstrated that none of the Western Section action alternatives would violate the CO NAAQS, based on projected 2035 traffic. It is important to note, however, that no residential receptors exist in the Community near the proposed interchanges and few residential receptors exist near the proposed action.

The air quality analysis showed that each of the Western Section action alternatives would conform to all relevant air quality requirements.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The CO project-level air quality analysis demonstrated that regardless of the Western Section action alternative selected (if any), no receptors in the Eastern Section would violate the NAAQS, based on projected 2035 traffic. Although a meaningful evaluation of O_3 concentrations at the project level is not possible, the action alternative is included in the RTP that has been determined by FHWA and the Federal Transit Administration to conform to the SIP.

Levels of CO near the proposed new fully directional interchanges along the Community boundary are projected to increase; these areas would not, however, violate the NAAQS, based on projected 2035 traffic. It is important to note that no residential receptors currently exist on Community land near the proposed interchanges and few residential receptors exist near the proposed action.

The air quality analysis showed that the E1 Alternative would conform to all relevant air quality requirements.

No-Action Alternative

For the project-level CO analysis, predicted 1-hour and 8-hour concentrations at receptors located at arterial street intersections near I-10 generally exhibited a small decrease from the existing conditions to the action alternatives' scenario (Table 4-32). Those receptors located at the arterial street intersections and freeway interchanges south of I-10 generally exhibited small increases. These projected 1-hour and 8-hour increases associated with the action alternatives were less than 4 ppm and 3 ppm, respectively. None of the action alternatives nor the No-Action Alternative would, however, violate the NAAQS, based on projected 2035 traffic.

MSATs emissions for the entire regional Study Area would decline regardless of whether the proposed action were constructed.

The proposed action is a part of the approved transportation plan and TIP. The No-Action Alternative would not meet the identified regional transportation needs for the proposed action contained within the RTP and TIP; therefore, the No-Action Alternative would not conform to the State's air quality implementation plan.

Mitigation

Construction air quality impacts of the proposed action would be limited to short-term increased fugitive dust and mobile source emissions. Fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and other earthmoving vehicles operating around the construction sites. Increased dust levels would be attributable primarily to PM resuspended by vehicle movement over paved and unpaved roads and other surfaces, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on size, height at which the emission occurs, and wind speed. Small particles (30 to 100 micron range) can travel more than 30 feet before settling to the ground, depending on wind speed. Most fugitive dust, however, is made up of relatively large particles (i.e., greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20–30 feet of their source.

CO is the pollutant of concern when considering localized air quality impacts of motor vehicles. Because CO emissions factors increase with slower vehicle speeds below 35 miles per hour, disruption of traffic during construction could result in short-term elevated concentrations of CO because of the temporary reduction of road capacity and increased queue lengths. To minimize emissions, efforts would be made during the construction phase to limit disruption to traffic, especially during peak travel periods.

To reduce the amount of construction dust generated, particulate control measures related to construction activities must be followed. The following mitigation measures would be followed, when applicable, in accordance with the most recently accepted version of the ADOT *Standard Specifications for Road and Bridge Construction* (2008).

- Site preparation
  - Minimize land disturbance.
  - Use watering trucks to minimize dust.
  - Stabilize the surface of dirt piles if not removed immediately.
  - Use windbreaks to prevent accidental dust pollution.
  - Limit vehicular paths and stabilize temporary roads.
  - To prevent dirt from being tracked or washed onto paved roads, 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, would be placed over geotextile fabric adjacent to paved roads.
- Construction
  - Use dust suppressants on unpaved traveled paths.
  - Minimize unnecessary vehicular and machinery activities.
  - To prevent dirt from being tracked or washed onto paved roads, 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, would be placed over geotextile fabric adjacent to paved roads.
- Postconstruction
  - Revegetate or use decomposed granite on all disturbed land (see section, *Mitigation*, beginning on page 4-124, regarding applicable measures to reduce impacts on biological resources).
  - Remove dirt piles and unused materials.
  - Revegetate all vehicular paths created during construction to avoid future off-road vehicular activities.

A traffic control plan would be developed and implemented to help reduce impacts of traffic congestion and associated emissions during construction. Prior to construction and in accordance with Maricopa County Rule 310, Fugitive Dust Ordinance, the contractor shall obtain an approved dust permit from MCAQD for all phases of the proposed action. The permit would describe measures to control and regulate air pollutant emissions during construction.

Greenhouse Gas Emissions (Climate Change)

Climate change is an important national and global concern. While the earth has gone through many natural changes in climate in its history, there is general agreement that the earth's climate is currently changing at an accelerated rate and will continue to do so for the foreseeable future. Anthropogenic (human-caused) greenhouse gas (GHG) emissions contribute to this rapid change. Carbon dioxide (CO_2) makes up the largest component of these GHG emissions. Other prominent transportation-related GHGs include methane and nitrous oxide.

Many GHGs occur naturally. Water vapor is the most abundant GHG and makes up approximately two thirds of the natural greenhouse effect. However, the burning of fossil fuels and other human activities are adding to the concentration of GHGs in the atmosphere. Many GHGs remain in the atmosphere for time periods ranging from decades to centuries. GHGs trap heat in the earth's atmosphere. Because the atmospheric concentration of GHGs continues to climb, our planet will continue to experience climate-related phenomena. For example, warmer global temperatures can cause changes in precipitation and sea levels.

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the CAA. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, EPA, and other federal agencies. GHGs are different than other air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases. The *affected environment* for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. In contrast to broad-scale actions such as those involving an entire industry sector or very large geographic areas, it is difficult to isolate and understand the GHG emissions' impacts for a particular transportation project. Furthermore, presently

there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should focus on issues that are significant and meaningful to decision making [40 C.F.R. §§ 1500.1(b), 1500.2(b), 1500.4(g), and 1501.7]. FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the proposed action (as discussed below and as shown in Table 4-37), that GHG emissions from the proposed action will not result in "reasonably foreseeable significant adverse impacts on the human environment" [40 C.F.R. § 1502.22(b)]. The GHG emissions from the action alternatives would be insignificant and would not play a meaningful role in a determination of the environmentally preferable alternative or identification of the Preferred Alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" [40 C.F.R. § 1502.22(a)] or to making a determination in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts [23 C.F.R. § 771.105(b)]. For these reasons, no alternatives-level GHG analysis has been performed for this project.

The context in which the emissions from the proposed project would occur, together with the expected GHG emissions contribution from the project, illustrate why the project's GHG emissions would not be significant and would not be a substantial factor in the alternatives screening process. The transportation sector is the second-largest source of total GHG emissions in the United States, behind electricity generation. The transportation sector was responsible for approximately 27 percent of all anthropogenic GHG emissions in the United States in 2009.[24] The majority of transportation-related GHG emissions result from fossil fuel combustion. CO_2 makes up the largest component of these GHG emissions. U.S. CO_2 emissions from the consumption of energy accounted for about 18 percent of worldwide energy consumption CO_2 emissions in 2009.[25] U.S. transportation CO_2 emissions accounted for about 6 percent of worldwide CO_2 emissions.[26]

While the contribution of GHGs from transportation in the United States as a whole is a large component of U.S. GHG emissions, as the scale of analysis is reduced the GHG contributions become quite small. Using CO_2 because of its predominant role in GHG emissions, Table 4-37 presents the relationship between current and projected Arizona highway CO_2 emissions and total global CO_2 emissions, as well as information on the scale of the project relative to statewide travel activity.

Based on emissions estimates from EPA's Motor Vehicle Emissions Simulator model[27] and on global CO_2 estimates and projections from the U.S. Energy Information Administration, CO_2 emissions from motor vehicles in the entire state of Arizona contributed less than one tenth of 1 percent of global emissions in 2010 (0.0986 percent) and are projected to contribute an even smaller fraction (0.0883 percent) in 2035.[28] VMT in the project study area represent slightly less than 20 percent of total Arizona travel activity; the proposed project itself would increase statewide VMT by slightly less than 1 percent. (Note that the project study area, as defined for the MSAT analysis, covers the entire southwestern portion of the Phoenix metropolitan area and, thus, includes travel on many other roadways in addition to the proposed project.) As a result, based on the action alternative with the highest VMT,[29] FHWA estimates that the proposed project could result in a potential increase in global CO_2 emissions in 2035 of 0.00077 percent (less than one thousandth of 1 percent) and a corresponding increase in Arizona's share of global emissions in 2035 of 0.876 percent. This very small change in global emissions is well within the range of uncertainty associated with future emissions estimates.[30,31]

Table 4-37 Statewide and Project Greenhouse Gas Emissions Potential, Relative to Global Totals

Time Frame	Global CO_2[a] Emissions, (million metric tons)[b]	Arizona Motor Vehicle CO_2 Emissions (million metric tons)[c]	Arizona Motor Vehicle Emissions, Percentage of Global Total	Project Study Area VMT[d] Percentage of Statewide VMT	Percentage Change in Statewide VMT Attributable to Project
2010	29,670	29.3	0.0986	19.0	Not applicable
Future Conditions (2035)	42,380	37.4	0.0883	18.6	0.876

Notes: Global emissions estimates are from the U.S. Energy Information Administration's *International Energy Outlook 2010*, data for Figure 104. Arizona emissions and statewide vehicle miles traveled (VMT) estimates are from the U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator model (2010). Project study area VMT data come from information compiled for the mobile source air toxics analysis documented in the air quality technical report; estimates reflect the action alternative that would result in the highest VMT.

[a] carbon dioxide

[b] Estimates are from the U.S. Energy Information Administration's *International Energy Outlook 2010* and are considered the best available projections of emissions from fossil fuel combustion. These totals do not include other sources of emissions such as cement production, deforestation, or natural sources; reliable future projections for such emissions sources are not available.

[c] The U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator model projections suggest that Arizona motor vehicle CO_2 emissions may increase by 28 percent between 2010 and 2035. The 2010 Arizona statewide transportation planning framework (www.bqaz.gov/StatewideTransportationPlanningFramework.asp) predicts that statewide vehicle miles travelled (VMT) will increase by 133 percent between 2005 and 2035; the increase in emissions is smaller than the increase in VMT because improved fuel economy in the vehicle fleet (as characterized in the model) would help offset much of the emissions increase that would otherwise occur.

[d] vehicle miles traveled

Mitigation for Global Greenhouse Gas Emissions

To help address the global issue of climate change, USDOT is committed to reducing GHG emissions from vehicles traveling on our nation's highways. USDOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower carbon-intensive fuels. The agencies have

jointly established new, more stringent fuel economy and first-ever GHG emissions standards for model year 2012–2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first-ever fuel economy and GHG emissions standards for heavy-duty trucks and buses[32]. Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions in future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist States and metropolitan planning organizations in performing GHG analyses, FHWA has developed a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process*. The handbook presents methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level, and demonstrates how such an evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and metropolitan planning organizations in assessing the climate change vulnerabilities of their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and has piloted the model in several locations.

Summary of Greenhouse Gas Discussion

This document does not incorporate an analysis of the GHG emissions or climate change effects of each of the action alternatives because the potential change in GHG emissions is very small in the context of the affected environment. Because of the insignificance of the GHG impacts, those impacts will not be meaningful to identification of the Preferred Alternative. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. Finally, the construction best practices described above represent practicable project-level measures that, while not substantially reducing global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

CONCLUSIONS

The CO project-level analysis showed that none of the alternatives would result in violation of the NAAQS based on the projected traffic (2035). Furthermore, the Preferred Alternative is included in the RTP that FHWA and the Federal Transit Administration have determined to conform to State air quality plans.

The qualitative analysis of PM conducted for the proposed action was based on a review of monitoring sites that would most closely resemble two interchange locations along the proposed action and the projected characteristics of the two proposed interchanges. Based on this analysis, it is unlikely that the proposed action alternatives would cause or contribute to an exceedance of the PM_{10} standards; therefore, this analysis demonstrates compliance with the requirements of CAA Section 176(a)(1).

Total exposure to MSAT pollutants is a function of exposures near roadways, exposures at other locations visited during the day, exposures incurred as part of traveling on roadways, and exposures from indoor air. Because of this complexity, along with uncertainties associated with the emissions and dispersion models, it is not possible to reasonably characterize the health impacts of the projected action/No-Action emission increases (or decreases) in any particular location. Within these uncertainties, the quantitative analysis performed for the proposed action determined that the action alternatives would likely result in a reduction of total MSATs emissions in the Study Area. Some subareas would likely experience an increase in emissions relative to the No-Action Alternative, while other areas would experience a decrease. In areas where emissions are expected to increase, this would be expected to contribute to increased exposure to MSATs emissions relative to the No-Action Alternative, while the reduced emissions in the Study Area as a whole would be expected to contribute to reduced exposure. Because overall emissions would be lower than 2010 levels, it is reasonable to infer that overall exposures would also be lower than 2010 levels. Because of the limitations in the methodologies of forecasting the health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, that are better suited for quantitative analysis.

These limitations notwithstanding, it is important to note that existing and proposed air pollution regulations are predicted to result in dramatic nationwide reductions in MSATs by the design year (2035). The specific analyses conducted for this project also show that emissions will decline, and that reductions on the order of 20 to 83 percent will occur irrespective of whether the proposed action is constructed. Congestion relief as a result of the proposed action would provide localized reductions on arterial streets and at interchanges, and reduced travel times would result in lower exposure to the elevated concentrations of MSATs occurring in traffic. Given the successful history of measurable emissions reductions to date and that projected emissions reductions are based on existing technologies, there is good reason to believe the projected reductions from 2010 levels would be achieved.

4

What is noise?

Noise is unwanted or excessive sound. In many ways, under this definition, noise is undesirable but it is, by fact, a real by-product of today's way of life. Noise can be intrusive and annoying. It can interfere with sleep, work, or recreation. Noise, in today's society, comes from many sources; a vacuum cleaner, for example, can be disruptive to a family member who is trying to read a book. But it is recognized that transportation noise is perhaps the most pervasive and difficult source to avoid in society today. Noise from airplanes flying overhead, from trains passing by, from motorized boats on a lake, and from cars and trucks traveling on the nation's roads and highways has become a daily part of our lives. And of these, highway traffic noise is admittedly a major contributor to overall transportation noise.

Therefore, the construction and operation of a freeway of the magnitude of a project like the proposed action would introduce a major noise source into locations where such noise may not have existed in the past. Therefore, a project like the proposed freeway could cause great concern to those who live and work near such a project. It could pass by residences, schools, parks, churches, and myriad land uses that would be particularly sensitive to the noise generated by such a project. The project team, using federal and State guidance, analyzed how a project like the proposed action would increase noise levels to adjacent areas and, for those areas that would warrant protection from the expected noise, proposed ways for ADOT and FHWA to reduce the noise to acceptable levels.

Noise mitigation strategies typically consist of placing a noise barrier, such as a concrete or masonry wall or an earth berm (or a combination of the two), along the main line or at the R/W line of a transportation corridor. Noise barriers are usually the most feasible and cost-effective strategy for mitigating highway transportation noise impacts.

NOISE

NOISE CRITERIA

The basic unit of measurement for noise is the decibel, which is a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level. Environmental noise is typically frequency-weighted using the A-scale (dBA) to approximate the frequency response of the human ear. Noise analyses for transportation projects use the hourly equivalent sound level (L_{Aeq1h}, or simply L_{eq}), which is a logarithmic energy average over a 1-hour period.

Under 23 C.F.R. § 772, FHWA is required to identify noise-sensitive land uses near its projects, to evaluate the noise impacts on those land uses, and to consider noise abatement options (see Activity Category B, in Table 4-38). To further clarify the process of noise analysis and the evaluation of noise abatement, ADOT adopted a Noise Abatement Policy (NAP), last updated in 2007. This policy was formally approved by FHWA.

Federal regulations specify noise abatement criteria (NAC) for various types of land use activity categories, summarized in Table 4-38, and state that noise abatement must be considered when the predicted future peak-hour traffic noise from a project would approach or exceed the NAC. The NAP defines "approach" to mean being within 3 dBA, thereby requiring noise abatement considerations when the predicted future peak-hour traffic noise at Category B (residential) land uses is 64 L_{eq} (i.e., within 3 dBA of 67 L_{eq}). Additionally, mitigation must be considered for residential properties if predicted traffic noise levels substantially exceed existing levels. "Substantially exceed" is defined in the NAP as 15 dBA.

Part of the noise abatement consideration process specifies that the abatement must be reasonable and feasible. Feasibility evaluations consist of various constructibility issues and assessments of whether the proposed noise abatement could provide substantial noise reduction. Reasonability criteria consist of cost-benefit considerations, maximum barrier heights, and other barrier design issues.

Table 4-38 Federal Highway Administration Noise Abatement Criteria

Activity Category	L_{Aeq1h} [a]	Description of Activity Category
A	57 (exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
C	72 (exterior)	Developed land, properties, or activities not included in Categories A or B above
D	—[b]	Undeveloped land
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

Source: 23 Code of Federal Regulations § 772

[a] L_{Aeq1h}, 1-hour equivalent sound level; logarithmic energy average over a 1-hour period (measured in dBA, a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level and is frequency-weighted using the A-scale, to approximate the frequency response of the human ear)
[b] not applicable (or no standard exists)

The NAP defines specific exceptions to conditions where the NAC would suggest that noise mitigation is warranted. These exceptions include, among others, isolated receivers and the cost of abatement per residence. These exceptions are defined in the ADOT noise policy as:

- **Isolated receivers** – "An isolated receiver is defined as one or two sensitive affected receivers (e.g., residences) set apart from other receivers in the project area. It generally would not be considered reasonable to provide abatement for isolated receivers." (ADOT 2005b)
- **Cost of abatement** – "The maximum recommended cost of abatement is $46,000 per benefited developed property. Benefited residential properties include all single-family dwelling residences (i.e., manufactured homes, condominiums, detached homes) whether occupied by the owner or a renter, that receive a dBA noise reduction from proposed mitigation measures. For benefited developed properties such as parks, schools, hospitals, and churches, noise abatement will be considered on a case by case basis, as specified in ADOT's noise guidelines." (ADOT 2007d)

EXISTING NOISE LEVELS

Ambient or existing noise level readings were taken at 44 locations in the Study Area. The monitoring sites, described below, were located at approximately 1-mile spacings along the corridor. Receiver locations are shown on Figures 4-29 through 4-32.

The existing noise levels were recorded at the monitoring sites with Larson Davis Model 812 and Model 820 Type I integrating sound level meters. The readings were taken on numerous occasions from September 2003 to July 2004 during nonpeak traffic conditions.

Weather conditions during the readings ranged from clear skies to mostly cloudy skies, 58° to 103° Fahrenheit and 8 to 35 percent relative humidity, with breezes averaging 0 miles per hour (mph) to 5.9 mph from variable directions. Such weather conditions are within the parameters established by FHWA in *Measurement of Highway-Related Noise* (FHWA 1996) and have little effect on the transmission of sound energy for the receivers in the Study Area.

Figure 4-29 Noise Receiver and Potential Barrier Locations, W101 Alternative and Options

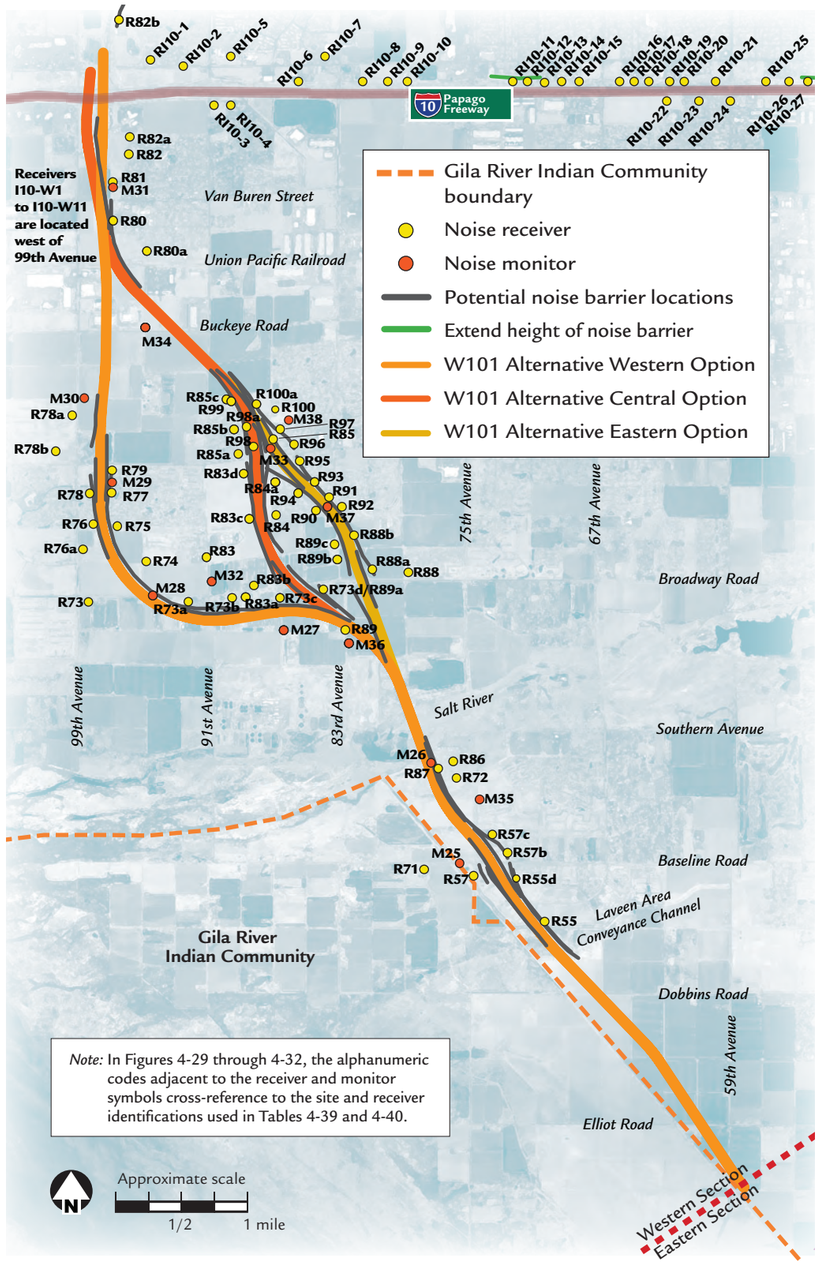


Figure 4-30 Noise Receiver and Potential Barrier Locations, W71 Alternative

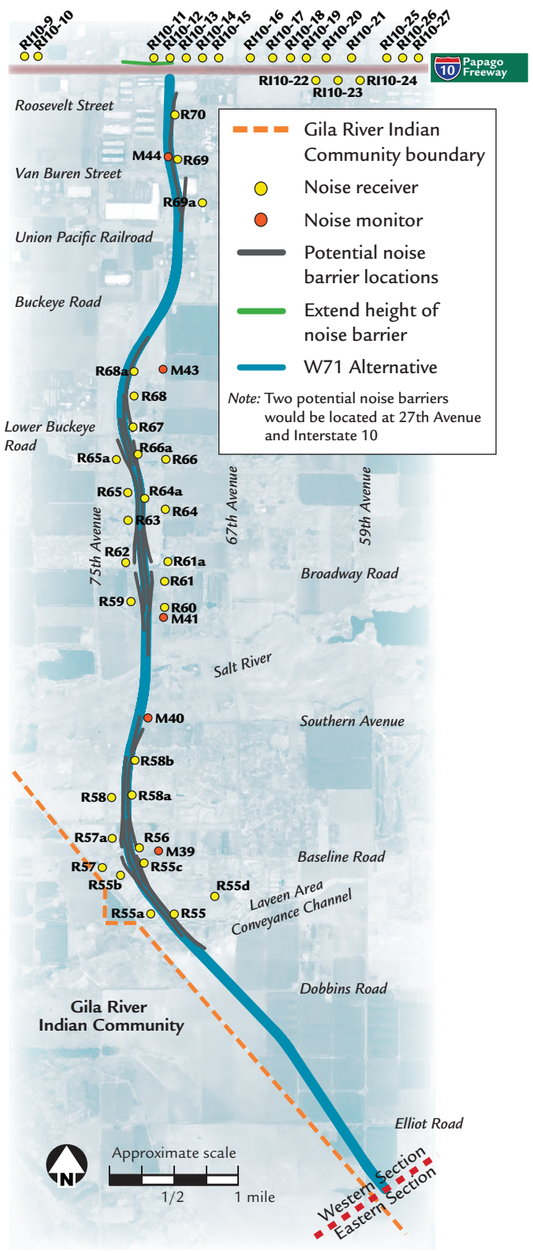
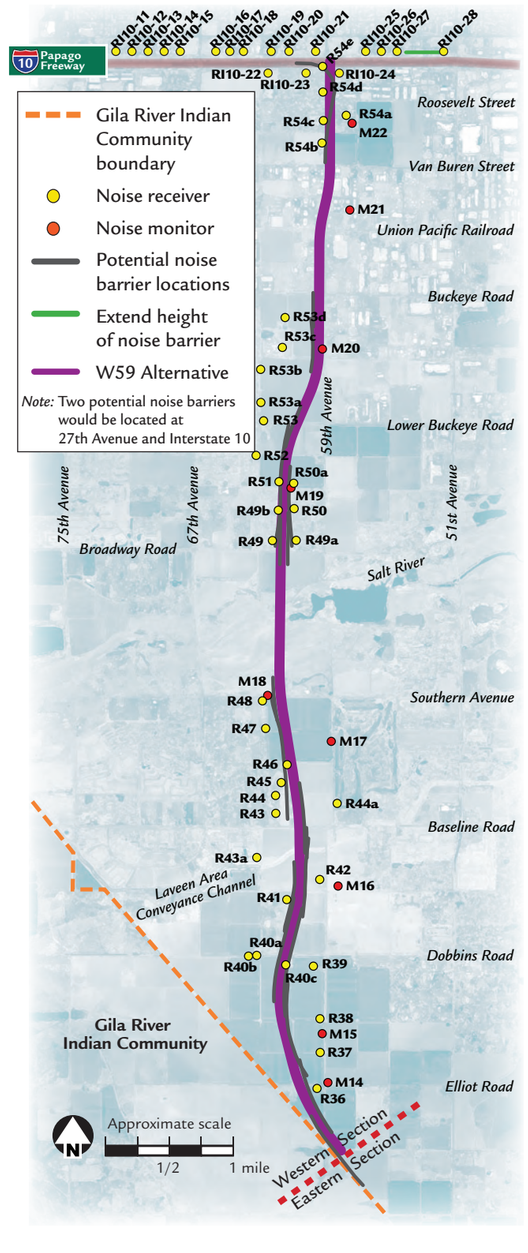
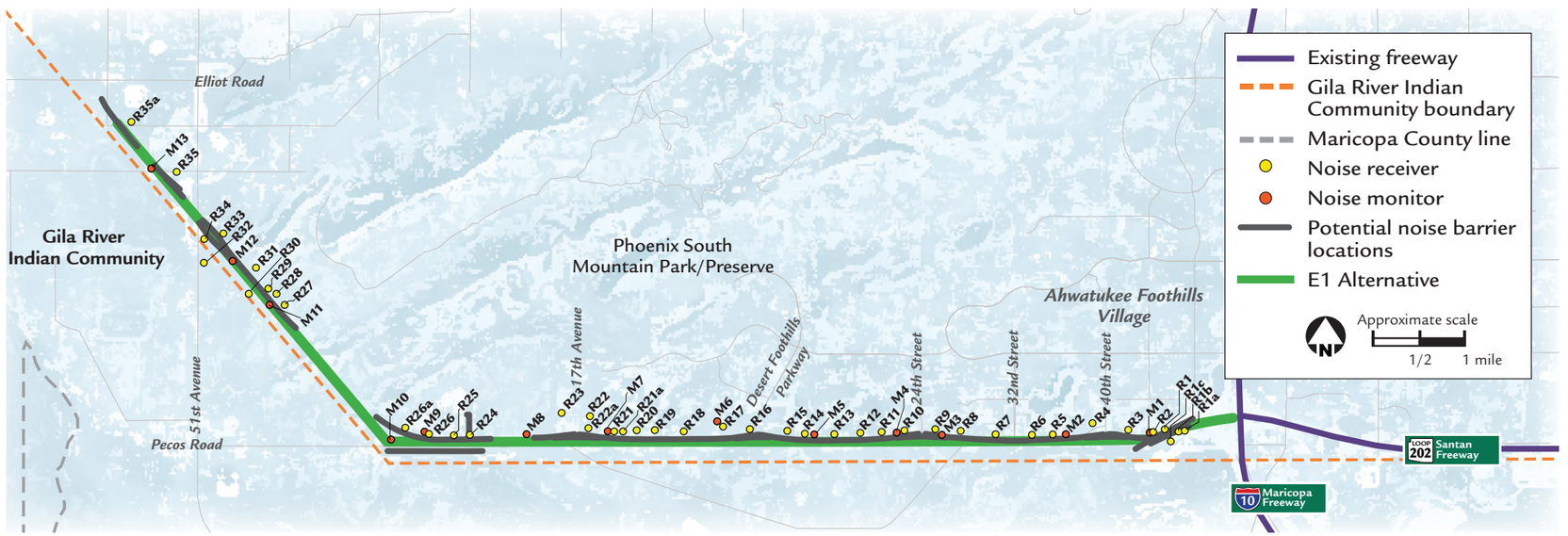


Figure 4-31 Noise Receiver and Potential Barrier Locations, W59 Alternative



Noise receivers were modeled adjacent to known noise-sensitive locations along the action alternatives' alignments in the Western Section. Locations and/or extent of barriers could change. Exact noise barrier locations and dimensions would be determined during the design phase. The public would continue to be engaged in freeway-related noise issues through construction and operation of the proposed action (see Figure 4-33, on page 4-92).

Figure 4-32 Noise Receiver and Potential Barrier Locations, Eastern Section



Noise receivers were modeled adjacent to known noise-sensitive locations along the E1 Alternative in the Eastern Section. Locations and/or extent of barriers could change. Exact noise barrier locations and dimensions would be determined during the design phase. The public would be encouraged to continue to be engaged in freeway-related noise issues through construction and operation of the proposed action (see Figure 4-33, on page 4-92).

Are the noise barriers shown in the DEIS the exact locations?

The noise analysis was based on preliminary design and traffic information. Numerous "state-of-the-practice" assumptions were made to complete the noise analysis. As the design of the proposed action further develops, additional noise analyses would be conducted. The results of this analysis and the mitigation recommendations should not be considered final and would need to be verified and refined as the design would progress.

Each monitoring period consisted of a 15- to 30-minute sound level recording using an integrating sound level meter. Most readings were conducted for a period of 15 minutes. Based on FHWA guidance, the longer monitoring periods were used at locations with little traffic noise and greater short-term variabilities in ambient noise. The duration of each reading was sufficient to record the existing noise characteristics at the monitoring location. At all locations, the meter was placed approximately 5 feet above the ground. Results of the ambient noise monitoring are shown in Table 4-39.

ENVIRONMENTAL CONSEQUENCES

For the three Western Section action alternatives and options and the Eastern Section action alternative, over 220 sensitive receivers were evaluated from a traffic noise perspective. All of the receivers represent noise-sensitive Activity Category B land uses, as described in Table 4-40, with the exception of the casino (R30), which is a commercial land use (Category C). Receiver locations for the Western Section of the Study Area are indicated on Figures 4-29 through 4-31. Receiver locations for the Eastern Section of the Study Area are indicated on Figure 4-32. The impacts from each of the action alternatives and options and those of the No-Action Alternative are discussed in more detail later in this section.

In areas where the Western Section action alternatives are located close together, nearby receivers were evaluated for both action alternatives and are listed in Table 4-40 under both alternatives. Also, several new residential subdivisions have been developed since the initial noise evaluations began in 2003. To include these new receiver locations without altering the sequential numbering system, additional receivers were assigned an identification beginning with the nearest receiver number, followed by a letter to distinguish the new receiver. For instance, if the nearest existing receiver was numbered 26, the additional nearby receiver was numbered 26a.

Results of the noise analysis for each receiver are summarized in Table 4-40. The first column of Table 4-40 lists a consecutive number assigned to identify each receiver. The second column in the table identifies the approximate distance and direction from the given action alternative's centerline to the receiver. The third column identifies the receiver, such as school or park, neighborhood, subdivision, or the area where the receiver is located. The fourth column displays the projected future noise level (in dBA L_{eq}) without noise mitigation, based on Traffic Noise Model 2.5 modeling (traffic noise model endorsed by FHWA—see the technical report on traffic noise) and the 2035 design year. Noise mitigation was then added to the model, resulting in the mitigated future noise levels shown in the fifth column. For some of the receivers, noise from nearby arterial street traffic limited the amount of noise reduction that could be achieved for the proposed action alternatives. Mitigation is discussed in further detail in the next section.

Action Alternatives, Western Section

The evaluation of impacts on noise-sensitive receivers included modeling noise level impacts from the W59 Alternative, W71 Alternative, and W101 Alternative and Options along I-10 (Papago Freeway) near and including where the new system traffic interchange would connect I-10 and the proposed action. The receivers for this analysis can be found in Table 4-40 and are denoted by the prefix "I-10" in the first column. Because the W101 Alternative and its Options would result in the same impacts along I-10, the results are presented only for the Western Option.

W59 (Preferred) Alternative

Projected peak-hour noise levels along the W59 Alternative and I-10 (Papago Freeway) would range from 60 to 78 dBA L_{eq} at the 84 receivers. The projected noise levels at 65 of the 84 receivers would approach or exceed the ADOT mitigation criterion. The 65 affected receivers along this action alternative and I-10 would be eligible for noise abatement consideration.

Table 4-39 Ambient Noise Monitoring Results, Western and Eastern Sections

Site Identification	Alternative/ Alignment Option	Location Description	Ambient Noise Level (L_{Aeq1h})[a]
Western Section			
M14[b]	W101, W71, W59	Corner of 59th Avenue and Elliot Road	49
M15	W59	59th Avenue, 3/8 mile north of Elliot Road	45
M16	W59	South Mountain Avenue, west of 59th Avenue	47
M17	W59	Corner of 59th Avenue and Vineyard Road	50
M18	W59	Southern Avenue, ½ mile west of 59th Avenue	58
M19	W59	Corner of 61st Avenue and Warner Street	51
M20	W59	59th Avenue and Roosevelt Irrigation District canal	64
M21	W59	57th Drive south of Jefferson Street	58
M22	W59	Southwest Village Apartments, 777 North 59th Avenue, southeast corner	49
M23	W101, W71, W59	Elliot Road at Community[c] boundary	49
M24	W101, W71	Dobbins Road at Community boundary	54
M25	W101 Western Option	Baseline Road at Community boundary	61
M26	W101 Western and Central Options	Alta Vista Road, west of 75th Avenue	50
M27	W101 Western and Central Options	87th Avenue, ¼ mile south of Broadway Road	52
M28	W101 Western Option	Broadway Road, ½ mile west of 91st Avenue	62
M29	W101 Western Option	Kingman Street, east of 97th Avenue	48
M30	W101 Western Option	99th Avenue, ½ mile north of Lower Buckeye Road	57
M31	W101 Central Option	Apartments on 96th Avenue, north of Van Buren Street	50
M32	W101 Central Option	91st Avenue, 500 feet north of Broadway Road	62
M33	W101 Central Option	87th Avenue, north of Lower Buckeye Road	53
M34	W101 Central and Eastern Options	Buckeye Road, ½ mile east of 99th Avenue	59
M35	W101 Eastern Option	75th Avenue, ½ mile south of Southern Avenue	49
M36	W101 Eastern Option	83rd Avenue, ¾ mile south of Broadway Road	53
M37	W101 Eastern Option	Elwood Street, west of 83rd Avenue	53
M38	W101 Eastern Option	Watkins Street, east of 86th Drive	54
M39	W71	Baseline Road, east of 75th Avenue	63
M40	W71	Southern Avenue, east of 75th Avenue	62
M41	W71	71st Avenue, south of Wier Avenue	44
M42	W71	Crown King Road, east of 73rd Drive	54
M43	W71	Durango Street, west of 71st Avenue	48
M44	W71	Corner of 71st Avenue and Polk Street	55
Eastern Section			
M1	E1	Near 44th Street and Cedarwood Lane	55
M2	E1	Near 36th Place and Windsong Drive	52
M3	E1	End of 26th Street, south of Redwood Lane	56
M4	E1	Apartments at 21st Street and Liberty Lane, southwest side	53
M5	E1	Church near 15th Street and Liberty Lane	54
M6	E1	Near Ashurst Drive and 2nd Place	45
M7	E1	Near 15th Avenue and Liberty Lane	44
M8	E1	North of Pecos Road, between 17th and 27th avenues	46
M9	E1	Corner of 30th Lane and Redwood Lane	51
M10	E1	Far west end of Pecos Road at Community boundary	45
M11	E1	Corner of 45th Avenue and Galveston	48
M12	E1	Corner of Dusty Lane and Ray Road	54
M13	E1	Estrella Drive at Community boundary	55

[a] L_{Aeq1h}, 1-hour equivalent sound level; logarithmic energy average over a 1-hour period (measured in dBA, a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level and is frequency-weighted using the A-scale, to approximate the frequency response of the human ear)

[b] Sites M1 to M13 are located in the Eastern Section and are presented later in the table.

[c] Gila River Indian Community

Table 4-40 Noise Analysis Results, Western and Eastern Sections

Receiver ID	Distance and Direction from Centerline	Neighborhood or Area	Unmitigated Action Alternative Noise Level[a]	Mitigated Noise Level[a]
Western Section				
W59 Alternative (Preferred Alternative)				
36[b]	580 feet east	59th Avenue and Elliot Road	69	63
37	1,170 feet east	59th Avenue north of Elliot Road	66	60
38	1,500 feet east	59th Avenue and Olney Avenue	64	58
39	1,225 feet east	59th Avenue and Dobbins Road	65	58
40a	925 feet west	63rd Avenue and Dobbins Road	65	60
40b	1,220 feet west	63rd Avenue and Dobbins Road	65	59
40c	250 feet west	61st Avenue and Dobbins Road	72	63
41	385 feet west	61st Avenue and South Mountain Avenue	74	63
42	790 feet east	59th Avenue and South Mountain Avenue	69	62
43	920 feet west	Rancho Grande	67	61
43a[d]	1,750 feet west	Avalon Village	63	58
44	835 feet west	Rancho Grande	67	61
44a	1,590 feet east	Cottonwood Golf Course	63	61
45	530 feet west	Rancho Grande	71	63
46	145 feet west	Rancho Grande	78	63
47	895 feet west	Rancho Grande	68	61
48	840 feet west	Rancho Grande	67	62
49	485 feet west	Rio Del Rey Unit 1	71	63
49a	470 feet east	Rio Del Rey Unit 2	70	63
49b	270 feet west	Rio Del Rey Unit 1	74	62
50	375 feet east	Rio Del Rey Unit 2	73	61
50a	345 feet east	Rio Del Rey Unit 2	74	63
51	250 feet west	Rio Del Rey Unit 1	76	63
52	1,245 feet west	Estrella Manor	65	58
53	1,285 feet west	Meadows	64	59
53a	1,825 feet west	Park at Terralea	62	58
53b	2,350 feet west	Park at Terralea	61	58
53c	1,520 feet west	Western Valley Elementary School	64	60[c]
53d	1,405 feet west	61st Avenue and Buckeye Road	65	60
54b	355 feet west	59th Avenue north of Van Buren Street	72	67[e]
54c	430 feet west	Centura West	72	69[e]
54d	700 feet west	Centura West	71	70[e]
54e	900 feet west	Patio Homes West	73	71[e]
Interstate 10 with W59 Alternative (Preferred Alternative)				
I-10-1	1,350 feet north	Sheely Farms Parcel 3	62	62
I-10-2	1,180 feet north	Apartments – McDowell Road and 93rd Avenue	61	61
I-10-3	510 feet south	Tolsun Farms	67	61
I-10-4	520 feet south	Tolsun Farms	68	62
I-10-5	1,440 feet north	Westpoint	60	60
I-10-6	470 feet north	EconoLodge	70	—[f]
I-10-7	1,440 feet north	Amberlea Cottages	60	60
I-10-8	460 feet north	Legacy Suites Apartments	63	58
I-10-9	410 feet north	Daravante	63	56
I-10-10	380 feet north	Daravante	67	56
I-10-11	440 feet north	Hampton Square Apartments	62	61
I-10-12	420 feet north	Hampton Square Apartments	62	58
I-10-13	390 feet north	Sunpointe Apartments	63	59
I-10-14	420 feet north	Las Gardenias Apartments	64	59
I-10-15	460 feet north	Las Gardenias Apartments	63	61
I-10-16	490 feet north	Westover Parc Condominiums	62	59
I-10-17	440 feet north	Apartments – McDowell Road and 85th Avenue	62	58
I-10-18	420 feet north	Apartments – McDowell Road and 84th Avenue	61	59
I-10-19	410 feet north	Apartments – McDowell Road and 83rd Avenue	61	58
I-10-20	400 feet north	Avanti Apartments	64	58
I-10-21	500 feet north	Avanti Apartments	63	59
I-10-22	340 feet south	La Terraza	64	60
I-10-23	280 feet south	Patio Homes West	70	62
I-10-24	350 feet south	Patio Homes West	66	63
I-10-25	430 feet north	Apartments – McDowell Road and 57th Avenue	67	62
I-10-26	390 feet north	Apartments – McDowell Road and 56th Avenue	68	60
I-10-27	360 feet north	Hallcraft Villas West Condominiums	71	59
I-10-28	380 feet north	Hallcraft Villas West Condominiums	72	62
I-10-29	320 feet north	Winona Park 1	68	60
I-10-30	250 feet north	Winona Park 6A	67	61

Note: Footnotes are at the end of the table, page 4-88.

(continued on next page)

Table 4-40 Noise Analysis Results, Western and Eastern Sections (continued)

Receiver ID	Distance and Direction from Centerline	Neighborhood or Area	Unmitigated Action Alternative Noise Level[a]	Mitigated Noise Level[a]
I-10-31	250 feet north	Winona Park 6A	67	61
I-10-32	310 feet south	Winona Park 2	68	61
I-10-33	270 feet south	Deluxe Mobile Home Park	66	61
I-10-34	280 feet south	Deluxe Mobile Home Park	66	61
I-10-35	300 feet north	Franmar Manor	67	60
I-10-36	300 feet north	West View Manor	72	61
I-10-37	310 feet north	West View Manor	71	61
I-10-38	270 feet south	West Phoenix No. 4	67	61
I-10-39	220 feet south	West Phoenix No. 4	72	62
I-10-40	370 feet south	West Phoenix No. 4	69	62
I-10-41	340 feet north	Westcroft Place	71	60
I-10-42	250 feet north	Isaac Infill	71	61
I-10-43	360 feet north	Westcroft Place Plat 2	64	59
I-10-44	260 feet north	El Retiro Block 1 and 2	69	61
I-10-45	240 feet north	Sharon Gardens	72	62
I-10-46	370 feet south	Westcroft Place Plat 2	67	61
I-10-47	220 feet south	Westcroft Place Plat 2	69	61
I-10-48	330 feet south	El Retiro Block 1 and 2	66	62
I-10-49	280 feet south	North Willow Square	70	62
I-10-50	370 feet south	North Willow Square	70	62
I-10-51	370 feet south	North Willow Square Plat 2	65	59
W71 Alternative				
55	415 feet east	Laveen Meadows	72	65[c]
55a	305 feet west	Laveen Meadows Parcel 3	74	67[c]
55b	450 feet west	Laveen Meadows Parcel 2	71	60
55c	590 feet east	Laveen Meadows Parcel 15	71	63
55d	2,000 feet east	Laveen Meadows Elementary School	64	59
56	590 feet east	Rancho Grande	70	63
57	1,040 feet west	75th Avenue and Baseline Road	66	63
57a	400 feet west	Laveen Ranch	72	63
58	410 feet west	75th Avenue and Vineyard Road	74	63
58a	410 feet east	Laveen Farms Phase 1	74	63
58b	425 feet east	Laveen Farms Phase 1	74	63
59	435 feet west	Western Heritage Estates	72	62
60	890 feet east	Western Heritage Estates 2	68	61
61	930 feet east	Western Heritage Estates 2	67	62
61a	1,150 feet east	Sienna Vista	66	61
62	495 feet west	Sienna Vista	72	63
63	290 feet west	Marbella	74	61
64	1,160 feet east	71st Avenue and Elwood Street	66	59
64a	345 feet east	Sienna Vista	74	63
65	260 feet west	Suncrest at Estrella Village	76	63
65a	410 feet west	Travertine at Estrella Village	72	61
66	1,440 feet east	Santa Marie Townsite	64	59
66a	445 feet east	Sienna Vista	70	61
67	535 feet east	Santa Maria Elementary School	71	65[c]
68	600 feet east	Valle Eldorado	71	61
68a	385 feet east	Valle Eldorado	74	63
69	460 feet east	Westridge Park 4	70	65[c]
69a	1,135 feet east	Western Acres	65	60
70	400 feet east	Westridge Park 2	69	62
Interstate 10 with W71 Alternative				
I-10-1	1,350 feet north	Sheely Farms Parcel 3	62	62
I-10-2	1,180 feet north	Apartments – McDowell Road and 93rd Avenue	61	61
I-10-3	510 feet south	Tolsun Farms	66	61
I-10-4	520 feet south	Tolsun Farms	68	62
I-10-5	1,440 feet north	Westpoint	60	60
I-10-6	470 feet north	EconoLodge	70	—[f]
I-10-7	1,440 feet north	Amberlea Cottages	60	60
I-10-8	460 feet north	Legacy Suites Apartments	63	58
I-10-9	410 feet north	Daravante	63	56
I-10-10	380 feet north	Daravante	67	57
I-10-11	440 feet north	Hampton Square Apartments	69	62
I-10-12	420 feet north	Hampton Square Apartments	67	59
I-10-13	390 feet north	Sunpointe Apartments	66	61
I-10-14	420 feet north	Las Gardenias Apartments	63	63

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Table 4-40 Noise Analysis Results, Western and Eastern Sections (continued)

Receiver ID	Distance and Direction from Centerline	Neighborhood or Area	Unmitigated Action Alternative Noise Level[a]	Mitigated Noise Level[a]
I-10-15	460 feet north	Las Gardenias Apartments	63	63
I-10-16	490 feet north	Westover Parc Condominiums	63	59
I-10-17	440 feet north	Apartments – McDowell Road and 85th Avenue	62	58
I-10-18	420 feet north	Apartments – McDowell Road and 84th Avenue	61	58
I-10-19	410 feet north	Apartments – McDowell Road and 83rd Avenue	61	57
I-10-20	400 feet north	Avanti Apartments	63	57
I-10-21	500 feet north	Avanti Apartments	62	58
I-10-22	340 feet south	La Terraza	60	60
I-10-23	280 feet south	Patio Homes West	69	61
I-10-24	350 feet south	Patio Homes West	63	61
I-10-25	430 feet north	Apartments – McDowell Road and 57th Avenue	61	61
I-10-26	390 feet north	Apartments – McDowell Road and 56th Avenue	68	59
I-10-27	360 feet north	Hallcraft Villas West Condominiums	72	59
I-10-28	380 feet north	Hallcraft Villas West Condominiums	72	60
I-10-29	320 feet north	Winona Park 1	68	59
I-10-30	250 feet north	Winona Park 6A	66	60
I-10-31	250 feet north	Winona Park 6A	67	61
I-10-32	310 feet south	Winona Park 2	68	60
I-10-33	270 feet south	Deluxe Mobile Home Park	66	60
I-10-34	280 feet south	Deluxe Mobile Home Park	66	60
I-10-35	300 feet north	Franmar Manor	67	60
I-10-36	300 feet north	West View Manor	72	61
I-10-37	310 feet north	West View Manor	70	60
I-10-38	270 feet south	West Phoenix No. 4	67	60
I-10-39	220 feet south	West Phoenix No. 4	72	62
I-10-40	370 feet south	West Phoenix No. 4	69	62
I-10-41	340 feet north	Westcroft Place	71	60
I-10-42	250 feet north	Isaac Infill	71	61
I-10-43	360 feet north	Westcroft Place Plat 2	64	59
I-10-44	260 feet north	El Retiro Block 1 and 2	69	61
I-10-45	240 feet north	Sharon Gardens	72	61
I-10-46	370 feet south	Westcroft Place Plat 2	67	61
I-10-47	220 feet south	Westcroft Place Plat 2	69	61
I-10-48	330 feet south	El Retiro Block 1 and 2	66	61
I-10-49	280 feet south	North Willow Square	70	62
I-10-50	370 feet south	North Willow Square	70	61
I-10-51	370 feet south	North Willow Square Plat 2	65	58
W101 Alternative Western Option				
55	410 feet east	Laveen Meadows	73	63
55d	545 feet east	Laveen Meadows Parcel 15	71	63
57	820 feet west	75th Avenue and Baseline Road	69	63
57b	800 feet east	Laveen Ranch	69	63
57c	670 feet east	Laveen Ranch	70	60
71	2,270 feet west	Community[g], 78th Avenue and Baseline Road	62	61
72	945 feet east	75th Avenue and Southern Avenue	69	61
73	1,750 feet west	95th Avenue and Broadway Road	63	62
73a	535 feet east	93rd Avenue and Broadway Road	71	66[c]
73b	745 feet east	89th Avenue and Broadway Road	70	63
73c	450 feet east	87th Avenue and Broadway Road	74	63
73d	950 feet east	84th Avenue and Broadway Road	69	61
74	1,040 feet east	Tivoli	68	62
75	615 feet east	Country Place Parcel 26	72	63
76	275 feet west	Country Place Parcel 25	76	63
76a	925 feet west	99th Avenue and Illini Street	69	63
77	485 feet east	Country Place Parcel 22	72	63
78	350 feet west	Country Place Parcel 21	73	61
78a	1,080 feet west	Country Place Phase 4	67	62
78b	1,705 feet west	Country Place Phase 4	64	59
79	485 feet east	Country Place Parcel 23	73	67[c]
80	445 feet east	Tolleson High School	72	63
80a	1,730 feet east	Tolleson-Goetz Tract, Block 100	64	59
81	475 feet east	Concord Sundancer Apartments	73	65[c]
82	1,090 feet east	Villa de Tolleson 1	66	61
82a	1,060 feet east	Parkview Casitas	64	59
82b	380 feet east	Sheely Farms Parcel 5	70	62
86	1,060 feet east	75th and Southern avenues	68	61
87	400 feet east	75th and Southern avenues	75	63
Interstate 10 with W101 Alternative (Western, Central, and Eastern Options)[h]				
I-10-1	1,350 feet north	Sheely Farms Parcel 3	62	62
I-10-2	1,180 feet north	Apartments – McDowell Road and 93rd Avenue	61	61

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Table 4-40 Noise Analysis Results, Western and Eastern Sections (continued)

Receiver ID	Distance and Direction from Centerline	Neighborhood or Area	Unmitigated Action Alternative Noise Level[a]	Mitigated Noise Level[a]
I-10-3	510 feet south	Tolsun Farms	61	61
I-10-4	520 feet south	Tolsun Farms	62	62
I-10-5	1,440 feet north	Westpoint	60	60
I-10-6	470 feet north	EconoLodge	70	—[f]
I-10-7	1,440 feet north	Amberlea Cottages	60	60
I-10-8	460 feet north	Legacy Suites Apartments	58	58
I-10-9	410 feet north	Daravante	55	55
I-10-10	380 feet north	Daravante	56	56
I-10-11	440 feet north	Hampton Square Apartments	60	60
I-10-12	420 feet north	Hampton Square Apartments	58	58
I-10-13	390 feet north	Sunpointe Apartments	58	58
I-10-14	420 feet north	Las Gardenias Apartments	58	58
I-10-15	460 feet north	Las Gardenias Apartments	60	60
I-10-16	490 feet north	Westover Parc Condominiums	58	58
I-10-17	440 feet north	Apartments – McDowell Road and 85th Avenue	57	57
I-10-18	420 feet north	Apartments – McDowell Road and 84th Avenue	58	58
I-10-19	410 feet north	Apartments – McDowell Road and 83rd Avenue	56	56
I-10-20	400 feet north	Avanti Apartments	56	56
I-10-21	500 feet north	Avanti Apartments	57	57
I-10-22	340 feet south	La Terraza	59	59
I-10-23	280 feet south	Patio Homes West	60	60
I-10-24	350 feet south	Patio Homes West	60	60
I-10-W1	1,280 feet north	Apartments – McDowell Road and 103rd Avenue	63	63
I-10-W2	1,270 feet north	Crystal Gardens Parcel 2A	63	63
I-10-W3	1,400 feet north	Crystal Point	62	62
I-10-W4	670 feet south	Hotel	66	—[f]
I-10-W5	960 feet north	Crystal Springs Apartments	58	58
I-10-W6	980 feet north	Mobile Home Park – McDowell Road and 119th Avenue	63	63
I-10-W7	810 feet south	Isolated homes – east of El Mirage Road	66	66[i]
I-10-W8	1,040 feet north	Avondale Friendship Park	63	63
I-10-W9	1,240 feet north	Avondale Friendship Park	62	62
I-10-W10	1,070 feet north	Rio Santa Fe Apartments	59	59
I-10-W11	350 feet south	Desert Sage Apartments	63	63
W101 Alternative Central Option				
83	2,375 feet west	Union Elementary School	71	63
83a	1,750 feet west	89th Avenue and Broadway Road	64	59
83b	1,200 feet west	89th Avenue and Broadway Road	61	56
83c	330 feet west	Hurley Ranch Parcel 3	63	59
83d	445 feet west	Hurley Ranch Parcels 1 and 2	66	61
84	765 feet east	Volterra	77	65
84a	750 feet east	Volterra	72	63
85	835 feet east	Ryland at Heritage Point	71	63
85a	595 feet west	Farmington Park	69	63
85b	550 feet west	Farmington Park	68	63
85c	295 feet west	Farmington Park	71	66[e]
89a	580 feet east	84th Avenue and Broadway Road	71	63
89b	1,805 feet east	83rd Avenue north of Broadway Road	75	63
100	1,240 feet east	Ryland at Heritage Point	66	61
W101 Alternative Eastern Option				
72	930 feet east	75th and Southern avenues	70	62
80	490 feet east	Tolleson High School	72	63
80a	1,395 feet east	Tolleson-Goetz Tract Block 100	66	61
84a	650 feet west	Volterra	70	60
86	1,060 feet east	75th and Southern avenues	69	62
87	400 feet east	75th and Southern avenues	73	63
88	1,920 feet east	Estrella Village Manor	63	60
88a	625 feet east	Tuscano Phase 2 Parcel C	71	63
88b	410 feet east	Tuscano Phase 2 Parcel A	72	61
89	1,205 feet west	83rd Avenue and Mobile Street	67	61
89a	1,460 feet west	84th Avenue and Broadway Road	65	62[e]
89b	550 feet west	83rd Avenue north of Broadway Road	72	63
89c	400 feet west	83rd Avenue north of Broadway Road	72	62
90	300 feet west	Volterra	73	63
91	370 feet east	Volterra	72	63
92	520 feet east	Tuscano Phase 1	70	61
93	400 feet east	Volterra	73	63
94	325 feet west	Volterra	73	62
95	580 feet east	Volterra	71	62
96	840 feet east	Ryland at Heritage Point	69	63
97	690 feet east	Ryland at Heritage Point	70	61

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Table 4-40 Noise Analysis Results, Western and Eastern Sections (continued)

Receiver ID	Distance and Direction from Centerline	Neighborhood or Area	Unmitigated Action Alternative Noise Level[a]	Mitigated Noise Level[a]
98	520 feet west	Farmington Park	72	62
98a	330 feet west	Farmington Park	74	63
99	305 feet west	Farmington Park	75	65[c]
100	950 feet east	Ryland at Heritage Point	68	61
100a	450 feet east	School at 87th Avenue and Durango Street	73	63
Eastern Section				
E1 Alternative				
1	250 feet north	Foothills Paseo 2	78	64[c]
1a	460 feet south	Pecos Park	74	62
1b	320 feet south	Pecos Park	77	63
1c	440 feet south	Pecos Park	74	61
2	260 feet north	Foothills Paseo 2	77	63
3	335 feet north	Foothills Paseo 2	73	62
4	785 feet north	Wilton Commons	69	63
5	235 feet north	Kyrene de los Lagos Elementary School	76	63
6	220 feet north	Lakewood Parcel 20	74	64[c]
7	215 feet north	Lakepoint 21 at Lakewood	76	63
8	380 feet north	Kyrene Akimel Middle School	75	62
9	390 feet north	Foothills Mountain Ranch 2	71	63
10	280 feet north	Foothills Apartments	72	63
11	320 feet north	Foothills Parcel 5B	75	63
12	325 feet north	Foothills Parcel 5A	75	63
13	305 feet north	Foothills Parcel 5C	76	63
14	290 feet north	Parcel 6A at the Foothills	75	63
15	370 feet north	Parcel 6A at the Foothills	74	68[c]
16	400 feet north	Foothills Parcels 12A, B, C	74	70[e]
17	690 feet north	Foothills Parcels 12A, B, C	70	63
18	405 feet north	Fairway Hills at Club West	74	63
19	455 feet north	Fairway Hills at Club West	72	62
20	460 feet north	Parcel 9G at Foothills Club West	73	62
21	350 feet north	Parcels 18A, 19D, 19E, 26B at Foothills Club West	75	63
21a	395 feet north	Parcels 18A, 19D, 19E, 26B at Foothills Club West	74	61
22	1,175 feet north	Parcel 26 at Foothills Club West	66	61
22a	470 feet north	Foothills Club West Parcels 20 and 25 Amended	71	64[c]
23	1,370 feet north	Parcel 23 at Foothills Club West	65	60
24	210 feet north	Foothills Reserve Parcel D	78	63
24a	865 feet north	Foothills Reserve	67	59
24b	1,400 feet north	Foothills Reserve	68	60
25	195 feet north	Foothills Reserve Parcel D	76	63
26	240 feet north	Foothills Reserve Parcel C	76	63
26a	350 feet north	Foothills 80	76	63
27	470 feet east	Dusty Lane area	73	62
28	490 feet east	Dusty Lane area	72	62
29	335 feet east	Dusty Lane area	74	63
30	760 feet west	Community Casino	68	—[f]
31	580 feet east	Dusty Lane area	70	61
32	1,540 feet west	Community, 51st Avenue area	64	59
33	420 feet east	Dusty Lane area	75	69[c]
34	760 feet west	Community, 51st Avenue area	68	63
35	670 feet east	53rd Avenue and Estrella Drive	68	63
35a	770 feet east	Tierra Montana Phase 1	70	63

[a] in decibels (dBA), which are logarithmic units that express the ratio of the sound pressure level being measured to a standard reference level and is frequency-weighted using the A-scale, to approximate the frequency response of the human ear
[b] Sites 1 to 35 are located in the Eastern Section and are presented later in the table.
[c] Further mitigation would require a noise barrier taller than 20 feet, which would not meet the Arizona Department of Transportation Noise Abatement Policy.
[d] Numerous new receivers were added to represent new development since the initial analysis began in 2003. These receivers are designated with a letter following the receiver number to maintain the sequential numbering system.
[e] Traffic noise from nearby cross street prevented further noise reduction at this receiver.
[f] mitigation typically not recommended for hotels, motels, and casinos
[g] Gila River Indian Community
[h] The noise analysis results along Interstate 10 are the same for all of the W101 Alternative Options.
[i] not eligible for mitigation based on land use category

Construction Noise

Short-term noise impacts may be experienced during construction along any of the various action alternatives. Quantification of such impacts is difficult without data on the proposed freeway's construction schedule and equipment to be used. Therefore, several assumptions were made to project the approximate noise level at R/W boundaries. These projections are based on the use of the noisiest equipment expected during each construction stage of a typical roadway project. Data on construction equipment noise are available from *FHWA Highway Construction Noise Handbook* (FHWA 2006b).

Measurements were taken during a freeway construction project in Arizona that assessed the collective impact of construction noise. The maximum noise levels (L_{max}) were calculated at the R/W line. The distance between the R/W and the construction activity was estimated based on the type of work being performed.

Results of the preliminary estimates, shown below, indicate that sensitive receivers could be adversely affected by construction noise if the receivers were immediately adjacent to the proposed R/W. The highest noise levels would occur during the grading/earthwork phase of the construction project.

Construction Equipment Noise

Phase	Equipment	Equipment (L_{max})[a]	Feet to R/W[b]	L_{max} at R/W
Site clearing	Dozer/Backhoe	82/78	50	83
Grading/Earthwork	Scraper/Grader	84/85	75	85
Foundation	Backhoe/Loader	78/79	100	78
Base preparation	Compactor/Dozer	83/82	100	82

[a] maximum noise level, measured in dBA (a logarithmic unit that expresses the ratio of the sound pressure level being measured to a standard reference level and is frequency-weighted using the A-scale, to approximate the frequency response of the human ear)
[b] right-of-way

W71 Alternative

Projected peak-hour noise levels along the W71 Alternative and I-10 (Papago Freeway) would range from 60 to 76 dBA L_{eq} at the 80 receivers. The projected noise levels at 63 of the 80 receivers would approach or exceed the ADOT mitigation criterion. The 63 affected receivers along this action alternative and I-10 would be eligible for noise abatement consideration.

W101 Alternative and Options

- Projected peak-hour noise levels along the W101 Alternative Western Option would range from 62 to 76 dBA L_{eq} at the 29 receivers. The projected noise levels at 27 of the 29 receivers would approach or exceed the ADOT mitigation criterion. The 27 affected receivers along this option would be eligible for noise abatement consideration.
- Projected peak-hour noise levels along the W101 Alternative Central Option would range from 61 to 77 dBA L_{eq} at the 14 receivers. The projected noise levels at 12 of the 14 receivers would approach or exceed the ADOT mitigation criterion. The 12 affected receivers along this option would be eligible for noise abatement consideration.
- Projected peak-hour noise levels along the W101 Alternative Eastern Option would range from 63 to 75 dBA L_{eq} at the 26 receivers. The projected noise levels at 25 of the 26 receivers would approach or exceed the ADOT mitigation criterion. The 25 affected receivers along this option would be eligible for noise abatement consideration.
- Projected peak-hour noise levels along I-10 (Papago Freeway) for the W101 Alternative would range from 55 to 70 dBA L_{eq} at the 35 receivers. The projected noise levels at 3 of the 35 receivers would approach or exceed the ADOT mitigation criterion. The 3 affected receivers along I-10 (Papago Freeway) would not be eligible for noise abatement considerations. Two of the receivers are hotels; hotel owners typically consider noise walls to be undesirable because they reduce the hotel's visibility. The third affected receiver represents an area of isolated homes, which would not be considered eligible for mitigation according to the ADOT NAP.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

Most of the 44 receivers are located along the existing Pecos Road; the remainder of the receivers are located between 43rd and 55th avenues.

Projected peak-hour noise levels along the E1 Alternative would range from 64 to 78 dBA L_{eq} at the 44 receivers. The projected noise level at 43 of the 44 receivers would exceed the ADOT mitigation criterion. Receiver 30 represents the casino near 51st Avenue, and because it is not considered a noise-sensitive land use, would not be eligible for noise abatement consideration. The 43 affected receivers along this action alternative, including one on Community land (Receiver 34), would be eligible for noise abatement consideration.

No-Action Alternative

Noise impacts from the No-Action Alternative would be caused by vehicle traffic along arterial and other area surface streets. Based on projected growth throughout the region, traffic congestion would increase under this alternative, which would reduce travel speeds and thereby reduce traffic noise levels. As such, the No-Action Alternative would generally result in lower noise levels at the selected receivers than would any of the action alternatives, but would result in higher noise levels at other locations, such as along arterial streets. Noise from this alternative would be generated by traffic

Noise policy as it applies to the proposed action

According to ADOT policy, noise mitigation should achieve a reduction of 5 dBA and result in a noise level of less than 64 dBA (ADOT 2005b). Some of the receivers along the proposed action alternatives would be affected by noise from adjacent surface streets in addition to that from the proposed freeway. For some of these receivers, the proposed noise barriers would achieve a 5 dBA reduction, but the mitigated noise level would remain above the 64 dBA NAC approach level. For many of these receivers, however, the proposed noise barriers would achieve only a 3 to 4 dBA reduction, because the dominant noise source at the receiver would be the local arterial street rather than the proposed freeway. It would not be feasible to achieve additional noise reduction because of the impact from the local streets. Noise barriers would need to be constructed outside of the proposed R/W of the action alternatives to effectively reduce noise levels from local streets at these receivers. It would not be feasible to construct noise barriers outside of the proposed R/W. Each of these receivers would achieve the ADOT NAP criterion when modeled without the local street traffic.

on neighborhood and arterial streets, as well as by nontraffic noise sources and other general neighborhood activity. Therefore, it is difficult to quantify the projected noise levels from the No-Action Alternative.

MITIGATION

ADOT Environmental Planning Group and Design Responsibilities

Projected noise levels would approach or exceed the Activity Category B NAC at 196 of the receiver locations. Noise mitigation was evaluated for these receivers. Noise mitigation, in the form of noise walls or earth berms, is discussed for each of the action alternatives and options. Noise walls and earth berms are the most common type of noise mitigation used along ADOT freeways. General locations of noise barriers for the Western and Eastern Sections are shown in Figures 4-29 through 4-32. Other noise mitigation strategies that could be applied in addition to or instead of standard noise walls or earth berms are discussed later in this section.

Where the main line would be elevated, each of the noise barriers would be placed on the freeway embankment, near the edge of the shoulder, to take advantage of the elevated profile. (Placing a noise barrier on an elevated section of freeway results in a lower wall height to achieve the same noise reduction.) Where feasible (but not likely in the areas where the main line would be elevated), noise barriers would be constructed as early as possible in the construction phasing to shield adjacent properties from construction-related noise impacts.

In addition, the ADOT NAP specifies that noise abatement should provide at least 5 dBA in noise reduction and result in a noise level below the 64 dBA criterion. Also, the ADOT NAP specifies that the maximum reasonable barrier height is 20 feet.

For some of the receivers along the action alternatives, a barrier as high as 20 feet would provide more than 5 dBA of noise reduction, but a noise level below 64 dBA could not be achieved. According to ADOT policy, barriers generally will not be constructed higher than 20 feet because of cost, aesthetics, and constructibility. Therefore, no further noise reduction would be provided.

Action Alternatives, Western Section

W59 (Preferred) Alternative

Nineteen new barriers and one raised barrier would be needed to reduce noise levels in accordance with the ADOT NAP along the W59 Alternative and I-10 (Papago Freeway). The barriers would range in height from 10 to 20 feet and would reduce noise levels at the 84 receivers to between 56 and 71 dBA L_{eq}. The noise levels at 1 of the receivers (R53c), even with a 20-foot-high noise barrier, would not be reduced to by at least 5 dBA, ADOT's goal for reducing traffic noise on new roadway projects. This receiver, however, would achieve a 4 dBA reduction in the projected noise levels and would be reduced to less than the approach threshold of 64 dBA. Additionally, the noise level at 4 of the receivers (R54b, R54c, R54d, and R54e) would not be reduced in full accordance with the ADOT NAP because of noise impacts from adjacent arterial streets. These receivers would achieve noise reductions of 1 to 5 dBA, but would still be higher than 64 dBA. Three of the receivers (R37, R38, and R42) would be affected because of a "substantial increase" and would all be mitigated with a 5 to 7 dBA reduction. The barriers would total approximately 745,500 square feet in area. Using the standard $33 per square foot of barrier recommended by ADOT, the cost of noise mitigation for the W59 Alternative would be approximately $24.6 million. The ADOT-recommended cost per square foot is subject to future increase.

W71 Alternative

Eighteen new barriers and one raised barrier would be needed to reduce noise levels in accordance with the ADOT NAP along the W71 Alternative and I-10 (Papago Freeway). The barriers would range in height from 10 to 20 feet and would reduce noise levels at the 80 receivers to between 56 and 67 dBA L_{eq}. The noise level at 4 of the receivers (R55, R55a, R67, and R69), even with a 20-foot-high noise barrier, would not be reduced to less than the approach threshold of 64 dBA, which is ADOT's goal for reducing traffic noise on new roadway projects. These receivers, however, would experience at least a 5 dBA reduction in the projected noise level. The barriers would total approximately 1,036,100 square feet in area. Using the standard $33 per square foot recommended by ADOT, the cost of noise mitigation for the W71 Alternative would be approximately $34.2 million.

W101 Alternatives and Options

- Seventeen barriers would be needed to reduce noise levels in accordance with the ADOT NAP along the W101 Alternative Western Option. The barriers would range in height from 10 to 20 feet and would reduce noise levels at the 29 receivers to between 59 and 67 dBA L_{eq}. The noise level at 3 of the receivers (R73a, R79, and R81) would not be reduced in full accordance with the ADOT NAP. These receivers would achieve a noise reduction of at least 5 dBA. The barriers would total approximately 835,100 square feet in area. Using the standard $33 per square foot recommended by ADOT, the cost of noise mitigation for the W101 Alternative Western Option would be approximately $27.6 million.
- Twenty barriers would be needed to reduce noise levels in accordance with the ADOT NAP along the W101 Alternative Central Option. The barriers would range in height from 10 to 20 feet and would reduce noise levels at the 14 receivers to between 56 and 66 dBA L_{eq}. The noise level at one of the receivers (R85a) would not be reduced in full accordance with the ADOT NAP because of noise impacts from adjacent arterial streets. This receiver would achieve a noise reduction of 5 dBA. The barriers would total approximately 825,500 square feet in area. Using the standard $33 per square foot recommended by ADOT, the cost of noise mitigation for the W101 Alternative Central Option would be approximately $27.2 million.
- Sixteen barriers would be needed to reduce noise levels in accordance with the ADOT NAP along the W101 Alternative Eastern Option. The barriers would range in height from 10 to 20 feet and would

reduce noise levels at the 26 receivers to between 60 and 65 dBA L_{eq}. The noise level at one of the receivers (R89a) would not be reduced in full accordance with the ADOT NAP because of noise impacts from adjacent arterial streets. Noise levels at this receiver would be reduced to a sound level below 64 dBA, but would achieve a noise reduction of only 3 dBA. The noise level at one of the receivers (R99), even with a 20-foot-high noise barrier, would not be reduced to less than the approach threshold of 64 dBA. This receiver, however, would experience a noise reduction of 5 dBA. The barriers would total approximately 859,400 square feet in area. Using the standard $33 per square foot recommended by ADOT, the cost of the noise mitigation for the W101 Alternative Eastern Option would be approximately $28.4 million.

- For the W101 Alternative and Options along I-10 (Papago Freeway), no barriers would be needed to reduce noise levels in accordance with the ADOT NAP.

Action Alternative, Eastern Section

E1 (Preferred) Alternative

Twenty barriers would be needed to reduce noise levels in accordance with the ADOT NAP along the E1 Alternative. The barriers would range in height from 8 to 20 feet and would reduce noise levels at the 44 receivers to between 59 and 70 dBA L_{eq}. One receiver (R30), the Vee Quiva Casino near 51st Avenue, is not considered noise-sensitive and is not eligible for noise mitigation. The noise levels at five of the receivers (R1, R6, R15, R22a, and R33) would not be reduced in full accordance with the ADOT NAP even with a 20-foot-high noise barrier. Each of these receivers, however, would achieve at least a 5 dBA reduction in projected noise levels. Additionally, the noise level at one of the receivers (R16) would not be reduced in full accordance with the ADOT NAP because of noise impacts from adjacent arterial streets. This receiver would achieve a noise reduction of 4 dBA. The barriers would total approximately 1,356,200 square feet in area. Using the standard $33 per square foot recommended by ADOT, the cost of the noise mitigation for the E1 Alternative would be approximately $44.8 million.

No-Action Alternative

The No-Action Alternative assumes that the proposed action would not be selected. Consequently, under the No-Action Alternative, noise mitigation would not be provided for any of the receivers.

OTHER POSSIBLE MITIGATION STRATEGIES

A number of mitigation strategies are available that could be used instead of, or in addition to, noise barriers. These involve elements of the action alternatives' alignments, design features, and restrictions.

- **Depressing the freeway** – For most alignments of each of the action alternatives, the proposed freeway would be elevated above the natural grade of the surrounding land. This elevated profile would allow noise to carry farther, creating noise impacts at greater distances from the freeway. Depressing the profile of the freeway below grade (see *Depressed Freeway Options,* on page 3-15) may result in reduced traffic noise levels adjacent to depressed sections (FHWA 1980). However, it would be necessary to also construct at-grade noise barriers to achieve noise reduction goals at receiver locations adjacent to depressed freeway sections. This strategy would also reduce the visual impacts associated with high noise walls on elevated freeways (FHWA 1994). A major disadvantage of this strategy, however, would be the added substantial construction cost of depressing the freeway, including possible acquisition of R/W and provision of drainage (pumping systems and retention basins).
- **Rubberized asphalt pavement surface** – Until recently, new freeways constructed by ADOT were composed of concrete pavement. ADOT has embarked on a multiyear pilot program in cooperation with FHWA to overlay the metropolitan Phoenix freeway system with a rubberized asphalt pavement surface. The rubberized asphalt paving program seeks to reduce freeway traffic noise levels by at least 4 dBA. At this point in the pilot study, such results appear to be achievable.

  ADOT would overlay the proposed action's concrete pavement with rubberized asphalt, but is not making any predictions at this time regarding expected noise reductions. Noise modeling during the final design phase would reflect the most current FHWA modeling criteria, which may include rubberized asphalt.
- **Truck traffic restrictions or reduced posted speed limits** – Discussions regarding reduction of transportation noise impacts have at times focused on restricting truck traffic entirely or during certain hours of the day and on reducing the posted speed limit of a transportation facility. Reducing weight limits is another potential noise reduction strategy. In theory, all of these strategies would reduce the noise impacts on adjacent properties because trucks produce higher noise levels than automobiles and higher speeds generate more noise than lower speeds (FHWA 1976). None of these strategies would, however, be consistent with the purpose and need for the proposed action and, therefore, are not feasible for the proposed freeway.

CONCLUSIONS

Implementation of the proposed action would introduce traffic noise where it currently does not exist or at higher levels than now experienced. There are sensitive receivers [e.g., residences, Section 4(f) resources, schools, parks, churches] where freeway noise might be perceived adversely by users of such facilities. Depending on which action alternatives might be implemented (Western Section combined with the Eastern Section), between 55 and 108 affected receivers would be eligible for noise abatement consideration. The combinations of the W59/E1 (Preferred) Alternative and W71/E1 Alternative would have the most affected eligible receivers, followed by the W101/E1 Alternative. These numbers are expected for a project of this magnitude located in a rapidly growing region. With the placement of noise

Evening traffic noise

The loudest traffic noise near an urban freeway is thought to occur during the morning and afternoon peaks associated with commuting cycles. Traffic noise analysis, therefore, has evolved to focus on these time periods. However, based on past experiences, ADOT also monitors noise levels during off-peak hours. Noise levels could be distinctly higher in the evening because vehicles cause substantially more noise at higher speeds. With fewer vehicles on freeways in the evening, vehicles are able to travel at higher speeds than in the peak periods. Higher speeds were found to cause high late-evening traffic noise.

If this condition were to be experienced along the proposed freeway ADOT would first investigate the occurrence and, if warranted, seek to reduce the noise to levels that would meet ADOT policy and FHWA regulations. It is ADOT policy to monitor a new freeway for 3 years.

Rubberized asphalt pavement pilot program

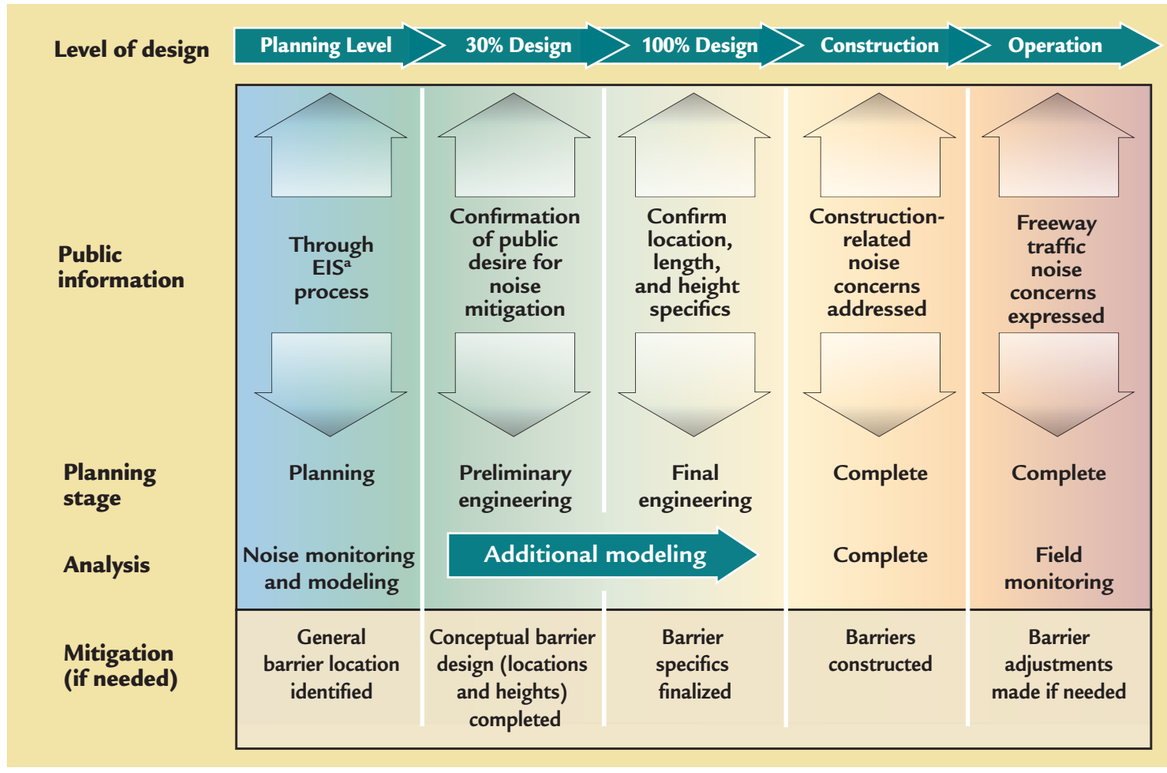
In 2003, ADOT and FHWA started a pilot program to study the noise reduction potential of rubberized asphalt pavement overlays.

The goal of the rubberized asphalt overlay program is to reduce traffic noise levels from freeways by 4 dBA. Initial noise measurements completed for the pilot study indicate the traffic noise reduction goal of 4 dBA for rubberized asphalt pavement is realistic; however, mitigation credit cannot be taken for potential noise reductions.

barriers in selected locations along whatever action alternatives might be implemented—if any—freeway noise would be reduced to levels that would meet ADOT policy and FHWA regulations for abatement. Under the No-Action Alternative, travel speeds would generally be reduced (along with noise levels) because of increased congestion near modeled receivers, but noise levels would increase in other areas, such as along arterial streets.

ADOT would continue to encourage the public's involvement in freeway-related noise issues through final design, construction, and operation of the proposed action (see Figure 4-33).

Figure 4-33 Noise Barrier Process



[a] environmental impact statement

The determination of the location, length, and height of noise barriers requires multiple stages of modeling analysis and offers the public a number of opportunities to gather information and provide comments.

WATER RESOURCES

This section describes water resources in the Study Area and potential impacts on those resources as a result of the proposed action. See the sections, *Floodplains* and *Waters of the United States*, beginning on pages 4-100 and 4-106, respectively, for discussions of the anticipated impacts.

AFFECTED ENVIRONMENT

Surface Water

The Salt and Gila rivers are the major surface water resources in the Study Area (Figure 4-34). The Salt River, located in the central portion of the Western Section of the Study Area, discharges to the Gila River near the northwestern boundary of the Study Area. Flow in the Salt River is seasonal and intermittent, influenced by groundwater withdrawals, treated sewage effluent discharges, diversions for irrigation, return flow from irrigated areas, and occasional floodwater releases from upstream dams.

Watershed Description and Flow Characteristics

The proposed action lies within the Gila River watershed, which encompasses an area of approximately 57,900 square miles in Arizona and New Mexico. The basin includes the greater Phoenix metropolitan area and receives water from the Salt and Verde rivers (Figure 4-35). Surface water flow in the basin is limited to periodic releases from upstream reservoirs, wastewater treatment plants (WWTPs), agricultural return flows, "dry" flows from stormwater outfalls (e.g., landscape irrigation runoff), and runoff from storms in the watershed below the reservoirs (ADOT 1989). Streambeds in the greater Phoenix metropolitan area have been left seasonally dry because of surface water diversions into reservoirs located on the Gila, Verde, and Salt rivers.

The Salt River Basin encompasses approximately 5,980 square miles and contains the Roosevelt, Apache, Saguaro, and Canyon reservoirs, with greater than 90 percent of the flow entering the system upstream of Roosevelt Lake. The Salt River Basin is the primary source of domestic and agricultural water for the Phoenix metropolitan area. The Granite Reef Dam and Diversion Structure, located approximately 25 miles east of the Study Area, diverts the majority of flows from the Salt and Verde rivers (including releases from upstream reservoirs) to an extensive canal system. The canal system is funded and owned by Reclamation and operated by SRP for the purposes of delivering water for agricultural and domestic use. Flow characteristics of water in the Salt River vary and are determined by canal diversions and the magnitude of releases from upstream reservoirs, which in turn depend on snow and rainfall conditions in the watershed. Historical records indicate that between 1940 and 1965, the Salt River channel through the Phoenix metropolitan area remained generally dry. Between 1965 and 1992, flows ranged from flood conditions to small releases as a result of increased rainfall in the watershed.

Surface water in the Eastern Section of the Study Area is limited to runoff from storms in the local watershed. Storm runoff from the southern side of the South Mountains discharges to the south through drainage culverts along Pecos Road. This storm runoff conveyance continues to the south through ephemeral washes to Community land.

Development along the southern side of the South Mountains in the Eastern Section of the Study Area consists of residential and commercial uses typical to the region. The City of Phoenix generally requires retention of flows from a 2-hour, 100-year storm (see description, page 4-100). The combination of residential and commercial development and the City of Phoenix stormwater retention requirements has changed stormwater attenuation. Development has increased stormwater flows, but the implementation of the City of Phoenix retention requirements may reduce stormwater flows to levels dissimilar to those of natural conditions, assuming retention facilities were constructed as part of ongoing development.

Surface Water Quality

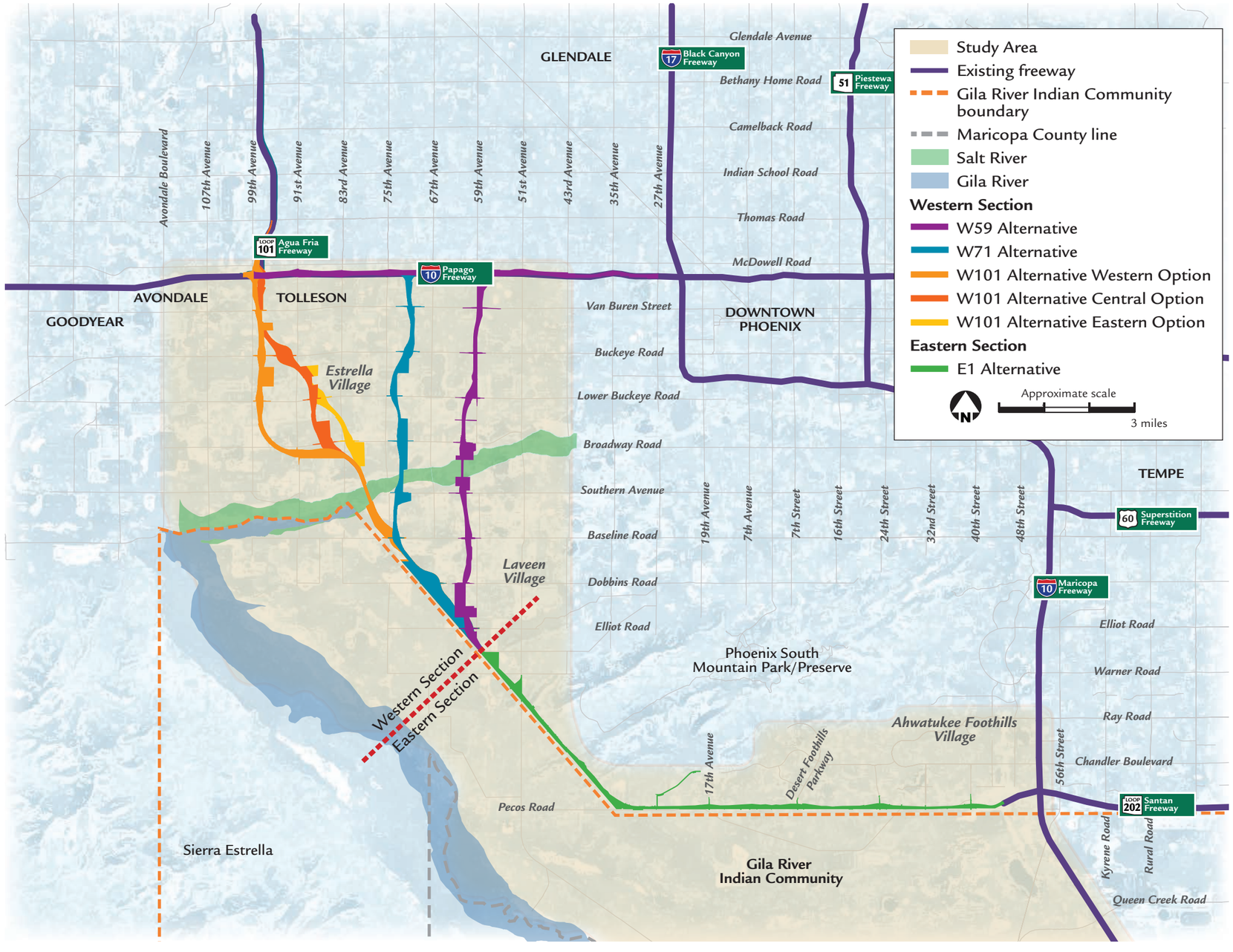
"Water quality limited waters" are water bodies assessed by ADEQ as having impaired quality and that need more than existing technology and permit controls to achieve or maintain water quality standards for intended uses in accordance with Section 303(d) of the Clean Water Act (CWA). The CWA Section 303(d) list identifies those waters that are impaired and the pollutant(s) causing impairment (ADEQ 2011). Several reaches of the Salt and Gila rivers are on the Section 303(d) list, including that portion of the Salt River in the Study Area.

The quality of the water in the Salt and Gila rivers is influenced by several factors. Total dissolved solids are the major constituent associated with degraded water quality. Sources of total dissolved solids in the Salt River may be traced to saline springs, mining operations, agricultural practices (including irrigation return flows), and other watershed activities associated with nonpoint source pollution (ADEQ 2011). Intermittent runoff from the existing road system in the Study Area is conveyed to the Salt River by storm drain facilities or washes or through percolation into the ground in areas not served by storm drains. Road runoff water quality may be impaired by suspended and dissolved contaminants from the road surface that contribute to degradation of surface water quality.

The Flood Control District of Maricopa County (FCDMC) has interconnected and shared drainage systems with the municipalities in the county, and stormwater discharges from nearly all its facilities have the potential to reach the Salt/Gila River system. Because of the shared drainage systems, FCDMC has been working with municipalities, EPA, and ADEQ to comply with the National Pollutant Discharge Elimination System and Arizona Pollutant Discharge Elimination System (AZPDES) regulations. Where possible, FCDMC has negotiated with multiple municipalities to locate, identify, and eliminate pollutants associated with regulated discharges. FCDMC also collects stormwater quality data for National Pollutant Discharge Elimination System permit compliance and inclusion in the FCDMC Regional Stormwater Quality database. As a result of collaboration with the municipalities on permit requirements, FCDMC operates a network of stormwater quality monitoring stations throughout Maricopa County. Sources of impacts on surface water quality in the Study Area include:

- nonpoint source pollution
- drainage from the southern side of the South Mountains near Ahwatukee Foothills Village

Figure 4-34 Major Surface Water Resources



The Salt and Gila rivers are the main water features in the Study Area. Portions of the Salt River have been subject to restoration projects in recent years (see the section, Waters of the United States*, beginning on page 4-108, regarding these projects).*

- Gila Drain discharges
- sand and gravel pit mining operations within and upstream of the Study Area

The Southeast Valley Regional Drainage System (SEVRDS) is part of a large watershed that drains the eastern portion of Maricopa County, including the area from Chandler to the Gila Drain. The Gila Drain discharges into the Gila River on Community land, west of Maricopa Road, near the Lone Butte Wastewater Treatment Facility. A stormwater detention facility provides treatment of stormwater to remove suspended sediment, nutrients, and other pollutants.

EPA has authorized ADEQ to operate the National Pollutant Discharge Elimination System and satisfy the requirements of Section 402 of the CWA at the State level. ADEQ implements the AZPDES permit program, regulating activities on nontribal lands resulting in the discharge of pollutants into jurisdictional waters. For most construction projects the program is regulated through the Construction General Permit. To satisfy Section 402 requirements, ADOT and its contractors file a Notice of Intent for coverage under the Construction General Permit with ADEQ and prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) to prevent erosion and the discharge of pollutants during construction. After construction is complete and the site is stabilized, ADOT and its contractors would file a Notice of Termination with ADEQ indicating that coverage under the Construction General Permit is no longer needed.

Municipal separate storm sewer systems (MS4s) convey stormwater runoff through drains, streets, and open channels, directly discharging untreated stormwater into retention basins, washes, rivers, or lakes.

Municipalities operating MS4s within local urbanized areas designated by EPA or ADEQ are required to obtain individual discharge permits under AZPDES authority. Large MS4s in the study area are operated by ADOT, Glendale, and Phoenix, which implement individual permits within the Study Area. Small MS4s in the Study Area are operated by Chandler, Goodyear, Tolleson, and Avondale.

ADOT's MS4 permit authorizes the discharge of stormwater and other discharges to jurisdictional waters for three elements:

- Activities associated with the MS4 operated by ADOT. ADOT is implementing a Statewide Stormwater Management Program to address operation of its MS4 facilities (i.e., culverts, outfalls); it includes best management practices (BMPs) development and implementation and monitoring of outfalls following storms.
- Activities associated with construction—from the commencement of construction activities until final stabilization—that are initiated and controlled by ADOT. Construction project activities are addressed similar to the Construction General Permit with implementation of a SWPPP and filing of Notices of Intent and Notices of Termination with ADOT and other MS4s having jurisdiction; however, ADOT has specific guidance for erosion control plans and SWPPPs.
- Facilities associated with industrial and maintenance activities owned and operated by ADOT (ADEQ 2008).

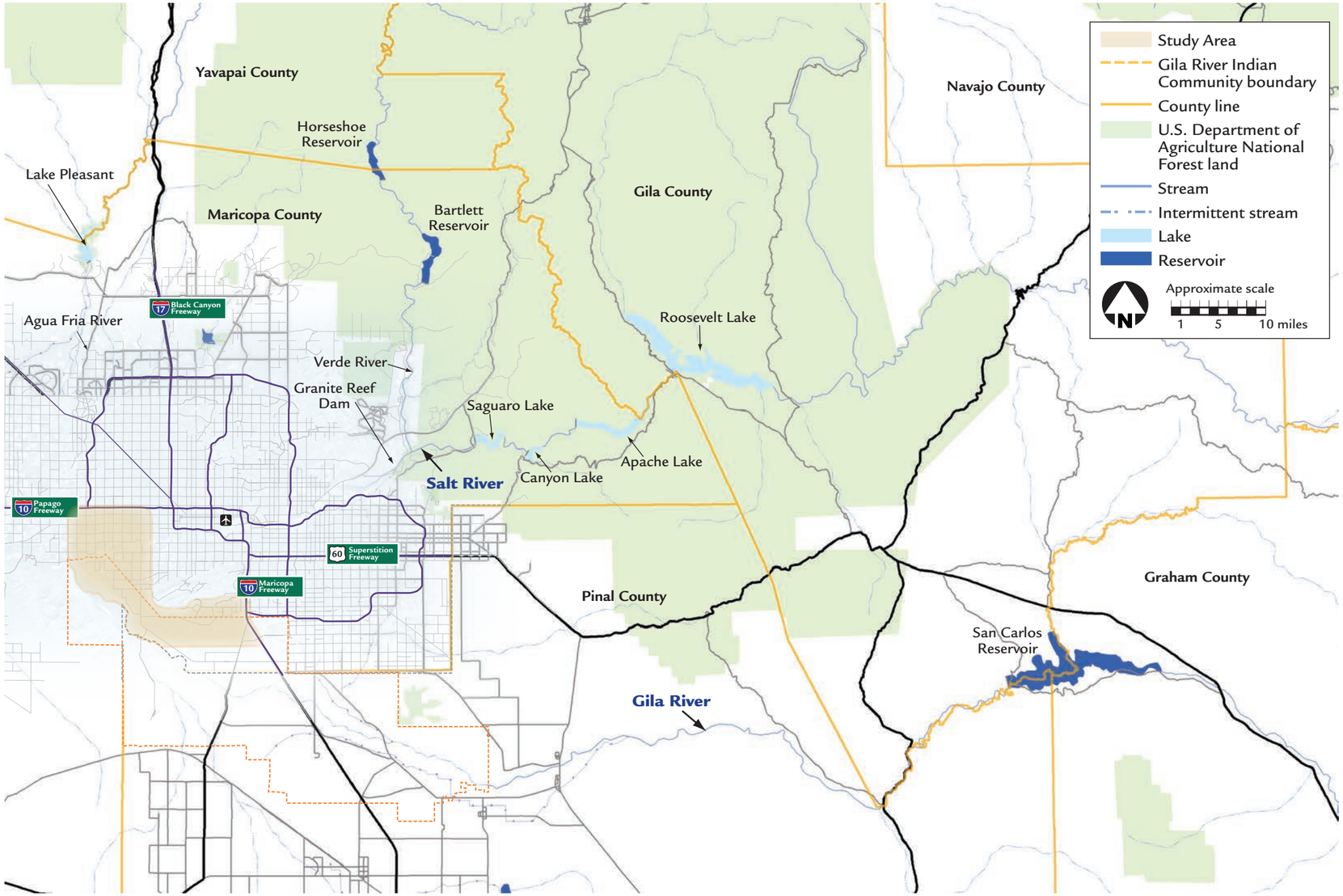
Groundwater

Groundwater Setting and Development

Groundwater is a source of public water supply in Arizona. In 1995, groundwater withdrawal in the Phoenix Active Management Area (AMA) supplied 39 percent of the total consumption of 2.29 million acre-feet (Arizona Department of Water Resources [ADWR] 1999). About 64 percent of the groundwater withdrawal was used for agriculture. The remainder was used for public water supply, industrial, domestic, and other purposes. Rapid population growth has resulted in the retirement of agricultural land and the conversion of agricultural groundwater supplies to urban uses. The availability of a suitable quality and quantity of water has influenced the development of cities and reduced the amount of agricultural land.

Issues created by groundwater overdraft include decreased water levels in aquifers and increased well drilling and pumping costs. Water quality may be an issue if groundwater pumped from greater depths contains more salts and minerals. In areas of severe groundwater depletion, the earth's surface may also subside, causing cracks or fissures that can damage roads, building foundations, and underground infrastructure.

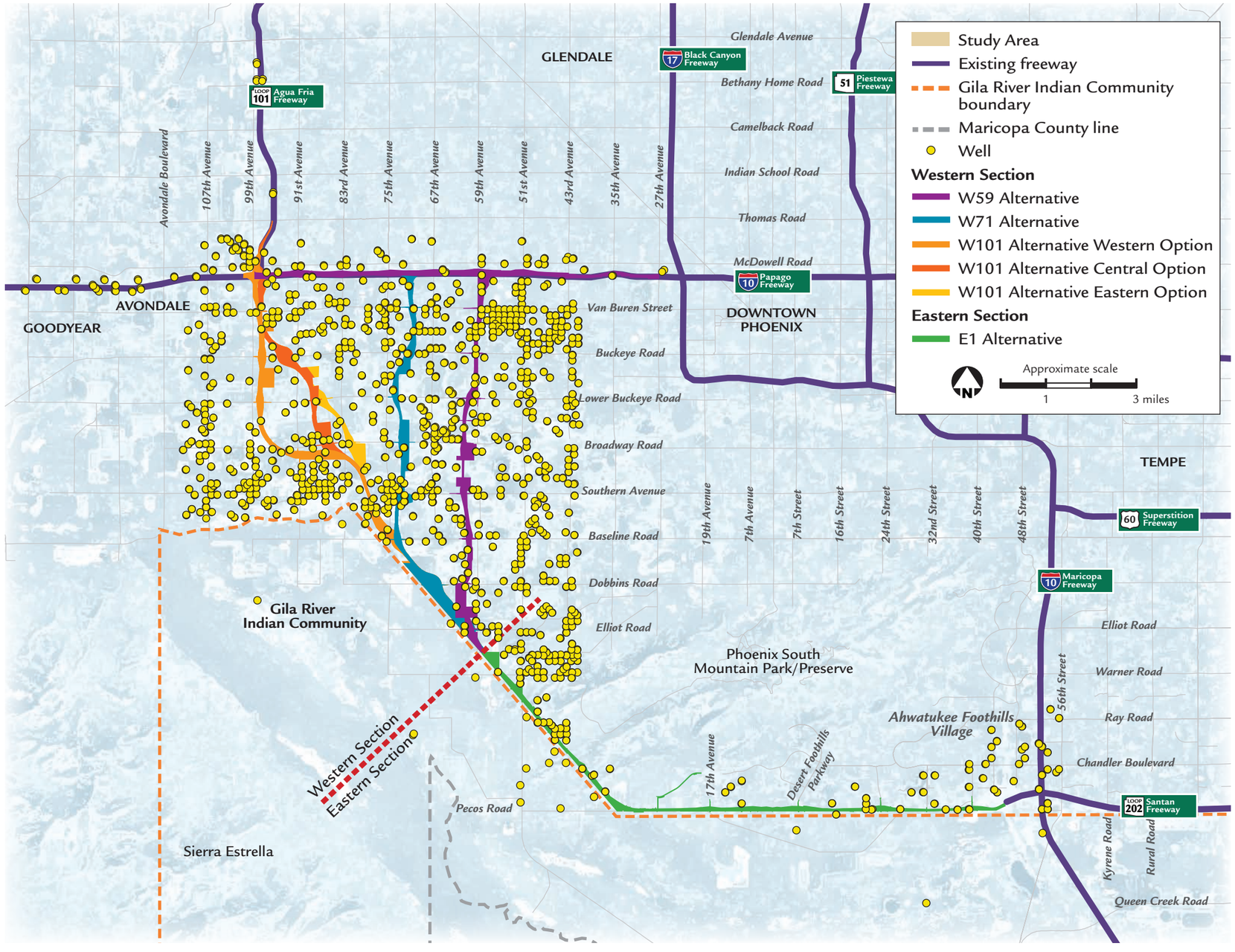
Figure 4-35 Watersheds in the Region



The Gila River Basin, which includes the drainages of the Salt and Verde rivers, is the primary influence on water resources in the Study Area.

The Study Area is located within two AMAs, each regulated by the State of Arizona through the Groundwater Management Act (ADWR 2011). Most of the Study Area is located in the Phoenix AMA. ADWR administers groundwater use through implementation of five successive management plan periods that will

Figure 4-36 Study Area Active Groundwater Wells



Extensive data gathering was undertaken to identify active wells in the Study Area. The wells serve varying purposes, from irrigation supply to drinking water supply.

result in a safe yield by 2025. *Safe yield* is the amount of groundwater pumped from AMA aquifers on an average annual basis and must not exceed the amount that is naturally or artificially recharged. Such an exceedance would "mine" the resource, i.e., deplete the water resource at an unsustainable rate. Water level declines in one subbasin of the Phoenix AMA can be offset by recharging water in another subbasin of the AMA. A small portion of the Study Area is located within the Pinal AMA. ADWR's management goal for the Pinal AMA is to preserve its agricultural economy for as long as feasible, while considering the need to preserve groundwater for future nonirrigation uses (ADWR 2011).

ADWR regulates the drilling, installation, and abandonment of groundwater wells. ADWR maintains a database containing annually updated well information. Active groundwater wells are located in the Study Area (Figure 4-36) (ADWR 2010).

The Roosevelt Irrigation District (RID) uses surface water and groundwater supplies and receives WWTP effluent from the City of Phoenix. Of the total amount of groundwater pumped by RID, approximately 85 percent is pumped from its well field in the southwestern portion of the SRP service area, just east of the Agua Fria River. RID annually purchases about 5,000 acre-feet of effluent from the City of Phoenix's 23rd Avenue WWTP. In addition, RID began annually taking 30,000 acre-feet of effluent from the City of Phoenix in 1995 through a water exchange agreement (City of Phoenix 2000).

SRP uses both surface water and groundwater pumped from its wells to meet its total delivery obligations.

The Buckeye Water Conservation and Drainage District (BWCDD) uses surface water and groundwater supplies, and receives WWTP effluent from the City of Phoenix. Groundwater makes up 12 to 18 percent of the total water supply for the BWCDD. In addition, up to approximately 40,000 acre-feet of effluent produced by the City of Phoenix's 91st Avenue WWTP is used by the BWCDD. The balance of water supply deliveries is from surface water diverted from the Gila River.

The irrigation districts in the Study Area (RID, SRP, and BWCDD) use groundwater wells and have both surface (canals) and subsurface (pipes) conveyance infrastructure associated with their operations. In addition, there are private, municipal, utility, and corporate-owned groundwater wells in the Study Area.

Groundwater Quality

Use of groundwater is limited by both the total content and the type of salt and mineral solids dissolved in the water. Generally, in the greater Phoenix metropolitan area, water containing more than 1,000 milligrams per liter (mg/L) of total dissolved solids is generally not preferred for potable water supply without treatment; water containing as much as 3,000 mg/L is, however, used for irrigation. The EPA secondary maximum contaminant level (SMCL)[33] (nonenforceable) for total dissolved solids is 500 mg/L for potable water supplies.

Groundwater quality in the Study Area generally satisfies existing EPA standards for drinking water, although the maximum contaminant level for nitrate (10 mg/L) and the EPA nonenforceable SMCL for dissolved solids is exceeded (U.S. Geological Survey [USGS] 2009). The West Van Buren Water Quality Assurance Revolving Fund (WQARF) site extends east-to-west beneath the Study Area between Van Buren Street and Buckeye Road. The WQARF site is regulated by ADEQ, and water quality in several of the groundwater well locations exceeds standards for VOCs (ADEQ 2006).

The following describes groundwater levels and general groundwater quality in the Western and Eastern Sections.

Western Section

- **Groundwater levels** – In the western portion of the Western Section, the depth-to-groundwater level varies from approximately 65 to 134 feet below ground surface, as reported by USGS for five measured wells from 1991 to 1997. In the north-central portion of the Western Section, near the Salt River, the depth-to-groundwater level ranges from 35 to 50 feet below ground surface, according to data collected from five wells from 1982 to 1992. In the southern portion of the Western Section, near Laveen Village, USGS data collected from four wells from 1923 to 1992 indicate the depth-to-groundwater level ranges from 9 to 40 feet below ground surface.
- **Groundwater quality** – In the western portion of the Western Section, USGS sampling results from five wells from 1951 to 1997 indicated that all five wells exceeded the EPA SMCL for chloride, which is 250 mg/L. Two of the wells also exceeded the maximum contaminant level for nitrate. In the north-central portion of the Western Section, near the Salt River, data collected from four wells from 1933 to 1997 show that all four wells exceeded the EPA SMCL for chloride and sulfate. The SMCL for both constituents is 250 mg/L. Two of the wells also exceeded the maximum contaminant level for nitrate. In the southern portion of the Western Section, near Laveen Village, USGS data collected from four wells from 1923 to 1992 revealed the SMCL for chloride and sulfate was exceeded in each of the wells. The maximum contaminant level for nitrate was exceeded in two of the four wells.

Eastern Section

- **Groundwater levels** – USGS groundwater level data (2009) in Ahwatukee Foothills Village were obtained for several wells from 1972 to 1992. Groundwater in this area is relatively deep, ranging from 97 to 117 feet below ground surface.
- **Groundwater quality** – Groundwater quality data from four wells from 1974 to 1983 indicated that the SMCL for chloride and sulfate was exceeded in each well (USGS 2009).

ENVIRONMENTAL CONSEQUENCES

This section describes water resource-related impacts that could result from the proposed action, including increases in sediment loading into receiving watercourses, release of pollutants generated by traffic, and erosion of unprotected banks. Impacts on water resources from construction activities are also discussed in the section, *Temporary Construction Impacts*, beginning on page 4-161.

Action Alternatives, Western and Eastern Sections

Surface Water

Regardless of the action alternative, pavement for the new road would increase the amount of impervious surface area, thereby increasing runoff quantities and peak flows during storms. Because the road surface would be impermeable, precipitation on the road would drain to catch basins and then to nearby natural channels. The increased runoff from the new impervious freeway surfaces would increase the transport of pollutants generated by vehicles using the freeway. This runoff would be transported from the road surface by the initial runoff generated during a storm. The most common impact would be the increase in pollutant loading into receiving waters. The action alternatives would concentrate vehicular traffic and the associated accumulation of pollutants throughout the road corridor. The total amount of road-related pollutants would be similar for each action alternative.

Mitigation, described in the section, *Mitigation*, on page 4-96, would reduce long-term impacts on water quality from operation of the road. In addition, the action alternatives would decrease regional and commuter traffic on the local road network. Runoff from the completed project would be directed to existing and new drainage facilities. Existing drainage facilities with inadequate capacity would be improved to handle increased runoff flows. New runoff detention facilities might be required in some locations to limit the maximum rate of runoff released to existing drainage facilities.

Several reaches of the Salt and Gila rivers are on the CWA Section 303(d) list, including that portion of the Salt River in the Study Area (ADEQ 2011). Increased pollutant loading from freeway operation might further impair listed reaches of the Salt River and might need measures in addition to existing permit controls to achieve or maintain water quality standards in accordance with CWA Section 303(d).

Construction activities such as clearing, grading, trenching, and excavating would disturb soils and sediment. If not managed properly, disturbed soils and

Ephemeral washes

An ephemeral wash has flowing water only during and for a short period following precipitation. Such washes are located in low areas and may or may not have well-defined channels. The washes are located above the water table year-round, so groundwater is not a source of water. Runoff from rainfall is the primary source of water for water flow.

Table 4-41 Potentially Affected Wells, Action Alternatives

Alternative/Option	Number of Wells
Western Section	
W59 Alternative	93
W71 Alternative	28
W101 Alternative Western Option	45
W101 Alternative Central Option	29
W101 Alternative Eastern Option	27
Eastern Section	
E1 Alternative	25

sediments can easily be washed into nearby water bodies during storms, where water quality is reduced.

Groundwater

Operational impacts on existing wells may include restricted access to the well casing or head, restricted use of the well, and safety issues associated with access to or use of the well. If a well were adversely affected by freeway operation, well abandonment and compensation (e.g., drilling a new well) may be required. According to ADOT's Right-of-Way Group, if the well were acquired, the water would be replaced. This would be accomplished through well replacement (drilling a new well in compliance with the 2006 ADWR well spacing and well replacement rules), or by well abandonment and compensation (if requested by the owner). Canal, ditch, well, or pipeline replacements may be needed.

All action alternatives could affect existing wells located within the proposed R/W (ADWR 2010). A field verification of wells would be conducted prior to construction of any action alternative.

Table 4-41 shows the number of wells potentially affected by each action alternative. This table was developed using information obtained from the ADWR database, which identifies wells as monitoring, piezometer, production, geotechnical, observation, domestic, test, irrigation, and abandoned. Abandoned wells have been included in the totals provided in Table 4-41. If a well were adversely affected by roadway construction, well abandonment and compensation (e.g., drilling a new well) may be required (see box on page 4-100 for additional information).

Action Alternatives, Western Section

Surface Water

In addition to the impacts identified as common to all action alternatives, the Western Section action alternatives would cross the Salt River and encroach into a federally mapped floodplain. If an action alternative were to become the Selected Alternative, runoff would be directed to drainage facilities that ultimately discharge to the Salt River. This runoff could temporarily increase contaminant concentrations in the river during periods of seasonal runoff. The impact of pollutant discharges to water quality would be directly proportional to traffic volumes on the proposed freeway.

Impacts on surface water (i.e., the Salt River) would depend on time of year and any associated flows. The Salt River bed is dry most of the year because of upstream flow diversions and SRP restrictions. If an action alternative were to become the Selected Alternative, however, a SWPPP would be prepared and would contain site-specific BMPs. In addition, the AZPDES permit would be consistent with discharge limitations and water quality standards established for the receiving water.

Several irrigation district conveyance canals, ditches, and pipelines would be crossed by the Western Section action alternatives (Figure 4-37). Impacts such as runoff discharge from the roadway to the irrigation district canals and conveyance ditches would be minimized by roadway design and the use of BMPs.

Groundwater

Affected wells that would need to be fully replaced (by drilling a new well) would be required to comply with the 2006 ADWR well spacing and well replacement rules pursuant to A.R.S. § 45-454(c). The rules, collectively called "well spacing rules," establish criteria for well spacing for certain new wells and well uses and define what constitutes a replacement well in approximately the same location.

Action Alternative, Eastern Section

Surface Water

In addition to the impacts identified as common to all action alternatives, the E1 (Preferred) Alternative could affect receiving water quality in the Gila River. Discharges of pollutants to ephemeral washes and, ultimately, to the Gila River would occur as a result of storms. The drainage design features of the E1 Alternative would be such that drainage patterns from the South Mountains toward the Gila River would not be altered. Currently, drainage flows generally from the north to the south, passing under Pecos Road through a series of culverts following natural drainages/washes. The E1 Alternative would include small drainage basins and channels on the northern side of the freeway to treat the water quality and meter and direct drainage flows under the freeway and onto Community land in the same manner as they are currently.

Groundwater

Affected wells that would need to be fully replaced (by drilling a new well) would be required to comply with the 2006 ADWR well spacing and well replacement rules pursuant to A.R.S. § 45-454(c). The rules, collectively called "well spacing rules," establish criteria for well spacing for certain new wells and well uses and define what constitutes a replacement well in approximately the same location.

No-Action Alternative

Project-related water quality impacts would not occur as a result of the No-Action Alternative. There would be no construction that could create project-related erosion or sediment deposits in existing watercourses or that could alter the existing groundwater. Because no new freeway facility would exist in the Study Area, pollutants associated with increased road runoff would not occur. As urban growth continues, traffic volumes would, however, likely increase on surface streets. As a result, pollutants would continue to be generated by the increased traffic on the surrounding road system and be dispersed over a larger area. Storms may cause erosion of exposed soil surfaces and subsequent runoff of sediment-laden water.

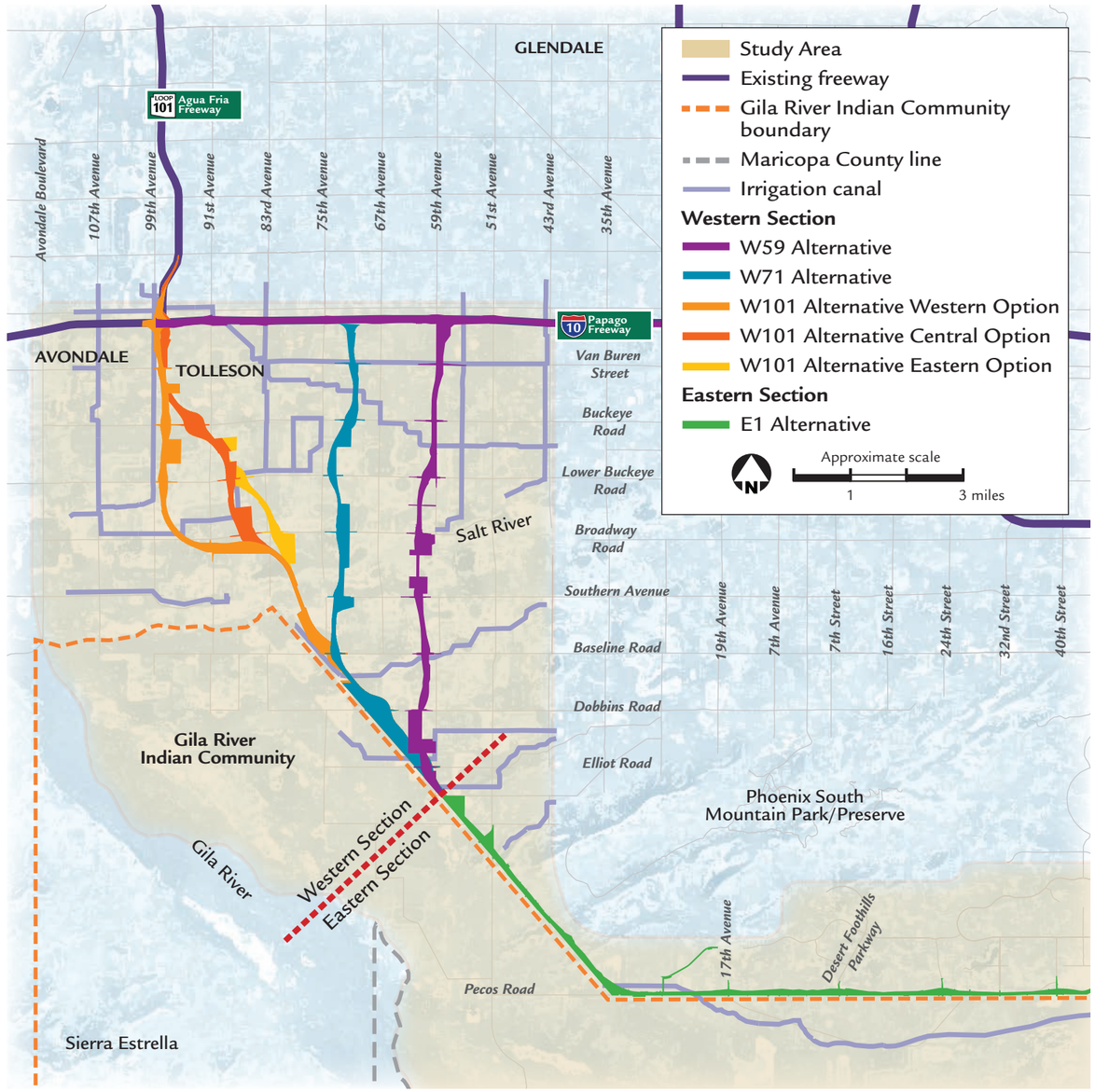
MITIGATION

None of the action alternatives would completely avoid causing impacts on water resources because any freeway in the southwestern Phoenix metropolitan area connecting to I-10 (Maricopa and Papago freeways) would cross the Salt River and ephemeral washes.

ADOT Design Responsibilities

Mitigation to reduce the quantity of pollutants reaching the Gila and Salt rivers is inherent in the design of the proposed freeway. All action alternatives would have

Figure 4-37 Irrigation Canals



An extensive network of irrigation canals is indicative of the region's long agricultural history.

properly designed roadway channels to resist erosion, energy-dissipating structures at all culverts where discharge velocity may cause downstream erosion, and sediment-trapping basins strategically located to maximize sediment removal and to function as chemical-spill containment structures.

Vegetative or mechanical means would be used to minimize erosion from cut and fill slopes. Vegetation would slow surface runoff, help bind soils, reduce raindrop impact, and break up flow patterns. Mechanical means include retaining walls, rock slope protection, and geotextiles such as matting. Where appropriate, retaining walls would decrease cut and fill slopes, which, in turn, would reduce runoff velocities and erosion potential. Rock slope protection, where placed, would armor the slope, thereby preventing soil movement. Geotextiles would prevent extensive contact between surface runoff and soil, keeping the soil intact.

Slopes along roadside channels and at discharge points from culverts may be steep, promoting erosion. Therefore, conveyance features may need protection in the form of channel lining, reduced slopes, or energy-dissipating structures. Impacts such as runoff discharge from the road to the irrigation district canals (east of 51st Avenue in the Eastern Section) and conveyance ditches would be minimized by roadway design and the use of BMPs.

To reduce the potential impact of contaminants such as oil, grease, soil, and trash, settling basins would be used to collect water and allow materials to settle. The basins could also serve to contain chemical spills resulting from vehicle accidents. Each basin would be designed to contain a certain rainfall runoff volume before allowing discharge. If an accident were to occur, and the basins were dry at the time of the accident, the spill volume, in most cases, could be accommodated. These settling basins would require periodic cleaning.

If an action alternative were to become the Selected Alternative, a construction AZPDES permit, for ground-disturbing activities exceeding 1 acre, would be obtained from ADEQ in accordance with the provisions set forth in Section 402 of the CWA (ADEQ 2008). The

Process to Find Replacement Water

In the area north of Pecos Road and west of 24th Street, the Foothills Community Association (FCA) owns a well that is used to provide irrigation water stored in five lakes distributed throughout the area. The proposed freeway alignment would likely necessitate acquisition of this well for the roadway R/W.

Members of the public expressed concerns about the loss of this well to the area. According to comments received, several wells have been drilled in the area and have either produced small amounts of water or no water. Because the FCA well is the highest-capacity well owned by the association and is associated with grandfathered water rights, its replacement would be considered vital to the FCA; therefore, clarification was requested regarding ADOT's process for assessing the value of the existing well and the procedures for well replacement.

The FCA's well (ADWR Identification No. 55-630347) is a part of the lake system that provides physical and aesthetic amenities to Foothills-area residents and to the golf course. According to the *Foothills Lake System Study* (FCA 1996), the well has a high capacity, capable of producing 730,000 gallons of water per day (gpd). The well is an integral part of the five-lake system, which 1) provides and stores irrigation water, 2) serves as an aesthetic feature, and 3) provides stormwater detention for area drainage. The lakes are interconnected by pressure and gravity piping, which allows water to be pumped to the lakes for storage and provides circulation as well as operational flexibility.

The *Foothills Lake System Study* states that the lakes are supplied by three water sources: reclaimed wastewater, groundwater from wells, and potable water supplied by the City of Phoenix. Irrigation of the golf course needs approximately 300,000 gpd in the winter and between 1.2 and 1.4 million gpd in the summer months. The lakes were designed with excess capacity that allows runoff to be stored. After a storm, water can be released at overflow points or be used to irrigate the golf course by being drawn down gradually.

The priority of water consumption for irrigation and maintenance of lakes is to first use reclaimed wastewater, then to use all well water available, and then, if necessary, to use City of Phoenix potable water as a last resort. Reclaimed wastewater generated from the treatment plant at 17002 South 7th Avenue is used for irrigation during the summer months. During the winter months, excess effluent is pumped to the lakes and, if not needed for irrigation, is discharged in accordance with the AZPDES permit. The wastewater is obtained from the Foothills Wastewater Reclamation Facility under a 60-year contract initiated with the City of Phoenix in 1988. This water source is more expensive than pumping from FCA's wells, but less expensive than obtaining potable water from the City of Phoenix.

Wastewater is more expensive than groundwater produced from a well and is of insufficient quantity to satisfy all irrigation needs, especially during the summer months. To meet the 1.2- to 1.4-million-gpd demand in the summer months, the wells are used to supplement the wastewater. The agreement with the City of Phoenix requires FCA to use its well water to the fullest extent before using City of Phoenix potable water.

The high-capacity well that may be acquired by the project and a second well (No. 55-630348, which has a capacity of 76,000 gpd and is not in jeopardy of acquisition) have Type 2 nonirrigation grandfathered water rights that allow a total of 45 acre-feet of groundwater to be withdrawn per year (40,176 gpd). According to the Arizona Groundwater Code, Type 2 rights can be used only for a nonirrigation purpose. The right is based on historical pumping of groundwater for a nonirrigation use and equals the maximum amount pumped in any one year between 1975 and 1980. Examples of nonirrigation uses include industry, livestock watering, and golf courses. Type 2 rights are the more flexible type of water rights because they may be sold separately from the land or well. In addition, the owner of Type 2 rights may, with ADWR approval, withdraw groundwater from a new location in the same AMA. It is possible to lease a portion of Type 2 rights, but if the rights are sold, they may not be divided; instead, the entire rights must be sold.

If the well were to be acquired, the water would be replaced, which could occur in a number of ways. Some of the methods of water replacement are summarized below.

ADOT's first choice would be replacement of the acquired well. ADOT prefers to pay well owners to replace the acquired well. This would involve negotiations with the well owner and a payment to the owner for associated replacement well costs. These costs could include, but not necessarily be limited to:

- costs of any hydrologic studies that may be required
  - according to ADWR regulations, if the replacement well is relocated within 660 feet of the existing well, no hydrologic study would be required; it is unknown at this time whether a new well could be located to meet this criterion; however, hydrologic studies may be required to determine the best location for a new well
- costs of exploratory drilling and final well development
- costs of reconnecting the new well to the lake system

ADOT's next choice would be to hire a contractor to perform the necessary studies on well placement and to drill a new well (not considered a replacement well by ADWR and assumed to be farther than 660 feet from the original well location). The well would then be provided to the owner of the acquired well. The preference would be to locate the new well on the former well owner's property; if additional R/W would be needed for the new well location, however, these costs would be included in negotiations. It is assumed that a new well location could be found that would produce water comparable in quality and quantity to the acquired well and that no change in the existing groundwater right would result.

It is understood that finding a suitable location for a new well in this area may be difficult. In the event that well replacement were not possible, ADOT would still replace the water that would be lost through the acquisition. As noted earlier, other sources of water are now used (wastewater and potable water) by the FCA. If well replacement were to be impossible, alternative sources of water may be provided. These replacement water sources would probably prove more costly than the pumping of wells; therefore, the difference between the costs of pumping the well and the new water source would be included in ADOT's negotiations with the well owner. In addition, the existing Type 2 water rights held by the FCA have value, and these rights could conceivably be lost if the well were not replaced. ADOT and the FCA would have to assign a value on the loss of the water rights, and this value would be included in the negotiations.

AZPDES permit must be consistent with discharge limitations and water quality standards established for the receiving water. Construction-related activities regulated under the permit are required to have a SWPPP, which would be prepared by the contractor.

To control construction-related pollution discharged to waters of the United States as defined in the CWA, ADOT would prepare erosion and sediment control plans, details, and specifications (see the section, *Waters of the United States*, beginning on page 4-106) set forth in the ADOT *Erosion and Pollution Control Manual for Highway Design and Construction* (ADOT 2005c). The contractor would use ADOT's project erosion and sediment control plans, details, and specifications to guide development of a SWPPP. BMPs set forth in the project erosion and sediment control plans, details, and specifications would be included in the contractor's SWPPP.

BMPs may include:

- Silt barriers (silt fences, compost-filled socks, or straw barriers) would be constructed to restrict and filter sediment flowing to off-site channels.
- Trapped silt and debris would be removed to an off-site location before removing barriers.
- Contamination from leaking equipment would be reduced or prevented through frequent construction equipment inspections. Faulty equipment would be repaired when discovered.
- Construction equipment would be cleaned on a regular basis to minimize potential runoff contamination from petroleum products.
- Sediment basins would be constructed to treat sediment-rich runoff before discharge to off-site drainage channels.
- Equipment would be fueled and serviced at designated locations to minimize work site contamination. These fueling locations would be located away from nearby channels, swales, or other features that would quickly facilitate movement in the event of a spill.
- Upon construction completion, all contaminated material (e.g., concrete wash water) would be

removed and disposed of in accordance with local, regional, and federal regulations.

Implementation of BMPs associated with any of the action alternatives would reduce water quality impacts on the receiving waters of the Salt and Gila rivers. Both construction and operational impacts may be mitigated through the use of BMPs.

ADOT would coordinate with appropriate governmental bodies such as flood control districts and the Community when designing drainage features for the proposed action (see section, *Drainage*, on page 3-58).

ADOT Right-of-Way Group Responsibilities

Existing groundwater wells within the proposed R/W may be abandoned or replaced, as necessary. New wells would be installed outside the proposed R/W in accordance with ADWR regulations. Groundwater wells can be replaced within 660 feet of the original location without a hydrogeologic analysis (ADWR 2006). If a well were affected by roadway construction, the well owner would maintain rights for the water (see box on this page). According to ADOT's Right-of-Way Group, if the well were acquired, the water would be replaced. This would be done through full well replacement (drilling a new well, in compliance with the 2006 ADWR well spacing and well replacement rules) or well abandonment and compensation (if requested by the owner).

Affected existing irrigation district canals may be relocated to allow for conveyance of irrigation water (through installation of pipe, conduit, or extension) from one side of the freeway to the other.

ADOT District and Contractor Responsibilities

To control construction-related pollution discharges to waters of the United States as defined in the CWA, ADOT will prepare erosion and sediment control plans, details, and specifications using BMPs from the ADOT *Erosion and Pollution Control Manual for Highway Design and Construction* (ADOT 2005c) and the ADOT *Post-Construction Best Management Practices Manual for Highway Design and Construction* (ADOT 2009b).

The contractor would use ADOT's project erosion and sediment control plans, details, and specifications as a guide in developing a SWPPP. BMPs set forth in the project erosion and sediment control plans, details, and specifications would be included in the contractor's SWPPP. The contractor would file a Notice of Intent and a Notice of Termination with ADEQ and MS4s (ADOT, Glendale, Phoenix, Chandler, Goodyear, Tolleson, and Avondale) in accordance with Section 402 of the CWA and provide copies to ADOT. ADOT would also comply with the State of Arizona Surface Water Quality Standard Rules (18 A.A.C. § 11).

The project would be located within designated MS4s. Therefore, the contractor, in association with the District, would send a copy of the certificate authorizing permit coverage and a copy of the Notice of Termination acknowledgement letter to the ADOT Office of Environmental Services Water Quality Group, Glendale, Phoenix, Chandler, Goodyear, Tolleson, and Avondale as appropriate based on the location of project activities.

Other measures that ADOT would undertake include:

- improving surface water quality when the freeway would be open to operation by proper maintenance of the retention, detention, and stormwater runoff facilities
- mitigating, as previously outlined, for wells that may be adversely affected during construction
- conveying affected irrigation ditches through pipe under the roadway
- securing CWA Section 401 certification by ADEQ
- relocating existing irrigation district canals that may be affected by the proposed action to allow for conveyance of irrigation water (through installation of pipe, conduit, or extension)

CONCLUSIONS

With implementation of any of the action alternatives, runoff from the action alternatives themselves would temporarily increase pollutant loading in surface water drainage during periods of seasonal runoff. Pollutant loading would be greatest with implementation of the W101 Alternative/E1 Alternative, primarily because the combined Western Section/Eastern Section action alternative would introduce the greatest amount of impervious surface into the Study Area. The differences in pollutant loading among action alternatives would be minor and the impacts from pollutant loading would be typical of such impacts experienced throughout the region's freeway system. Impacts would be effectively mitigated through the AZPDES and SWPPP permitting processes.

In the Eastern Section, runoff from the South Mountains passes under Pecos Road through a series of culverts following natural drainages/washes. The design of the E1 Alternative would alter the drainage pattern by use of a series of drainage detention basins to direct runoff to specific locations to discharge under the proposed freeway and onto Community land (see the section, *Drainage*, on page 3-58). Under the No-Action Alternative, increased traffic volumes on surface streets would contribute to increased pollutant loading dispersed over a larger area.

Additionally, implementation of any of the action alternatives would alter water well access or may require well abandonment. The W101 Alternative Eastern Option/E1 Alternative (when combining the Western and Eastern Sections) would affect 52 wells, the least of any action alternative; the W59 Alternative/E1 Alternative (the Preferred Alternative) would affect 118 wells, the most of any action alternative. The number of wells potentially affected would be consistent with that of a project the magnitude of the proposed action, and the well replacement program as outlined by State law has been regularly implemented by ADOT to effectively mitigate well impacts associated with its projects throughout the region.

4

FLOODPLAINS

AFFECTED ENVIRONMENT

A *base flood*, commonly referred to as a 100-year flood, is caused by a flood with a probability of occurring once every 100 years. The area where it occurs is referred to as the 100-year floodplain. To identify the locations and extent of the 100-year floodplains in the Study Area, two data sources were used. First, the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps were reviewed to determine the relationship of the proposed action to the boundaries of 100-year floodplains. Second, in areas where FEMA floodplain mapping was not available, geomorphology was used to identify and delineate any 100-year floodplains.

Because of the lack of FEMA floodplain mapping for the Gila River on Community land, geomorphology and aerial photography provided the best sources of data for analysis. Geomorphology is a type of geology that examines the structure of features along the ground surface. Geomorphologic analysis provided an understanding of the Gila River on Community land and the way the river might respond to imposed change, such as the influence of vegetative cover patterns, stream flow changes, and erosional and depositional changes (Rosgen 1996). Review of historical geomorphologic surveys and aerial photographs indicates a relatively stable Gila River channel profile over the last 90 years (Waters 2001).

An *encroachment* is an action within the limits of the 100-year floodplain. The regulatory floodway is the portion of the floodplain area reserved by federal, State, and/or local requirements in an unconfined and unobstructed manner to provide for discharge of a base flood so that the overall increase in water surface elevation is no more than 1 foot (not a significant increase), as established by FEMA. It is normally the channel defined by the ordinary high water mark (OHWM). Development in the floodway is allowed if it can be demonstrated that no rise in the base flood elevation will occur (Association of State Floodplain Managers 2003).

Existing Conditions

The FEMA Flood Insurance Rate Maps include Special Flood Hazard Areas (SFHAs), which are the 100-year floodplains. SFHAs are also areas where the National Flood Insurance Program floodplain management regulations must be enforced and where the mandatory purchase of flood insurance applies. SFHAs applicable to the proposed action are:

- **Zone A:** Areas subject to inundation by a 100-year flood that are generally determined using approximate methodologies. Detailed hydraulic analyses have not been performed; therefore, no Base Flood Elevations or flood depths are shown.
- **Zone A99:** Areas subject to inundation by a 100-year flood, but which will ultimately be protected from flooding upon completion of an under-construction federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, or levees, to consider the system complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion and when neither Base Flood Elevations nor depths are shown.
- **Zones AE and A1-30:** Areas subject to inundation by a 100-year flood that are determined by detailed methodologies. Base Flood Elevations are shown.
- **Zone AH:** Areas subject to inundation by shallow flooding under a 100-year flood (usually areas of ponding) where average depths are between 1 and 3 feet. Base Flood Elevations derived from detailed hydraulic analyses are shown in this zone.
- **Zone AO:** Areas subject to inundation by shallow flooding under a 100-year flood (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Some Zone AO sites have been designated in areas with high flood velocities such as alluvial fans and washes.
- **Zone AR:** Areas resulting from the decertification of a previously accredited flood protection system that have been determined to be in the process of being restored to provide base flood protection.

Moderate flood hazard areas are also shown on the Flood Insurance Rate Maps as Zone X. These are areas between the limits of the 100- and 500-year floodplains. Other flood areas labeled Zone X are areas of minimal flood hazard (areas outside the SFHA and higher than the elevation of the 500-year floodplain).

Areas in which flood hazards are undetermined, but possible, are shown as Zone D.

The Study Area crosses three 100-year floodplains. These are associated with an area north of the UPRR tracks that is intersected by an irrigation canal, the Salt River, and the Gila River (Figure 4-38).

A 100-year floodplain is located on the northern side of the UPRR tracks between 107th and 69th avenues. At approximately 73rd Avenue, the RID Canal crosses the railroad tracks, and an associated levee creates discontinuous 100-year floodplain areas north of the canal until it intersects with the Salt River floodplain to the east, outside of the Study Area. The SFHAs associated with this 100-year floodplain include Zones AH, AE, and X.

Because of dams and water diversions upstream of the Study Area, the Salt River is dry under normal hydrologic conditions. Floodplain widths along the Salt River vary from 1,900 feet near 79th Avenue to more than 7,000 feet in other Western Section Study Area locations. The SFHAs associated with this 100-year floodplain include Zones AH and X. The widest portions of the floodplain are associated with ponding that occurs in ineffective flow areas. The narrowest portions are where the floodwater conveyance is highest and the floodplain is contiguous with the floodway. The floodway width for the Salt River varies from 1,200 feet just upstream of 75th Avenue to 3,000 feet near the confluence with the Gila River.

FEMA mapping does not extend onto Community land upstream of the Gila River's confluence with the Salt River. The upstream areas (from the Salt River and Gila River confluence) are shown on the *Surficial Geologic Map of the Gila River Indian Community, Arizona* (Waters 2001). The streambed alluvium (designated T-0) and Holocene Terrace (T-1) geomorphology correspond with the floodplain mapping at the confluence of the Gila and Salt rivers. Determination of specific flood hazards is difficult because of limited information, which includes the *Surficial Geologic Map of the Gila River Indian Community, Arizona*, topographic information, and existing drainage studies. Areas downstream of the confluence of the Salt and Gila rivers—south of Baseline Road and west of 99th Avenue—are mapped as Zone D.

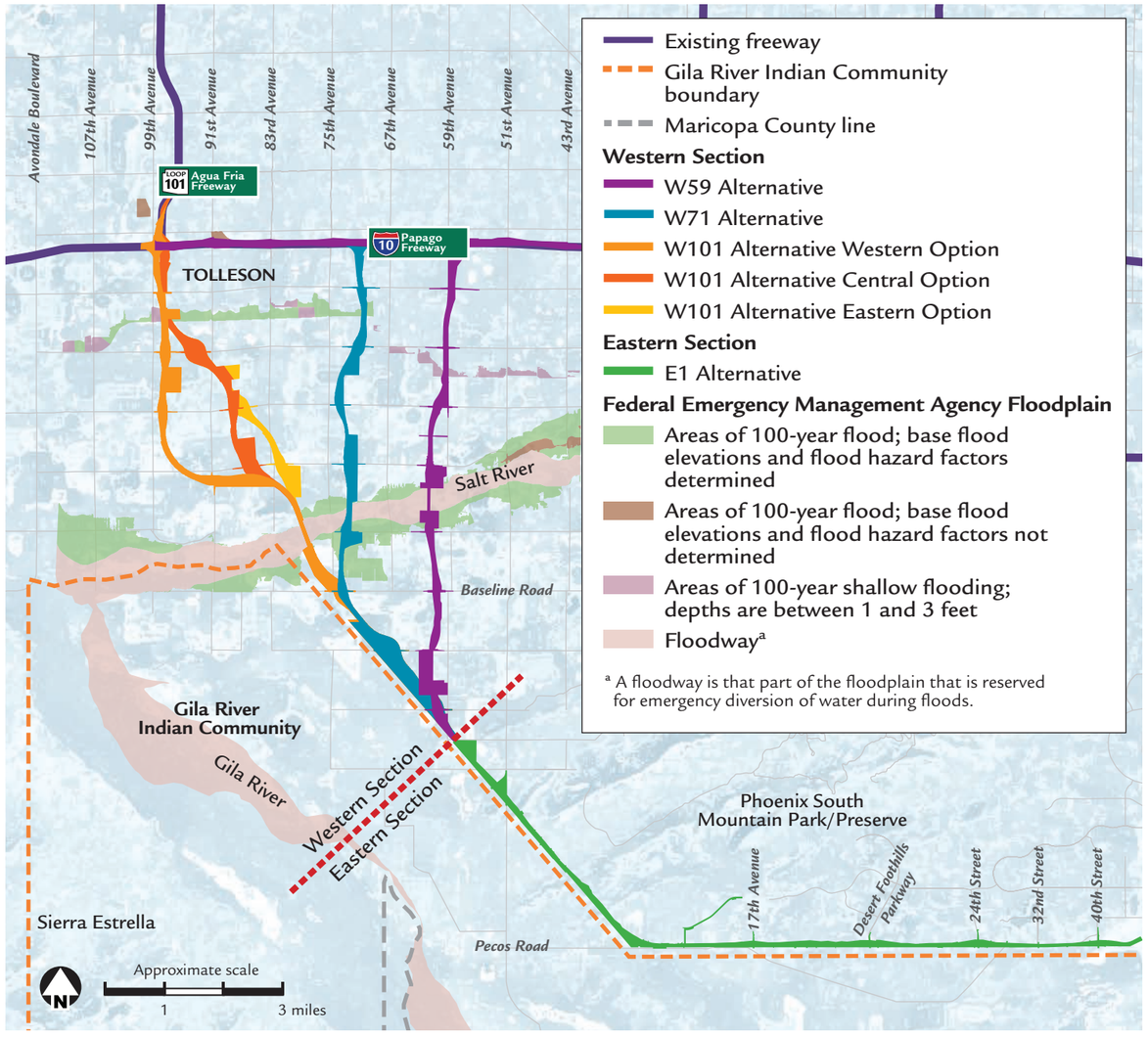
Watercourse Descriptions

Salt River

The Salt River is the largest tributary in the Gila River Basin, with its headwaters in rugged mountain terrain at elevations exceeding 7,000 feet in northern Arizona. The Salt River enters the Gila River at the western edge of the greater Phoenix metropolitan area. The Salt River watershed is approximately 5,980 square miles in size. Prior to construction of upstream water supply dams, the Salt River was perennial. Historical records indicate the Salt River had a wide, braided channel and experienced annual floods. Above its confluence with the Gila River, the Salt River has estimated 100- and 500-year peak discharge capacities of 162,000 cubic feet per second (cfs) and 235,000 cfs, respectively (USACE 2000).

Throughout the Study Area, flows in the Salt River are controlled by six upstream water supply and hydropower dams operated by SRP. Only the Roosevelt Dam, on the Salt River, now has allocated flood control storage that may be used to diminish peak flood flows through controlled releases. The other dams must release water in anticipation of flood flows to provide any attenuation. The Salt River largely remains dry downstream of the dams. In addition, during the past two decades, the riverbed has undergone substantial changes because of urbanization and sand and gravel mining. These activities have generally narrowed and deepened the main channel. In some portions of the Salt River, water has been reintroduced. Examples of this include development of Tempe Town Lake and construction of the City of Phoenix 91st Avenue WWTP. In 1999, the City of Tempe impounded the Salt River behind an innovative, inflatable rubber dam to create the 200-acre Tempe Town Lake. In times of high upstream discharges from the reservoirs, the dam can be rapidly deflated to allow peak flows to pass into the main channel.

Figure 4-38 100-year Floodplains



The Salt River floodplain is the more prominent of the two delineated floodplains in the Study Area.

Gila River

The reach of the Gila River upstream of the Salt River confluence and downstream of the Coolidge Dam (San Carlos Reservoir) has a watershed characteristic of the Basin and Range lowlands province. The Gila River watershed (located in Arizona and New Mexico) is approximately 57,900 square miles in area. Two dams on the Gila River system, upstream of the Salt River confluence, help regulate flow. Coolidge Dam, primarily a water supply dam, is located on the Gila River upstream of the confluence of the San Pedro and Gila rivers. Tat Momolikot Dam is a flood control facility located on Santa Rosa Wash. The estimated 100-year discharge capacity for the Gila River, downstream of the Salt River confluence, is 227,000 cfs (USGS 1989).

The Gila Drain is an SRP irrigation return flow channel that discharges to the Gila River. The Gila Drain conveys minor flood flows and irrigation tailwater from areas northeast of the Study Area into the Study Area at I-10 and Pecos Road. Flows from the drain are ultimately discharged into the Gila River on Community land (ADOT 1998). Flows are captured in the Gila Drain, which passes east-to-west through the Study Area and under 51st Avenue south of St. Johns (Komatke), on Community land. Larger flows that cannot be contained in the Gila Drain can be expected to break out into the Gila Drain Floodway. The Gila Drain Floodway watershed includes outflow from the 48th Street Basin, SEVRDS/Santan Channel Detention Basin, and miscellaneous irrigation return water flows. The SEVRDS is part of a large watershed that drains the eastern portion of the Phoenix metropolitan area. The SEVRDS/Santan Channel intercepts the off-site flow originating in this watershed and ultimately discharges these flows to the Gila Drain Floodway. The detention facility provides treatment of "first-flush" stormwater to remove suspended sediment, nutrients, and other pollutants. Flows from the Gila Drain enter the Gila River west of the community of St. Johns (Komatke), on Community land.

Summary of Flooding Risk and Flooding History

Flooding risk is based on the potential for damage during a 100-year or lesser flood. Several factors unrelated to the proposed action may affect flooding risk. These include operation of the upstream reservoir system on the Salt River, future water resource facilities, and sand and gravel mining activities. Changes in water-related facilities include modifications completed in the late 1990s to Roosevelt Dam to increase its height and reservoir storage capacity. The increased height of the dam is intended to provide dedicated flood control storage for runoff from the upper Salt River Basin.

Major flows occur in the Salt and Gila rivers only when water is released from the upstream water storage facilities. These releases occur when runoff from the watershed is expected to exceed the capacity of the reservoirs. Smaller flows may result from storms within the watershed downstream of dams. Studies of rainfall and runoff relationships indicate that the greatest runoff quantities and resultant floods occur in the winter season. Floods of record within the watershed include:

- 300,000 cfs in 1891 on the Salt River prior to completion of the dams within the system
- 250,000 cfs in 1891 on the Gila River downstream of the confluence with the Salt River, at Gillespie Dam
- 212,000 cfs in 1980 on the Salt River (largest since construction of the dams within the system)
- 32,850 cfs in January 1993 on the Gila River upstream of its confluence with the Salt River (Maricopa County Department of Emergency Management 2005)
- 17,594 cfs in January 2010 on the Gila River downstream of the confluence with the Salt River, at 116th Avenue (FCDMC 2010)

Flood flows in the river systems continue to have the potential to alter the human-modified and natural landscapes. There have been five floods on the Salt River in excess of 100,000 cfs since 1978: 1978 (two), 1980, 1983, and 1993. Flood damage potential has been reduced by upstream dam improvements. Major 2004 winter storms (December) in the Salt River watershed prompted SRP to release 30,000 cfs from Granite Reef Dam into the Salt River, requiring the deflation of the Tempe Town Lake Dam. This was the first release into the Salt River since Tempe Town Lake was constructed. A second release from Granite Reef Dam began in the fall of 2010 to refill Tempe Town Lake after replacement of the last of the dam's four large rubber bladders. (One of the bladders failed and drained the lake at a rate of 15,000 cfs in July 2010. The other three bladders were also replaced under a planned replacement schedule.) The area at the confluence of the Gila and Salt rivers has experienced numerous floods, with property damage through inundation and scouring effects. Wildlife habitat restoration and associated flows from the 91st Avenue WWTP are being addressed through USACE, Los Angeles District (*Tres Rios Arizona Feasibility Report* [USACE 2000]).

Flooding in the northern portion of the Western Section of the Study Area is caused by the interception of sheet flow from the rise in ground elevation associated with the UPRR railbed and the RID Canal channel.

ENVIRONMENTAL CONSEQUENCES

Action Alternatives, Western Section

All Western Section action alternatives would affect floodplains. Two 100-year floodplains would be affected: one associated with the Salt River and one north of the UPRR tracks (referred to as the UPRR floodplain). FHWA policies and procedures for the location and hydraulic encroachments on floodplains are set forth in 23 C.F.R. § 650. This section of the DEIS summarizes the evaluation of the proposed action in relation to applicable provisions of those regulations, including flooding risks, impacts on natural and beneficial floodplain values, probable incompatible floodplain development, measures to minimize floodplain impacts, alternatives to encroachment, and the potential for significant encroachment.

All Western Section action alternatives would laterally cross the Salt River and UPRR floodplains. The Salt River has an associated federally mapped floodplain and regulatory floodway. The UPRR floodplain is federally mapped, but, unlike the Salt River floodplain, it is not associated with a regulatory floodway. There is no alternative to crossing the Salt River or the UPRR floodplain because both form a continuous east-to-west feature across the Study Area. All Western Section action alternatives would result in limited encroachment on the floodplain and limited flooding risk.

Table 4-42 lists estimates of floodplain encroachment for the W59 (Preferred) Alternative and the other Western Section action alternatives and options. The estimates of encroachment include all the area within the proposed R/W of each action alternative; thus, more than just the project footprint (e.g., that area occupied by freeway structures and fill needed to create or stabilize these structures) is included. The floodway acreage is included in the Salt River floodplain total.

The acreage estimates are the potential extent of encroachment if the roadway were completed entirely on embankment fill. The extent of encroachment is expected to be smaller than that shown in Table 4-42, which would further reduce flooding risk in the Study Area. The Salt River floodplain crossings would include bridges, and the UPRR floodplain crossings would include either bridges or flood mitigation structures, such as basins and diversion structures. Minor design modifications that could further mitigate floodplain impacts, if warranted, are typically considered during the design process.

The W101 Alternative would have the least overall floodplain encroachment potential. In addition, the W101 Alternative would have the least potential for encroachment on the floodplain associated with the Salt River. The W71 Alternative would have the greatest potential for encroachment on the UPRR floodplain. The W71 Alternative would also have the potential to encroach on the greatest amount of floodplain in the Study Area.

Risks Associated with the Proposed Action

Risks are the consequences associated with the probability of flooding attributable to encroachment. The mitigation measures described in the section, *Mitigation*, beginning on page 4-106, would minimize the potential for property loss or hazard to life. Developments south of the freeway in the Western Section would have a higher level of flood protection than now exists because the freeway off-site drainage system would be designed to collect runoff for up to a 100-year storm, which would protect the freeway from flooding and, additionally, anything downstream of the freeway.

Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values associated with the Salt River floodplain include:

- wildlife habitat
- open space
- scientific research opportunities
- outdoor recreation
- agriculture
- natural flood control
- mining and industry (building material source)
- water quality maintenance
- groundwater recharge

As previously mentioned, the Salt River has been substantially altered from its natural condition. Control of flow by upstream dams and reservoirs has resulted in the channel being dry throughout most of the year. Major flow occurs only when water is released from the upstream facilities. The dry channel has been subject to sand and gravel operations, which have further altered the channel configuration. These alterations can increase some beneficial values and decrease others, such as wildlife habitat.

Because of these altered conditions, freeway facilities would not further diminish the natural floodplain values. Open space and outdoor recreational opportunities would be preserved. Because of urbanization adjacent to the Salt River and the continuing sand and gravel mining operations, wildlife habitats in the affected areas are of low value. The ability for wildlife to move freely within the remaining habitat would continue because bridges associated with any of the action alternatives would not impede movement. Therefore, the proposed action would not diminish values of remaining habitat. Bridge piers would have a negligible impact on the floodplain's capacity for groundwater recharge. Other activities, within the definition of natural and beneficial values, are not known to occur in the affected areas. Therefore, the proposed action would have no such impacts.

Table 4-42 Estimated Acreage of Floodplain Impacts, Western Section, Action Alternatives

Action Alternative/ Option	Salt River Floodplain Encroachment[a]	Union Pacific Railroad Floodplain Encroachment[a]	Total Floodplain Encroachment[a]
W59	53	4	57
W71	117	10	127
W101 Western Option	19	33	52
W101 Central Option	19	29	48
W101 Eastern Option	19	29	48

Note: There are no designated floodplains in the Eastern Section.
[a] based on right-of-way footprints

Support of Incompatible Floodplain Development

The 100-year floodplain associated with the Salt River is dominated by agriculture, mining, and undeveloped open space. Each Western Section action alternative and option would be a controlled-access facility and would cross the 100-year floodplain with structures above the 100-year floodwater surface elevation. Floodplain management regulations are enforced by FCDMC, with statutory authority as prescribed under A.R.S. §§ 48-3603 and 48-3609. In addition, the action alternatives and options are consistent with existing

development plans of the City of Phoenix and Maricopa County (see the section, *Land Use*, beginning on page 4-3). The freeway would provide improved access to future development, which, in turn, would be consistent with floodplain regulations. The action alternatives would not contribute to incompatible floodplain development.

Measures to Minimize Floodplain Impacts

The measures described in the section, *Mitigation*, beginning on this page, would be effective in minimizing impacts associated with encroachments into 100-year floodplains.

Alternatives to Encroachment

Potential encroachments into 100-year floodplains are quantified in Table 4-42. Encroachments on the Salt River floodplain and the UPRR floodplain by any of the Western Section action alternatives and options were determined to be unavoidable. Both floodplains extend across the entire width of the Western Section of the Study Area. The location of the encroachments correlates to the established western logical terminus at I-10 (Papago Freeway) for any of the action alternatives and options.

Potential for Significant Encroachment

Significant encroachment, as defined in 23 C.F.R. § 650, Subpart A, would occur when the highway encroachment and any base floodplain development would involve one or more of the following construction or flood-related impacts:

- interruption or termination of a transportation facility needed for emergency vehicles or one that provides a community's only evacuation route
- significant risk
- significant adverse impact on natural and beneficial floodplain values

Regardless of action alternative, the proposed action would not have the potential to interrupt or terminate transportation facilities needed for emergency vehicles or emergency evacuation routes. The proposed action would neither create a substantial risk nor adversely affect natural or beneficial floodplain values. Therefore, the proposed action would not have a significant encroachment on floodplains.

Action Alternative, Eastern Section

The E1 (Preferred) Alternative would not cross any federally mapped floodplains. The Eastern Section action alternative would have no impact on floodplains in the Study Area.

No-Action Alternative

The No-Action Alternative would have no impact on floodplains in the Study Area. Growth projections supported by affected jurisdictions' planning policies for the Phoenix metropolitan area, however, indicate that land in the Study Area will be developed within the next 20 years. If a freeway were not constructed, it is expected that floodplains would need to be crossed in several locations at major arterial streets to enable transportation into and out of the Study Area. Some streets now cross the Salt River at grade and have been periodically closed because of minor channel flooding.

MITIGATION

Mitigation of the 100-year floodplain encroachments of the Western Section action alternatives would be accomplished by constructing bridge and culvert structures, where appropriate, to accommodate 100-year floodwaters. Design changes would be evaluated during the project design phase to further mitigate the impact.

The proposed action would affect floodplains. The Salt River and UPRR floodplains extend across the entire width of the Western Section of the Study Area. The location of the encroachments correlates to the established western logical terminus at I-10 (Papago Freeway) for all of the action alternatives and options.

Mitigation measures would minimize the potential for property loss or hazard to life. Developments to the south and west of the freeway in the Western Section would have a higher level of flood protection than now exists. The following describes measures to minimize impacts on floodplains as a result of the proposed action.

None of the action alternatives would completely avoid causing impacts because any freeway in the southwestern Phoenix metropolitan area and located near the Salt and Gila rivers would necessarily encroach onto floodplains.

ADOT Design Responsibilities

The Maricopa County Floodplain Regulations define a *floodway* as "the channel of a river or other watercourse and the adjacent land areas necessary in order to discharge the 100-year flood without cumulatively increasing the water surface elevation more than one foot." The floodway is the stream channel and the portion of the adjacent floodplain that must remain open to permit passage of a base flood. Bridge structures for all of the action alternatives would be designed to cross floodplains in such a way that their support piers and abutments would not contribute to a rise in floodwater elevation of more than a foot. Floodplain impacts would be minimized by implementing transverse crossings of the floodplains and avoiding longitudinal encroachments. Any of the action alternatives would require comprehensive analyses of hydrology, hydraulics, sediment transport, and erosion to minimize the impacts of encroachment. ADOT would conduct these analyses during the design phase. As indicated in Section 505(a) of the Floodplain Regulations for Maricopa County:

> In accordance with A.R.S. § 48-3613, written authorization shall not be required, nor shall the Board prohibit the following except that before any construction authorized by this subsection may begin, the person shall submit plans for the construction to the Floodplain Administrator for review and comment: a. Construction of bridges, culverts, dikes and other structures necessary to the construction of public highways, roads and streets intersecting or crossing a watercourse.

The Maricopa County Floodplain Manager would be given an opportunity to review and comment on the design plans.

On-site Drainage

Design criteria for on-site drainage would be based on ADOT's *Roadway Design Guidelines* (2007a) and

Highway Drainage Design Manual – Hydrology (1993) and on FHWA's *Urban Drainage Design Manual* (2001b).

Off-site Drainage

ADOT's *Roadway Design Guidelines* (2007a) provides criteria to be used for off-site flows affected by the proposed action:

- Culverts would be sized based on the design discharge of a 100-year storm.
- Increases in water surface elevations as a result of the new facilities would be contained within the existing and proposed R/W or as noted in accordance with Section 611.3.C.
- Culverts would be designed to be self-cleaning, Section 611.3.E.
- Reinforced concrete box culvert and reinforced concrete pipe would be provided with adequate cover.

If an action alternative were to become the Selected Alternative, it would need comprehensive hydrologic, hydraulic, sediment transport, and erosion-related assessments regarding potential 100-year flood effects associated with ephemeral washes. Results would provide information necessary to make a determination regarding what mitigation measures would need to be implemented. Measures may include physical structures associated with the freeway such as culverts. These measures would be determined during the design phase.

CONCLUSIONS

Implementation of any of the Western Section action alternatives would involve crossing the Salt River and UPRR floodplains, with the W71 Alternative having a substantially greater impact on floodplain acreage (127 acres) than would either the W59 (Preferred) Alternative (57 acres) or W101 Alternative and its Options (48–52 acres). Regardless of the action alternative identified as the Selected Alternative, if an action alternative were to be so identified, impacts on the overall natural and beneficial values of the floodplain would be negligible. The differences in floodplain impacts among action alternatives in the Western Section would be inconsequential, and impacts from floodplain encroachment would be effectively mitigated through an elevated crossing (on piers) of the floodplain, using appropriate bridge design. Under the No-Action Alternative, continuing urbanization in the foreseeable future would likely lead to further encroachment into federally mapped floodplains.

The E1 (Preferred) Alternative would not cross any federally mapped floodplains.

WATERS OF THE UNITED STATES

USACE administers Section 404 of the CWA, which regulates the discharge of dredged or fill material into waters of the United States (jurisdictional waters; see sidebar on page 4-110), including wetlands. USACE regulates jurisdictional waters through permitting, using nationwide and individual permits. Types of waters of the United States that are regulated include ephemeral washes, intermittent and perennial streams, springs, riverbeds, wetlands, and other special aquatic sites. The physical attributes of a water body are a key component of the waters of the United States determination. The types of activities that may affect jurisdictional waters are fundamental to the associated permitting requirements and development of appropriate mitigation measures.

Figure 4-39 Waters of the United States, Western Section

Note: Widths of canals, washes, and laterals are not to scale.

Waters of the United States are associated with ephemeral washes, canal laterals, and the Salt and Gila rivers.

AFFECTED ENVIRONMENT

Jurisdictional waters in the Study Area include ephemeral washes and the Salt and Gila rivers. No springs, wetlands, or other special aquatic sites have been identified in the Study Area. The guidance for identifying existing conditions for jurisdictional waters was:

- USACE regulatory guidance letter (No. 08-02) for jurisdictional delineations, dated June 26, 2008 (USACE 2008a)
- discussions with USACE regarding the method of identifying waters of the United States in Arizona, including ephemeral washes and the Salt River channel
- field investigation of waters of the United States to determine jurisdictional limits
- CWA jurisdictional memorandum and guidance to EPA regions and USACE districts regarding the Supreme Court decision in the consolidated cases *Rapanos v. United States* and *Carabell v. United States* (December 2, 2008)

Field delineation of ephemeral washes in the Eastern Section was conducted in 2003. All delineations were conducted in accordance with *USACE Wetland Delineation Manual* (USACE 1987), *Guidelines for Jurisdictional Determinations for Waters of the United States in the Arid Southwest* (USACE 2001), and *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid Region of the Western United States* (USACE 2008b).

No field verifications have occurred since 2003. At that time, USACE concurred that the ephemeral washes identified are jurisdictional. Guidance from EPA and USACE (2008) calls for these determinations to be revisited with USACE. This process will occur prior to the FEIS.

Western Section

Approximately 9 linear miles of the Salt River channel are within the Study Area. The Salt River channel is considered a water of the United States. The channel functions as a surface water conveyance system and offers some attenuation of flood flows (Arizona Floodplain Management Association 2000). The channel may trap suspended sediment and retain nutrients from discharge flows, thus serving a water quality function. The Salt River is oriented from east to west across the Western Section of the Study Area from 39th to 111th avenues. The Salt River channel is surrounded by cultivated fields and various forms of development (residential, commercial, and industrial). These areas are relatively flat, with drainage patterns having been altered by land use practices. Numerous irrigation supply, feeder, and return channels have been constructed in the upland agricultural areas. Figure 4-39 illustrates waters of the United States in the Western Section of the Study Area.

Several locations in the Salt River channel have been mined for aggregate material, and, as a result, there are several abandoned or active aggregate extraction pits. The pits may intercept groundwater and may have varying depths of water, depending on time of year and fluctuating annual hydrologic cycles. Consultation with the USACE Arizona office regarding these mined areas, however, resulted in a determination that the former gravel mining pits are not jurisdictional wetlands.[34]

The Tres Rios Constructed Wetlands Demonstration Project includes three separate facilities near the 91st Avenue WWTP (USACE 2000). These constructed wetlands do not exhibit the three wetland criteria (hydrophytic vegetation, hydric soils, or wetland hydrology) and are not considered to be jurisdictional.

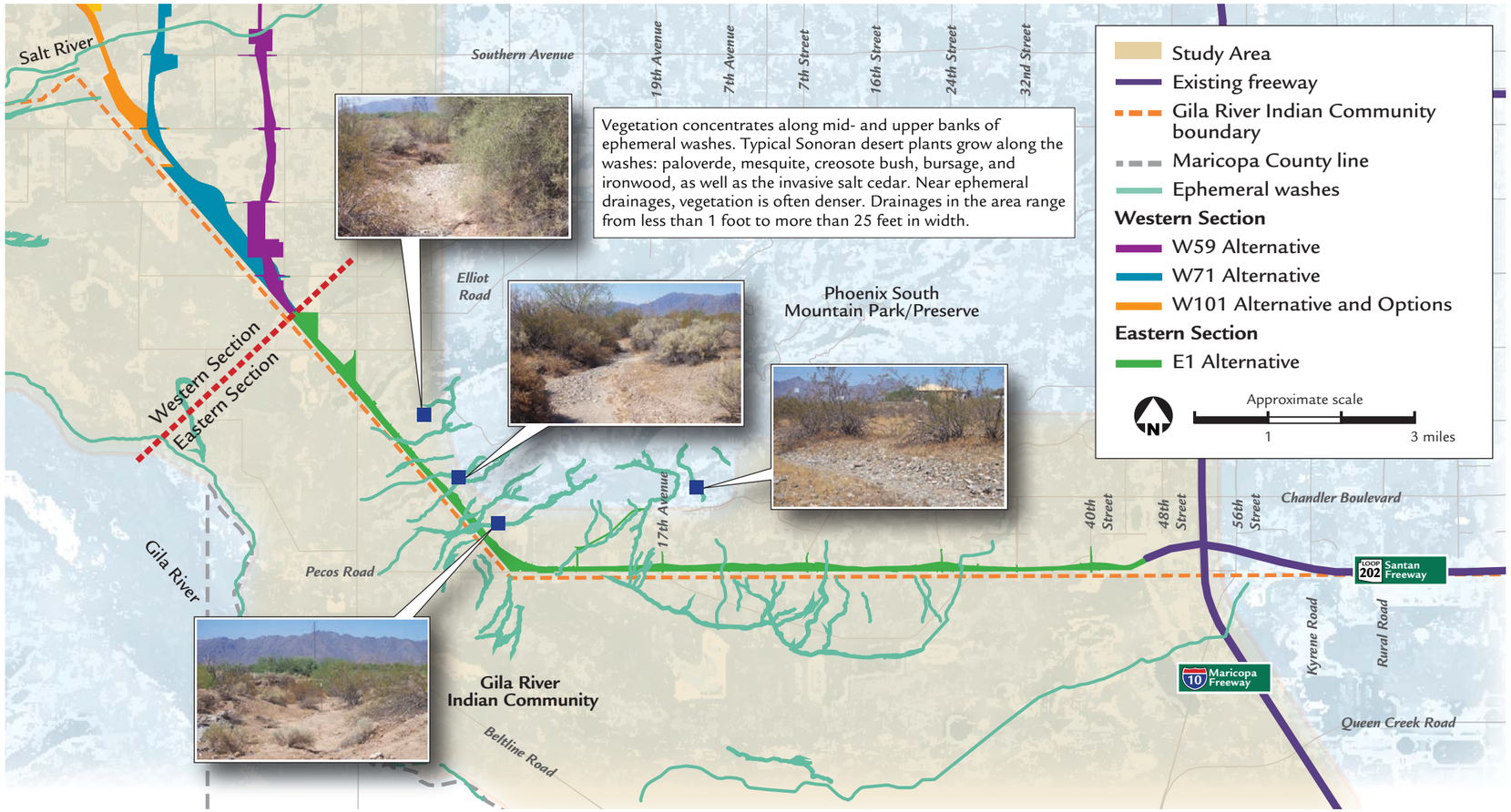
Eastern Section

The Eastern Section of the Study Area contains numerous ephemeral washes that drain the southern

side of the South Mountains and their associated foothills. These ephemeral washes, which are potentially jurisdictional waters, trend to the south or slightly southwest and discharge to either the Gila River (south of the E1 Alternative) or to the inactive agricultural fields along the border of Community land. Residential development along the foothills of the South Mountains has altered some drainages and washes. The delineated washes are shown in Figure 4-40.

These channels and drainages vary from less than 1 foot to more than 25 feet in width. The channel substrate also varies, but is generally bedrock, gravel/cobble, or coarse sand. Many of the channels are relatively shallow, with marginal bank definition. In addition, many of the channels have braided subchannels within the main channel. This is most evident in the channels along the southernmost portion of the South Mountains' drainage. Most of the channel bottoms are devoid of vegetation, with the upland vegetation adjacent to the drainages consisting of typical Sonoran Desert plants such as paloverde, mesquite, ironwood, creosote bush, and various species of cacti, including saguaros. Northwest of the South Mountains foothills, the channel banks of these ephemeral washes become less defined. Many of the washes near 51st Avenue and the boundary with Community land comprise shallow, multibraided subchannels. These subchannels are subject to movement and realignment during storms and along existing road alignments or other areas of disturbance.

Figure 4-40 Typical Ephemeral Washes, Eastern Section



Note: Widths of washes are not to scale.

The Eastern Section of the Study Area is heavily dissected, with washes throughout, particularly along the southern flanks of the South Mountains.

ENVIRONMENTAL CONSEQUENCES

Action Alternatives, Western Section

All action alternatives in the Western Section would cross the Salt River channel, a water of the United States. The roadway bridge associated with each action alternative would affect jurisdictional waters (the Salt River) through construction of piers in the channel. The preliminary bridge design was used to calculate the area of potential impact for each action alternative. The acreage associated with bridge construction was determined based on the estimated dimensions of the bridge. Bridge width would be approximately 145 feet without auxiliary lanes and 160 feet with auxiliary lanes. The actual impact of the bridge within the bed of the Salt River would be substantially less because the structure would be designed so that only fill associated with the bridge piers would be placed in the riverbed. Table 4-43 shows jurisdictional waters impacts that may occur as a result of the Western Section action alternatives. As shown in Table 4-43, the W101 Alternative would affect the least amount of jurisdictional waters, while the W59 (Preferred) Alternative would affect the greatest amount. For the W101 Alternative, the impacts on jurisdictional waters would be the same regardless of option.

Table 4-43 Area of Impact to Jurisdictional Waters, Western Section, Action Alternatives

Western Section Action Alternative	Area (acres)
W59	26
W71	19
W101 Western Option	17
W101 Central Option	17
W101 Eastern Option	17

What are "waters of the United States"?

Section 404 of the CWA defines waters of the United States to mean the interstate "navigable waters" of the United States, including the territorial seas, that are currently, have been used in the past, or may be used in the future for foreign or interstate commerce. Specifically, such waters may be interstate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, whose use, degradation, or destruction could affect interstate or foreign commerce activities.

USACE determines whether a feature is eligible for protection under the CWA. Its court-upheld interpretations of waters of the United States have historically been far-reaching, including features such as wetlands isolated from other waters of the United States, ephemeral desert washes, and agricultural irrigation ditches. On June 19, 2006, the U.S. Supreme Court found that the USACE definition of waters of the United States had exceeded Congressional intent in the original CWA. In remanding several cases to lower courts for reevaluation, the Supreme Court ordered the lower courts to bear in mind that waters of the United States require relatively continuous flows and that wetlands are considered waters of the United States only if they maintain a continuous surface connection with recognized waters.

Action Alternative, Eastern Section

The Eastern Section of the Study Area contains numerous washes that drain the southern side of the South Mountains and their associated foothills (Figure 4-40). Ephemeral washes potentially constitute waters of the United States in the Eastern Section of the Study Area. Field inspections were conducted in August 2003, and 51 ephemeral washes were identified. Figure 4-40 provides photographs of typical ephemeral washes in the Eastern Section of the Study Area. The findings from the field investigation were presented and discussed with USACE in October 2003, and USACE has concurred that the ephemeral washes identified are waters of the United States (see the sidebar on this page). However, recent guidance from EPA and USACE (2008) has brought into question USACE's concurrence that the washes are waters of the United States. These issues would be determined prior to the FEIS.

The E1 (Preferred) Alternative would cross most of the washes identified in the Study Area. Roadway structures associated with the E1 Alternative would affect jurisdictional waters by placing fill in some of the channels. The drainage system anticipated for this section of the project would channel minor washes to major washes. Transverse crossings for major washes would be constructed using culverts to convey stormwater runoff beneath the roadway. The acreage impacts associated with roadway construction were determined using the following assumptions:

- Average ephemeral wash width is 5 feet, based on field observations.
- Proposed roadway R/W width varies between 300 and 1,000 feet. However, near the washes, it would be closer to 300 feet.
- The proposed roadway would affect all ephemeral washes crossed (51 ephemeral washes estimated to be crossed).

The E1 Alternative would permanently affect approximately 4 acres of jurisdictional waters (ephemeral washes). Temporary construction zones may result in additional impacts on jurisdictional waters. Once these zones have been identified, a determination would be made by USACE, ADOT, and FHWA regarding whether additional mitigation would be warranted. Because the impact acreage is based on R/W limits, it is anticipated that design refinement and construction sequencing would result in a reduction of impacts on jurisdictional waters.

No-Action Alternative

The No-Action Alternative would not result in direct impacts on waters of the United States.

MITIGATION

It is anticipated that an Individual Permit under Section 404 of the CWA would be required for the proposed project if any action alternative were chosen. On February 8, 2005, FHWA, ADOT, and USACE entered into an Operating Agreement (Appendix 4-3, beginning on page A555), which applies to transportation projects that are both FHWA actions under NEPA and that require a USACE individual permit under Section 404 of the CWA (USACE 2005). The Operating Agreement commits FHWA, USACE, and ADOT to integrating NEPA and Section 404 of the CWA in the transportation planning, alternatives screening, and implementation processes. In accordance with the Operating Agreement and with Section 404(b)(1) of the CWA, USACE participated in identification of the Preferred Alternative. Under Section 404(b)(1), USACE is obligated to select the least environmentally damaging practicable alternative after considering cost, existing technology, and logistics, in light of overall project purposes (40 C.F.R. § 230).

None of the action alternatives would provide the opportunity for complete avoidance of jurisdictional waters because any freeway in the southwestern Phoenix metropolitan area connecting I-10 (Maricopa Freeway) to I-10 (Papago Freeway) would cross the Salt River and ephemeral washes. Crossing jurisdictional waters of the United States was, however, one of the screening criteria used during the alternatives analysis (see the section, *Alternatives Development and Screening*, beginning on page 3-1). The Project Owners Team, which included ADOT, FHWA, and USACE, sought to avoid waters of the United States, where practicable.

According to the Operating Agreement, when avoidance of waters of the United States would not be practicable, minimization of impacts would be achieved and unavoidable impacts would be mitigated to the extent reasonable and practicable.

The following steps have been or would be taken by ADOT as part of the Section 404 Individual Permit requirements in addressing Section 404(b)(1) guidelines:

- minimize impacts by limiting the degree or magnitude of the action and its implementation by using appropriate technology or by taking affirmative steps to avoid or reduce impacts
- rectify impacts by repairing, rehabilitating, or restoring the affected environment
- reduce impacts over time by preservation and maintenance operations during the life of the action
- compensate for impacts by replacing, enhancing, or providing substitute resources or environments

The general and special conditions of the Section 404 Individual Permit would minimize impacts on waters of the United States to the extent practicable. The proposed project would require water quality certification under Section 401 of the CWA. The following is a summary of potential minimization measures outlined to satisfy conditions of the Sections 404/401 permits.

ADOT Design Responsibilities

- ADOT would prepare and submit an application to USACE for a CWA Section 404 permit for the entire project. The permit conditions would be developed according to the current Operating Agreement. No work would occur within jurisdictional waters until the appropriate CWA Sections 401 and 404 permits were obtained.
- If more time were to be required to complete the proposed action than authorized by the permit, ADOT would submit a request for a time extension

to USACE at least 1 month prior to reaching the authorized date.

- If previously unidentified cultural resources were to be encountered in or adjacent to waters of the United States during the proposed undertaking, ADOT would notify FHWA and USACE immediately to make arrangements for the proper treatment of those resources.

ADOT Right-of-Way Group Responsibility

- If ADOT were to sell the freeway, ADOT would obtain the signature of the new owner in the applicable space provided in the permit and forward a copy of the permit to USACE to validate the transfer of the authorization.

ADOT District Responsibilities

- The CWA Section 401 water quality certification would certify only the activities and construction of the Selected Alternative and would be valid for the same period as the CWA Section 404 Individual Permit. If project construction were not started by the USACE deadline, the applicant would notify ADEQ.
- ADOT would provide a copy of the Section 401 water quality certification conditions to all appropriate contractors and subcontractors. ADOT would post a copy of these conditions in a water-resistant location at the construction site where it may be seen by workers.
- ADOT would maintain the project authorized by the permit in good condition and in conformance with the terms and conditions of the permit. ADOT would not be relieved of this condition even if ADOT were to abandon the project. Should ADOT cease to maintain the freeway or abandon the freeway without a good faith transfer, ADOT would obtain a modification of the permit from USACE.
- If a substantive change/modification to the project were necessary, ADOT would provide notice and supporting information to ADEQ for review. ADEQ would then modify the certification to include the change/modifications, provided that water quality standards for surface waters (18 A.A.C. § 11, Article 1) would be achieved.
- When construction were to begin, ADOT would notify ADEQ within 7 days of the start date. When notification were made, ADOT would provide the start date and the name and phone number of the primary contractor and a contact person. ADEQ may conduct inspections to determine compliance with surface water quality standards. When the activities were completed, ADOT would notify ADEQ within 30 days after project completion.
- Water used for dust suppression would not contain contaminants that could violate ADEQ water quality standards for surface waters or aquifers. ADOT would obtain the necessary permits for such activities.
- If a dewatering operation were needed, ADOT would not discharge into waters of the United States unless the quality were to meet the appropriate water quality criteria for the receiving water body and ADOT were to obtain the necessary permits.
- ADOT would comply with all conditions set forth in the Section 401 water quality certification made as part of the project.
- ADOT would allow USACE representatives to inspect the project at any time as determined to be necessary to ensure that it was being accomplished in accordance with the terms and conditions of the permit.
- ADOT would prepare written instruction for all supervisory construction personnel on the protection of cultural and ecological resources, including all agreed-to environmental stipulations for the project and all conditions required by the permit. The instructions would address federal and State laws regarding antiquities, plants, and wildlife, including collection, removal, and the importance of these resources and the purpose and necessity of their protection.
- Prior to initiating construction activities under the permit, ADOT would ensure that the contractor(s) would have been provided with a copy of the Section 404 authorization. This would be intended to confirm that the contractor(s) would comply with the terms and conditions of the Section 404 authorization.

Contractor Responsibilities

- Debris (such as soil, silt, sand, rubbish, cement, asphalt, oil or petroleum products, organic materials, tires, or batteries) derived from construction or demolition activities would not be deposited at any site where it may be washed into waters of the United States. After completion of the proposed project, the washes would be left in an environmentally acceptable condition, with all temporary construction and nonnative materials removed from the watercourse.
- Pollution from the operation of equipment in the floodplain would be cleaned up and removed before it could be washed into a watercourse. Spills would be promptly cleaned and properly disposed.
- Temporary erosion and sediment control measures would be installed, at a minimum, according to ADOT's *Standard Specifications for Road and Bridge Construction* (2008) and *Erosion and Pollution Control Manual* (2005c), prior to construction and would be maintained as necessary during construction.
- If permanent erosion and sediment control measures were required, they would be installed as soon as practicable, preferably prior to construction activities, and would be maintained throughout the life of the project. Permanent erosion and sediment control measures would be located to protect downstream entities from construction impacts when there would be a flow in watercourses within the project boundary.
- Access roadways and staging areas would be designed to allow normal storm flows to pass unimpeded. There would be no significant change to the hydraulic conditions of the upstream waters as a result of the temporary constructed features.
- No petroleum products would be stored within the 25-year flood boundary of the Salt River, the

Gila River, or unnamed tributary washes. Any soil contaminated as a result of contractors' operations would be disposed of in an appropriate, approved disposal facility.

- No excavation, fill, or leveling would be permitted in the watercourses outside the boundaries of the permitted work area.
- No fill would be taken from any watercourse outside the boundaries of the permitted work area. Fill would come from an area outside the OHWM of any watercourses and would be free of any contaminants or pollutants.
- Heavy equipment traffic would be restricted from entering the watercourses outside the boundaries of the permitted work area. Appropriate barricades would be installed to preclude this activity.
- During construction, the work sites would be maintained such that no construction debris or material spillover would be allowed in the watercourses. Upon completion of the work, all construction debris and excess material would be removed from the job sites and disposed of appropriately outside the USACE jurisdictional areas.
- During construction, appropriate measures would be taken to accommodate flows within the watercourses, such that waters would not be diverted outside the OHWM.
- Prior to construction, the contractor would review *Environmental Protection on Arizona Department of Transportation Projects: Instructions to Contractors* and review and sign the *Checklist for Environmental Compliance*. ADOT would also sign the checklist and return it to the EPG 7 calendar days prior to construction.
- The contractor should comply with all terms, general conditions, and special conditions of the Section 404 permit, as established by USACE.
- No work would occur within jurisdictional waters until the appropriate CWA Sections 401 and 404 permits were obtained.

CONCLUSIONS

Each Western Section action alternative would cross between 17 and 26 acres of jurisdictional waters (the Salt River). Actual, permanent disturbance in the river channel would result from bridge pier placement and is anticipated to be substantially less than the acreages reported in this section. While the W59 (Preferred) Alternative would have a greater impact on jurisdictional water acreage than would either the W71 or W101 Alternative, the impact on jurisdictional waters in the region would be negligible.

In the Eastern Section, the E1 (Preferred) Alternative would cross several washes that are potential jurisdictional waters. These washes receive runoff from the South Mountains that passes under Pecos Road through a series of culverts following natural drainages/washes. The design of the E1 Alternative would alter the drainage pattern through use of a series of drainage detention basins that would direct runoff to specific locations to discharge under the freeway and onto Community land (see the section, *Drainage*, beginning on page 3-58).

Under the No-Action Alternative, no project-related impacts on jurisdictional waters would occur; however, continuing urban development associated with projected growth in the region and Study Area would continue to exert pressure to alter jurisdictional waters.

With any action alternative, permits would be required under Sections 404/401 of the CWA. ADOT has followed Section 404 Individual Permit requirements in addressing Section 404(b)(1) guidelines (see page 3-27). In accordance with the Operating Agreement, USACE participated with FHWA and ADOT in the identification of the Preferred Alternative. Under Section 404(b)(1), USACE is obligated to select the least environmentally damaging practicable alternative after considering cost, existing technology, and logistics, in light of overall project purposes.

The general and special conditions of the Section 404 Individual Permit would minimize impacts on jurisdictional waters to the extent practicable. ADEQ would issue Section 401 Individual certification for compliance with water quality prior to Section 404 permit issuance.

TOPOGRAPHY, GEOLOGY, AND SOILS

This section provides an overview of the geologic setting in the Study Area and preliminary information concerning geotechnical and geologic conditions in the Study Area. The evaluation presented in this section is based on available information on regional and local geology, mining activity, regional and local seismicity, and regional and local land subsidence and earth fissuring.

Numerous geotechnical studies have been conducted in the Study Area. Two previous studies, *Preliminary Geotechnical Investigation Report, Southwest Loop Highway – SR 218, I-10 & 59th Avenue to I-10 & Pecos Road* (Sergent, Hauskins, & Beckwith 1987a) and *Geotechnical Investigation Report, Southwest Loop Highway – SR 218, I-10 & 59th Avenue to I-10 & Pecos Road* (Sergent, Hauskins, & Beckwith 1987b), were performed for ADOT. Reynolds (1985) performed a detailed study of geology at the South Mountains, and Demsey (1989), Reynolds and Skotnicki (1993), and Waters and Ravesloot (2000) published studies regarding the Quaternary geology in the Study Area. Studies regarding soils in the Study Area were performed by Adams (1974), Hartman (1977), and Johnson et al. (1986). Groundwater and well data are available from the Arizona Well Registry Distribution Database (ADWR 2002) and from the Groundwater Sites Inventory (ADWR 2008). Regional land subsidence and earth fissuring maps were created by Laney et al. (1978), Schumann (1974, 1992), Shipman (2007), and the ADWR Hydrology Division (ADWR 2008). The regional seismicity was detailed by Euge et al. (1992) and USGS (2006).

AFFECTED ENVIRONMENT

Overview of Geologic Conditions

The Study Area lies within the desert region of the Basin and Range Physiographic Province. The dominant physiographic feature in the Study Area is the South Mountains, which are isolated, northeast-trending ridges surrounded by a broad expanse of alluvial deposits. The northern side of the South Mountains is drained by the Salt River, and the southern and southwestern sides of the South Mountains are drained by the Gila River.

Study Area topography is dominated by the presence of the Salt and Gila rivers and the South Mountains. The elevation generally ranges from 2,400 feet above mean sea level at the crest of the South Mountains to 950 feet above mean sea level at the confluence of the Salt and Gila rivers, which is at the western edge of the Study Area, in the Western Section. In the Western Section of the Study Area, the topography north of the Salt River is relatively flat, gently sloping to the southwest. The topography south of the Salt River also is relatively flat, gently sloping either to the northwest toward the Salt River or to the southwest toward the Gila River. The topography in the Eastern Section of the Study Area is variable in elevation, traversing the low foothills of the South Mountains.

The dominant geologic features are the bedrock of the southern flanks and foothills of the South Mountains, adjacent alluvial fans and piedmonts, and the basin sediments of the Salt and Gila rivers, including their associated floodplains and terraces. The bedrock geology of the southern flanks of the South Mountains and their associated foothills in the Study Area consists of granitic and related rock and metamorphic gneissic rock. The alluvial fan deposits and piedmonts of the South Mountains are predominantly granular deposits that can include abundant cobble- and boulder-sized material. These deposits vary in thickness and often exist as only a thin veneer of colluvium or alluvium overlying bedrock. The geology of the Salt and Gila rivers and of their associated floodplains and terrace deposits generally consists of highly stratified, predominantly fine-grained, alluvial deposits and active channel deposits consisting of varying mixtures of clay, silt, sand, gravel, and cobbles. Typically, the Gila River channel deposits contain less gravel and cobbles and more sand than do the Salt River deposits.

Groundwater

The Study Area lies within the West Salt River Valley Subbasin of the Phoenix AMA. Groundwater distribution in the Study Area is highly variable. In the alluvial environments dominated by the Salt and Gila rivers, groundwater is abundant and may be found near the surface. In the bedrock, piedmont, and alluvial fan environments associated with the South Mountains, little-to-no groundwater is likely to be found. Groundwater use differs substantially in the Study Area. South of Estrella Drive, generally in the Eastern Section of the Study Area, there is relatively little groundwater use. North of Estrella Drive, generally in the Western Section of the Study Area, groundwater is used extensively for agricultural and municipal purposes. In Ahwatukee Foothills Village, in the Eastern Section of the Study Area, groundwater is used to fill private lakes for golf courses and residential neighborhoods.

Depth to groundwater varies throughout the Study Area. Along the Eastern Section of the Study Area, depth to groundwater is greater than 50 feet. USGS groundwater level data were obtained in the Ahwatukee Foothills Village area for several different wells, and the depth to groundwater ranged between 97 and 117 feet below ground surface (USGS 2006). Areas south of Lower Buckeye Road may have depths to groundwater of less than 50 feet (ADWR 2002). Also in the Eastern Section, ADWR Groundwater Site Inventory data from 2007 to 2008 indicate depths to groundwater of about 65 to 75 feet below ground surface in the Laveen Village area just west of the western flanks of the South Mountains (based on data from two wells), and about 120 feet below ground surface in the Ahwatukee Foothills Village area near Chandler Boulevard and I-10 (based on data from one well). USGS data for multiple wells in the Western Section of the Study Area (including Laveen Village and the Salt River areas) indicate that depths to groundwater range from 9 to 134 feet below ground surface. Also in the Western Section, ADWR Groundwater Site Inventory data from 2007 to 2008 indicate depths to groundwater of about 40 to 120 feet below ground surface north of the Salt River (based on data from seven wells), and about 30 to 40 feet below ground surface south of the Salt River (based on data from four wells). Shallow, perched groundwater could be present in the southern portion of the Eastern Section and the northern portion of the Western Section in areas under irrigation

or previously under cultivation. In most instances, this groundwater would be the result of seepage from tailwater ditches or unlined irrigation laterals. In both the Eastern and Western Sections, progressing toward the South Mountains and their foothills, the unconsolidated deposits thin and groundwater may be isolated in perched zones.

Land Subsidence and Earth Fissuring

Land subsidence attributable to groundwater withdrawal in alluvial basins in the Basin and Range Physiographic Province is a process of compression and subsequent consolidation of the alluvial sediments. Through geologic time, groundwater levels in the alluvial basin materials were at or near the ground surface or at elevations controlled by the rivers and drainage systems traversing the basins. Human activities have affected and are continuing to affect groundwater levels in many of these basins. Groundwater pumping, primarily for agricultural, industrial, and municipal uses, has depleted stored groundwater in many areas. In addition, damming of rivers in mountainous portions of the surrounding watersheds has reduced the available recharge potential.

Based on regional mapping (Laney et al. 1978; Schumann 1974, 1992) and available National Geodetic Survey data, land subsidence in the Study Area has been limited to less than 1 foot. Historic groundwater declines have been between 50 and 100 feet in areas located away from the South Mountains and their associated foothills (Laney et al. 1978; Laney and Hahn 1986; ADWR 2002). Declines of this magnitude have resulted in only minor land subsidence. In the early 1990s, scientists began to use Synthetic Aperture Radar and interferometric processing (Interferometric Synthetic Aperture Radar) to detect land surface elevation changes. Interferometric processing has developed into a highly reliable land subsidence monitoring tool used by ADWR since 2002 to identify and map subsidence features in Arizona. The most current ADWR subsidence maps were reviewed at the ADWR Web site (ADWR 2009). Based on the ADWR mapping, no land subsidence zones exist within or adjacent to the Study Area.

Earth fissuring poses an erosional hazard because normal surface drainage captured by fissures can result in the formation of substantial fissure gullies. Earth fissures in areas of large groundwater decline in alluvial aquifers are likely associated with a process termed "generalized differential compaction." Because of this process, fissures commonly develop along the perimeter of subsiding basins, often in apparent association with buried or protruding bedrock highs, suspected mountain-front faults, or distinct facies changes in the alluvial section. The Arizona Geological Survey conducts comprehensive mapping of earth fissures and delivers earth fissure map data to ASLD. Earth fissure planning maps covering Maricopa County (Shipman 2007) were reviewed to identify known or reported earth fissures within or near the Study Area. Based on these maps, no earth fissures are known to exist within or adjacent to the Study Area.

Regional and Local Seismicity

Minimal historical seismic activity has been recorded in Maricopa County and the Study Area. No recognized active faults are located within the proposed alignments of any of the action alternatives (USGS 2006). Euge et al. (1992) prepared a report for ADOT that included evaluation of seismic criteria for the state of Arizona. This report presents maps of expected horizontal acceleration in bedrock, with a 10 percent probability of exceedance in both 50 and 250 years. For the Study Area region, the approximate values of acceleration are 0.03 of unit gravity (g) for an exposure time of 50 years and 0.07g for 250 years.

While the Euge et al. (1992) report included a regional evaluation of seismic criteria, USGS data were used to evaluate a specific site within the Study Area. Probabilistic earthquake ground motion values were obtained from the USGS National Seismic Hazard Mapping Project, Earthquake Hazards Program (USGS 2002) for the intersection of 51st Avenue and Pecos Road (specifically, for 36.28 degrees North latitude, –112.16 degrees West longitude). Interpolated, probabilistic ground motion values of peak ground acceleration in rock for 2 and 10 percent probabilities of exceedance in 50 years were obtained for this site in the Study Area:

- 10 percent probability of exceedance in 50 years, with a return period of 475 years: 0.037g
- 2 percent probability of exceedance in 50 years, with a return period of 2,475 years: 0.072g

These peak ground acceleration values are for firm rock (rock with shear-wave velocity of 2,500 to 5,000 feet per second in the upper 100 feet of profile), categorized as Site Class B in accordance with the International Building Code, Chapter 16, Section 1613.2, Table 1613.5.2 (International Code Council, Inc. 2006). These values would need to be evaluated and adjusted as appropriate based on the subsurface profile encountered during final geotechnical investigations. Seismic ground motion values for design of the roadway, bridges, and other structures would need to be adjusted using appropriate attenuation factors for actual in-place materials as presented in Chapter 16 of the International Building Code (2006).

Mineral Resources

Mineral resources in the Study Area include sand and gravel and precious metals. Sand and gravel are the most important mineral resources in the Study Area. These resources are primarily found adjacent to or within the Salt and Gila rivers. The South Mountains and their associated foothills contain potential precious metal resources. Historical mining of precious metals has been limited in scope, however, and it is unlikely that mining in the Study Area would occur in the foreseeable future.

A search of the Arizona Mineral Industry Location System database (Arizona Department of Mines and Mineral Resources 2001), examination of aerial photographs, and field investigations indicated that seven sand and/or gravel operations or companies are within the R/W of the various Western Section action alternatives.

One gold mining claim and six unknown mining claims are included in the database but are not located within the proposed alignments of the action alternatives. From topographic maps, several mining features are located south of the South Mountains, but none of these are located within the proposed alignment of the E1 Alternative.

ENVIRONMENTAL CONSEQUENCES

This section outlines the construction impacts on geologic and geotechnical conditions in the Study Area. No impacts on geologic and geotechnical conditions would occur as a result of operation of the proposed action.

Action Alternatives, Western and Eastern Sections

Within the context of this preliminary analysis, substantive variations in the geotechnical conditions do not appear to exist among the action alternatives. Alternative and design option divergences would occur in terrain underlain by the alluvial, unconsolidated sediments of the Salt River near its confluence with the Gila River, which is located at the western edge of the Western Section. All of the Western Section action alternatives would cross the Salt River, with no notable distinction between the various locations when considering the anticipated ground conditions that would be encountered. In addition, the alluvial deposits both north and south of the Salt River channel would be similar throughout the Study Area to a degree that no distinction should be made based on this preliminary analysis.

In the Western Section of the Study Area, shallow groundwater exists throughout the area where the action alternatives and design options would diverge across the floodplain and terraces of the Salt River. Coarse-grained alluvial deposits, some cemented soils, and the potential for encountering both expansive and compressible/collapsible soils in the shallow profile would provide constraints in the Western Section. These groundwater and soil conditions may influence both the design and method of construction of roadway sections and/or bridge foundations; such conditions are commonly encountered, however, and construction technologies to overcome these conditions are readily available.

The W59 (Preferred) Alternative would adversely affect three different sand and gravel companies, at least one of which appears to be an active operation. The W71 Alternative would adversely affect two different sand and gravel companies; the operations of each appear to be inactive. The W101 Alternatives and Options would adversely affect two sand and gravel companies; the operations of only one appear to be active.

In the Eastern Section, geotechnical constraints would likely include excavation of competent bedrock and evaluation of stability of slopes completed in the bedrock. The E1 (Preferred) Alternative would traverse the foothills along the southern flank and western tip of the South Mountains, where competent bedrock generally consisting of granite and gneiss is either exposed or likely underlies a thin surface veneer of colluvial and alluvial deposits. During construction of the proposed freeway, these bedrock units would likely be encountered, resulting in difficult excavation conditions in cut sections and possibly requiring blasting to facilitate removal. The rock material resulting from the excavation of bedrock would be highly variable in particle size, with the likely production of some materials not directly suitable for use as roadway embankment fill because of the preponderance of oversized particles. If produced, these materials would need to be rejected or subjected to additional processing.

Construction through several rock slopes would likely occur along portions of the Eastern Section of the Study Area and along the aforementioned mountain flank. Design of stable slope angles and configurations would need detailed geomechanical characterization to define the orientation and condition of the rock discontinuities. These slopes would probably not be influenced by groundwater seepage nor by freeze-thaw mechanisms, thus providing a relatively stable environment for safe slopes over the long term. The major design issue would be evaluation and mitigation of the potential for detachment of portions of the constructed slope face along natural fractures in the rock mass.

In addition to the likelihood of production of some oversized particles during the excavation of rock, both the channel deposits of the Salt River and the upland portions of the alluvial fan and piedmont deposits likely contain a relatively coarse fraction. Selection or treatment may be required to use these materials as structural fill. These upland, unconsolidated alluvial units may also be cemented to a degree such that excavation would be moderately difficult.

Although their lateral distribution is not defined in the available data reviewed for this report, the geologic setting related to the valley floor and the mountain flank is conducive to the deposition of soils that may

Mitigation for Vibration-related Impacts

Near the South Mountains, bedrock may be encountered during project construction. Cuts through ridgelines of the South Mountains would be anticipated. As a result, blasting may be needed to fragment the bedrock material for removal.

Members of the public expressed concerns about potential damage to structures caused by blasting. According to one individual, blasting for construction of homes near the Study Area caused damage to other homes.

Three main adverse effects occur from blasting: flyrock, airblast, and ground motion. Flyrock is rock that is propelled through the air from a blast. Flyrock is controlled by blasting methods that reduce the likelihood of flyrock's occurrence. Access is controlled at blast sites to reduce the potential for bodily injury. Airblast is the airborne shock wave that results from the blast. In some cases, the airblast is audible, but normally the predominant frequencies are below the range of human hearing; therefore, airblast is usually felt rather than heard. The primary cause of blast damage is ground motion. Ground motion also may be caused by heavy equipment operation such as ripping. Ground motion is measured in terms of peak particle velocity, usually expressed in inches per second. As vibrations from a blast arrive at a particular location, a particle of soil or rock will vibrate randomly in all directions (longitudinal, transverse, and vertical) for a short period of time. Peak particle velocity refers to the highest velocity that the particle achieves in any of the three directions following an event.

According to the ADOT *Standard Specifications for Road and Bridge Construction* (2008), Section 107.10, the contractor is responsible for all damage resulting from the use of explosives. Special provisions for a recent project (Grand Avenue Underpass Project, constructed in 2004) required that the contractor perform preblast surveys of two existing structures. Preblast surveys are required routinely for mining operations. According to 30 C.F.R. § 816.62, preblast surveys within ½ mile of blasting are required for mining operations.

Preblast surveys assess the condition of the dwellings or structures and document any existing defects and other physical factors that could reasonably be affected by blasting. Minor defects in structures, such as cracks in plaster, masonry, and other structural materials, normally result from the relative movement of the different materials of construction with changes in temperature and humidity. Preblast surveys document existing damage by photographing and recording the location, length, and width of any cracks or other visible defects in the building's foundation, interior, or exterior.

Postblast surveys may be performed following a blasting episode, but normally occur only if a blast-related damage claim is made by the homeowner to the contractor. If damages were documented in the postblast survey, according to ADOT's *Standard Specifications for Road and Bridge Construction* (2008), the contractor would be responsible for the damages.

According to the ADOT *Standard Specifications for Road and Bridge Construction* (2008), responsibility for all damage resulting from the use of explosives is assigned to the contractor that uses the explosives. In the special provisions of the construction contract for the proposed action, ADOT would include a requirement for the contractor to perform in-depth pre- and postconstruction surveys for all structures located within ½ mile in the event any blasting and/or heavy ripping were to be planned for construction purposes. This documentation should include photographic and video documentation.

possess potential for either expansion or compression/collapse. Moisture-sensitive, low-density alluvial deposits susceptible to compression or collapse often occur along the fringes of alluvial fans. Expansive soils may occur in the overbank deposits of the master streams, low in the valley floor. Geotechnical conditions would be further defined during the design phase. However, based on available data, no geotechnical constraints are anticipated.

Some soils in irrigated portions of the Study Area near tailwater ditches and canals may have a high moisture content. If present, these soils would require drying before use as roadway embankment fill or to provide sufficient bearing capacity under roadways or other structures. Because of more recent rises in the groundwater table elevation in portions of the Study Area and a slowing of the rate of decline in other parts of the Study Area, future land subsidence would be expected to have only minimal, if any, effects on the design or performance of project elements (see *Alternatives Studied in Detail*, on page 3-40, for descriptions of the action alternatives). If future groundwater withdrawal were to result in considerable groundwater-level decline, however, subsidence of sufficient magnitude to affect performance of project elements would be possible. If land subsidence were to occur within or adjacent to the Study Area, earth fissures could develop along the foothills of the South Mountains.

No-Action Alternative

Under the No-Action Alternative, only ongoing development and construction activities would affect the geologic and geotechnical conditions in the Study Area.

MITIGATION

Appropriate design of the facilities would mitigate geotechnical-related construction effects. Appropriate design would include excavations and slopes in soil and rock with an accepted degree of safety, placement of fills with an accepted degree of safety, protection of excavation and fill slopes against erosion, and design of roadway subgrade and foundations in accordance with accepted practices (see text box on page 4-115 for additional mitigation).

Implementation of the Western Section action alternatives would mean acquisition of sand and gravel operations within the Salt River riverbed. These properties would be included in the project's acquisition and relocation assistance program. The program is conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 C.F.R. § 24), which identifies the process, procedures, and time frame for R/W acquisition and relocation of affected businesses. Relocation resources would be available to all business relocatees, without discrimination. All acquisitions and relocations resulting from the proposed freeway would comply with Title VI of the Civil Rights Act of 1964 and with 49 C.F.R. § 24. Private property owners would be compensated at fair market value for land and may be eligible for additional benefits. In the final determination of potential relocation impacts during the acquisition process, ADOT would provide, where possible, alternative access to properties losing access to the local road network. In the event that alternative access could not be provided, ADOT would compensate affected property owners in accordance with 49 C.F.R. § 24.

Prior to issuance of the ROD, ADOT would consider protective and hardship acquisition on a case-by-case basis in accordance with criteria outlined in the ADOT *Right-of-Way Procedures Manual* (2009a). After the ROD, ADOT would consider protective and hardship acquisition of properties in those freeway sections not planned for immediate construction. Protective acquisition would aid in reducing the number of required acquisitions closer to the time of construction.

CONCLUSIONS

Geologic conditions within the Study Area would influence how the proposed action would be designed and ultimately constructed. Although preliminary investigations did not reveal any unique conditions that would substantially constrain the majority of construction activities, two geologic conditions were identified that would control design aspects and construction techniques for the proposed action. In the Western Section, shallow groundwater may influence the design of elements of the proposed freeway. In the Eastern Section, construction through mountain ridgelines would entail rock excavation in some form and need additional coordination with surrounding residents. Under the No-Action Alternative, continuing urban development would alter the landscape of the area.

No substantial differences were identified when comparing impacts among the Western Section action alternatives. Appropriate design—as commonly applied to projects of the size and features of the proposed action and to the mitigation measures outlined in this section—would mitigate any geotechnical-related construction effects.

BIOLOGICAL RESOURCES

AFFECTED ENVIRONMENT

The Study Area falls completely within the Sonoran Desert and the Basin and Range Province, between an elevation of 950 feet—at the confluence of the Salt and Gila rivers—and 2,400 feet above mean sea level at the crest of the South Mountains (Chronic 1998). The topography of the Study Area includes broad, flat, low-lying desert valleys between isolated mountains of relatively low relief (the South Mountains and the Sierra Estrella). The 16,600-acre SMPP is located within a mountain range that is part of the Phoenix Mountain Preserve system.

Some portions of the Study Area have been disturbed by development, mining (sand and gravel), and agriculture. The western end of SMPP still supports undisturbed, natural desert spaces. The area between the South Mountains and the Sierra Estrella, to the southwest, has been altered by agriculture, small commercial properties, roads, and housing. Adjacent residential development, roads, and agriculture have truncated many drainages in the area, affecting the extent of the xeroriparian vegetation.

Vegetation and Wildlife Resources

Plants are specific to the types of soil found in the area. The Study Area is located in several geologic provinces consisting of mostly sand and gravel in stream channels, with sand, silt, and clay on floodplains and playas. At the base of the South Mountains, metamorphic rocks are exposed, showing sedimentary and volcanic rocks metamorphosed to schist and gneiss (Chronic 1998; Kamilli and Richard 1998). The soils in the Study Area support a broad range of plants, from desert to wetland and riparian species.

Vegetation in the Study Area is classified as being in the biotic communities of Arizona Upland Sonoran Desertscrub and Lower Colorado River Sonoran Desertscrub (Turner and Brown 1994). Numerous tree, shrub, flower, and grass species can be found in these two biotic communities. Examples include blue paloverde (*Parkinsonia florida*), foothill paloverde (*Parkinsonia microphylla*), catclaw acacia (*Acacia greggii*), mesquite (*Prosopis* spp.), Fremont cottonwood (*Populus fremontii*), smoketree (*Psorothamnus spinosus*), ironwood (*Olneya tesota*), creosote bush (*Larrea tridentata*), triangle-leaf bursage (*Ambrosia deltoidea*), fourwing saltbush (*Atriplex canescens*), littleleaf saltbush (*Atriplex polycarpa*), desert broom (*Baccharis sarothroides*), ocotillo (*Fouquieria splendens*), and brittlebush (*Encelia farinosa*). Cacti can include saguaro (*Carnegiea gigantea*), buckhorn cholla (*Opuntia acanthocarpa*), hedgehog cactus (*Echinocereus engelmannii*), barrel cactus (*Ferocactus wislizenii*), prickly pear (*Opuntia* spp.), and Christmas cactus (*Opuntia leptocaulis*) (Turner and Brown 1994; Epple 1995). Small numbers of these species are found in the Study Area because much of the native habitat has been altered by agricultural, commercial, and urban development. Displacement of these species is expected to continue because of rapid development in portions of the Study Area.

Plant Communities

During an initial July 2003 field visit, different plant communities and plant species were recorded by a qualified biologist. A field visit in October 2009 revealed that the plant communities were still represented, although their extents varied somewhat because of natural processes and development. Distinct vegetation communities, as defined by the Arizona Land Resource Information System (1996), in the Study Area are:

- Sonoran creosotebush scrub
- Sonoran creosotebush-bursage scrub
- Sonoran paloverde mixed cacti/Sonoran creosotebush-bursage
- mixed/agriculture
- riparian/flood damaged in 1993
- Sonoran riparian/leguminous short tree forest/scrub
- Sonoran riparian/mixed riparian scrub
- Sonoran creosotebush-mesquite scrub

Some of these plant communities are represented at various locations adjacent to action alternative alignments (Figure 4-41).

Sonoran Creosotebush Scrub

Creosote bush is a dominant or codominant species in many Sonoran communities and flourishes on gravelly plains and sandy flats. Found throughout the Study Area, the plant community typically includes foothill paloverde, ironwood, and prickly pear, among others. Remnants of the plant community intersect action alternatives in the Western Section, following the Salt River north of Baseline Road, from approximately 83rd Avenue east to 59th Avenue.

Sonoran Creosotebush-Bursage Scrub

Remnants of the plant community exist in the Western Section along the Salt River (just north of Baseline Road) and near the intersection of Ray Road and 51st Avenue in the Eastern Section. Triangle-leaf bursage thrives on rocky or gravelly flats as well as hills. Bursage is one of the most abundant shrubs in the Sonoran Desert. Together, creosote bush and bursage dominate this community. Associated members of the creosotebush-bursage scrub community are acacia, fourwing saltbush, and ocotillo.

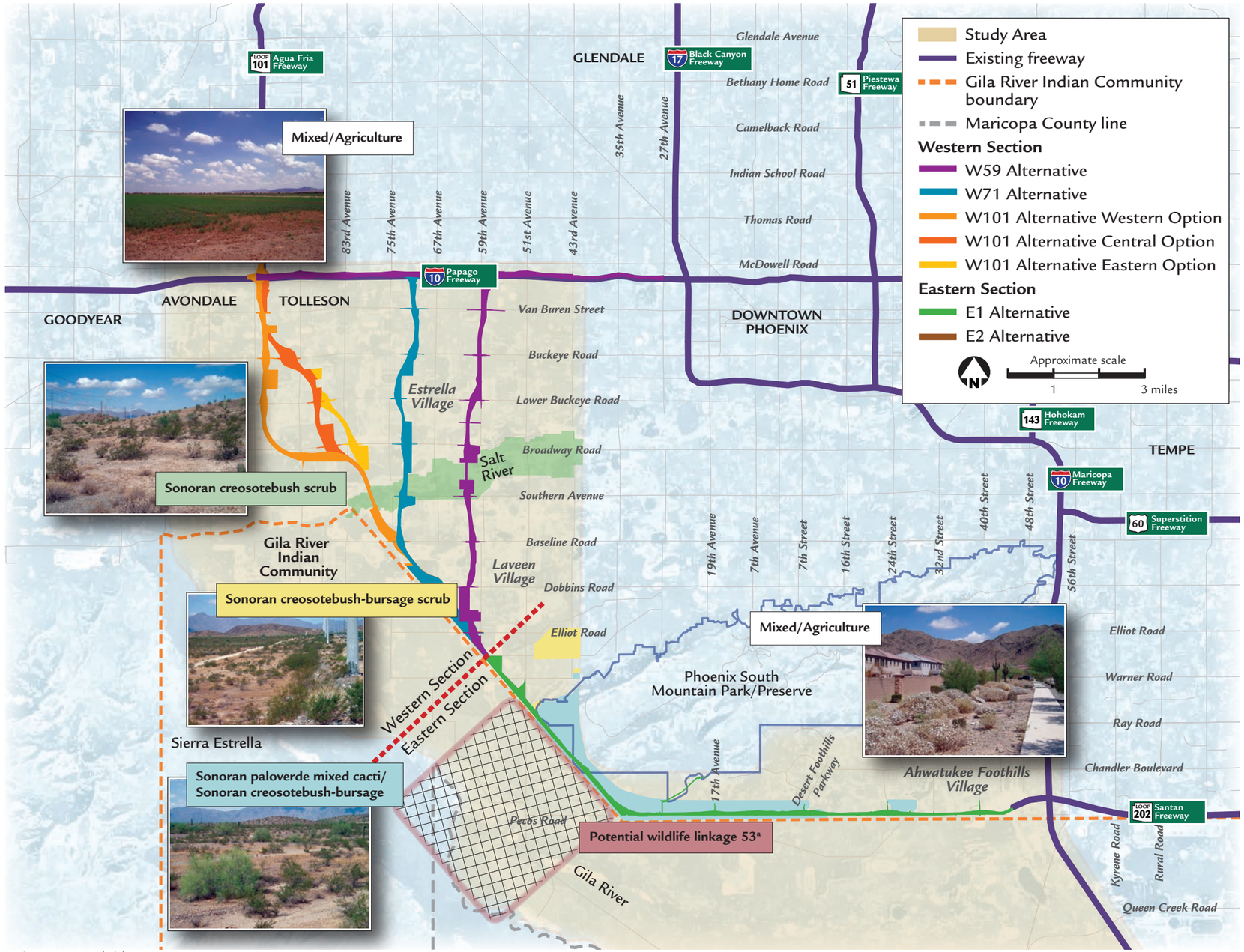
Sonoran Paloverde Mixed Cacti/Sonoran Creosotebush-Bursage

The community is distinguished by the presence of paloverde and various cacti and shrubs, including triangle-leaf bursage and creosote bush. Within the Study Area, saguaro is the most visible cactus. This plant community is found west of 32nd Street where the terrain becomes hilly approaching SMPP. Littleleaf saltbush, ironwood, and mesquite are also found within this community.

Mixed/Agriculture

The mixed/agriculture plant community covers the largest portion of the Study Area and occurs adjacent to all of the action alternatives. This community is defined

Figure 4-41 Plant Communities Adjacent to Action Alternative Alignments



[a] Arizona Game and Fish 2012

The photos typify the Study Area's major plant communities. The mixed/agriculture community is found throughout much of the Study Area (identification of specific locations is not applicable). Other distinct plant communities are found locally.

by the mix of native and nonnative vegetation associated with development land uses, including residential, commercial, and industrial interspersed with agricultural fields. Much of the Western Section is predominantly in this plant community, roughly from Ray Road north to the Study Area boundary. Residential land uses occur north of Pecos Road from SMPP to the eastern Study Area boundary. Agricultural crops include corn, cotton, and alfalfa.

Near ephemeral drainages in all plant communities, vegetation becomes denser and the invasive salt cedar (*Tamarix pentandra*) and prickly Russian thistle (*Salsola tragus*) are abundant.

Applicable Plant Community-Related Regulations

Two plant community-related regulations would have direct application to the proposed action. Applicability of the regulations is summarized below.

Arizona Native Plant Act

Many of Arizona's native plants are protected under the Arizona Native Plant Act (A.R.S. §§ 3-901 et seq.). Because these plants are often unusual or rare, have high value for landscaping, or are long-lived and not easily replaced, they are susceptible to theft and vandalism or are unnecessarily lost because of development (Arizona Department of Agriculture [ADA] 2009; Maricopa County 2004b). Plants that would be affected by the proposed action alternatives and options include many species protected by this law. Protected plants in the Study Area that are commonly recognized include, but are not limited to, paloverde, mesquite, ironwood, ocotillo, saguaro and other cactus species, and various yucca species. Protected plant species in the Study Area are primarily in the undeveloped, nonagricultural areas adjacent to or in SMPP; mesquite trees, however, can be found along canals and roads throughout the Study Area.

To comply with the Arizona Native Plant Act, ADOT would notify ADA at least 60 calendar days prior to construction so that ADA could determine the disposition of those plants.

Executive Order 13112, Invasive Species

No invasive species surveys were conducted during field visits because of the extent of the Study Area. Based on Executive Order 13112, dated February 3, 1999, all projects will,

> subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: i) prevent the introduction of invasive species; ii) detect and respond rapidly to, and control, populations of such species in a cost-effective and environmentally sound manner; iii) monitor invasive species populations accurately and reliably; and iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

If an action alternative were to be identified as the Selected Alternative, invasive species in the project footprint would be treated according to an invasive species management plan and any necessary treatments would continue following completion of construction. For example, all earthmoving and hauling equipment would be washed at the contractor's storage facility prior to entering the construction site. To prevent invasive species from leaving the site, the contractor would inspect all construction equipment and remove all attached plant/vegetation and soil/mud debris prior to leaving the construction site. Finally, all disturbed soils that would not be landscaped or otherwise permanently stabilized by construction would be seeded using species native to the project vicinity.

Aquatic/Wetland Communities

No wetlands, as regulated under Section 404 of the CWA, are found in or near the Study Area. The Tres Rios Constructed Wetlands Demonstration Project, however, consists of several water impoundments located near the 91st Avenue WWTP. These nonregulated wetlands provide important foraging and nesting sites for water birds and other wildlife species needing wetland habitat conditions.

Other nonregulated wetlands are also found in the Study Area. For example, a large set of gravel mining pits located along the Salt River hold water year-round. A field investigation conducted in October 2009 determined that these abandoned gravel pits are not jurisdictional under Section 404 of the Clean Water Act. These abandoned gravel pits are not regulated wetlands because there is an absence of wetland vegetation. Finally, concrete-lined irrigation canals are scattered throughout the Study Area, but offer little value to wildlife or plants. Through continued field observations since initial fieldwork in 2003, no additional wetlands have been identified.

In the Study Area, the habitat in the Salt River is highly disturbed as a result of reduced water flows and mining activities. The majority of the water flow is diverted to irrigation canals at the Granite Reef Dam. There are several sand and gravel companies that extract materials from the riverbed for use in construction. Within the Study Area, a large portion of the habitat surrounding the Salt River has been developed for agricultural, industrial, commercial and residential use.

Wildlife Resources

General Wildlife

Wildlife abundance and diversity are directly related to the amount and variety of habitat types located in the area. Outside SMPP, few wildlife species were observed in the Study Area. These consisted mainly of birds and a few species of lizards. During field visits, coyote (*Canis latrans*), deer (*Odocoileus hemionus*), and javelina (*Dicotyles tajacu*) signs (i.e., tracks and scat) were detected adjacent to the SMPP boundary in the western foothills of the South Mountains, and numerous rodent holes were scattered throughout the Study Area.

Common desert birds that were observed in the Study Area included curve-billed thrasher (*Toxostoma curvirostre*), Gambel's quail (*Callipepla gambelii*), cactus wren (*Campylorhynchus brunneicapillus*), canyon wren (*Catherpes mexicanus*), black-throated sparrow (*Amphispiza bilineata*), phainopepla (*Phainopepla nitens*), blue-gray gnatcatcher (*Polioptila caerulea*), Abert's towhee (*Pipilo aberti*), greater roadrunner (*Geococcyx californianus*), white-winged dove (*Zenaida asiatica*), mourning dove (*Zenaida macroura*), turkey vulture (*Cathartes aura*), and different species of raptors, including owls and hawks. Bald eagles have been sighted near the Western Section action alternatives.

Inactive and active agricultural fields are found in both the Western and Eastern Sections. Inactive agricultural fields would likely support native flora and fauna adapted to dry and disturbed conditions, whereas active agricultural fields would likely provide areas of standing water that could be used by water birds for foraging and nesting. Similarly, both types of agricultural fields may provide habitat for burrowing owls (*Athene cunicularia hypugaea*), which are frequently found nesting and hunting on the perimeter of agricultural fields and irrigation dikes. Small mammals, reptiles, rodents, and some birds may use the fields for cover and foraging. In flooded fields along Baseline Road, black-necked stilt (*Himantopus mexicanus*), cattle egret (*Bubulcus ibis*), and killdeer (*Charadrius vociferus*) were documented. Along irrigation canals, white-winged dove, mourning dove, Inca dove (*Columbina inca*), and a roadrunner were documented. Gravel and sand pits that contain water and some riparian vegetation could attract various species of birds that may use the human-made habitat for cover, foraging, and nesting. The steep sides of the pits, however, create less diverse riparian habitat compared with more gently sloping natural riverine ecosystems.

Xeroriparian habitats (desert washes) have high value for many species of wildlife, not only because of the vegetation density and composition, but also as movement corridors. Washes occur throughout the Study Area; many, however, have been altered by previous disturbance, chiefly past agricultural activities. In addition, many have been turned into retention basins or into constructed channels through housing developments.

Many species of wildlife are found in SMPP. Reptiles include Sonoran desert tortoises (*Gopherus agassizii*), snakes, Gila monsters (*Heloderma suspectum*), horned lizards (*Phrynosoma* sp.), geckos (*Coleonyx* sp.), and chuckwallas (*Sauromalus obesus*). The mammalian

population, which is restricted by limited cover and food supply and human activity at SMPP, includes the black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus audubonii*), ground squirrel (*Spermophilus* sp.), ringtail cat (*Bassariscus astutus*), coyote, kit fox (*Vulpes macrotis*), gray fox (*Urocyon cinereoargenteus*), javelina, and various species of bats. A mountain lion (*Puma concolor*) was removed from an area north of SMPP in 1994, and from approximately 1998 to 1999 there were credible reports of a mountain lion in SMPP. The Arizona Game and Fish Department (AGFD) states that lions should be considered an animal that has the potential to occur in SMPP, but not a resident animal.[35] Although wild horses are present on Community land, the habitat assessment concluded no suitable habitat for wild horses exists within the Study area.

Applicable Wildlife Resources-Related Regulations

Wildlife species in Arizona are regulated and protected through State and federal laws and regulations. A description of each, including its applicability to the proposed action, is presented below, first by State regulation (Table 4-44) and then federal law (Table 4-45). Federally listed threatened and endangered species are also Arizona wildlife species of concern but are not included in Table 4-44 because they are addressed separately in Table 4-45.

Arizona Wildlife of Special Concern

A wildlife of special concern species is an animal species whose occurrence in Arizona is or may be in jeopardy or is one with known or perceived threats or population declines, as described in AGFD's Heritage Data Management System. A brief description of the natural history of wildlife of special concern species is provided in Table 4-44.

Endangered Species Act

The federal Endangered Species Act (ESA), as amended, is designed to protect critically at-risk species from extinction. In addition to protecting these listed species, it protects their habitat. The ESA forbids federal agencies from authorizing, funding, or carrying out actions that may jeopardize endangered species and forbids any agency, corporation, or citizen from "taking" (harming, harassing, or killing) listed species without a permit. Protected species are designated as:

- **Endangered** – A plant or animal species that is in danger of extinction throughout all or a significant portion of its range.

Table 4-44 Arizona Wildlife of Special Concern

Species Common Name	Scientific Name	Habitat	Occurrence: Known or Potential
Birds			
American peregrine falcon	*Falco peregrinus anatum*	Steep, sheer rock cliffs for nesting and a large foraging area with abundant avian prey species; suitable nesting sites on rock cliffs have heights of 200 to 300 feet Elevation range: <9,000 feet (AGFD[a] 2002a)	May occasionally use the area during migration or as foraging habitat; no suitable nesting habitat near action alternatives
Bald eagle	*Haliaeethus leucocephalus*	Large trees or cliffs near rivers and lakes with open water and adequate food supply Elevation range: Varies (AGFD 2002b)	Nesting eagles are known to occur near action alternatives as well as foraging individuals during winter months along the Salt River (AGFD 2009)
Belted kingfisher	*Megaceryle alcyon*	Rivers, ponds, lakes, and streams with adjacent perch sites; nests in burrows along embankments Elevation range: 1,840–8,400 feet (AGFD 2007)	No suitable nesting habitat near action alternatives; foraging individuals may occur at gravel pits filled with water within Salt River
Black-bellied whistling duck	*Dendrocygna autumnalis*	Ponds, rivers, stock tanks, marshes; nests in tree cavities, dense thickets, and on the ground near water Elevation range: 985–4,200 feet (AGFD 2002c)	No suitable nesting habitat near action alternatives; may forage in agricultural fields
Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	Prefers mature cottonwood and willow galleries, mesquite bosques, and Sonoran desertscrub habitat Elevation range: 1,300–4,000 feet (AGFD 2001a)	Not known to currently occur in Maricopa County
Common black hawk	*Buteogallus anthracinus*	Dependent on mature, relatively undisturbed riparian habitat supported by a permanent flowing stream Elevation range: 1,750–7,080 feet (AGFD 2005)	No undisturbed riparian habitat near action alternatives
Great egret	*Ardea alba*	Marshes, streams, lakes, rivers, ponds, fields, and meadows Elevation range: <1,500 feet (AGFD 2002d)	Known to occur throughout Study Area
Least bittern	*Ixobrychus exilis*	Dense cattail/bulrush marshes interspersed with open water Elevation range: 850–1,500 feet (AGFD 2004)	No suitable marsh and open water habitat near action alternatives

(continued on next page)

Table 4-44 Arizona Wildlife of Special Concern (continued)

Species Common Name	Scientific Name	Habitat	Occurrence: Known or Potential
Mississippi kite	*Ictinia mississippiensis*	Tall woodlands, prairies, semiarid rangelands, shelterbelts, wooded areas bordering lakes and streams, mesquite bosques, and lowland/floodplain forests; breeds in riparian deciduous forests that border desertscrub upland habitats Elevation range: 1,400–3,040 feet (AGFD 2003a)	No suitable breeding habitat near action alternatives; foraging may occur throughout Study Area
Osprey	*Pandion haliaetus*	Near water bodies containing fish in a variety of habitats; typically nests in conifer trees along rivers or lakes Elevation range: 800–8,300 feet (AGFD 2002e)	No suitable breeding habitat in Study Area; can be found foraging throughout Study Area where fish are found in water bodies
Snowy egret	*Egretta thula*	Marshes, lakes, ponds, and canals for foraging; roosts in trees or shrubs Elevation range: <1,950 feet (AGFD 2002f)	Potential for migrants or breeding populations throughout Study Area
Western snowy plover	*Charadrius alexandrines nivosus*	Flat, barren salt flats, braided river channels, and playas Elevation range: <10,000 feet (AGFD 2002g)	No suitable habitat in Study Area; may occur as migrant
Amphibians			
Great Plains narrow-mouthed toad	*Gastrophryne olivacea*	Mesquite semidesert grassland to oak woodland near streams, springs, or rain pools Elevation range: <4,700 feet (AGFD 2003b)	No suitable habitat in Study Area
Lowland burrowing treefrog	*Pternohyla fodiens*	Mesquite grasslands associated with large washes Elevation range: <4,900 feet (AGFD 2003c)	No suitable habitat in Study Area
Lowland leopard frog	*Lithobates yavapaiensis*	Natural and human-made aquatic systems with relatively permanent water Elevation range: <8,200 feet (AGFD 2006a)	May occur throughout Study Area where canals, stock tanks and drinkers, irrigation ponds, and backyard ponds occur
Mammals			
California leaf-nosed bat	*Macrotus californicus*	Sonoran desertscrub; roosts in mines, caves, and rock shelters Elevation range: <4,000 feet (AGFD 2001b)	May occur throughout Study Area during foraging; roost sites unlikely near action alternatives
Western red bat	*Lasiurus blossevillii*	Riparian and wooded areas; roosts in tree foliage Elevation range: 1,900–7,200 feet (AGFD 2003d)	May occur throughout Study Area
Western yellow bat	*Lasiurus xanthinus*	Urban areas with palm trees and low- to mid-elevation riparian habitats with broad leaf trees; roosts in leaf skirts of palm trees Elevation range: <6,000 feet (AGFD 2003e)	May occur throughout Study Area
Reptiles			
Arizona skink	*Eumeces gilberti arizonensis*	Mesquite riparian drainages to oak and pine woodlands with rocks, logs, and leaf litter near streams Elevation range: 1,865–1,970 feet (AGFD 2003f)	No suitable habitat in Study Area
Northern Mexican gartersnake	*Thamnophis eques megalops*	Desert grassland with dense vegetation around cienegas, streams, and stock tanks Elevation range: 3,000–8,500 feet (AGFD 2001c)	No suitable habitat in Study Area
Fish			
Little Colorado sucker	*Catostomus* sp. 3	Small to medium rivers and impoundments mostly in pools with abundant cover but also found in riffles Elevation range: 2,200–7,350 feet (AGFD 2001d)	No suitable aquatic habitat in the Study Area

Source: Arizona Game and Fish Department Heritage Data Management System, <www.azgfd.com/w_c/edits/documents/allspecies_bycounty_007.pdf>, April 1, 2013
Note: For information on Arizona wildlife of special concern that are also considered threatened and endangered species, see Table 4-45. These species include: Southwestern willow flycatcher, Yuma clapper rail, Mexican spotted owl, desert pupfish, roundtail chub, Gila topminnow, razorback sucker, Sonoran pronghorn, lesser long-nosed bat, and Sonoran desert tortoise.
[a] Arizona Game and Fish Department

- **Threatened** – A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
- **Proposed** – A plant or animal species that is being proposed for listing as threatened or endangered.
- **Candidate** – A review status of a plant or animal species for which the U.S. Fish and Wildlife Service (USFWS) has on file substantial information concerning the biological vulnerability and threat(s) to support the appropriateness of proposing to list a species as endangered or threatened.

The ESA also allows for protection of habitat considered critical to the preservation of designated species. *Critical habitat* is a term defined in the ESA as:

> (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. (USFWS 1988)

There is no critical habitat designated in or adjacent to the Study Area for any threatened or endangered species.

A letter regarding special-status plant and animal species that could occur within a 5-mile radius of the Study Area that was received from AGFD in January 2002. A revised list was received in October 2004, and included those within a 2-mile radius. In August 2011, the AGFD Environmental Review On-Line Tool was accessed to define those species within a 3-mile radius of the action alternatives. The information contained in the Environmental Review On-Line Tool receipt and information gathered from the USFWS list of threatened, endangered, candidate, and proposed species (threatened and endangered species) for Maricopa County, 2011, were used as the basis for determining which species and habitat to evaluate when considering the action alternatives. Correspondence from AGFD and USFWS is in Appendix 1-1.

Discussed in the following sections are plant and animal species that are proposed for listing or are listed as threatened, endangered, or candidate species by USFWS (2013). All species listed by USFWS as occurring or potentially occurring in Maricopa County are presented in Table 4-45. Some species have been documented within a 3-mile radius of the action alternatives; the exact locations, however, are not shown in this report because of the sensitive nature of the information. These threatened, endangered, or candidate species are presented below.

Yuma clapper rail (*Rallus longirostris yumanensis*)

Source: USGS[36]
Photo by J. A. Spendlow

The Yuma clapper rail has a range in Arizona that encompasses several major river drainages in central and southwestern Arizona, including the lower Gila and Salt rivers. Habitat requirements include freshwater and brackish marsh habitat, with nests built in dense vegetation near water's edge (AGFD 2006b). The main threats to the Yuma clapper rail are loss and alteration of marshland habitat.

Breeding pairs have been documented from the 91st Avenue WWTP west to the confluence of the Salt and Gila rivers, where several large artificial ponds have developed in the Salt River as a result of active gravel mining operations. Although these ponds may provide some value as aquatic habitat for water birds, they lack the dense marshland vegetation required by Yuma clapper rails for foraging and nesting. Furthermore, the future of these ponds is uncertain and would be expected to change with ongoing gravel mining operations.

Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

The yellow-billed cuckoo is a migrant that arrives in Arizona from South America in late May to late June to establish breeding territories; it leaves breeding areas in late August to late September. In Arizona, it ranges from the southern and central part of the state to the extreme northeast (Monson and Phillips 1981). Preferred habitat in Arizona includes mature cottonwood, willow, or mesquite woodlands near water (AGFD 2002h). The yellow-billed cuckoo population is declining throughout its range because of loss and alteration of habitat.

Source: USGS[37]
Photo by Jim Rorabaugh

Yellow-billed cuckoos are known to inhabit portions of the Salt and Gila rivers between 83rd and 115th avenues. Historically, the lower Salt River supported mature riparian woodlands that would have provided suitable habitat for the yellow-billed cuckoo. More recently, habitat alteration and disruption of water flow throughout the lower Salt River have created unsuitable habitat for this species. While few mature riparian trees can be found scattered in the riverbed, especially near remnant sources of water, they generally do not compose the dense gallery forests needed. Suitable habitat does exist at the Tres Rios Demonstration Wetlands, the Salt River-Gila River confluence, and along scattered segments of the Gila River.

Desert tortoise – Sonoran population (*Gopherus agassizii*)

Source: HDR Engineering, Inc.
Photo by Eric Herman

The Sonoran population of desert tortoises was listed as a candidate species in December 2010. This distinction describes populations located east and south of the Colorado River in Arizona. Suitable habitat for this species includes rocky, steep slopes and bajadas in areas of Sonoran paloverde-mixed cacti desertscrub (AGFD 2011b). Threats to this species include predation, illegal collection, loss of habitat attributable to development, degradation of habitat attributable to human activities, and nonnative plant species invasions (AGFD 2011b). Sonoran desert tortoises have been documented within the Eastern Section of the Study Area, along the slopes of SMPP (AGFD 2009).

Table 4-45 Threatened and Endangered Species Potentially Occurring in Maricopa County

Species Common Name	Scientific Name	Habitat	Federal Status	Occurrence: Known or Potential
Birds				
California least tern	*Sterna antillarum browni*	Bare or sparsely vegetated sand, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, or drainage systems	Endangered	Most likely to occur as migrants; occasional breeding documented in Arizona; not documented near action alternatives
Mexican spotted owl	*Strix occidentalis lucida*	Canyons and dense forests	Threatened	No canyons or forests within the Study Area; no occurrence within Study Area
Southwestern willow flycatcher	*Empidonax traillii extimus*	Riparian communities along rivers and streams	Endangered	Not documented near action alternatives; no suitable habitat
Sprague's pipit	*Anthus spragueii*	Native grasslands with vegetation of intermediate height and lacking woody shrubs	Candidate	Not known to breed in Arizona; in Arizona found wintering mainly in the southeastern grasslands; only a few wintering individuals have been found, in alfalfa fields near Phoenix (AGFD[a] 2010)
Yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Open woods and stream sites	Candidate	Migratory; known to occasionally occur on portions of the Salt and Gila rivers, west of 83rd to 115th avenues
Yuma clapper rail	*Rallus longirostris yumanensis*	Fresh water and brackish marshes	Endangered	Suitable habitat exists and individuals have been documented in 2008 and 2009 from 91st Avenue Wastewater Treatment Plant to the Salt River-Gila River confluence
Plants				
Acuna cactus	*Echinomastus erectocentrus var. acunensis*	Well drained knolls and gravel ridges in Sonoran desertscrub; elevation 1,198 to 3,773 feet	Proposed	Species not within known range in Maricopa County or its anticipated potential habitats (USFWS 2011c)
Arizona cliffrose	*Purshia subintegra*	Rolling, rocky limestone lakebed deposits; elevation 2,120 to 4,000 feet	Endangered	No occurrence within Study Area because of a lack of suitable habitat
Mammals				
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Desert scrub habitat at <6,000 feet; roosts in caves, abandoned mines, and unoccupied buildings at the base of mountains where agave and columnar cacti are present	Endangered	No occurrence within Study Area because of a lack of suitable habitat
Sonoran pronghorn	*Antilocapra americana sonoriensis*	Alluvial valleys with Sonoran creosotebush-bursage and Sonoran paloverde-mixed cacti/Sonoran cresotebush-bursage associations	Endangered	No occurrence within Study Area because of a lack of suitable habitat
Fish				
Desert pupfish	*Cyprinodon macularius*	Shallow springs, small streams, and marshes	Endangered	Transplanted into the Salt River in 1958 but no longer found in the Salt River Basin, including the Study Area
Gila topminnow	*Poeciliopsis occidentalis occidentalis*	Small streams, springs, and cienegas with vegetated shallows	Endangered	Stocked in the Salt River in Tempe in 1966, but no longer found in the Salt/Gila River basin, including the Study Area (USFWS[b] 1998)
Razorback sucker	*Xyrauchen texanus*	Riverine and lacustrine areas, generally not in fast-moving water; may use backwaters	Endangered	Historically occurred within Gila River drainage and Salt River; now, populations only in Lakes Mohave and Mead; no occurrence in Study Area
Roundtail chub	*Gila robusta*	Cool to warm waters of rivers and streams; often occupies deepest pools and eddies of large streams	Candidate	Only populations in the Little Colorado River, Bill Williams, and Gila River basins are candidate species; no occurrence in Study Area
Woundfin	*Plagopterus argentissimus*	Shallow, warm, turbid, and fast-flowing water	Endangered	Experimental nonessential populations designated in portions of Gila River; no occurrence in Study Area
Reptiles				
Desert tortoise (Sonoran Desert population)	*Gopherus agassizii*	Rocky hillsides of Sonoran desertscrub	Candidate	Occur in Eastern Section of Study Area along slopes of Phoenix South Mountain Park/Preserve
Tucson shovel-nosed snake	*Chionactis occipitalis klauber*	Sonoran desertscrub; soft sandy soils with sparse gravel; creosotebush-mesquite floodplains	Candidate	No soft, sandy soils with sparse gravel within the floodplains in the Study Area

Source: U.S. Fish and Wildlife Service list of threatened and endangered species in Maricopa County <www.fws.gov/southwest/es/arizona/Documents/CountyLists/Maricopa.pdf> April 1, 2013
[a] Arizona Game and Fish Department [b] U.S. Fish and Wildlife Service

Migratory Bird Treaty Act of 1918

The 1916 Migratory Birds Convention between the United States and Great Britain (acting for Canada) for the protection of migratory birds set the terms for and facilitated legislation later enacted in the United States as the Migratory Bird Treaty Act (MBTA) of 1918. Later amendments implemented treaties between the United States and Mexico, the United States and Japan, and the United States and the Soviet Union (now Russia).

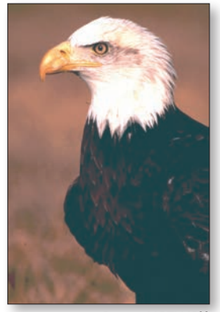
Specific provisions in the statute include establishment of a federal prohibition, unless permitted by regulations, to:

> pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof, included in the terms of the conventions between the United States and Great Britain for the protection of migratory birds . . . . [16 United States Code (U.S.C.) § 703]

Habitat destruction and alteration do not qualify as a take as long as these activities involve no loss of birds, eggs, or nests (FHWA 2001c). Birds protected under the act include all common songbirds, waterfowl, shorebirds, hawks, owls, eagles, ravens, crows, native doves, swifts, martins, swallows, and others, including their body parts (feathers, plumes, etc.), nests, and eggs (50 C.F.R. § 10.13).

Federal-aid highway projects such as the proposed action with the potential to result in take of birds protected under the MBTA require the issuance of take permits from USFWS. Freeway project activities that would likely result in take of migratory birds include land clearing, bridge demolition, or reconstruction/retrofitting undertaken during the nesting season (FHWA 2001c). A wide range of migratory birds, including the western burrowing owl, are expected to occur within and adjacent to the Study Area. Necessary avoidance measures would be undertaken and permits would be acquired, as necessary, from the USFWS MBTA permits office in Albuquerque, New Mexico.

Bald and Golden Eagle Protection Act



Source: USFWS[38]
Photo by John and Karen Hollingsworth

Although they are protected under the MBTA, bald eagles (*Haliaeetus leucocephalus*) receive additional protection under the Bald and Golden Eagle Protection Act, enacted in 1940. The Act prohibits pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing eagles. The National Bald Eagle Management Guidelines state that "disturbing" also includes impacts resulting from human-induced alterations initiated near a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment (USFWS 2007).

The bald eagle can be found throughout Arizona; however, breeding areas are primarily located within the central part of the state along the Salt and Verde rivers (AGFD 2002b). Until 2010, nesting bald eagles had not been documented near the action alternatives, although migrating bald eagles—individuals of the winter population—have occasionally occurred along the Salt River (AGFD 2009). In January 2010, an eagle nest with eggs was observed near the confluence of the Gila and Salt rivers within the Study Area. The eagles successfully nested again in 2011. From those two nesting occurrences, three young eagles left the nest.[39] The nest is located within approximately 1 mile of the W101 Alternative crossing of the Salt River. The Salt River and artificial pits that have been created by mining activities provide foraging habitat when water is present. Foraging habitat is present within the Study Area year-round along the Salt River from the 91st Avenue WWTP downstream to the confluence of the Gila River because of continuous effluent discharges; however, the Salt River is typically dry upstream where the action alternative crossings are located, according to a June 8, 2012, aerial photograph. The gravel mining pits retain water for longer periods. These pits become continually smaller during dry periods, and competition with numerous other fish-eating birds, such as herons, egrets, and cormorants, makes these pits less productive habitat. The future of these pits is uncertain and would be expected to change with ongoing gravel mining operations.

ENVIRONMENTAL CONSEQUENCES

Action Alternatives, Western and Eastern Sections

Sonoran desert tortoises have been documented in the Eastern Section of the Study Area, and suitable habitat for this species is present within SMPP and the foothills of the South Mountains. The E1 Alternative would directly affect suitable habitat as it crosses SMPP and would be expected to affect individuals of this species.

No other federally listed threatened or endangered species have been documented in the proposed R/W of any of the action alternatives and options. The Yuma clapper rail and yellow-billed cuckoo have been documented west of the action alternatives and options along the Salt River and would not be affected by construction activities or freeway operation. Additionally, there is no critical habitat designated in the Study Area. Therefore, within the limits of construction and operational disturbance, the proposed action may affect Sonoran desert tortoises, but would have no effect on any other threatened and endangered species as defined under Section 7 of the ESA.

Bald eagles have been documented nesting along the Salt River within 1 mile of the W101 Alternative. These eagles likely forage along the Salt River within the Study Area. Although the action alternatives are not expected to affect the nesting activities of these eagles because of the project's distance from the nest, the project may

Habitat Connectivity and the Proposed Action

Support is growing among State and federal agencies, as well as the general public, for maintaining landscape connectivity as it pertains to wildlife movement. Many scientific studies have concluded that roads can fragment habitat, isolate wildlife populations, and ultimately diminish landscape connectivity. As reported in the *ADOT Environmental and Enhancement Group Annual Report FY 2004*:

Arizona Habitat Connectivity Planning Group – As Arizona has experienced record growth in population, the need to preserve wildlife diversity is on the forefront. In the fall 2003, wildlife experts from various agencies and organizations throughout the state came together in an effort to address wildlife habitation fragmentation within Arizona. Representatives from the Arizona Game and Fish Department, ADOT, Federal Highway Administration, Bureau of Land Management, US Fish and Wildlife Service, USDA [U. S. Department of Agriculture] Forest Service, Northern Arizona University, and the Wildlands Project formed the Arizona Habitat Connectivity Planning Group. Their Arizona's Wildlife Linkages Assessment (Arizona Wildlife Linkages Workgroup 2006) identifies the Salt River within the Study Area as a Potential Linkage Zone, Linkage 151, which is considered a critical area for wildlife movement between the fractured habitats resulting from development in metropolitan Phoenix. The linkage zone would provide habitat and movement for a variety of species including mammals, birds, fish, and reptiles. Additionally, a report supported by AGFD and the Arizona Wildlife Linkages Workgroup, entitled *The Maricopa County Wildlife Connectivity Assessment: Report on Stakeholder Input* (AGFD 2012) summarizes a workshop attended by a broad range of organizations and interests that interactively provided input and mapping for important wildlife linkages across Maricopa County. The report identifies the area between SMPP and the Sierra Estrella as a landscape movement area; however, the report describes the need to provide additional expert input and research for assessing wildlife movement patterns.

Example of a typical small-animal crossing

ADOT EPG has implemented several measures in the report. While there are no formally identified major migration corridors in the Study Area, the maintenance of habitat connectivity is a consideration for the proposed action.

The proposed action would cross the Salt River in the Western Section. The City of Phoenix and USACE are currently in the planning phases for the Rio Salado Oeste project, an approximately 8-square-mile habitat restoration project located in the 100-year floodplain along the Salt River, between 19th and 83rd avenues. The intent of the project is native riparian habitat restoration in conjunction with flood control, water quality, and passive recreation in the form of multiuse trails. The City and USACE have anticipated a South Mountain Freeway crossing and view it as an opportunity to direct stormwater runoff from the proposed freeway to "irrigate" the river habitat. Piers for the proposed freeway bridge structure would be constructed within the Rio Salado Oeste project area, but the bridge would span the area. As planning progresses, the City and USACE have agreed to coordinate with ADOT on enhancement opportunities for the proposed action.

Example of a typical large-animal crossing

Several locations were examined for potential wildlife crossings that could be accommodated in the Eastern Section, generally along the South Mountains. Potential surface drainage crossing the freeway would be accommodated by a series of culverts and box culverts along natural washes. After examination of these locations, some of the crossings were reexamined in further detail, and preliminary designs were altered by either expanding the culverts or by replacing them with bridges to enhance habitat connectivity opportunities in the region.

affect their foraging behavior along the Salt River when foraging opportunities exist near action alternatives.

General Impacts on Vegetation, Wildlife, and Wildlife Habitat

Within the context of overall vegetation, wildlife, and wildlife habitat, all action alternatives and options would decrease the amount of cover, nesting areas, and food resources for wildlife species caused by habitat loss, fragmentation, and traffic disturbance. During construction activities, noise disturbance would represent a short-term impact on the environment. The duration and level of construction noise would depend on the activities, such as blasting, ground clearing, utility relocations, the placement of roadbeds and foundations, and construction of structures. Noise may have a temporary impact on nesting birds adjacent to construction. Some species rely on hearing to avoid predators, communicate, and find food (Noise Pollution Clearinghouse 2004). An increase in traffic noise may affect the ability of some animals to hear at a level necessary for survival when near the proposed action. In addition, hearing loss resulting from vehicle noise has been shown to occur in some desert animals (Bondello and Brattstrom 1979). Some nesting, roosting, foraging, and shelter sites may be destroyed as vegetation would be removed. Construction activities would disturb vegetation and soils that could provide wildlife habitat.

The magnitude of impacts associated with each of the action alternatives and options would be comparable because of their similar type and size of physical footprint on the land and because of similarities in roadway design and traffic volumes on the proposed freeway. In the Eastern Section of the Study Area, the E1 (Preferred) Alternative would affect wildlife because of the presence of undeveloped areas and open space land uses along the SMPP and Community boundaries—the areas with the most natural habitat.

Construction of any action alternatives and options would involve vegetation removal and would cause a decrease in habitat, foraging, and nesting resources for wildlife. Along and within the Salt River, the W101, W71, and W59 (Preferred) Alternatives would modify

former gravel pits used by birds as a local water source. It is likely that birds would continue to use these pits, depending on the availability of water, or would use other existing surface water habitats such as the Tres Rios constructed wetlands or similar habitat located farther downstream.

The proposed project would not affect the Yuma clapper rail or its habitat because no suitable habitat exists in the Study Area. Direct impacts such as freeway noise would have no effect because of a 2,000-foot separation between the nearest documented Yuma clapper rail occurrence and the W101 Alternative. If constructed, the Rio Salado Oeste restoration project may create suitable habitat conditions within the Salt River from approximately 83rd Avenue east through the Study Area, and the Tres Rios demonstration wetlands project will restore suitable habitat from the 91st Avenue WWTP west to the confluence of the Agua Fria River with the Gila River.

The proposed action would not affect the yellow-billed cuckoo or its habitat because insufficient suitable habitat exists in or adjacent to the Study Area. Impacts such as noise and increased activity in the Study Area would have no effect because of the approximately 1,300-foot separation between the nearest documented species occurrence and the W101 Alternative.

Sonoran desert tortoises have been documented in the Eastern Section of the Study Area, and construction of the E1 Alternative could affect individuals of this species. The E1 Alternative would directly affect suitable habitat as it crosses SMPP.

The proposed action may cause bald eagles to alter their foraging activity because of the presence of a busy freeway corridor; however, the potential for foraging exists only if water is present and forage species are available. The project would not affect forage species or their potential and would not remove nesting habitat. Direct impacts such as noise and increased activity in the Study Area would be negligible because of the approximately 1-mile distance from the nest to the nearest action alternative, the W101 Alternative.

Habitat Connectivity

Impacts on biological resources during freeway operation would mostly be limited to vehicle-wildlife collisions and disturbances caused by traffic noise (FHWA 2000). A report supported by AGFD and the Arizona Wildlife Linkages Workgroup summarizes a workshop attended by a broad range of organizations and interests that interactively provided input and mapping for important wildlife linkages across Maricopa County (AGFD 2012). The report identifies the area between SMPP and the Sierra Estrella as a landscape movement area. With respect to vehicle-wildlife collisions, no major migration corridors were documented in the Study Area. Many species of wildlife, however, could travel through the Study Area for life requirement purposes. Multifunctional crossing locations were identified to provide a potential movement corridor between SMPP and the Sierra Estrella (see text box on habitat connectivity on page 4-125).

No-Action Alternative

The No-Action Alternative would result in no direct project-related impacts on biological resources. Indirectly, selection of the No-Action Alternative may increase the pace of urban expansion in some areas because some land (set aside for freeway R/W in the past by local jurisdictions) could be released and become available for development. Therefore, it is anticipated that habitat loss, fragmentation, and traffic disturbance would also occur under the No-Action Alternative.

The proposed action, however, offers an opportunity to promote wildlife connectivity with multiuse crossings that may facilitate the movement of wildlife throughout the region in the long term. Selection of the No-Action Alternative would make it less likely that such multiuse crossings would be constructed. Therefore, the projected development could result in even greater habitat loss, habitat fragmentation, and animal-vehicle collisions than would be expected with the proposed action.

MITIGATION

ADOT EPG Responsibilities

- During the design phase, ADOT EPG would coordinate with USFWS and AGFD to determine whether any additional species-specific mitigation measures would be required.

ADOT EPG, Roadside Development, and Design Responsibilities

- Protected native plants within the project limits would be affected by this project; therefore, the ADOT Roadside Development Section would determine whether ADA notification would be needed. If notification were needed, the ADOT Roadside Development Section would send the notification at least 60 calendar days prior to the start of construction
- The proposed action would be designed to provide opportunities for wildlife movement between SMPP and the Gila River Basin and the Sierra Estrella. These opportunities would be located in the region where the E1 Alternative would intersect the southwestern portion of SMPP. Drainage structures incorporated into the roadway plans would be designed to accommodate multifunctional crossings in appropriate locations. If drainage structures were not included in locations identified as likely wildlife movement corridors, strategically located multifunctional crossing structures would be considered. These crossing structures would reduce the incidence of vehicle-wildlife collisions and would ensure the proposed action would not further contribute to complete habitat isolation between SMPP and the Gila River Basin and the Sierra Estrella. In addition, fencing would be installed along both sides of the proposed freeway to ensure that wildlife would be guided into the crossing structures. ADOT would coordinate with AGFD during the design phase regarding the potential for locating and designing wildlife-sensitive roadway structures (see the section, *Measures to Minimize Harm*, beginning on page 5-23, for additional information regarding multifunctional crossings).

- Construction activities would be scheduled and performed in a manner that would attempt to avoid breeding seasons of migratory birds, if necessary, or would develop other mitigation, such as removing dormant nests or obtaining permits from USFWS during the design phase.
- All disturbed soils that would not be landscaped or otherwise permanently stabilized by construction would be seeded using species native to the project vicinity.
- During the design phase, ADOT would reexamine the USFWS threatened and endangered species list for Maricopa County, and mitigation would be developed, if necessary, for any newly listed species.
- During the design phase, ADOT EPG would coordinate with USFWS and AGFD and determine whether any additional species-specific mitigation measures would be required.
- During the design phase, ADOT EPG would be contacted to initiate a review for updating biological requirements for the project, completing bird surveys as necessary, and developing species-specific mitigation measures to minimize potential impacts to birds protected under the MBTA.

ADOT District and Contractor Responsibilities

- To prevent the introduction of invasive species seeds, all earthmoving and hauling equipment would be washed at the contractor's storage facility prior to entering the construction site.
- To prevent invasive species seed from leaving the site, the contractor would inspect all construction equipment and remove all attached plant/vegetation and soil/mud debris prior to that equipment leaving the construction site.
- All disturbed soils that would not be landscaped or otherwise permanently stabilized by construction would be seeded using species native to the project vicinity.
- Habitat impacts could be minimized by restricting construction activities to the minimum area necessary to perform the activities and by maintaining natural vegetation where possible.
- If any Sonoran desert tortoises were encountered during construction, the contractor would adhere to AGFD's most current *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects*.
- The contractor would employ a biologist to complete a preconstruction survey for burrowing owls 96 hours prior to construction in all suitable habitat that would be disturbed. The biologist would possess a burrowing owl survey protocol training certificate issued by AGFD. Upon completion of surveys, the contractor would contact ADOT EPG to provide survey results.
- If any burrowing owls were located during preconstruction surveys or construction, the contractor would employ a biologist holding a permit from USFWS to relocate burrowing owls from the Study Area, as appropriate.
- If burrowing owls or active burrows were identified during the preconstruction surveys or construction, no construction activities would take place within 100 feet of any active burrow until the owls were relocated.

CONCLUSIONS

Construction and operation of any of the action alternatives would involve vegetation removal; would diminish habitat, foraging, and nesting resources for wildlife; and would contribute to habitat fragmentation. No critical habitat is designated in or adjacent to the Study Area for any threatened or endangered species. Construction of the E1 Alternative could affect Sonoran desert tortoises, which have been documented in the Eastern Section of the Study Area. Wildlife species of special concern have been documented as being in or within 3 miles of the Study Area. Although no major migration corridors are known to exist in the Study Area, wildlife movement between the South Mountains and Sierra Estrella through the Gila River Basin is expected to occur. In response, multifunctional crossing locations have been identified to provide potential movement corridors under the E1 Alternative. Most impacts on wildlife and native plant communities would occur in the Eastern Section, primarily because of the presence of undeveloped areas and open space land uses along the SMPP and Community boundaries—the areas with the most natural habitat. During construction activities, noise disturbance would represent a short-term impact on the environment. Impacts on biological resources during operation of the proposed freeway would be mostly limited to vehicle-wildlife collisions and disturbances caused by traffic noise. BMPs would be followed to serve as mitigation, and the use of wildlife corridors is being studied [see the section, *Presentation of Section 4(f) Resources, Impacts, and Measures to Minimize Harm*, beginning on page 5-5].

Under the No-Action Alternative, rapid urban development would contribute to cumulative conversion of natural land/habitat to human-oriented uses.

CULTURAL RESOURCES

AFFECTED ENVIRONMENT

Cultural Resource Regulations

Cultural resource investigations were performed to establish the proposed action's compliance with federal laws identified below. Cultural resources generally include archaeological sites, historic buildings and structures, artifacts and objects, and places of traditional, religious, and cultural significance. *Historic property* refers to cultural resources that are listed in or eligible for listing in the National Register of Historic Places (NRHP).

For the proposed action, FHWA is the lead agency responsible for compliance with the National Historic Preservation Act (NHPA). Under NHPA, the lead federal agency must take into consideration the effects of its actions on historic properties (sites or places eligible for or listed in the NRHP). NHPA stipulates that the lead federal agency make determinations of NRHP eligibility and project effects in consultation with the State Historic Preservation Office (SHPO). The State Historic Preservation Officer (also SHPO) is the appointed official in each state charged with administering the national historic preservation program mandated by NHPA.

In 1992, NHPA amendments allowed federally recognized Native American tribes to assume any or all of the functions of a SHPO with respect to tribal land [Section 101(d)(2)]. Pursuant to these amendments, the Community applied for and was granted Tribal Historic Preservation Officer (THPO) status in February 2009. As a result, federal agencies must consult with THPO in lieu of SHPO for actions occurring on, or affecting historic properties on, Community land.

National Environmental Policy Act

NEPA requires federal agencies to consider the impacts of their activities on the human environment, which includes historic properties. NEPA stipulates that:

- federal agencies work to preserve important historical and cultural aspects of our national heritage [Section 101(b)(4)]
- compliance studies involving historic properties require coordination with other preservation laws such as NHPA

National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and afford SHPO and/or THPO and other parties with a demonstrated interest a reasonable opportunity to comment on such undertakings. Section 106 compliance is implemented through the regulations for *Protection of Historic Properties* (36 C.F.R. Part 800). To be determined eligible for inclusion in the NRHP, properties must be at least 50 years old, meet at least one of four criteria of significance, and retain sufficient historic integrity to convey that significance. The four criteria of significance are:

- Criterion A – be associated with events that have made a significant contribution to the broad patterns of our history
- Criterion B – be associated with the lives of persons significant in our past
- Criterion C – embody the distinctive characteristics of a type, period, or method of construction; or represent the work of a master; or possess high artistic values; or represent a significant distinguishable entity whose components may lack individual distinction
- Criterion D – have yielded, or may be likely to yield, information important in prehistory or history

Integrity is assessed in terms of location, design, workmanship, materials, setting, feeling, and association. The significance of property may be at the local, state, or national level, depending on its historical associations. Typically, historic properties are at least 50 years of age, but more recent properties may be considered for listing if they are of exceptional significance.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act established that it is the policy of the federal government to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions. If a place of religious importance to American Indians may be affected by a proposed federal project, the American Indian Religious Freedom Act promotes consultation with Indian religious practitioners, which may be coordinated with Section 106 consultation under NHPA (see above). Amendments to Section 101 of NHPA strengthened the interface between the two Acts by clarifying that:

- Properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion in the NRHP [16 U.S.C. § 470a(d)(6)(A)].
- In carrying out its responsibilities under Section 106, a federal agency shall consult with any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to properties described in subparagraph (A) [16 U.S.C. § 470a(d)(6)(B)].

National Register Bulletin #38

Amendments to NHPA in 1980 directed the Secretary of the Interior to study means of "preserving and conserving the intangible elements of our cultural heritage such as arts, skills, folklife, and folkways . . ." and to recommend ways to "preserve, conserve, and encourage the continuation of the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are a living expression of our American heritage" (16 U.S.C. § 470a note). As an eventual response, federal guidelines were established (as published in National Register Bulletin #38 [Bulletin #38]) to define, document, and evaluate traditional cultural properties (TCPs) (Parker and King 1990). Bulletin #38 was intended to help determine whether properties thought to have traditional cultural importance would be NRHP-eligible and to assist federal agencies in evaluating such properties.

A TCP is generally defined as a property eligible for inclusion in the NRHP "because of its association with cultural practices or beliefs of a living community

How is NRHP eligibility determined?

The NHPA of 1966, as amended (16 U.S.C. § 470), requires federal agencies to take into account the effects of their undertakings on historic properties and afford the SHPO and other parties with a demonstrated interest a reasonable opportunity to comment on such undertakings. Regulations for Protection of Historic Properties (36 C.F.R. Part 800) implement Section 106 of the NHPA. These regulations define a process for the responsible federal agencies to consult with SHPO or the THPO, Native American groups, other interested parties, and, when necessary, the Advisory Council on Historic Preservation (ACHP) to ensure that historic properties are duly considered as federal projects are planned and implemented.

To be determined eligible for inclusion in the NRHP, properties must be important in American history, architecture, archaeology, engineering, or culture. They also must possess integrity of location, design, settings, materials, workmanship, feeling, and association, and meet at least one of four criteria listed on this page.

Properties may be of local, state, or national importance. Typically, historic properties are at least 50 years old, but may be younger if they are of exceptional importance.

that a) are rooted in that community's history, and b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1990). The guidelines in Bulletin #38 were appropriate for evaluating potential TCPs associated with the proposed action.

Identification of Cultural Resources

Previously Recorded Resources

A records search was performed in 2002 that covered a broad portion of the valley between the Sierra Estrella and SMPP. Over 300 previously recorded archaeological sites within or partly within the Study Area were identified from archaeological investigations conducted between 1955 and 2002. These sites were categorized as:

- prehistoric artifact scatters (166 sites)
- prehistoric habitations (45 sites)
- prehistoric villages (14 sites)
- prehistoric and historic canals (14 sites)
- historic trash dumps (13 sites)
- prehistoric rock piles, rings, and outlines (12 sites)
- prehistoric lithic scatters/quarries (4 sites)
- prehistoric mounds (9 sites)
- prehistoric petroglyphs (10 sites)
- historic structures/foundations (4 sites)
- historic roads (1 site)
- prehistoric trails (3 sites)
- historic mining operations (3 sites)
- unknown sites (no information available) (4 sites)

The identified sites were:

- listed in the NRHP (2 sites)
- determined to be NRHP-eligible (27 sites)
- determined to be potentially NRHP-eligible (122 sites)
- determined to be NRHP-ineligible (15 sites)
- not assessed for NRHP eligibility (136 sites)

Three years later, a supplemental records search was performed to address newly included areas of the Study Area along I-10 (Papago Freeway) and SR 101L (Agua Fria Freeway). The additional investigation identified 27 previously recorded prehistoric and historic archaeological sites, 5 historical-period linear sites (railroad lines, roadways, and canals), and 129 historic building properties. In addition, historical maps indicated that several prehistoric canal alignments had been documented in the Study Area. Of the archeological sites, 5 were considered NRHP-eligible, 5 were not eligible, 9 were not evaluated for eligibility, and the eligibilities of 8 were unknown because information was lacking. Historically documented prehistoric canals in the area were viewed as potentially eligible resources that should be investigated if encountered. The 5 historical-period linear sites were considered eligible. Of the 129 historic building properties, 25 were previously recommended as NRHP-eligible, 37 were recommended as not eligible, and 67 had not been evaluated.

Field Survey

After known sites were researched by records investigations, field surveys were conducted to identify historic properties that could be affected by the proposed action. In 2003 and 2004, the initial cultural resources survey for the project documented 19 archaeological sites and 191 isolated occurrences (Darling 2005). The survey resulted in the recording of 6 new archaeological sites and the expansion of the boundaries of 4 previously recorded sites. In addition, the conditions of 9 other previously recorded sites were updated, with no changes to their previously defined boundaries. The isolated occurrences included individual artifacts, features, and small groupings of artifacts that did not qualify as sites. Of the newly recorded or updated sites, 19 were determined NRHP-eligible and one of the sites was determined not eligible.

In 2005, 2006, and 2009, supplemental surveys were performed (Brodbeck and Pratt 2005; Brodbeck 2006a; Dorigo 2006; Fackler et al. 2009). The purposes of these surveys were to:

- evaluate the NRHP eligibility of properties with historic buildings that were not documented in earlier studies and, consequently, provide the information needed to determine whether they qualified as Section 4(f) resources under the Department of Transportation Act [see Chapter 5, *Section 4(f) Evaluation*]

The South Mountains as a Traditional Cultural Property

The South Mountains are highly valued and considered sacred by some Native American communities. The Community, which includes the Akimel O'odham (River Pima) and Pee Posh (Maricopa) tribes, and other Native American entities—including the Colorado River Indian Tribes and three O'odham groups: the Salt River Pima-Maricopa Indian Community, the Ak-Chin Community, and the Tohono O'odham Nation—consider the South Mountains to play a role in their cultures, identities, histories, and oral traditions. Because of their importance in the Community's history and cultural identity, the South Mountains are NRHP-eligible as a TCP under Criteria A and B.

View to southwest from the South Mountains toward the Community.

Through the course of preparing the DEIS, the Community has continuously expressed to ADOT its concerns about the roadway going through the South Mountains and the possible irreversible impacts on the South Mountains from the proposed action. In addition to a large portion of the South Mountains being protected as a city park, all of the mountain range and some of the surrounding landscape are also afforded protection under the provisions set forth in Section 4(f) as an NRHP-eligible TCP.

The South Mountains appear in the creation stories of the Akimel O'odham and Pee Posh tribes and, as such, are regarded as sacred. From the perspective of the Akimel O'odham and Pee Posh, the South Mountains are part of a continuum of life and not an individual entity that can be isolated and analyzed. The South Mountains TCP extends beyond SMPP. The South Mountains qualify as a Section 4(f) resource and are discussed in Chapter 5.

The South Mountains continue to be a focus for tribal tradition and ceremony and contain petroglyph sites, shrines, trails, named places in traditional stories, and traditional resources. The South Mountains also remain as a resource area for upland plants and animals used by Native Americans.

The portions of the South Mountains on Community land are the Main Ridge North and Main Ridge South, at the western end.

In addition to the mountains themselves, two specific areas (sites) in the Study Area were identified as contributing components of the TCP based on their own merit as historic properties. Both are considered NRHP-eligible under Criterion D.

Site AZ T:12:197 (ASM)[a] contains a trail segment, two rock features, and an artifact scatter. Although the site's age and function are unknown, its position on the landscape is unique and possibly associated with traditional religious and ceremonial activities associated with the South Mountains. Site AZ T:12:198 (ASM) has a collection of well-preserved prehistoric petroglyphs situated within the boundary of the South Mountains TCP. While the rock art is prehistoric in age, these sites continue to function in the living Akimel O'odham and Pee Posh communities and often serve as shrines or spiritual places. Both sites are eligible under Criterion D.

[a] Site naming conventions follow protocols prescribed by the Arizona State Museum (ASM).

The South Mountains as a historic resource

SMPP, which occupies much of the land area of the South Mountains and is NRHP-eligible, has played a key role in the development of the City of Phoenix's parks and recreation program. It is NRHP-eligible because of its rich history:

- **The park's origins began in 1924 when prominent local citizens, aided by then-Congressman Carl Hayden, started a process to obtain 13,000 acres from the federal government. The parkland was conveyed in 1927 by BLM to the City of Phoenix by a grant under the Recreation and Public Purposes Act.**
- **The National Park Service developed the original Master Plan for the park in 1934; this represented the largest municipal park planning effort in the United States.**
- **The development of the park from 1933 to 1942 was the direct result of President Franklin D. Roosevelt's New Deal programs, which provided relief from the Great Depression by employing the Civilian Conservation Corps (CCC).**
- **Today, the park retains many of its original CCC-constructed buildings, structures, and facilities, and it retains its master-planned layout and design.**

In 1989, the City of Phoenix listed SMPP in the City of Phoenix Historic Property Register as a Nonresidential Historic District. The City of Phoenix Historic Preservation Office is in the process of nominating SMPP for listing in the NRHP. SHPO has concurred that SMPP is eligible for the NRHP under Criteria A, B, C, and D for its numerous important historical associations.

- survey additional alignment configurations introduced as part of the iterative EIS process
- survey agricultural fields that had been plowed since the original survey

Of the documented sites from the 2005 supplemental survey, one prehistoric site, six historic sites, and two historic linear sites—a railroad and a canal—were determined NRHP-eligible. As a result of the findings, the action alternatives were reconfigured to avoid the historic properties determined NRHP-eligible.

In 2006, two additional surveys were performed. These surveys assessed historic sites that had not been previously evaluated for NRHP eligibility and that had been included in the area of potential effects as a result of shifts in the action alternative alignments. The properties include SMPP, the Roosevelt Canal, and three farmhouses. SMPP was determined NRHP-eligible. The Roosevelt Canal was determined eligible with contributing and noncontributing components. The three farmhouses were determined not eligible.

In 2009, another supplemental survey and an additional records search were conducted to identify surveys conducted and sites recorded within 1 mile of the W59 and E1 Alternatives since the original records search. The supplemental survey documented nine isolated occurrences, but no new archaeological sites or historic properties.

A survey and records search of two additional areas within the Study Area occurred in September 2011. These efforts focused on areas where Western Area Power Administration (Western) towers and lines would be relocated to accommodate the proposed freeway. The surveys covered 101 acres and documented eight sites: six NRHP-eligible sites and two NRHP-ineligible sites. Three previously unrecorded sites were discovered.

NRHP-eligible and formerly eligible properties exist near Dobbins Road in Laveen near the W59 Alternative. The Hudson Farm district is eligible for listing in the NRHP under Criterion A for its association with Laveen's agricultural development. In addition, four structures—the two cement stave silos on the Hudson Farm, the dairy flat barn on the Hackin Farmstead/Dairy, and the dairy head-to-toe barn on the Tyson Farmstead/Barnes Dairy—are individually eligible under Criterion C for their design and construction (Solliday and Macnider 2012).

Although previously recommended as eligible for the NRHP (Brodbeck and Pratt 2005), the Dobbins Road Streetscape (6100 Block of West Dobbins Road) was reevaluated and determined to be not eligible because many components of the streetscape, including buildings, vegetation, and views of agricultural fields, have lost their historic character (Solliday and Macnider 2012). SHPO concurred with these eligibility recommendations on July 16, 2012.

Identification of Traditional Cultural Properties

A TCP evaluation within the proposed action's area of potential effects was conducted. Ten locations were identified by the Community as places of cultural importance that could qualify as NRHP-eligible TCPs. The NRHP eligibility of two of the properties was confirmed by FHWA through consultation with the Community. To be in full accordance with NHPA, all ten potential TCPs were evaluated for NRHP eligibility.

Traditional Cultural Properties

The initial field survey for the proposed action (Darling 2005) identified ten potential TCPs: the South Mountains, two prehistoric village sites, an active shrine site, two prehistoric petroglyph sites, and four prehistoric trail sites. As a result of TCP evaluations and consultations with the Community, five TCPs have been identified within the area of potential effects. The South Mountains were determined eligible for NRHP listing as a TCP under Criteria A and B. The two prehistoric villages, Villa Buena [AZ T:12:9 (ASM)] and Pueblo del Alamo [AZ T:12:52 (ASM)], were determined eligible for listing in the NRHP as TCPs under Criterion A and as archaeological sites under Criterion D. An active shrine site, AZ T:12:112 (ASM), was determined eligible as a TCP under Criterion A and as an archaeological site under Criterion D. One petroglyph site, AZ T:12:198 (ASM), was determined eligible as a TCP under Criterion A and as an archaeological site under Criterion D.

In addition, two of the ten potential TCPs identified by the initial field survey were found to be eligible for listing in the NRHP under Criterion A as contributors to the South Mountains TCP. These included a prehistoric trail site [AZ T:12:197 (ASM)] and a prehistoric petroglyph site [AZ T:12:198 (ASM)], both of which retained qualities that contributed to the NRHP eligibility of the South Mountains TCP.

Four sites identified as potential TCPs included three trail sites and one heavily altered rock art site. The trail sites— AZ T:12:201 (ASM), AZ T:12:207 (ASM), and AZ T:12:211 (ASM)—were determined not eligible for NRHP listing as TCPs but eligible under Criterion D as archaeological sites. The rock art site, AZ T:12:208 (ASM), was determined to be not eligible for NRHP listing as a TCP but eligible under Criterion D as an archaeological site.

ENVIRONMENTAL CONSEQUENCES

Prehistoric Site Impacts, Action Alternatives, Western and Eastern Sections

All action alternatives would affect archaeological resources. All but one of the archaeological sites are eligible for the NRHP under Criterion D. Table 4-46 presents the number and types of NRHP-eligible archaeological sites that would be affected by the action alternatives.

The action alternatives in the Western Section would affect artifact scatters, mostly visible in agricultural fields; the scatters likely represent the remains of prehistoric habitations and related agricultural activities. In contrast, the E1 (Preferred) Alternative would affect NRHP-eligible archaeological sites that are activity-specific sites, such as small artifact scatters, lithic quarries, and trails. The construction footprint would avoid a petroglyph site in the E1 Alternative corridor.

The W59 (Preferred) Alternative would affect the greatest number of sites in the Western Section, while the W101 Alternative and its Options would affect the fewest. When comparing impacts on archaeological sites, however, it is important to consider the types of sites being affected. Although the W101 Alternative would

Table 4-46 Archaeological Resources Affected, Action Alternatives

Action Alternative[a]	Number of Sites Affected	Site Type	NRHP[b] Eligibility Criterion	Mitigation Required[c]
Western Section				
W59	5	2 village sites[d], 3 artifact scatters	D[e]	Yes
W71	4	1 village site[d], 3 artifact scatters		
W101 Western Option	3	1 village site[d], 2 artifact scatters		
W101 Central Option	2	1 village site[d], 1 artifact scatter		
W101 Eastern Option	2	1 village site[d], 1 artifact scatter		
Eastern Section				
E1	7	1 artifact scatter (limited activity site) 2 lithic quarry sites[f] 4 trail sites[g, h]	D	Yes

[a] Impacts associated with the No-Action Alternative are presented on page 4-132.
[b] National Register of Historic Places
[c] Mitigation requirements are presented on page 4-146.
[d] Village sites are eligible for listing in the NRHP under Criterion A.
[e] a cultural resource or site having yielded, or one that may be likely to yield, information important in prehistory or history
[f] One lithic quarry site had petroglyphs destroyed by modern development.
[g] The ages of trail sites are unknown, but likely have historic and prehistoric associations.
[h] Some trails have associated artifacts and features.

affect the fewest number of archaeological sites, the sites that would be affected include an artifact scatter of one extensive prehistoric Hohokam village. Similarly, the W71 Alternative would affect the same village site, and the W59 Alternative would affect two other prehistoric Hohokam village sites of similar extent. These sites have been identified through observations of surface artifacts, which may or may not be reliable indicators of buried cultural features. Without archaeological testing, the full extent, distribution, and condition of buried archaeological resources are unknown within and among action alternatives. To further clarify, the process of identifying sites through observations of surface artifacts to be documented through archaeological test excavations later in the process would not be atypical, but would represent the standard, accepted analytical progression.

Historic Site Impacts, Action Alternatives, Western and Eastern Sections

All of the Western Section action alternatives would cross the historic Southern Pacific Railroad and the Roosevelt Canal, which are NRHP-eligible; the segments of the Roosevelt Canal that would be crossed by the W101 Alternative and Options, however, are not eligible because the canal segments are modern realignments. The segments of the Roosevelt Canal that would be crossed by the W59 (Preferred) and W71 Alternatives are NRHP-eligible because they are well-preserved and represent the original design and construction.

As discussed in Chapter 3, *Alternatives*, the 62nd Avenue Option of the W59 Alternative was advanced for further study because this option would avoid historic properties (Hudson Farm district and the dairy barn on the Tyson Farmstead/Barnes Dairy) and would not conflict with City-approved zoning in Laveen Village. Therefore, the W59 Alternative would have no adverse effect on these resources. SHPO concurred with these findings of effect on September 14, 2012.

Although the E1 (Preferred) Alternative would cross SMPP, no features contributing to its historic significance would be affected by the proposed action (however, see the TCP discussion in the following section). Table 4-47 summarizes known historical sites that would be affected by the action alternatives.

Impacts on TCPs, Action Alternatives, Western and Eastern Sections

The Community has expressed concerns that the proposed action may interfere with the perpetuation of its cultural traditions and identity through the loss of spiritual and physical connections; loss of social memory; interference with cultural knowledge, creation stories, and song traditions; and damage to the knowledge that resides in Villa Buena and Pueblo del Alamo. To prevent adverse effects, the Community submitted a proposal to develop an enhancement and management plan for the Villa Buena and Pueblo del Alamo TCPs. These enhancement measures may include short-term (traditional religious activities, exhibits to increase awareness of losses and gains to culture, additional tribal consultation, and protection of sites of equivalent importance) and long-term (cultural preservation and education) programs. THPO concurred with this approach on October 22, 2012.

FHWA and ADOT have committed to implementing the TCP enhancement and management plan for these two sites. As a result, the W71 and W101 Alternatives in the Western Section would not adversely affect the NRHP-eligible TCP attributes of Villa Buena, while the W59 Alternative would not adversely affect the NRHP-eligible TCP attributes of Pueblo del Alamo. SHPO concurred with the effect determination on October 25, 2012.

In the Eastern Section, the E1 (Preferred) Alternative would adversely affect the South Mountains TCP. A second TCP, an active shrine, is located within the E1 Alternative footprint, but would be avoided by construction. The Community has concurred with proposed mitigation of direct and indirect adverse impacts on the South Mountains TCP. In a letter from the Lt. Governor to the Director at FHWA dated June 23, 2010, the Community submitted a proposal for the "Evaluation of Traditional Cultural Property and Adverse Effects of Transportation Corridor Development posed by the proposed construction of the current Pecos Alignment of the South Mountain Freeway."

What actions have been taken to reduce or avoid impacts on cultural resources?

The section, *Alternatives Development and Screening*, beginning on page 3-1, outlines the process undertaken to identify the range of action alternatives presented in detail in the DEIS. Through the screening process, some action alternatives were eliminated completely from the study because of the severity of impacts they would have caused on cultural resources. Design adjustments to the W59, W71, W101, and E1 Alternatives have been made to further reduce or avoid impacts on known cultural resources in the Study Area. Specific measures taken include:

- **The South Mountain Freeway, as proposed in 1988, would have resulted in a direct use of just over 40 acres of SMPP (ADOT 1988a). Using approximately the same alignment as planned in 1988, R/W needs of the proposed action through SMPP would result in an actual use of just under 31.3 acres; the design as planned in the DEIS would use approximately 9 acres less than what was planned in 1988 (see page 5-23).**
- **The alignment of the South Mountain Freeway, as planned in 1988, was located to avoid bisecting SMPP and to avoid the creation of remnant parcels of parkland. As such, the alignment was placed on the SMPP and Community boundary lines (see Figure 5-14, on page 5-23). The intent behind this decision has not changed with the proposed action.**
- **In the mid-1980s, as plans progressed to design and construct the South Mountain Freeway, ADOT purchased land adjacent to the SMPP boundary and turned it over to the City of Phoenix; the intent was to replace parkland that would be converted to the freeway use. The approximately 16-acre property is located on the western side of the SMPP boundary.**
- **The alignment options for the W59 Alternative were adjusted near Dobbins Road to avoid historic resources.**

Table 4-47 NRHP[a]-eligible Historical Sites (non-TCP[b]), Action Alternatives

Action Alternative[c]	Site	NRHP Eligibility Criterion	Status of Section 106 Consultation	Affected	Mitigation Required[d]
Western Section					
W59	Roosevelt Canal[e]	Criterion A	Ongoing	No	No
	Historic Southern Pacific Railroad[f]			No	No
W71	Roosevelt Canal			No	No
	Historic Southern Pacific Railroad			No	No
W101 Western Option	Historic Southern Pacific Railroad			No	No
W101 Central Option					
W101 Eastern Option					
Eastern Section					
E1	Phoenix South Mountain Park/Preserve	Criteria A, B, C, D	Ongoing	Yes	No[g]

[a] National Register of Historic Places
[b] traditional cultural property
[c] Impacts associated with the No-Action Alternative are presented on this page.
[d] Mitigation requirements are presented on page 4-146.
[e] The Roosevelt Canal has been recommended as NRHP-eligible for its associations with the development of historical irrigation districts in the lower Salt River and Buckeye valleys. A portion of the open canal would be routed beneath the W59 and W71 Alternatives. The freeway would be constructed on a bridge to eliminate potential impacts.
[f] The Wellton-Phoenix-Eloy main line of the Arizona Eastern Railroad (which became part of what is most generally known as the historic Southern Pacific Railroad and is now part of the Union Pacific Railroad) was recommended as NRHP-eligible for its association with the development of Arizona's railroad network. The railroad has been maintained and upgraded over the years and remains an important component of Arizona's transportation network. All action alternatives in the Western Section would cross the railroad on a grade-separated structure. Given that the railroad's setting has been highly modified by modern development, it is expected that a bridge crossing would not affect the qualities of the railroad that contribute to its eligibility to the NRHP. Therefore, no impacts on the railroad would occur.
[g] The E1 (Preferred) Alternative would not significantly adversely affect qualities of SMPP that qualify it for listing in the National Register of Historic Places.

This proposal addresses several key points related to the proposed freeway:

- "… the current proposal only addresses partial measures for the mitigation of adverse effects posed by the Pecos alignment to Traditional Cultural Property (TCP) including individual sites and the mountain (*Muhadagi Doag* – South Mountain) and may be used in the preparation and finalization of the Environmental Impact Statement (EIS)."
- "The attached proposal also acknowledges the engineering solutions provided by ADOT in the form of overpasses for the avoidance and protection of sensitive cultural sites as acceptable concepts and that implementation of their design and construction will require further consultation in the event these go forward. This includes especially the implementation of proposed massive cuts through the western ridges of *Muhadagi Doag* and earthworks required for construction of the Pecos alignment, which will significantly impact the mountain and the surrounding cultural landscape."
- "… this proposal identifies the important and significant overlap of wildlife and culture corridors and the significance of all plants and animals in the traditional culture of the Akimel O'odham and Pee Posh of this Community."

Consultation with THPO and other tribes regarding appropriate mitigation of the South Mountains TCP is ongoing (Table 4-48 documents past efforts). SHPO concurred with TCP eligibility, potential project effects, and proposed TCP mitigation on May 15, 2012.

The E1 Alternative would have an adverse effect on the South Mountains TCP. The conversion and permanent loss of part of the mountains to a transportation use by the action alternative would be compounded by the following related Community-expressed concerns focused on impacts on the Community's history, culture, traditions, and its ability to maintain and sustain its cultural identity.

- The proposed action's cuts through the South Mountains would remove two archaeological sites identified as contributing components of the South Mountains TCP, based on their own merits as historical properties (considered NRHP-eligible under Criteria A and D).
- The proposed action's cuts through the South Mountains would result in the modification of the spiritual landscape of Native peoples.
- The E1 Alternative location between the Community and the South Mountains would alter access by Native American groups to culturally important places.
- The location and operation of the E1 Alternative would interfere with ceremonial practices and religious activities of some Native American groups [the sections, *Public Parkland Resources (SMPP) Associated with the South Mountains*, *NRHP-Eligible Historic Resources (SMPP) Associated with the South Mountains,* and *The South Mountains (Muhadagi Doag) as a Traditional Cultural Property*, beginning on pages 5-14, 5-25, and 5-26, respectively, further elaborate the extent of impacts on the resources].

No-Action Alternative

The No-Action Alternative would not affect archaeological and cultural resources in the Study Area. Cultural resources in protected areas, such as SMPP, would not be affected by construction activities associated with the proposed action.

Table 4-48 Record of Section 106 Consultation

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
8/20/03 (FHWA[a])	• To initiate Section 106[b] consultations • To request concurrence that consultations continue to address eligibility, area of potential effects, project scope and effect, and the development of a PA[d] as alternatives alignments are developed • To provide an opportunity to review the initial records search report of the overall Study Area (Burden 2002)	Arizona State Land Department	—[c]	No response	—	—	—	—
		Bureau of Indian Affairs	10/27/03	Concurred	—	—	—	—
		Bureau of Land Management	9/22/03	Concurred	—	—	—	—
		Bureau of Reclamation	9/11/03	Concurred	—	—	—	—
		City of Avondale	—	No response	—	—	—	—
		City of Chandler	—	No response	—	—	—	—
		City of Phoenix – City Archaeologist	9/17/03	Concurred, with comments	—	—	—	—
		City of Phoenix –Historic Preservation Office	9/8/03	Noted that records search report did not address some known historic resources	—	—	—	—
		City of Tolleson	—	No response	—	—	—	—
		Salt River Project	11/10/03	Concurred	—	—	—	—
		State Historic Preservation Office	9/19/03	Concurred	—	—	—	—
		Ak-Chin Indian Community	—	No response	—	—	—	—
		Gila River Indian Community	—	No response	—	—	—	—
		Hopi Tribe	9/10/03	Concurred	—	—	—	—
		Salt River Pima-Maricopa Indian Community	—	No response	—	—	—	—
		Tohono O'odham Nation	—	No response	—	—	—	—
		Yavapai-Apache Nation	—	No response	—	—	—	—
		Yavapai-Prescott Indian Tribe	9/10/03	Deferred participation to the Southern tribes	—	—	—	—
12/9/03 (ADOT[e])	• To request concurrence on draft PA	Arizona State Land Department	—	No response	—	—	—	—
		Bureau of Land Management	12/30/03	Concurred	—	—	—	—
		Bureau of Reclamation	12/18/03	Concurred, with comments	—	—	—	—
		City of Phoenix – City Archaeologist	12/17/03	Concurred	—	—	—	—
		City of Phoenix – Historic Preservation Office	—	No response	—	—	—	—
		Salt River Project	4/1/04	Concurred	—	—	—	—
		State Historic Preservation Office	1/12/04	Concurred	—	—	—	—

Note: The correspondence listed in this table can be found in Appendix 2-1.

[a] Federal Highway Administration [b] part of the National Historic Preservation Act [c] not applicable [d] programmatic agreement [e] Arizona Department of Transportation

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
12/9/03 (ADOT) (continued)	• To request concurrence on draft PA	Gila River Indian Community	—	No response	—	—	—	—
		Hopi Tribe	12/11/03	Deferred participation in PA to Gila River Indian Community; requested continued participation in Section 106 consultations	—	—	—	—
3/4/04 (FHWA)	• To notify the ACHP[f] about the project and determine Council participation	ACHP	3/30/04	Declined participation; encouraged the development of a PA without ACHP involvement	—	—	—	—
7/1/05 (ADOT)	• To request concurrence on the adequacy of the field survey[g] report (Darling 2005) • To request concurrence on second draft PA	Arizona State Land Department	—	No response	—	—	—	—
		Bureau of Indian Affairs	8/3/05	Declined participation in PA; concurred verbally	—	—	—	—
			8/11/05	Written response received	—	—	—	—
		Bureau of Land Management	7/26/05	Concurred	—	—	—	—
		Bureau of Reclamation	7/12/05	Concurred	—	—	—	—
		City of Phoenix – City Archaeologist	7/18/05	Concurred, with comments	—	—	—	—
		Salt River Project	8/8/05	Concurred	—	—	—	—
		State Historic Preservation Office	7/11/05	SHPO[h] did not concur; comments on the eligibility of the isolated occurrences and historic canals, and on the draft PA	1/12/06	ADOT requested concurrence on eligibility recommendations for the isolated occurrences and prehistoric sites for the initial field survey report (Darling 2005); noted that the isolated occurrences would be considered in the overall treatment plan.	1/23/06	SHPO concurred that the 19 prehistoric sites are eligible individually under Criterion D,[i] but noted that a broader context is needed to understand the significance of the Study Area and surrounding setting.
7/7/05 (FHWA)	• To request concurrence on the adequacy of the field survey report (Darling 2005) • To request information regarding TCP[j] concerns • To request adequacy of draft PA • To request participation in the PA	Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Indian Tribe	—	No response	—	—	—	—
		Cocopah Indian Tribe	—	No response	—	—	—	—
		Colorado River Indian Tribes	—	No response	—	—	—	—
		Fort McDowell Yavapai Nation	8/5/05	Concurred	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—
		Fort Yuma-Quechan Tribe	—	No response	—	—	—	—
		Gila River Indian Community	9/30/05	Identified South Mountains, Villa Buena, and Pueblo del Alamo as TCPs	11/22/2005	Acknowledged South Mountains TCP; requested boundary for South Mountains TCP and input on appropriateness of TCP evaluation for Villa Buena and Pueblo del Alamo	—	—

[f] Advisory Council on Historic Preservation [g] ground (field) survey for cultural resources [h] State Historic Preservation Office [i] see page 4-128 for criterion definition [j] traditional cultural property

(continued on next page)

Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
7/7/05 (FHWA) (continued)	• To request concurrence on the adequacy of the field survey report (Darling 2005) • To request information regarding TCP[j] concerns • To request adequacy of draft PA • To request participation in the PA	Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	—	No response	—	—	—	—
		Hualapai Tribe	—	No response	—	—	—	—
		Kaibab-Band of Paiute Indians	—	No response	—	—	—	—
		Navajo Nation	—	No response	—	—	—	—
		Pascua Yaqui Tribe	—	No response	—	—	—	—
		Pueblo of Zuni	7/12/05	Concurred	—	—	—	—
		Salt River Pima-Maricopa Indian Community	—	No response	—	—	—	—
		San Carlos Apache Nation	—	No response	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Tohono O'odham Nation	—	No response	—	—	—	—
		Tonto Apache Tribe	—	No response	—	—	—	—
		White Mountain Apache Tribe	—	No response	—	—	—	—
		Yavapai-Apache Nation	—	No response	—	—	—	—
		Yavapai-Prescott Indian Tribe	7/22/05	Deferred participation to Southern Tribes	—	—	—	—
8/3/05 (ADOT)	• To request concurrence of adequacy of draft PA • To request participation in final PA	City of Avondale	—	No response	—	—	—	—
		City of Chandler	—	No response	—	—	—	—
		City of Glendale	—	No response	—	—	—	—
		City of Tolleson	—	No response	—	—	—	—
8/17/05 (ADOT)	• To request participation in final PA and in discussions regarding effects on TCPs	Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Indian Tribe	—	No response	—	—	—	—
		Cocopah Indian Tribe	—	No response	—	—	—	—
		Colorado River Indian Tribes	—	No response	—	—	—	—
		Fort McDowell Yavapai Nation	—	No response	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—
		Fort Yuma-Quechan Tribe	—	No response	—	—	—	—
		Gila River Indian Community	—	No response	—	—	—	—
		Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	—	No response	—	—	—	—
		Hualapai Tribe	—	No response	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
8/17/05 (ADOT) (continued)	• To request participation in final PA and in discussions regarding effects on TCPs	Kaibab-Band of Paiute Indians	—	No response	—	—	—	—
		Navajo Nation	—	No response	—	—	—	—
		Pascua-Yaqui Nation	—	No response	—	—	—	—
		Salt River Pima-Maricopa Indian Community	10/2/05	Concurred (Concurring Party)	—	—	—	—
		San Carlos Apache Nation	—	No response	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Tohono O'odham Nation	11/8/05	Concurred (Concurring Party)	—	—	—	—
		Tonto-Apache Tribe	—	No response	—	—	—	—
		White Mountain Apache Tribe	—	No response	—	—	—	—
		Yavapai-Apache Nation	—	No response	—	—	—	—
8/31/05 (ADOT)	• To request concurrence on adequacy of draft PA • To request participation in final PA	Flood Control District of Maricopa County	—	No response	—	—	—	—
		Maricopa County Department of Transportation	9/20/05	Concurred	—	—	—	—
		Roosevelt Irrigation District	—	No response	—	—	—	—
8/31/05 (ADOT)	• To request concurrence on adequacy and eligibility recommendations of the addendum records search and field survey reports (Brodbeck and Touchin 2005; Brodbeck and Pratt 2005)	Arizona State Land Department	—	No response	—	—	—	—
		Bureau of Land Management	—	No response	—	—	—	—
		Bureau of Reclamation	9/19/05	Concurred	—	—	—	—
		City of Phoenix – City Archaeologist	11/1/05	Concurred, with comments	—	—	—	—
		City of Phoenix – Historic Preservation Office	—	No response	—	—	—	—
		Salt River Project	9/13/05	Concurred, with comments (dated 9/19/05)	—	—	—	—
		State Historic Preservation Office	9/19/05	SHPO did not concur; requested revisions	9/29/05	ADOT requested concurrence on the eligibility recommendations in the addendum records search and field survey reports (Brodbeck and Touchin 2005; Brodbeck and Pratt 2005); letter not in file	10/3/05	SHPO concurred with eligibility recommendations
9/27/05 (FHWA)	• To notify ACHP of revised PA	Advisory Council on Historic Preservation	12/27/05	ACHP declined participation	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
9/29/05 (FHWA) (continued)	• To request comments on draft PA by 10/3/05 • To request participation in final PA • To request information on TCP concerns • To provide meeting minutes from TCP meeting held in Sacaton on September 20, 2005	Gila River Indian Community	–	No direct response; see letter from the Gila River Indian Community dated September 30, 2005	–	–	–	–
11/30/05 (FHWA)	• To request participation in PA	Gila River Indian Community	–	No response	–	–	–	–
3/7/06 (FHWA)	• To request concurrence on adequacy of technical reports and eligibility recommendations (Brodbeck and Pratt 2005; Brodbeck and Touchin 2005; Burden 2002; Darling 2005) • To request concurrence on adequacy of draft PA • To request participation in the PA	U.S. Army Corps of Engineers	–	No response	–	–	–	–
6/26/06 (FHWA)	• To request concurrence on the adequacy of the second addendum cultural resources report and eligibility recommendations (Brodbeck 2006a) • To request concerns regarding TCPs (tribes only)	Arizona State Land Department	–	No response	–	–	–	–
		Bureau of Indian Affairs	–	No response	–	–	–	–
		Bureau of Land Management	–	No response	–	–	–	–
		Bureau of Reclamation	8/1/06	Concurred	–	–	–	–
		City of Avondale	7/25/06	Concurred	–	–	–	–
		City of Chandler	7/3/06	Concurred	–	–	–	–
		City of Glendale	–	No response	–	–	–	–
		City of Phoenix – City Archaeologist	7/5/06	Concurred	–	–	–	–
		City of Phoenix – Historic Preservation Officer	8/16/06	Concurred	–	–	–	–
		City of Tolleson	–	No response	–	–	–	–
		Flood Control District of Maricopa County	7/6/06	Concurred	–	–	–	–
		Maricopa County Department of Transportation	7/5/06	Concurred	–	–	–	–

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
6/26/06 (FHWA) (continued)	• To request concurrence on the adequacy of the second addendum cultural resources report and eligibility recommendations (Brodbeck 2006a) • To request concerns regarding TCPs (tribes only)	Roosevelt Irrigation District	—	No response	—	—	—	—
		Salt River Project	7/7/06	Concurred	—	—	—	—
		State Historic Preservation Office	7/19/06	Concurred; with comments on eligibility of SMPP	—	—	—	—
		U.S. Army Corps of Engineers	—	No response	—	—	—	—
		Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Indian Tribe	—	No response	—	—	—	—
		Cocopah Indian Tribe	—	No response	—	—	—	—
		Colorado River Indian Tribes	7/6/06	Notified ADOT by phone call that South Mountains are a TCP for the Colorado River Indian Tribes.	7/6/06	During the same phone call, ADOT requested written response from Colorado River Indian Tribes regarding the TCP concerns.	No response	—
		Fort McDowell Yavapai Nation	—	No response	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—
		Fort Yuma-Quechan Tribe	—	No response	—	—	—	—
		Gila River Indian Community	—	No response	—	—	—	—
		Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	7/3/06	Concurred	—	—	—	—
		Kaibab-Band of Paiute Indians	—	No response	—	—	—	—
		Navajo Nation	—	No response	—	—	—	—
		Pascua Yaqui Tribe	8/1/06	No concerns with project (e-mail)	—	—	—	—
		Pueblo of Zuni	—	No response	—	—	—	—
		Salt River Pima-Maricopa Indian Community	—	No response	—	—	—	—
		San Carlos Apache Nation	7/17/06	Concurred; no TCP concerns	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Tohono O'odham Nation	—	No response	—	—	—	—
		Tonto Apache Tribe	—	No response	—	—	—	—
		White Mountain Apache Tribe	7/7/06	No TCP concerns	—	—	—	—
		Yavapai-Apache Nation	—	No response	—	—	—	—
		Yavapai-Prescott Indian Tribe	8/14/06	Concurred; no TCP concerns	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
6/28/06 (FHWA)	• To request concurrence on the adequacy of the TCP report and eligibility recommendations (Brodbeck 2006b)	Gila River Indian Community	9/25/06; 12/19/06	Confirmed receipt of report and notified FHWA that a response was pending review with the Gila River Indian Community's Cultural Resource Standing Committee; provided comments on the report and requested revisions; concurred with some TCP eligibility recommendations	—	—	—	—
		State Historic Preservation Office	8/1/06	Did not concur; further response contingent on Gila River Indian Community response	—	—	—	—
12/11/06 (FHWA)	• To request signature on final PA	Arizona State Land Department	—	No response	—	—	—	—
		Bureau of Land Management	—	No response	—	—	—	—
		Bureau of Reclamation	—	No response	—	—	—	—
		City of Avondale	—	No response	—	—	—	—
		City of Chandler	2/22/07	Declined signing the PA	—	—	—	—
		City of Glendale	—	No response	—	—	—	—
		City of Phoenix–City Archaeologist	—	No response	—	—	—	—
		City of Phoenix–Historic Preservation Officer	1/8/07	Signed PA	—	—	—	—
		City of Tolleson	—	No response	—	—	—	—
		Flood Control District of Maricopa County	1/30/07	Signed PA; no cover letter	—	—	—	—
		Maricopa County Department of Transportation	1/16/07	Signed PA; no cover letter	—	—	—	—
		Roosevelt Irrigation District	—	No response	—	—	—	—
		Salt River Project	1/15/07	Signed PA; cover letter dated 1/16/07	—	—	—	—
		U.S. Army Corps of Engineers	—	No response	—	—	—	—
		Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Tribe	—	No response	—	—	—	—
		Cocopah Tribe	—	No response	—	—	—	—
		Colorado River Indian Tribe	—	No response	—	—	—	—
		Fort McDowell Yavapai Nation	1/11/07	Signed PA; cover letter dated 1/17/07	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
12/11/06 (FHWA) (continued)	• To request signature on final PA	Fort Yuma-Quechan Tribe	—	No response	—	—	—	—
		Gila River Indian Community	—	No response	—	—	—	—
		Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	—	No response	—	—	—	—
		Hualapai Tribe	—	No response	—	—	—	—
		Kaibab-Paiute Tribe	—	No response	—	—	—	—
		Navajo Nation	—	No response	—	—	—	—
		Pascua Yaqui Tribe	—	No response	—	—	—	—
		Pueblo of Zuni	—	No response	—	—	—	—
		Salt River Pima-Maricopa Indian Community	—	No response	—	—	—	—
		San Carlos Apache Tribe	—	No response	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Tohono O'odham Nation	—	No response	—	—	—	—
		Tonto Apache Tribe	2/3/07	Signed PA; no cover letter	—	—	—	—
		White Mountain Apache Tribe	—	No response	—	—	—	—
		Yavapai-Apache Nation	1/3/07	Signed PA; no cover letter	—	—	—	—
12/20/06 (FHWA)	• To request signature on final PA	Arizona State Museum	1/10/07	Signed PA	—	—	—	—
		State Historic Preservation Office	12/28/06	Signed PA	—	—	—	—
1/18/07 (FHWA)	• To request agreement for disclosing the location of AZ T:12:112 (ASM) to pertinent project team members	Gila River Indian Community	—	No response	—	—	—	—
5/15/07 (ADOT)	• To request concurrence on adequacy of the Jackson Farmstead evaluation report and eligibility recommendation	City of Phoenix–Historic Preservation Officer	—	No response	—	—	—	—
		State Historic Preservation Office	5/31/07	Concurred	—	—	—	—
5/24/07 (FHWA)	• Sent ACHP copy of final PA [36 C.F.R. 800.6(b)(iv)]	Advisory Council on Historic Preservation	—	No response required	—	—	—	—
6/13/07 (FHWA)	• To request concurrence on TCP boundary revision • To request agreement to disclose the location of AZ T:12:112 (ASM) to pertinent team members • To request meeting on cultural resources issues	Gila River Indian Community	7/2/07	Requested additional consultation on revised TCP report prior to its submission for NRHP determination and agreed that a meeting to discuss AZ T:12:112 (ASM) was needed; suggestion was made to include SHPO	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
4/22/08 (FHWA)	• To request meeting to discuss options for minimizing harm to sites AZ T:12:112 (ASM) and AZ T:12:198 (ASM) • To request a proposal for a study of Muhadagi Doag (South Mountains) TCP and a meeting to discuss avoidance measures	Gila River Indian Community	11/18/08	Provided a draft scope of work for a TCP evaluation for the traditional uses and significance of Muhadagi Doag (South Mountain)	1/13/09 and 4/28/10	FHWA provided additional information and clarification on the requested scope of work for the TCP evaluation. FHWA sent a follow-up letter requesting any comments on the Muhadagi Doag TCP proposal.	6/23/10	Provided a revised scope of work, which would define the cultural significance of the TCP and serve as partial mitigation for adverse effects that would result from the project
9/13/10	• Meeting to discuss cultural resources studies for the South Mountain EIS	ADOT, Gila River Indian Community, Cultural Resource Management Program	—	—	—	—	—	—
9/16/10 (FHWA)	• To request signature on the PA	Western Area Power Administration	10/18/10	Signed PA, cover letter dated 10/25/10	—	—	—	—
10/19/10	• Meeting to discuss cultural resource avoidance and the results of cultural resources surveys	ADOT, Gila River Indian Community, Cultural Resource Management Program	—	—	—	—	—	—
2/1/11 (FHWA)	• To request concurrence on approach for the mitigation of effects on historic properties near the W59 Alternative and Dobbins Road	State Historic Preservation Office	2/4/11	Concurred	—	—	—	—
2/7/11 (FHWA)	• To request concurrence on the adequacy of the revised TCP report NRHP-eligibilty recommendations	Gila River Indian Community	8/17/11	Provided comments; did not concur	—	—	—	—
4/14/11	• Meeting to discuss cultural resources issues and the Section 106 consultation process	FHWA, ADOT, Gila River Indian Community, Cultural Resource Management Program, Tribal Historic Preservation Officer	—	—	—	—	—	—
8/8/11 (FHWA)	• To request concurrence on determination of project effects and adequacy of the field survey report for geotechnical work at the 59th Avenue railroad crossing	State Historic Preservation Office	8/11/11	Concurred	—	—	—	—
		Union Pacific Railroad	—	No response	—	—	—	—
10/31/11 (FHWA)	• To request signature on the PA	Bureau of Indian Affairs	—	No response	—	—	—	—
1/23/12 (FHWA)	• To request signature on the PA	Bureau of Indian Affairs	—	No response	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
4/24/12 (FHWA)	• To request concurrence on TCP NRHP eligibility, adequacy of draft TCP mitigation plans, and Section 4(f) determinations	State Historic Preservation Office	5/15/12	Concurred with comments	—	—	—	—
		Gila River Indian Community	7/3/12	Concurred	—	—	—	—
6/11/12	• Meeting to discuss Section 106 consultations for TCPs	FHWA, ADOT, Gila River Indian Community	—	—	—	—	—	—
7/11/12 (FHWA)	• To request concurrence on reassessment of eligibility of resources near Dobbins Road	Arizona State Land Department	—	No response	—	—	—	—
		Bureau of Land Management	—	No response	—	—	—	—
		Bureau of Reclamation	7/25/12	Concurred	—	—	—	—
		City of Phoenix-Historic Preservation Office	7/18/12	Concurred	—	—	—	—
		City of Phoenix-Pueblo Grande Museum	7/17/12	Concurred	—	—	—	—
		Salt River Project	7/13/12	Concurred	—	—	—	—
		State Historic Preservation Office	7/16/12	Concurred	—	—	—	—
8/8/12 (FHWA)	• To request concurrence on eligibility and project effects on resources near Chandler Boulevard extension	Arizona State Land Department	8/14/12	Concurred	—	—	—	—
		Arizona State Museum	9/11/12	Concurred	—	—	—	—
		Bureau of Indian Affairs	9/21/12	Concurred	—	—	—	—
		Bureau of Land Management	—	No response	—	—	—	—
		Bureau of Reclamation	8/13/12	Acknowledged receipt of consultation letter	—	—	—	—
		City of Avondale	—	No response	—	—	—	—
		City of Chandler	9/10/12	Concurred	—	—	—	—
		City of Glendale	8/13/12	Concurred	—	—	—	—
		City of Phoenix-Historic Preservation Officer	8/29/12	Concurred	—	—	—	—
		City of Phoenix-Pueblo Grande Museum	9/26/12	Concurred			—	—
		City of Tolleson	—	No response	—	—	—	—
		Flood Control District of Maricopa County	8/20/12	Concurred	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
8/8/12 (FHWA) (continued)	• To request concurrence on eligibility and project effects on resources near Chandler Boulevard extension	Maricopa County Department of Transportation	—	No response	—	—	—	—
		Salt River Project	8/24/12	Concurred	—	—	—	—
		State Historic Preservation Office	8/13/12	Deferred response until Gila River Indian Community response	10/11/12	Provided Gila River Indian Community response	10/17/12	Concurred
		U.S. Army Corps of Engineers	—	No response	—	—	—	—
		Western Area Power Administration	—	No response	—	—	—	—
		Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Indian Tribe	—	No response	—	—	—	—
		Cocopah Indian Tribe	8/27/12	Concurred	—	—	—	—
		Colorado River Indian Tribes	—	No response	—	—	—	—
		Fort McDowell Yavapai Nation	8/21/12	Concurred	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—
		Fort Yuma-Quechan Tribe	—	No response	—	—	—	—
		Gila River Indian Community	9/10/12	Concurred; recommended site visit	—	—	—	—
		Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	8/14/12	Concurred	—	—	—	—
		Hualapai Tribe	—	No response	—	—	—	—
		Kaibab-Band of Paiute Indians	—	No response	—	—	—	—
		Navajo Nation	—	No response	—	—	—	—
		Pascua Yaqui Tribe	—	No response	—	—	—	—
		Pueblo of Zuni	—	No response	—	—	—	—
		Salt River Pima-Maricopa Indian Community	8/14/12	Deferred to Gila River Indian Community	—	—	—	—
		San Carlos Apache Nation	—	No response	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Tohono O'odham Nation	—	No response	—	—	—	—
		Tonto Apache Tribe	8/14/12	Concurred	—	—	—	—
		White Mountain Apache Tribe	8/17/12	Concurred	—	—	—	—
		Yavapai-Apache Nation	—	No response	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
9/6/12 (FHWA)	• To request concurrence on project effects to resources near Dobbins Road	Arizona State Land Department	9/20/12	Concurred	—	—	—	—
		Bureau of Land Management	—	No response	—	—	—	—
		Bureau of Reclamation	—	No response	—	—	—	—
		City of Phoenix-Historic Preservation Office	—	No response	—	—	—	—
		City of Phoenix-Pueblo Grande Museum	9/27/12	Concurred	—	—	—	—
		Salt River Project	9/24/12	Concurred	—	—	—	—
		State Historic Preservation Office	9/14/12	Concurred	—	—	—	—
9/26/12 (FHWA)	• To request concurrence on the adequacy of the TCP Enhancement Plan for the Pueblo del Alamo and Villa Buena TCPs • To request concurrence on a finding of "no adverse effect" for the Pueblo del Alamo and Villa Buena TCPs	Gila River Indian Community	10/22/12	Concurred	—	—	—	—
10/23/12 (FHWA)	• To request concurrence on a finding of "no adverse effect" for the Pueblo del Alamo and Villa Buena TCPs and Section 4(f) determination	State Historic Preservation Office	10/25/12	Concurred	—	—	—	—
10/31/12 (FHWA)	• To request concurrence with adequacy of the field survey report for the Western Area Power Administration power line shifts • To request concurrence with a finding of "adverse effect" for Pueblo del Alamo under Criterion D as an archaeological site as it pertains to the Western Area Power Administration power line shifts • To request concurrence with a finding of "no adverse effect" for Pueblo del Alamo as a TCP under Criterion A as it pertains to the Western Area Power Administration power line shifts	Gila River Indian Community	Response pending	—	—	—	—	—
		State Historic Preservation Office	11/5/12	Concurred	—	—	—	—
		Western Area Power Administration	11/20/12	Concurred	—	—	—	—

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Table 4-48 Record of Section 106 Consultation (continued)

Date Sent (from)	Purpose of Consultation	Consulting Parties	Date Responded	Response	Reply Date	Response	Response Date	Response
1/31/13	• to request concurrence on the adequacy of the Traditional Cultural Properties Technical Summary report • to request concurrence on the Traditional Cultural Property NRHP eligibility recommendations • to request concurrence on the finding of project effect for Traditional Cultural Properties • to request concurrence on the management recommendations for the treatment of Traditional Cultural Properties	Bureau of Indian Affairs	02/19/13	Concurred	—	—	—	—
		City of Phoenix	02/20/13	Concurred	—	—	—	—
		Ak-Chin Indian Community	—	No response	—	—	—	—
		Chemehuevi Tribe	—	No response	—	—	—	—
		Cocopah Tribe	02/11/13	Concurred	—	—	—	—
		Colorado River Indian Tribes	02/25/13	Concurred	—	—	—	—
		Fort McDowell Yavapai Nation	02/04/13	Concurred	—	—	—	—
		Fort Mojave Indian Tribe	—	No response	—	—	—	—
		Havasupai Tribe	—	No response	—	—	—	—
		Hopi Tribe	02/06/13	Concurred	—	—	—	—
		Hualapai Tribe	—	No response	—	—	—	—
		Kaibab-Paiute Tribe	—	No response	—	—	—	—
		Navajo Nation	03/20/13	Concurred	—	—	—	—
		Pascua Yaqui Tribe	—	No response	—	—	—	—
		Quechen Inidan Tribe	—	No response	—	—	—	—
		San Carlos Apache Tribe	02/05/13	Concurred	—	—	—	—
		San Juan Southern Paiute	—	No response	—	—	—	—
		Salt River Pima-Maricopa Indian Community	—	No response	—	—	—	—
		Tonto Apache Tribe	02/06/13	Concurred	—	—	—	—
		Tohono O'odham	—	No response	—	—	—	—
		White Mountain Apache Tribe	02/21/13	Concurred	—	—	—	—
		Yavapai-Apache Nation			—	—	—	—
		Pueblo of Zuni			—	—	—	—

Because of the growth of the Phoenix metropolitan area as it is currently planned and as it is projected to occur, cultural resource properties and sites in areas zoned for development may eventually be disturbed. In most instances, federally required surveys to locate and assess cultural resources sites would not be required and would not occur. However, City of Phoenix ordinances do require developers to perform cultural resources studies to acquire building permits. The potential does exist that, in some instances, important sites would not be discovered and mitigation, even in the form of documentation, would not occur. Further, the No-Action Alternative would not preclude the proposal and possible implementation of a project similar to the proposed action from occurring in the future.

MITIGATION

ADOT EPG Responsibilities

Specific mitigation strategies would vary depending on the types of cultural resources that would be affected. Strategies to mitigate adverse effects to the prehistoric sites eligible for NRHP listing under Criterion D, including Villa Buena and Pueblo del Alamo, would include:

- A preconstruction testing plan would be developed and implemented for the sites by ADOT EPG's Historic Preservation Team. The testing plan would define locations of test excavations within sites to determine whether important archaeological deposits exist within the area of potential effects. The Historic Preservation Team would consult with SHPO and other consulting parties as required. Depending on the results of the testing program, follow-up data recovery excavations might also be required.
- A burial agreement with the Arizona State Museum (ASM) and concerned Native American tribes would be developed to outline procedures for proper removal, treatment, and reburial of any human remains and associated funerary objects that might be encountered.

Impacts on the Roosevelt Canal and historic Southern Pacific Railroad would be avoided through the use of bridges to span the resources.

Bulletin #38 - Traditional Cultural Properties

For the proposed action, several sites were evaluated for eligibility as TCPs, consistent with Bulletin #38 (Parker and King 1990; see page 4-126). The evaluation was conducted to:

- Ensure that the entity under consideration is a "property" – The entity evaluated must be a tangible property, that is, "a district, site, building, structure, or object." The NRHP defines a "site" as "the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archaeological value regardless of the value of any existing structure" (Parker and King 1990).
- Consider the property's integrity – To be eligible for inclusion in the NRHP, a property must have "integrity of location, design, setting, materials, workmanship, feeling, and association" (36 C.F.R. Part 60). In the case of a TCP, the National Park Service (NPS) poses two fundamental questions to ask about integrity (Parker and King 1990): 1) does the property have an integral relationship to traditional cultural practices or beliefs? and 2) is the condition of the property such that the relevant relationships survive?
- Apply the NRHP criteria outlined in National Register Bulletin #15, *How to Apply the National Register Criteria for Evaluation* (NPS 1990) – The entity is to be evaluated against the four basic NRHP criteria set forth in the NRHP-published regulations (36 C.F.R. Part 60). If the property meets one or more of the criteria, it may be eligible (Parker and King 1990). These criteria were discussed earlier under NHPA.
- Determine whether any of the NRHP criteria considerations (36 C.F.R. Part 60.4) make the property ineligible (NPS 1990; Parker and King 1990) – In general, a property is not eligible for inclusion in the NRHP if it represents a class of properties to which one or more of the seven criteria considerations listed in 36 C.F.R. Part 60.4 apply and is not part of a district that is eligible (Parker and King 1990; NPS 1990). These considerations are:
  - **Consideration A:** Ownership by a religious institution or use for religious purposes – A "religious property" requires additional justification for nomination because of the necessity to avoid any appearance of judgment by government about the merit of any religion or belief (NPS 1990).
  - **Consideration B:** Relocated properties – Properties that have been moved from their historically important locations are not usually eligible for inclusion in the NRHP because "the significance of (historic properties) is embodied in their locations and settings as well as in the (properties) themselves" and because "one basic purpose of the National Register is to encourage the preservation of historic properties as living parts of their communities" (NPS 1990).
  - **Consideration C:** Birthplaces and graves – Although not usually eligible for inclusion in the NRHP as such (NPS 1990), it is possible for the birth or burial itself to have been ascribed such cultural importance that its association with the property contributes to its significance.
  - **Consideration D:** Cemeteries – Cemeteries are not ordinarily eligible for inclusion in the NRHP unless they "derive (their) primary significance from graves of persons of transcendent importance, from age, from distinctive design values, or from association with historic events" (NPS 1997).
  - **Consideration E:** Reconstruction – A property constructed to reproduce the form and detail of a property or portion of a property that has vanished is not normally eligible for inclusion in the NRHP unless it meets strict criteria (Parker and King 1990; NPS 1990).
  - **Consideration F:** Commemoration – Properties constructed to commemorate a traditional event or person cannot be found eligible for inclusion in the NRHP based on association with that event or person alone (Parker and King 1990).
  - **Consideration G:** Significance achieved within the past 50 years – Properties that have achieved significance within only the 50 years preceding their evaluation are not eligible for inclusion in the NRHP unless "sufficient historical perspective exists to determine that the property is exceptionally important and will continue to retain that distinction in the future" (NPS 1997).

In addition to the considerations above, TCPs were defined and documented in terms of a given property's period of significance, boundary, and relevant setting (Parker and King 1990). A property's period of significance may be described in terms of traditional periods (e.g., the dawn of time) or by its period of use for traditional purposes.

Because effects of the proposed action on NRHP-eligible properties are not and would not be always fully known, ADOT—on behalf of FHWA and in conjunction with tribal and local authorities, Western, and the U.S. Bureau of Indian Affairs (BIA)—developed a Programmatic Agreement (PA) for the proposed action. A PA is a document that spells out the terms of a formal, legally binding agreement between lead agencies and other interested parties for the proper treatment and management of affected cultural resources. A PA establishes a process for consultation, review, and compliance with federal and State preservation laws as the effects of the project on historic properties become known. ADOT would follow the terms and conditions of the Section 106 PA developed for the proposed action (Appendix 4-4, page A561). No ground-disturbing activities would be conducted until ADOT EPG has notified the District Engineer that the terms and stipulations of the PA have been fulfilled.

To mitigate impacts on the South Mountains TCP, ADOT and FHWA would fund an eligibility report for the TCP to be prepared by the Community.

Consultation is continuing with the Community and other tribes regarding other appropriate mitigation strategies; selected, limited disclosures of locations of cultural resources sites; and other cultural resources issues related to the proposed action.

Other measures to reduce impacts on the NRHP-eligible cultural resources associated with the South Mountains are included in Chapter 5, *Section 4(f) Evaluation*, beginning on page 5-23.

ADOT Design Responsibilities

The placement of a freeway between the Community and the South Mountains would affect access to culturally important places. Although pedestrian access to traditional cultural places would be modified extensively by the proposed action, access would be provided by proposed crossings under the freeway [see the section, *Biological Resources*, beginning on page 4-117, and Chapter 5, *Section 4(f) Evaluation*]. These multifunctional

Coordination Associated with the Section 106 Consultation Process

Coordination efforts regarding cultural resources were extensive (see Chapter 2, *Gila River Indian Community Coordination*; Chapter 6, *Comments and Coordination*; and Appendix 2-1, beginning on page A223). The following is a sample of the degree of coordination undertaken.

Agencies at the federal, tribal, State, and local levels have been engaged in document reviews, development of a PA for the proposed action, and the eligibility evaluation of cultural resources. NHPA Section 106 consultations were initiated with correspondence from FHWA in August 2003. The letter requested concurrence with the adequacy of the initial records search report and recommended that a PA be developed for the proposed action. Concurrence was received from SHPO, BLM, BIA, Reclamation, SRP, and the Hopi Tribe. The City of Phoenix's Pueblo Grande Museum concurred, with comments, and the City of Phoenix Historic Preservation Officer noted that no historic resources were included in the records search report. The Yavapai-Prescott Indian Tribe deferred participation in the proposed action to the southern tribes. No responses were received from ASLD, City of Avondale, City of Chandler, City of Tolleson, Tohono O'odham Nation, Ak-Chin Indian Community, Gila River Indian Community, Salt River Pima-Maricopa Indian Community, and the Yavapai-Apache Nation.

A draft PA to establish protocol and procedures to be followed for cultural resources investigations in the area covered by the agreement was prepared and submitted for concurrence in December 2003. Concurrence letters from SHPO, BLM, SRP, and the City of Phoenix's Pueblo Grande Museum were received, and Reclamation concurred, with comments. The Hopi Tribe declined participation in the PA (deferring to the Community), but requested continued participation in Section 106 consultations. Responses were not received from ASLD, the City of Phoenix Historic Preservation Officer, and the Community. In March 2004, ACHP was informed of the proposed freeway and the ongoing PA effort. Later that month, the Council responded that there was insufficient information to warrant its involvement, but the Council recommended that development of the PA continue.

The initial field survey report was distributed to the consulting agencies in July 2005, with a request for concurrence on the report's adequacy and eligibility recommendations. Concurrence with the report findings was received from BLM, Reclamation, and SRP. BIA concurred verbally in August 2005, and the City of Phoenix Archaeologist at the Pueblo Grande Museum concurred, with comments. In response to SHPO comments, the report was amended to include that isolated occurrences would be considered in the overall treatment plan, and ADOT again requested concurrence. SHPO concurred in January 2006 that the 19 prehistoric sites were eligible under Criterion D, but stated that a broader context would be required to understand the importance of the proposed action area and surrounding setting.

In July 2005, correspondence was sent to consulting Native American groups to 1) request concurrence on the adequacy of the field survey report, 2) request information on TCP concerns, 3) request concurrence on the draft PA, and 4) request participation as Concurring Parties to the PA (see Appendix 2-1, beginning on page A223). Concurrence letters with no TCP concerns were received from the Zuni Pueblo, the Yavapai-Prescott Indian Tribe, and the Fort McDowell Yavapai Nation. The Gila River Indian Community identified the South Mountains, Villa Buena, and Pueblo del Alamo as TCPs. No response was received from the Fort Yuma-Quechan Tribe, Fort Mojave Indian Tribe, Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribe, Ak-Chin Indian Community, Yavapai-Apache Nation, White Mountain Apache Tribe, Tonto Apache Tribe, Tohono O'odham Nation, San Juan Southern Paiute Tribe, San Carlos Apache Tribe, Salt River Pima-Maricopa Indian Community, Pascua Yaqui Tribe, Navajo Nation, Kaibab Paiute Tribe, Hualapai Tribe, and the Hopi Tribe.

Municipalities in the Study Area (other than Phoenix) were contacted in August 2005 to request concurrence on the adequacy of the draft PA and to request participation in the final PA; the Cities of Chandler, Avondale, Glendale, and Tolleson did not respond. Of 21 tribes that were requested to participate in the final PA, only the Salt River Pima-Maricopa Indian Community and the Tohono O'odham Nation concurred. The other 19 tribes did not respond.

In response to an additional August 2005 agency request to concur on the adequacy of the draft PA and to request participation in the final PA, only MCDOT concurred. FCDMC and RID did not respond.

Additional consultation occurred in August 2005, when agencies were asked to review and concur with the adequacy of the addendum record search and field survey reports. Reclamation concurred, and SRP and the City of Phoenix's Pueblo Grande Museum concurred, with comments. No response was received from ASLD, BLM, and the City of Phoenix Historic Preservation Officer. SHPO did not concur and requested revisions. The eligibility recommendations in the addendum reports were revised and resubmitted in late September 2005. SHPO concurred with the eligibility recommendations of the amended reports.

ACHP was notified of the revised PA in late September 2005. The Council responded in late December 2005 that its involvement was still not warranted.

Several December 2006 letters requested signatures on the final PA from those parties who had expressed an interest in participating in the PA. The final PA was signed by FHWA, SHPO, and ADOT. Concurring parties who signed the PA are SRP, MCDOT, the City of Phoenix, FCDMC, ASM, the Fort McDowell Yavapai Nation, the Tonto Apache Tribe, and the Yavapai-Apache Nation.

In August 2010 and June 2011, in response to requests from Western and BIA, respectively, FHWA revised the PA to include Western and BIA as concurring parties. Furthermore, FHWA and ADOT took the opportunity to invite Native American Tribes that did not sign the original PA to participate as concurring parties.

See subsequent consultation efforts listed in Table 4-48.

crossings would facilitate pedestrian access to culturally important places. The E1 Alternative was designed to avoid a site that is a contributing element to the South Mountains TCP and an active shrine site, resulting in no adverse effects on these resources. Fencing along the sites at the R/W would limit access to the site by freeway users, but Community members would continue to gain access to the site as they currently do.

Many of the agricultural fields in the action alternatives' footprints have been in production with crops such as alfalfa that have prevented inspection of the ground surface for cultural resources. These gaps in the cultural resources inventory would be investigated by ADOT in the design phase, prior to any construction or other ground-disturbing activities.

Measures to avoid, minimize, and mitigate adverse impacts on the NRHP-eligible South Mountains, AZ T:12:112 (ASM), and AZ T:12:198 (ASM) TCPs would be considered (see Chapter 5) and approaches would be developed through consultation with the Community and other affected tribes.

Contractor Responsibilities

If previously unidentified cultural resources are encountered during activity related to the construction of the proposed freeway, the contractor would stop work immediately at that location and would take all reasonable steps to secure the preservation of those resources and notify the ADOT EPG Historic Preservation Team immediately and make arrangements for the proper treatment of those resources. The ADOT EPG Historic Preservation Team would, in turn, notify the appropriate agency(ies) to evaluate the significance of those resources.

SHPO CONCURRENCE

SHPO has been involved and will continue to be involved in the cultural resources issues related to the proposed action. SHPO concurred with the adequacy of the initial records search report and the draft PA for the proposed action. SHPO signed the PA in December 2006 and, following amendments to the initial field survey report, concurred that the 19 prehistoric sites were eligible under Criterion D, but stated that a broader context would be required to understand the significance of the Study Area and surrounding setting. SHPO did not concur with the eligibility recommendations of the addendum records search and field survey reports, and requested revisions. The addendum reports were revised and resubmitted in late September 2005. SHPO concurred with the eligibility recommendations of the amended reports (see Appendix 2-1, beginning on page A223).

SHPO concurred with TCP eligibility, potential project effects, and proposed South Mountains TCP mitigation on May 15, 2012. SHPO concurred with the finding of no adverse effects on the Villa Buena and Pueblo del Alamo TCPs on October 25, 2012.

SHPO concurred with the initial eligibility recommendations for historic resources near Dobbins Road on July 19, 2006, and then with the approach to reassess the eligibility of these resources on February 4, 2011. SHPO concurred with the eligibility recommendations of the reassessment of Dobbins Road resources on July 16, 2012, and also concurred with findings of effect on these resources on September 14, 2012.

CONCLUSIONS

Coordination efforts to assess possible impacts of implementation of the proposed action on cultural resources have been extensive. As part of this coordination, adjustments have been made to the action alternatives to avoid and reduce impacts on known cultural resources in the Study Area. Avoidance of impacts entirely would not be possible; implementation of any of the action alternatives would affect prehistoric and historic cultural resources:

- Each of the Western Section action alternatives would cross the NRHP-eligible Wellton-Phoenix-Eloy main line of the historic Southern Pacific Railroad. The W59 (Preferred) and W71 Alternatives would cross segments of the Roosevelt Canal. All three action alternatives would cross prehistoric artifact scatters attributable to Hohokam habitation sites; archaeological testing is recommended to determine the full extent of the resources.
- The E1 (Preferred) Alternative in the Eastern Section would adversely affect NRHP-eligible archaeological sites and the South Mountains TCP.

Cultural resources impacts caused by implementation of any of the Western Section action alternatives would be inconsequential with respect to differentiating among the action alternatives. The types of impacts would be typical of those experienced in constructing and operating other parts of the region's freeway system. Impacts would be effectively mitigated through use of strategies outlined on page 4-146. In addition, implementation of the enhancement and managment plan for the Villa Buena and Pueblo del Alamo TCPs would prevent adverse effects on these sites. Impacts on the South Mountains TCP caused by implementation of the E1 Alternative in the Eastern Section would be substantial and unique in context.

Under the No-Action Alternative, no project-related impacts on cultural resources would occur; continuing urban development from projected growth in the Study Area may result in the undocumented loss of cultural resources in the area. City of Phoenix ordinances do require developers to perform cultural resources studies to acquire building permits.

Mitigation measures are described previously in this section. Because effects on NRHP-eligible sites are not fully known, a PA has been developed and adopted. The PA describes the process for proper treatment and management of affected resources (see text box on the previous page).

PRIME AND UNIQUE FARMLANDS

AFFECTED ENVIRONMENT

An assessment of prime and unique farmlands (see sidebar for definitions of prime and unique farmlands) impacts was conducted to comply with the Farmland Protection Policy Act (FPPA) (7 C.F.R. § 658). The FPPA, administered by the Natural Resources Conservation Service (NRCS), states that "the purpose of the Act is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses." In addition, the FPPA states that federal programs shall be administered in a manner that, as practicable, would be compatible with State and local government and private programs and policies to protect farmland.

Existing Prime and Unique Farmlands

The presence of prime and unique farmlands in the Study Area was determined using the most current soil survey data (U.S. Department of Agriculture 1977) and aerial mapping to identify irrigated farmland with soil types that support prime and unique farmlands (NRCS 2007).

It is important to note that prime farmland and agricultural land (as identified in the *Land Use* section) are not necessarily the same. The agricultural land use designation is a product of local community planning efforts, while the prime farmland designation is a product of NRCS criteria such as soil type and availability of irrigation. Most of this land is located in the Western Section of the Study Area, with the Eastern Section acreage being located near 51st Avenue and Carver Road.

In general, Study Area agricultural land, including land under consideration as prime farmland, has been converted to other uses (e.g., residential, commercial, industrial developments) as planned and approved by local municipalities (see section, *Developments Plans*, on page 4-7, regarding the conversion of agricultural land). As such, this land has been and is projected to be a diminishing resource.

Criteria for Determining Farmland Impact

The Farmland Conservation Impact Rating is used to determine the relative impact of projects on land regulated by the FPPA. Land that receives a combined score of 160 points or more from the Land Evaluation and Site Assessment (LESA) criteria is protected by the Act. The U.S. Department of Agriculture recommends that sites receiving scores totaling 160 or more be given increasingly higher levels of consideration for protection (7 C.F.R. § 658.4). If the LESA score is less than 160 points, the land need not be given further consideration for protection and no additional sites need to be evaluated. This land is, thus, not considered "farmland" as defined by the FPPA. The LESA score for action alternatives is determined by completing the NRCS-CPA-106 form, "Farmland Conversion Impact Rating for Corridor Type Projects." The NRCS-CPA-106 form, containing scoring for the proposed action, is in Appendix 4-5, beginning on page A579.

The LESA scoring system is a two-component, numerical rating system that measures the quality of farmland based on land evaluation and corridor assessment criteria. The land evaluation criterion (Part V of the NRCS-CPA-106 form) is used to assign a score of between 0 and 100 to groups of soil types based on their productivity and capability to support most types of crops. This portion is customarily completed by NRCS. The corridor assessment criteria (Part VI of the NRCS-CPA-106 form) is used to assign a score of between 0 and 160 to farmland within the Study Area based on multiple criteria that assess the suitability of each alternative for protection as farmland (7 C.F.R. § 658.5). NRCS has completed appropriate sections of the NRCS-CPA-106 form. ADOT has completed both Parts III and VI of the form to obtain scores.

The instructions that accompany the NRCS-CPA-106 form and 7 C.F.R. § 658.5(c) were used for guidance to complete the assessment portion, Part VI.

Procedurally, for projects where the value of Part VI is 60 points or more, the NRCS-CPA-106 form is forwarded to NRCS. NRCS is required by the FPPA to respond within 45 days. Where the LESA score (determined by combining results from Parts V and VI) is 160 points or greater, alternatives to avoid farmland impacts would be discussed with NRCS. If avoidance of farmland impacts would not be possible, measures to minimize or reduce the impacts would be evaluated.

ENVIRONMENTAL CONSEQUENCES

The types of environmental impacts expected as a result of the proposed action are:

- **direct conversion** – actions or projects that result in making land nonfarmable (an action on a specific area results in a direct impact)
- **cumulative** – may include isolation of remnant parcels (agricultural land that is bisected by a project such as a highway, resulting in two isolated parcels) (see section, *Secondary and Cumulative Impacts*, beginning on page 4-167)
- secondary – taking land adjacent to a specific impact area out of agricultural production (see section, *Secondary and Cumulative Impacts*, beginning on page 4-167)

All Action Alternatives, Western and Eastern Sections

All action alternatives would directly affect prime farmland by conversion. Depending on farm ownership and plot size, farmland not directly affected by R/W acquisition could become too small for continued economic use and be eliminated from further usefulness as farmland. An agricultural parcel that would be bisected by the proposed action and would become isolated parcel islands is an example of farmland that could become too small for continued economic use. In addition, on bisected parcels, farm equipment may have to be transported by the existing road network to gain access to agricultural land on opposite sides of the freeway.

Prime and unique farmlands

"Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion. Prime farmland includes land that possesses the above characteristics, but is being used to produce livestock and timber. It does not include land already in or committed to urban development or water storage." [7 C.F.R. § 658.2]

"Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables." [7 C.F.R. § 658.2]

The action alternatives would not affect any wetlands that may be associated with agriculture (see June 14, 2002, letter from NRCS in Appendix 1-1, page A45).

Action Alternatives, Western Section

All Western Section action alternatives would convert agricultural land to a transportation use. The overall contribution of the conversion of agricultural land to nonfreeway-related uses would be negligible (see section, *Secondary and Cumulative Impacts*, beginning on page 4-167). Table 4-49 provides the acreage of prime and unique farmlands, by action alternative, that would be directly converted to nonagricultural uses.

In the Western Section, the W71 Alternative would convert the least amount of farmland to a transportation use.

Table 4-49 also summarizes the results for the impact rating analysis from the NRCS-CPA-106 form for the action alternatives in the Western Section. The LESA scores (Parts V and VI combined) for most action alternatives in the Western Section are at least 160 points. If an action alternative were to become the Selected Alternative, the NRCS-CPA-106 form should be resubmitted to NRCS for final evaluation and signature. If the returned scores remained 160 points or greater, technical assistance would, at that time, be requested from NRCS.

Action Alternative, Eastern Section

The E1 (Preferred) Alternative would convert agricultural land to freeway-related uses. Table 4-49 summarizes the total acreage of prime and unique farmlands to be directly converted and presents results for the impact rating analysis, from the NRCS-CPA-106 form, for the E1 Alternative.

The LESA score (Parts V and VI combined) for the E1 Alternative is less than 160 points. The score for the E1 Alternative must, however, be considered with the score for any of the action alternatives in the Western Section; therefore, NRCS technical assistance would be requested for the action alternatives in both the Western and Eastern Sections.

Table 4-49 Farmland Conversion Impact Rating, Prime and Unique Farmlands, Western and Eastern Sections

Action Alternative/ Alignment Option	Total Acreage to be Converted Directly (Part[a] III)	Impact Rating (Part V) Points	Impact Rating (Part VI) Points	LESA[b] Score
Western Section				
W59	588	86	74	160
W71	583	86	74	160
W101 Western Option	827–851	86–87	74	160–161
W101 Central Option	917–841	82–84	74	156–158
W101 Eastern Option	739–863	88	74	162
Eastern Section				
E1	154	89	16	105

[a] "Part" refers to the U.S. Department of Agriculture's Natural Resources Conservation Service's (NRCS) NRCS-CPA-106 form "Farmland Conversion Impact Rating for Corridor Type Projects," completed by NRCS in April 2011.
[b] Land Evaluation and Site Assessment

Implementation of the E1 Alternative would cause no conversion of agricultural uses on Community land.

No-Action Alternative

Without the proposed action, the conversion of land from agricultural use to residential, commercial, and industrial uses is projected to continue. Because of the projected long-term urban growth of the Phoenix metropolitan area, farmland in the Study Area would continue to be lost through conversion to urban uses.

MITIGATION

ADOT Right-of-Way Group Responsibilities

During the design phase, ADOT would implement a R/W acquisition program in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 C.F.R. § 24) (see section, *Displacements and Relocations*, beginning on page 4-39, for additional information regarding this law).

During the design phase of the proposed action, ADOT would coordinate with affected property owners as part of the R/W acquisition process to provide access, if possible, for farm equipment between divided agricultural parcels or to purchase remaining farm parcels considered too small to be farmed either economically or functionally.

ADOT District Responsibility

Farmland mitigation would include provision for access to farmland otherwise made functionally inaccessible by the project (FPPA Part 523.52 Exhibit C – Glossary). Additional mitigation measures may be considered based on NRCS guidance.

CONCLUSIONS

Congress enacted the FPPA to minimize the extent to which federal programs contribute to unnecessary and irreversible conversion of farmland to nonagricultural uses and to ensure that federal programs are administered in a manner that, to the extent practicable, are compatible with State, local government, and private programs and policies to protect farmland. Implementation of each of the action alternatives would be considered a federal action and each would convert farmland to a transportation use.

The W71 Alternative would convert the least amount of farmland to transportation use. Farmland conversion to a

transportation use would increase with the more westerly action alternatives. Consequently, the W101 Alternative would have the greatest impact on farmland. Additional factors should be considered when reaching such a conclusion:

- The W59 Alternative is the most eastern of the Western Section action alternatives and, as planned, would closely follow the freeway alignment as it has been planned for over 20 years. Unlike with the W71 and W101 Alternatives, much of what has been planned along the W59 Alternative is commercial and industrial uses (more compatible with a freeway use).
- Urbanization is rapidly moving in a westward direction. By the time freeway construction would begin (if an action alternative were to become the Selected Alternative), it is likely that farmland acreage converted to transportation use for the westernmost alternatives would be less than now reported because such land would likely have already been converted from agricultural use to residential, commercial, and/or industrial uses, although some remnants of farmland may remain (see the section, *Development Plans*, on page 4-7, regarding the planned urbanization occurring in the Western Section).
- When considered as acres of farmland converted per freeway mile, impacts would be relatively comparable among action alternatives, with the exception of the W59 and W71 Alternatives, for reasons described in the respective sections.

Placed in context, the impacts on prime and unique farmlands from implementation of the proposed action, regardless of action alternative, would be negligible. Further, farmland impacts among action alternatives in the Western Section would be inconsequential in differentiating among the action alternatives.

Under the No-Action Alternative, no project-related impacts on farmlands would occur; continuing urban development would, however, result in the cumulative loss of farmland in the region, although some remnants of farmland would likely remain.

HAZARDOUS MATERIALS

AFFECTED ENVIRONMENT

A hazardous materials evaluation for the construction and operation of the proposed freeway was conducted to determine whether:

- contaminated soils would be present near potential hazardous materials sites
- underground storage tanks would need removal or relocation because of freeway construction
- wells and dry wells would be present, providing unintended conduits for preexisting or accidental releases from the construction process to groundwater supplies
- during construction activities, workers could encounter soil contaminated with hazardous materials that had not previously been identified

Aerial photographs and topographic maps indicate that development began in the northwestern section of the Study Area in the late 1950s. Several petroleum tanks and process buildings were located on the southwestern corner of 51st Avenue and Van Buren Street. The transportation system at that time consisted of light-duty roads and secondary highways.

Aerial photography since the 1980s indicates increased development in the entire Study Area. Specific points of interest in the 1980s-era aerial photography include:

- development of the Phoenix WWTP, located between 91st and 83rd avenues
- a sewage disposal area, located west of 91st Avenue between Buckeye and Lower Buckeye roads
- an increase in the number of tanks and buildings in the area bordered by 59th Avenue to the west, Van Buren Street to the north, 43rd Avenue to the east, and Buckeye Road to the south
- a gravel pit located west of I-10, south of Pecos Road (near Firebird International Raceway)

Heavy industrial and commercial land uses are now situated along I-10 between 19th Avenue and Litchfield Road and between Buckeye and McDowell roads. In the central and western portions of the Western Section, agricultural and residential are the predominant zoning classifications. Residential and undeveloped lands predominate in the Eastern Section.

ENVIRONMENTAL CONSEQUENCES

For this assessment (findings presented in Table 4-50), hazardous materials sites were classified as low-priority, medium-priority, and high-priority, as follows:

- **Low-priority** sites are those having few indications of potential for release of hazardous materials. On some occasions, sites that have had a hazardous materials issue in the past but have been remediated with approval of the State environmental agency (or EPA) may qualify as low-priority. Examples of low-priority sites include undeveloped or agricultural property, residential property, or benign commercial properties such as office buildings, warehouses, distribution facilities, or municipal facilities with no listed violation.
- **Moderate-priority sites** are those having some indications of possible hazardous materials issues. A moderate-priority site may appear on a database as having a permit to handle hazardous materials, but has recorded no violations to date. Another way that a site could be interpreted as a moderate priority would be if the environmental records search indicated no listing, but the site is an auto repair facility with visible surface staining. Examples of moderate-priority sites include auto repair garages, welding shops, or manufacturing facilities with minor listings in the environmental database.
- **High-priority sites** are those with high potential for releasing hazardous materials to the soil or groundwater, or those that have a recorded release issue. Examples of high-priority sites include current service stations, bulk fueling terminals, sites listed in the environmental database, or a known release that has not been remediated.

Sites that have more than one priority level are included in each appropriate priority column of Table 4-50 according to the highest priority level ranking.

Impacts on Action Alternatives, Western and Eastern Sections

Table 4-50 lists the number of potential hazardous materials sites by action alternative. The W59 (Preferred) Alternative would encounter the most high-priority sites. This is expected because the W59 Alternative is the closest of the action alternatives in the Western Section to urbanized Phoenix. The W59 Alternative would closely follow, along areas of commercial and industrial uses, the same general freeway alignment that has been accommodated in various planning decisions for over 20 years.

Table 4-50 Hazardous Materials Impacts, Action Alternatives

Action Alternative	Number of Potential Hazardous Materials Sites		
	Low-priority	Medium-priority	High-priority
Western Section			
W59	8	3	5
W71	13	4	4
W101	12	5	1
Eastern Section			
E1	0	0	0

Note: All options under the W101 Alternative would affect the same hazardous materials sites.

The identified sites and specific recommendations for remediation are presented in the technical report *Draft Initial Site Assessment*. It is important to note that approximately 1.5 mile of the W59 Alternative has no regulatory database coverage (approximately between Roosevelt Street and Buckeye Road). A field review conducted in 2009, however, indicated that few, if any, additional sites are likely to be identified in this section of the W59 Alternative. Several wells would be located within the action alternative alignments. (See the section, *Water Resources*, beginning on page 4-93, to learn more about proposed action effects on water wells.)

Action Alternatives, Western Section

W59 (Preferred) Alternative

The W59 Alternative would potentially affect five high-priority sites (including the West Van Buren Water Quality Assuance Revolving Fund [WQARF] site, discussed below) and three medium-priority sites. Each site is located either within the proposed W59 Alternative footprint or within a buffer area around the proposed footprint. Consideration of buffer zones is important because contaminants may travel laterally in the subsurface. Three of the high-priority sites are current service stations (Pilot Travel Center, Petrostop, and Circle K) and one is a Resource Conservation and Recovery Act large-quantity generator (Onyx Environmental Services).

Another high-priority site is the West Van Buren WQARF site, found within the proposed footprint but not within the construction zone, which is known to contain six contaminants in the groundwater at a depth of 30 to 60 feet. The contaminants with concentrations that exceed regulatory standards are tetrachloroethylene; trichloroethylene; 1,1-dichloroethylene; cis-1,2-dichloroethylene; 1,1-dichloroethane; and chromium.

W71 Alternative

The four high-priority sites are three current service stations (Arco, Flying J Travel Plaza, and Danny's Truck Stop) and the West Van Buren WQARF.

The West Van Buren WQARF site, found within the proposed footprint but not within the construction zone, is known to contain six contaminants in the groundwater at a depth of 30 to 60 feet. The contaminants with concentrations that exceed regulatory standards are tetrachloroethylene; trichloroethylene; 1,1-dichloroethylene; cis-1,2-dichloroethylene; 1,1-dichloroethane; and chromium.

W101 Alternative

The one high-priority site is a current service station (SuperStar Chevron).

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The E1 Alternative would not affect any known hazardous materials sites.

No-Action Alternative

No direct hazardous materials impacts are associated with the No-Action Alternative.

MITIGATION

When possible, avoidance or minimization is the primary mitigation for identified hazardous materials sites. The following list describes potential mitigation measures to avoid, reduce, or otherwise mitigate environmental impacts associated with the proposed action.

ADOT Design Responsibilities

- The *Draft Initial Site Assessment* recommends a site-specific Phase I assessment be performed prior to acquisition of each site. Based on preliminary information gathered for the corridor-wide Phase I assessment, none of the high-priority sites are believed to have hazardous materials issues significant enough to warrant avoidance of acquisition.
- ADOT would review the status of open regulatory cases relating to hazardous materials releases during the design phase. The responsible parties associated with any open regulatory cases would be determined at that time. ADOT would coordinate with the responsible parties to determine the status of any required cleanup actions.
- ADOT would conduct asbestos and lead-paint inspections of structures to be demolished and require abatement measures during demolition.
- The ADOT project manager would contact the ADOT EPG hazardous materials coordinator to determine the need for additional site assessment.

ADOT District Responsibilities

- Staging for construction activities near wells or dry wells would be located in areas where accidental releases of potential contaminants would be minimized and any accompanying threat to groundwater resources minimized.
- In cooperation with the contractor, ADOT's Construction District would develop and coordinate emergency response plans with local fire authorities, local hospitals, and certified emergency responders for hazardous materials releases or chemical spills.
- If suspected hazardous materials were encountered during construction, work would cease at that location and the ADOT Engineer would arrange for proper assessment, treatment, or disposal of those materials.

ADOT Right-of-Way Group Responsibilities

- Asbestos- and lead-paint-containing materials identified in structures to be demolished would be properly removed and disposed of prior to demolition.
- Any existing aboveground storage tanks or underground storage tanks would be removed or relocated.

Contractor Responsibilities

- The contractor would develop an on-site health and safety plan for construction activities.
- Staging for construction activities near dry wells would be located in an area where, if potential contaminants were to be accidentally released, any accompanying threat to groundwater resources would be minimized.

- If relocation or removal of an AST or UST were necessary, the removal/relocation activities would be addressed in accordance with the applicable laws and regulations of the State of Arizona.
- A hazardous waste management plan should be prepared for the handling of hazardous materials during construction.
- Use of asbestos-containing construction materials would be avoided during construction.
- The contractor would develop and coordinate emergency response plans with local fire authorities, local hospitals, and certified emergency responders for hazardous materials releases or chemical spills.
- If suspected hazardous materials were encountered during construction, work would cease at that location and the ADOT Engineer would be contacted to arrange for proper assessment, treatment, or disposal of those materials.

CONCLUSIONS

All action alternatives in the Western Section would potentially interact with known hazardous materials sites. The W59 (Preferred) Alternative would cross the most high-priority sites. The E1 (Preferred) Alternative in the Eastern Section would not affect any known sites. No substantial differences were identified when comparing the action alternatives; implementation of any of the action alternatives would not introduce unique impacts related to hazardous materials that would pose a threat to the human environment. Appropriate design, as commonly applied to projects of the size and features of the proposed action, would effectively mitigate hazardous materials-related effects.

Under the No-Action Alternative, no project-related interaction with hazardous materials would likely occur; continuing urban development over the long term would, however, possibly result in disturbance of known sites.

Transport of Hazardous Materials on the Regional Freeway System

During public meetings for the proposed action, comments were received requesting restriction of the transportation of hazardous materials if the proposed action were constructed. Questions were raised about how restrictions would be imposed and why some state routes are restricted from hazardous materials transport.

Carriers of hazardous and radioactive cargo are responsible for planning their transportation routes. To plan hazardous material transportation routes, carriers use lists of designated and restricted routes, by state, published in the *Federal Register*.[40]

The federal government has given the States the responsibility of developing, implementing, and maintaining the list of designated and restricted routes. In Arizona, ADOT is responsible for the route designations and the Department of Public Safety is responsible for the enforcement of restrictions on the transport of hazardous materials along these routes. Also, local governments are given the responsibility for developing, implementing, and maintaining the list of designated and restricted routes within their respective jurisdictions; therefore, if a local government requests that ADOT restrict hazardous material transport through a particular area, it is ADOT's responsibility to analyze and adopt or reject that request. The agency's decision is based on a number of considerations, including, but not necessarily limited to, public safety and the presence of acceptable alternative routes (49 U.S.C. § 5112).

In Arizona, three routes are restricted for all hazardous materials (including radioactive materials):

- The I-10 Deck Park Tunnel in Phoenix from 7th Street exit to 7th Avenue exit – The restriction has been in place since the tunnel opened to traffic in 1990. ADOT imposed the restriction with involvement from the City of Phoenix, in particular the Phoenix Fire Department, because of the perceived increased danger of fires, explosions, and/or the release of toxic gases in a confined area. I-17 provides a close and suitable alternative to I-10 in this area.
- The exit ramp from U.S. Route 60 (US 60) (eastbound) to SR 101L (southbound) – The restriction was the result of constrained ramp geometry.
- SR 202L from MP 8.33 (McClintock Drive exit) to MP 11.07 (Dobson Road exit) – The restriction was the result of the freeway passing over a linear segment of the Salt River on an extreme skew for approximately a mile, with most of the bridge over the riverbed. The bridge has deck drains that discharge directly into the Salt River. The cost of collecting and retaining all drainage from the bridge was determined to be excessively high (and an engineering challenge); therefore, restriction of hazardous material from SR 202L was an environmental stipulation.

A local agency could request that ADOT restrict hazardous material routing on the proposed action; ADOT would, however, be required to analyze and adopt or reject the request based on its merits. Unless requested by a local agency or unless ADOT made the decision to restrict the transport of hazardous materials on the proposed action, the proposed road would be available for hazardous material transport.

Emergency responders would address the construction of the proposed freeway by amending the local emergency response plan to include the facility. This would include emergency response on the road and alternative routes for diversion of traffic in the event that a hazardous materials incident occurred along the roadway.

ADOT has made several formalized studies of hazardous materials transport in Arizona over the years. A 1986 study showed that the two most frequently shipped hazardous materials in Arizona are gasoline and paint products. ADOT has a continuing commitment to studying hazardous materials transport in the state. Both ADOT and the Arizona Emergency Response Commission are studying current hazardous materials traffic patterns in Arizona. The results of these studies will increase safety, improve emergency response planning, and provide objective data for hazardous materials routing.

VISUAL RESOURCES

AFFECTED ENVIRONMENT

Pertinent Regulations and Guidance

Under NEPA, it is a policy goal for the federal government to:

> use all practicable means . . . [to] . . . assure for all Americans safe, healthful, productive, and *aesthetically and culturally pleasing surroundings* . . . [and to] . . . preserve important historic, cultural, and natural aspects of our national heritage, and maintain, whenever possible, an environment which supports diversity, and variety of individual choice . . . [§ 101(b)(2) and (4); emphasis added]

To this end, federal agencies are directed to:

> utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the *environmental design arts in planning and in decisionmaking* which may have an impact on man's environment . . . [§ 102(2)(A); emphasis added]

The process used to determine potential impacts of the proposed transportation corridor on existing visual resources generally followed FHWA Technical Advisory T 6640.8A (1987) and FHWA guidelines outlined in *Visual Impact Assessment for Highway Projects* (1988).

Local Setting

The Study Area lies within the Basin and Range Physiographic Province, characterized by rocky mountain ranges that alternate with desert basins as the primary landform organization. Dominant landforms visible in the Study Area are the Sierra Estrella, the South Mountains, and the Salt and Gila river valleys. Elevations along the various proposed action alternatives range from approximately 1,160 feet above mean sea level at Pecos Road (eastern end) to about 1,015 feet above mean sea level where 99th Avenue intersects I-10 (Papago Freeway). Numerous viewpoints in SMPP provide panoramic vistas and views of adjacent landforms, agriculture, and urban development in the Study Area.

The Study Area is located in the Sonoran Desert scrub vegetative community, characterized by saguaro, bursage, creosote bush, ocotillo, prickly pear/cholla, paloverde, and ironwood. Native plant communities have been substantially replaced by crops and ornamental plants in the agricultural and urban areas. Outstanding natural features in the viewshed include prominent off-site landforms and vistas across the lowlands of the Community land to the south. Lone Butte is an identifiable landmark just south of the Eastern Section of the Study Area. The Sierra Estrella defines the background to the majority of the westward views. The mountain range also provides distinct rugged landforms and skyline character.

The northwestern portion of the Study Area is level agricultural land that is rapidly transitioning to warehouse and distribution facilities, light industrial uses, and to medium-density housing. The South Mountains and the Sierra Estrella provide backdrops to many southerly and easterly views in this area. Throughout the Study Area, views of SMPP are available because of the steep rise in elevation of the South Mountains (see the text box on the next page for a typical view from the South Mountains). This fault-block desert mountain range provides a distinctive backdrop to the north along Pecos Road in the Eastern Section of the Study Area and is visible from most anywhere in the Study Area.

Visual Quality, Visual Character, and Viewer Sensitivity

The Study Area was evaluated in terms of the existing visual conditions and landscape character. The visual conditions analysis consisted of identifying distinct features, areas of preservation and disturbance, and key landmarks, and of locating major viewpoints. Distinct features comprise landscape elements and patterns that make a memorable visual impression. Major viewpoints offer distant views of distant landforms/landmarks that attract attention away from the foreground area (the area within 0.25 mile of the viewer's position).

The Study Area was subdivided into Visual Assessment Units (VAUs) based on landform, land use, length, and the presence of special features in the foreground, middleground, and background. In particular, these units were defined by observable changes in the primary biotic community as marked by vegetation, land use and visual character, and viewpoint (to or from the action alternatives) as well as by the presence of special features in the landscape. For the action alternatives in the Western Section of the Study Area, 32 VAUs were developed along the proposed alignments. Twelve additional VAUs were identified and analyzed along the existing I-10 (Papago Freeway) and SR 101L freeways in the northern portion of the Western Section. The action alternative in the Eastern Section was divided into 6 VAUs. The proposed action alternatives were not anticipated to affect the 12 additional VAUs' visual resources in the Western Section because the existing freeway corridors are well-established and any changes in visual quality would be low. Therefore, the project team did not include these units in its assessment because they would tend to artificially lower (dilute) the values of the impact assessments without providing any corresponding ability to distinguish visually preferable alternatives or options. Any potential impacts at system traffic interchange locations would be captured in the terminal VAU along a given alternative's corridor.

ENVIRONMENTAL CONSEQUENCES

Potential impacts of the proposed action were assessed against the current visual setting. The impact analysis sought to evaluate the effects on the scenic quality and cohesiveness that each of the proposed alignments would have on the area's visual conditions. The Study Area landscapes are in the state's major metropolitan area. Most VAUs have only low-to-moderately low visual quality and offer only relatively modest visual quality when considered on a statewide basis. For a major urban area, however, the Study Area contains high-to-moderately high-quality views of the region's mountains. For the most part, implementation of any of the action alternatives would not adversely affect these views. The analysis was able to discriminate among action alternatives in terms of the degree of change in visual quality between the pre- and postproject conditions.

Components Used in Assessing Impacts on Visual Resources

Visual quality or attractiveness is a combination of attributes based on landforms, water characteristics, vegetation patterns, and architectural/cultural elements. For each VAU, the relative distinctiveness/vividness, intactness, and unity of the landscape were determined. Visual quality was rated in seven rankings, from "very low" to "very high," depending on the distinctiveness, unity, and intactness of the patterns and attributes of the VAU. Unity is the visual coherence and harmony of the landscape when considered as a whole. Visual intactness relates to the integrity of the visual order in the natural and built landscapes and the extent to which landscape elements and the patterns that they create cohere. The level of visual intactness was expressed as "low," "medium," or "high."

Using this process, the existing visual quality of the Study Area was determined to be generally in the moderate-to-low range for most VAUs. Several VAUs, primarily associated with industrial and warehouse activities, scored in the low range. The VAUs nearest the western end of SMPP are relatively undisturbed or have lower levels of disturbance that could reduce visual quality; these scored in the moderately high range.

Visual character, or landscape character, is the physical appearance of the landscape, including the natural, physical, and architectural/cultural features that give it an identity and "sense of place." It is the order and composition of the elements of form, line, color, and texture that make up the visual landscape. It is a value-free measure in that changes in visual character are neither "good" nor "bad." There are few highly distinctive features in the Study Area except for SMPP and the Salt River channel. Land use is a patchwork of residential, industrial, and agricultural, creating heterogeneous settings of forms, colors, and textures. Most individual Study Area land uses, however, lack diversity and have few dominant elements.

Visual sensitivity is a relative measure of viewer response to changes in the landscape. The primary viewer types in the Study Area include local residents (the majority of existing viewers), businesspersons, SMPP visitors, and daily commuters to destinations in the Study Area and in the Phoenix metropolitan area. Residents would likely respond to changes in the scenic quality of the landscape as viewed from their homes. Scenic viewing for these residents would also occur from local streets and parks. Views from SMPP would include vantage points from dispersed recreational activities such as hiking and mountain biking. Most viewers from areas of warehouse or industrial use (e.g., the Salt River channel, near I-10) would be assumed to have lower sensitivity to landscape changes.

This residential landscape is unified, intact, and harmonious—well representing the visual quality component.

This agricultural scene exhibits strong elements of form, line, color, and texture—well representing the visual character component.

Hikers in the far western end of SMPP would likely notice any adverse visual changes in views toward the Sierra Estrella. Such landscapes well represent the visual sensitivity component.

Action Alternatives, Western and Eastern Sections

Determination of the visual impacts of the proposed freeway were qualitatively made based on an evaluation of the changes in visual quality, on an assessment of the overall change in visual character, and on the likely sensitivity of the most likely frequent Study Area viewers to changes in the visual landscape. Appendixes B and C in the technical report, *Visual Resources Report*, describe the process the project team employed to evaluate visual impacts and display the details of the results. The setting, especially in the Western Section of the Study Area, is somewhat similar for each action alternative. Therefore, a quantitative method that took into account small changes within each proposed corridor was developed to determine the magnitude of visual change. The approach considered the distribution of landscape features and land use in each action alternative to compare the alternatives' visual impacts.

Construction and operation of the proposed freeway would facilitate access to views of the Gila River Valley between the Sierra Estrella and the South Mountains. More people would be exposed to views of these fault-block mountains so close to central Phoenix. For some people, the freeway might provide a superior driving experience, visually, compared with driving through downtown Phoenix using I-10.

Action Alternatives, Western Section

Table 4-51 displays the visual impacts projected to be caused by the action alternatives in the Western Section. The greater the number, the greater the visual impact that would be experienced with construction and operation of the given action alternative.

In the Western Section, residential areas, expanses of agricultural fields, and natural areas such as the Salt River channel drive higher visual impact scores. Warehouses and light and heavy industry generate the least visual impact changes because of their low sensitivity to visual change. The degree to which specific corridors would avoid directly conflicting with the most visually sensitive land uses largely determined overall visual impacts. In the relatively flat landscape of the Western Section action alternatives, distances of even a half mile would provide substantial buffering from much of the adverse visual impacts of the proposed project.

W59 (Preferred) Alternative

Largely because of the buffering provided by the land use controls undertaken over the years since the South Mountain Freeway was first proposed in the 1980s, reduced viewer sensitivity and exposure meant low visual impacts for this alternative, particularly along its southern portion. Land uses that would conflict with a freeway have been somewhat constrained along this alignment, despite its proximity to Phoenix's urban growth. Construction of a system traffic interchange at I-10 (Papago Freeway) would entail substantial visual impact, but it would be in an area of existing freeway impacts and of warehouse and light industrial activity. The W59 Alternative would cross Dobbins Road near 62nd Avenue, thereby avoiding direct and adverse impacts on nearby historic properties [see Chapter 5, *Section 4(f) Evaluation*, for more information]. Blending colors, lines, textures, and forms of the freeway with the surrounding environment would reduce its visual impact on the historic resources. Because the freeway would be elevated over Dobbins Road, aesthetic treatment of the overpasses would help diminish any visual impacts and could, over time, help unify what may become a visually complex landscape. Ideas illustrated in the text box on page 4-159 would help protect the visual integrity of the historic properties and the visual unity of the proposed freeway in its increasingly urbanizing context.

W71 Alternative

While the W71 Alternative would create the most visual impact of all the Western Section action alternatives, the impacts would not be substantially different from that of the other action alternatives. It ranked highest (most impact) in terms of visual sensitivity, the visual element that caused it to have the highest overall impact. The W71 Alternative would cross or be near numerous residential areas. Using a length-weighted approach (VAU score divided by VAU linear feet), three of the eight highest-rated (most adversely affected) VAUs are in the W71 Alternative corridor and W101 Alternative Eastern Option.

W101 Alternative

Because of their location farther west than the other alternatives, the options under the W101 Alternative scored in the middle to low range in terms of visual change. This is largely attributable to having retained much agricultural land use because the land is farther from Phoenix and because of the existence of warehouses and light industry along I-10. Relative to the W71 Alternative, there is less residential development that would be disrupted, and industrial activities would experience little change in viewer sensitivity by having a transportation facility nearby. Because of the greater height and mass, increased number of travel lanes, and likely perceived complexity, construction of a system traffic interchange at I-10 (Papago Freeway) and SR 101L would create a visual impact substantially greater than that from a system traffic interchange at either of the other two action alternatives' intersections with I-10 (Papago Freeway).

Action Alternative, Eastern Section

E1 (Preferred) Alternative

The evaluation of visual impacts for the Eastern Section VAUs and the E1 Alternative followed the same analytical steps as used for the Western Section action alternatives. The results are summarized in Table 4-51. The overall visual impacts would be substantially higher than for any of the Western Section action alternatives. This is chiefly attributable to the severe visual impacts that would accompany the road cuts at the western end of the South Mountains, altering views from the Community north to the mountains and altering views from the mountains to the Community to the south and southwest. Also, the proximity of numerous residences along Pecos Road creates high viewer sensitivity to disturbances in these views.

Attention was given to the sensitive views along the E1 Alternative, including views from SMPP, views from residential areas in Ahwatukee Foothills Village, views from the Community, and views of the major road cuts at the western end of SMPP. Hikers and other users of SMPP would have distant, elevated, open views of the proposed action, with the closest views being from some of the most popular trails in the park. Sketches of these views, with the proposed project, are in the *Visual Resources Report* (also, see simulations in Figure 5-9, on page 5-16). The proposed freeway would be readily visible from houses directly fronting Pecos Road on its northern side and from Community land on its southern side. During the design phase, the sizes and locations of any noise barriers or retaining walls that might become part of the proposed action (see the text box on page 4-159 and the section,

Table 4-51 Visual Impacts, Action Alternatives

Action Alternative	Magnitude of Change			Overall Impact on Visual Resources
	Visual Quality	Visual Character	Visual Sensitivity	
Western Section				
W59	1.79	1.65	1.68	1.70
W71	1.75	2.29	2.33	2.12
W101 Western Option	1.97	2.03	1.29	1.76
W101 Central Option	1.90	1.90	1.63	1.81
W101 Eastern Option	1.71	1.98	1.52	1.74
Eastern Section				
E1	1.99	2.86	2.72	2.52

Note: Valuations derive from analytical procedures described in the *Visual Resources Report*. "Magnitude of Change" refers to the difference in the evaluations of the three visual resource assessment components (see page 4-156), before and after the proposed freeway's construction, i.e., the visual impact. Using the state's landscapes as the basis of comparison, impacts to visual resources from the action alternatives were evaluated on a scale of 1 to 3, with 3 representing the most severe impact. In general, areas of low to moderately low initial visual quality would tend to experience only moderate or low visual impact with construction and operation of a freeway. This conclusion is generally applicable across all action alternatives, except for those in areas with the highest initial visual quality (e.g., near Phoenix South Mountain Park/Preserve) or with the most sensitive viewers (e.g., close to recreation areas or residential communities). Higher numbers mean greater visual impact. "Overall Impact on Visual Resources" is the average of these three components' impacts, standardized by each respective action alternative's length.

Noise, beginning on page 4-80, for additional information regarding noise barriers) would be determined. Farther north, the proposed freeway would be less visible because of intervening houses, vegetation, and, in many cases, topography. It is only with an increase in elevation, along the side slopes of the South Mountains, that the freeway would become visible; at these distances (1–1.5 mile or more) from the proposed freeway, its visibility and any change in visual quality would be minimal, given that Pecos Road is already a four-lane, divided road. Service traffic interchanges would be only moderately elevated and would result in only moderate visual impacts beyond those existing with the divided, four-lane Pecos Road.

No-Action Alternative

The No-Action Alternative would result in no direct change in visual character or quality because it would not involve freeway construction. Over time, the visual character and quality of the Study Area would be expected to change because of the Phoenix metropolitan area's continued urban development. Urban expansion would inevitably replace rural or undeveloped portions of the Study Area. The loss of rural or natural areas would potentially reduce the visual quality of the Study Area. If low-visual-quality development were to occur, there would be an additional reduction of overall visual quality. If future development, however, were harmonious with existing Study Area visual elements and patterns in terms of scale, color, line, and form, beneficial effects may be realized.

MITIGATION

ADOT Design Responsibilities

The following list describes measures that ADOT might employ to avoid creating visual impacts, reduce such impacts, or otherwise mitigate visual impacts associated with the proposed project. Upon review of these measures, ADOT, along with FHWA, may choose to modify or delete measures or may choose to add new measures to avoid, reduce, or mitigate impacts. During the design phase, ADOT would evaluate:

- leaving in place rock outcrops—if stable and not a hazard to the traveling public—not interfering with construction or looking out-of-place in the natural landscape
- using vegetative buffers to screen views both of the road and from the road
- transplanting larger saguaro cacti, mature trees, and large shrubs likely to survive the transplanting and setting-in period to visually sensitive or critical roadway areas
- blending retention basins and their landscape treatments into their natural surroundings
- placing landscape treatment on the periphery of R/W areas at overpass locations as well as at other areas adjacent to residential development
- clustering or grouping plant material in an informal pattern to break up the linear form of the freeway
- using strategic gaps in plantings to frame positive views from the road
- using earth colors for overpasses, retaining and screen walls, and noise barriers
- using natural-tone metals with a noncontrasting, nonglare finish for guardrails and handrails
- using riprap that blends with the surrounding rocks and exposed soil color
- using shotcrete that matches the color and texture of adjacent rocks
- using bridges and overpass structural systems that help unify a visually complex landscape
- minimizing structural sizes and/or recessing the face of structural members from the edge of the roadway to reduce real or apparent breadth of structures

The use of treatments and patterning on noise barriers and screen walls, piers, concrete barriers, retaining walls, and highly visible headwalls is an opportunity for exercising community aesthetic preferences. ADOT maintains a palette of treatments that it is willing to incorporate into such structures. If a community through which the proposed freeway would pass were to request other treatments, such efforts may be negotiated with ADOT. Treatments beyond the ADOT standard palette may be more expensive to construct and/or maintain. In such cases, a given community may wish to cover the additional expenses to secure the desired treatment.

The extensive and high road cuts proposed for the western end of the South Mountains would incorporate the newly exposed rock faces characteristic of the adjacent natural rock features, including scale, shape, slope, and fracturing to the extent that could be practicable and feasible as identified through geotechnical testing and constructibility reviews. ADOT would require the contractor to round and blend new slopes to mimic the existing contours to highlight natural formations. ADOT would evaluate having the contractor adjust and warp slopes at intersections of cuts and natural grades to flow into each other or transition with the natural ground surfaces without noticeable breaks.

CONCLUSIONS

Implementation of any of the action alternatives would introduce a substantial human-made feature (the proposed action) into the environment. In the Western Section, any of the action alternatives would be visually consistent with the development occurring and projected to continue to occur; differences in visual impacts among the action alternatives would be negligible.

In the Eastern Section, the E1 (Preferred) Alternative would be visually inconsistent with the natural setting in and around the South Mountains. The E1 Alternative would cut through a series of three ridgelines; the severe cuts and the freeway would be visually inconsistent with the natural setting of the surrounding area. In the easternmost portion of the Eastern Section, the proposed action would replace an existing four-lane, east–west arterial street along the southern edge of a primarily built-out community; at this location, the proposed action would be more intensive than the visual effect created by the arterial street. Some Study Area residents with distant views of the surrounding agricultural land and mountains may find such views adversely affected by implementation of the proposed action.

Noise barriers would offset some adverse impact on foreground viewsheds created by the freeway, but the noise barriers themselves could cause viewshed impacts. Most single-family residences are, however, bounded by cinder-block walls that serve to obstruct foreground and

Aesthetic Treatment of Freeway Structures

Portions of the proposed freeway would require structures, including noise barriers (some in the form of walls). ADOT has received public input requesting additional information on how structures are aesthetically treated and how the public could be directly involved in developing aesthetic treatments. The requests stem in part from the different appearances of freeway structures throughout the region.

Decorative or aesthetic treatments are sometimes applied to noise barriers and other freeway structures to help them blend into the surroundings and/or fit in with the tone of the community. The ADOT Roadside Development Section is responsible for assigning a wide range of standard treatment applications and wall materials, including color, to noise barriers. Typically the community where the wall will be constructed will work closely with its City Architect or planning department to decide on a theme for the wall. Most times this can be accomplished from ADOT's standard applications. ADOT has expanded its selection of acceptable wall treatments to include thematic emblems or symbols and, in some cases, more than one color.

As an example, for SR 101L (Pima Freeway) in Scottsdale, the City of Scottsdale chose to add public art to the sound barriers. The City's intent went above and beyond ADOT's guidelines of reasonable aesthetics and, therefore, ADOT did not fund the aesthetic portion of the project. ADOT and the City of Scottsdale entered into an intergovernmental agreement (IGA) for the purposes of allowing Scottsdale rights to design and construct artistic embellishment on the ADOT-supplied noise barrier. ADOT provided the funds for construction of the noise barriers themselves, but the City of Scottsdale provided the funds to cover the aesthetic portion of the walls. In the end, the City of Scottsdale contributed funds considerably greater than those initially estimated for the aesthetic treatment.

Like the above example, a municipality can be entirely responsible for the aesthetic treatment, although ADOT's Roadside Development Section is normally responsible for these functions. An IGA entered into between ADOT and the municipality would typically establish lines of responsibility. In one instance, the municipality maintained artistic control of the design throughout the process while ADOT provided suggestions in relation to aesthetics, directed issues centered around traffic speeds correlated to the size of the imagery, and maintained final approval of design plans and had the authority to request design changes if the proposed imagery was in any way offensive or otherwise distasteful.

Below are examples of the process that could occur to determine aesthetic treatment of structures:

- As general practice, ADOT's Roadside Development Section would work with the local jurisdiction to develop a theme for the noise walls from the standard, approved ADOT wall applications. Once a theme is decided on, the Roadside Development staff would design the aesthetic treatment.
- ADOT and the local jurisdiction would collaborate to develop a theme for the noise walls and design the aesthetic treatments. In this instance, a different design outside of standard ADOT applications could be applied while still having ADOT fully involved in the process. This option may require the local jurisdiction to contribute a portion of the funds necessary for the aesthetic treatment.
- ADOT and the local jurisdiction could engage the public in either of the above scenarios. The public would be provided the opportunity to comment on and make suggestions for the aesthetic treatments. When conducted this way, often a citizens committee is formed to contribute to the design process.
- In the unusual circumstance that none of the above options are adequate, an option exists for the local jurisdiction to initiate an IGA with ADOT. This would allow the local jurisdiction to have primary artistic control over the aesthetic treatment of structures. In this scenario the local jurisdiction would be solely responsible for all design costs and any added construction costs of the advanced aesthetic treatments. Using more than one color for the aesthetic treatments is acceptable if the local jurisdiction commits to maintenance.


Examples of aesthetic treatments on freeway-related structures in the Phoenix metropolitan area

long-range views. Further, ADOT would work with municipalities' staff to incorporate aesthetically pleasing features into the project to offset impacts. Regardless, some views would remain adversely altered.

Under the No-Action Alternative, no project-related visual impacts would occur; however, continuing urban development—primarily in the Western Section—would transform views of remaining agrarian landscapes to views of homogeneous suburban residential and commercial landscapes.

ENERGY

This section discusses the energy that would be used within the region for the No-Action and action alternatives. Primary energy use would be fossil fuel consumption by vehicles traveling within and around the Study Area. Other energy use would be associated with construction, maintenance, and development activities. Fuel would be consumed during the planned construction of new arterial streets and freeways identified in the RTP and regional transportation programs. Also, fuel would be consumed during construction of commercial developments, industrial buildings, and residences throughout the Study Area and surrounding region. Operational energy use was calculated using VMT and vehicle hours traveled projections from the MAG travel demand model, vehicle mix percentages from the Maricopa County vehicle registration records, and fuel economy data from the U.S. Department of Energy's Energy Information Administration.

AFFECTED ENVIRONMENT

The average fuel economy of the nation's vehicles, measured in miles per gallon (mpg), has been consistently improving over the past 40 years, and this trend is expected to continue during the next 20 years. Barring a technological breakthrough in the engines providing power to the vehicles of 2035, a substantial change in fuel economy is unlikely and, therefore, not assumed in the analysis. Even with such an breakthrough, penetration of a new technology across the country's total vehicle fleet can take decades. The average fuel economy of a passenger car operated in the United States in 1987 was 18 mpg and, 20 years later in 2007, it was 22.5 mpg (Energy Information Administration 2009). Automobiles are most efficient when operating at steady speeds between 35 mph and 45 mph with no stops (Oak Ridge National Laboratory 2002; USDOT 1983). Fuel consumption increases by approximately 30 percent when speeds drop from 30 mph to 20 mph, and a drop from 30 mph to 10 mph results in a 100 percent increase in fuel use. Similarly, fuel consumption increases by approximately 17 percent as speeds increase from 55 mph to 70 mph.

Total fuel consumption in the United States has also consistently risen from year to year. From 1987 to 2007, motor vehicle fuel consumption increased from 125 to 176 billion gallons per year in the United States, and the state of Arizona consumed 3.8 billion gallons per year, or 2 percent of the 2007 total (USDOT Bureau of Transportation Statistics 2009). Increased congestion on freeways and arterial streets has become a major contributor to the increase in fuel consumption. The *2007 Annual Urban Mobility Report* (Texas Transportation Institute 2007) reported that vehicles in the Phoenix urban area consumed approximately 59 million gallons of fuel in 2007 because of congestion.

Table 4-52 Annual Regional Energy Consumption, 2035

		No-Action Alternative	Action Alternative		
			W59/E1	W71/E1	W101/E1
Vehicle Miles Traveled per Year[a] (millions)		57,390	57,844	57,824	57,841
Operational Energy Use[b] (millions of gallons per year)	Passenger cars[c]	1,961	1,942	1,942	1,941
	Light-duty trucks[c]	621	615	615	615
	Heavy-duty trucks[c]	1,641	1,625	1,625	1,625
	Total	4,223	4,182	4,182	4,181

Note: Operational energy use for action alternatives was calculated by combining action alternatives from the Western and Eastern Sections.

[a] Vehicle miles traveled per year (VMT/yr) were calculated from daily VMT estimates provided by the Maricopa Association of Governments in its travel demand model (2010b). Daily estimates were converted to annual estimates by assuming 6 days per week (the equivalent of 1 day of traffic for Saturday and Sunday combined) and 52 weeks per year.

[b] Gallons/year data were determined by dividing the VMT for each category by an assumed base fuel economy factor for each class, adjusted by miles per gallon according to speed (VMT/vehicle hours traveled). Base factors were obtained from the Monthly Energy Review (Energy Information Administration 2009).

[c] Vehicle mix data were derived from Maricopa County vehicle registrations as projected by the Maricopa Association of Governments through 2035. Gasoline and diesel vehicles for all classes were combined. Buses were added to the heavy-duty trucks category. Motorcycles and alternative fuel and electric vehicles were assumed to have an insignificant contribution.

ENVIRONMENTAL CONSEQUENCES

Impact Overview, All Alternatives

Construction activities for any of the action alternatives would have comparable fuel commitments. While the No-Action Alternative would not need fuel for construction, other road projects and improvements would need to be developed in the Study Area to accommodate the region's growth. Construction energy use is not addressed in further detail because the total fuel needed for construction of the action alternatives is assumed to be essentially the same as the total fuel needed for construction of other road projects under the No-Action Alternative.

Operational energy use was calculated by dividing the yearly VMT projections for each of the action alternatives and for the No-Action Alternative by the fuel economy of the different classes of vehicles. The analysis included light-duty cars, light-duty trucks, and heavy-duty trucks and buses, which have average fuel economies of 22.5 mpg, 18 mpg, and 5.9 mpg, respectively. Fuel economies were adjusted for each alternative based on the projected average speed (mph), and were calculated by dividing the VMT by the vehicle hours traveled.

Table 4-52 shows that among the action alternatives, operational energy use is essentially the same and that all action alternatives are projected to result in less fuel consumption than the No-Action Alternative. Implementing the W59, W71, or W101 Alternative with the E1 Alternative would reduce fuel consumption regionwide by approximately 40 million gallons per year when compared with the No-Action Alternative. Although the No-Action Alternative shows the smallest VMT of all the alternatives, substantially more fuel use is projected because of the higher vehicle hours traveled. Lower speeds and, therefore, lower fuel economy are associated with the No-Action Alternative.

If the No-Action Alternative were to become the Selected Alternative, energy use due to project construction would not occur; operational energy use, however, would be higher because of higher levels of traffic congestion.

MITIGATION

No mitigation is proposed for energy use associated with the proposed action.

CONCLUSIONS

The No-Action Alternative would involve the most energy consumption of all of the alternatives. In 2035, it would consume approximately 40 million gallons of fuel per year more than any of the action alternatives. The annual fuel consumption savings associated with any of the action alternatives would represent substantial economic savings over the design life of the freeway, regardless of fluctuations in fuel prices.

TEMPORARY CONSTRUCTION IMPACTS

Construction activities would have a temporary impact on businesses and residences in the Study Area. During construction, motorists and other people living and working in the surrounding area could experience temporary inconveniences associated with traffic delays, detours, and construction dust and noise.

Potential construction impacts for each action alternative and measures to reduce impacts are presented in this section. The following environmental categories have been considered in this analysis: air quality, noise, water resources, socioeconomic conditions, pedestrian and vehicular traffic, utilities, and visual resources. Construction impacts on biological resources and cultural resources are presented in the sections, *Biological Resources* and *Cultural Resources*, on pages 4-117 and 4-128, respectively.

ENVIRONMENTAL CONSEQUENCES AND MITIGATION

All Action Alternatives, Western and Eastern Sections

Air Quality

Construction air quality impacts of the proposed action would be limited to short-term increased fugitive dust and mobile source emissions. CO is the pollutant of concern when considering localized air quality impacts of motor vehicles. Because CO emissions from motor vehicles increase with slower speeds, disruption of traffic during construction could result in short-term elevated concentrations of CO because of the temporary reduction of road capacity and increased queue lengths. To minimize emissions, efforts would be made during the construction phase to limit disruption to traffic, especially during peak travel periods.

A traffic control plan would be developed and implemented (as described later in this section) to help reduce impacts of traffic congestion and associated emissions during construction.

Fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and other earthmoving vehicles operating around the construction sites. Increased dust levels would be attributable primarily to PM resuspended by vehicle movement over paved and unpaved roads and other surfaces, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on size, height at which the emission occurs, and wind speed. Small particles (30- to 100-micron range) can travel more than 30 feet before settling to the ground, depending on wind speed. Most fugitive dust, however, is made up of relatively large particles (i.e., greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20–30 feet of their source.

To reduce the amount of construction dust generated, particulate control measures related to construction activities must be followed. The following mitigation measures would be followed, when applicable, in accordance with the most recently accepted version of the ADOT *Standard Specifications for Road and Bridge Construction* (2008).

- Site preparation
  - Minimize land disturbance.
  - Use watering trucks to minimize dust.
  - Stabilize the surface of dirt piles if not removed immediately.
  - Use windbreaks to prevent accidental dust pollution.
  - Limit vehicular paths and stabilize temporary roads.
  - Prevent dirt from being tracked or washed onto paved roads, by using 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, placed over geotextile fabric adjacent to paved roads.
- Construction
  - Use dust suppressants on unpaved travel paths.
  - Minimize unnecessary vehicular and machinery activities.
  - Prevent dirt from being tracked or washed onto paved roads, by using 50-foot-long track-out pads consisting of 12-inch-deep aggregate, 3 to 6 inches in diameter, placed over geotextile fabric adjacent to paved roads.
- Postconstruction
  - Revegetate or use decomposed granite on all disturbed land (see section, *Mitigation*, beginning on page 4-126, regarding applicable measures to reduce impacts on biological resources).
  - Remove dirt piles and unused materials.
  - Revegetate all vehicular paths created during construction to avoid future off-road vehicular activities.

In accordance with Maricopa County Rule 310, Fugitive Dust Ordinance, the contractor shall obtain an approved "Application for Earth Moving Permit, Demolition, and Dust Control Plan" prior to construction from MCAQD for all phases of the proposed action. The permit would describe measures to control and regulate air pollutant emissions during construction.

Noise

Construction noise differs from traffic noise in several ways (see text box on page 4-89 regarding construction noise).

- Construction noise can be louder than traffic noise, but lasts only during the construction contract and is usually limited to the daylight hours, when most human activity occurs.
- Construction activities generally are of a short-term nature, and, depending on their nature, such activities could last from seconds (e.g., a truck passing a receiver) to months (e.g., construction of a bridge).
- Construction noise is also intermittent and dependent on the type of operation, location, function of the equipment, and the equipment use cycle. Traffic noise, on the other hand, is present in a more continuous fashion after construction activities are completed.

Land uses near the proposed freeway would be exposed to noise from construction activity if any of the action alternatives were the Selected Alternative. The only differences between alternatives would be the location where construction would occur. As noted, the impacts would be temporary, ending upon completion of construction.

To minimize noise impacts from construction activities, the following measures would be implemented for the Selected Alternative:

- All equipment exhaust systems would be in good working order. Properly designed engine enclosures and intake silencers would be used.
- Equipment would be maintained on a regular basis.

- New equipment would be subject to new product emission standards.
- Stationary equipment would be located as far away from sensitive receivers as possible.
- Construction-related noise generators would be shielded from noise receivers (e.g., use temporary enclosures to shield generators or crushers, take advantage of site conditions to provide topographic separation).
- Construction alerts would be distributed to keep the public informed of construction activities and a toll-free number for construction-related complaints would be provided.
- During the design phase, hours of operation would be evaluated to minimize disruptions during construction.

Water Resources

Construction activities for all action alternatives would result in the potential for soil erosion and subsequent increased sediment loading into Study Area receiving waters. Without protective measures during construction, these conditions could persist until the proposed freeway were completed, when permanent measures would be established to minimize impacts on the quality of the receiving waters.

The types of construction-related impacts on water quality would be similar among the action alternatives. Each action alternative would require earthwork with the potential to adversely affect water quality in adjacent receiving waters in the Study Area. The permitting processes described in the sections, *Water Resources* and *Waters of the United States*, beginning on pages 4-93 and 4-108, respectively, outline procedures to mitigate water quality impacts during construction.

Socioeconomic Conditions

Construction may temporarily disturb access to local businesses in the Study Area. The effect would be expected to be minimal because most of the freeway would be built on a new alignment. Mitigation of potential business impacts would be achieved using traffic control management procedures set forth in ADOT's *Standard Specifications for Road and Bridge Construction* (2008).

Pedestrian and Vehicular Traffic

Construction would temporarily affect traffic movement, on-street parking, and access to adjacent properties along existing streets during times that construction activity would occur (e.g., during interchange construction). The number of lanes along existing arterial streets near construction may need to be reduced at times. Detours may be necessary at some locations.

Congestion from construction-related traffic would create temporary impacts in the project vicinity. The magnitude of these impacts would vary, depending on the location of sources of fill material and of disposition sites for surplus material, land uses along the routes, duration of hauling operations, staging locations, and construction phasing. To identify acceptable routes and times of operation, ADOT, or its representative, would prepare an agreement with local agencies regarding hauling of construction materials on public streets.

Traffic would be managed by detailed traffic control plans and by procedures and guidelines specified in Part VI of FHWA's *Manual on Uniform Traffic Control Devices*, 2009 edition, and by the Arizona Supplement to Part VI of the *Manual on Uniform Traffic Control Devices* (ADOT 2012). In planning traffic control measures, the contractor would coordinate with potentially affected public services. Access would be maintained during construction, and construction activities that might substantially disrupt traffic would not be performed during peak travel periods. To minimize disruption, ADOT would coordinate with local jurisdictions regarding traffic control and construction activities during special events. Requirements for the use of construction notices and bulletins would be identified as needed. The effectiveness of the traffic control measures would be monitored during construction and any necessary adjustments would be made.

Cultural Resources

Pedestrian access to the TCPs would not be precluded during construction, but might temporarily involve out-of-direction travel. It is understood that Community use of the TCPs is not seasonal, so avoidance of impacts would not be possible through construction scheduling. All TCPs would be appropriately protected (e.g., temporary fencing) during construction.

Utilities

Table 4-53 shows the major existing public utilities within the alignments of the action alternatives. Lengths of impact shown in this table are at the planning level and are subject to change. ADOT would coordinate with the responsible local entities regarding the relocation of utilities, as appropriate. ADOT coordination with affected utilities would be ongoing and would continue through the design phase. Utilities with prior rights would be relocated at ADOT cost according to the requirements of the utility.

Disruptions to utility services, if necessary, would be restricted to being short term and localized. Advanced planning would be accomplished during the Selected Alternative's design phase (if an action alternative were identified as the Selected Alternative) so that interruptions in utility services to customers would not occur or would be minimized. ADOT and project contractors would continue to coordinate with utility providers during the design phase and during project construction to identify potential problems and/or conflicts and to provide opportunities for their resolution prior to proposed actions. Replacement and/or relocation of utilities would be coordinated with ADOT construction activities and other projects in the area to minimize disruption to adjacent properties and traffic. Planning for the proposed action, if an action alternative were to become the Selected Alternative, would include scheduling of disruptions and prior notification of adjacent property owners who would be affected by temporary service cutoffs. Emergency response procedures would be outlined by ADOT in consultation with local utility providers to ensure quick and effective repair of any inadvertent or accidental disruptions in service.

Visual Resources

Temporary construction features, such as excavation areas, soil stockpiles, crane towers, equipment and materials storage, false work, and other miscellaneous items, would be visible from surrounding land. Temporary visual impacts would be greatest where the freeway route would be located adjacent to existing residential developments and where large system traffic interchanges would be constructed. No mitigation measures are proposed.

Table 4-53 Potential Major Utility Impacts, Action Alternatives

Utility	Western Section										Eastern Section	
	W59 Alternative		W71 Alternative		W101 Alternative Western Option		W101 Alternative Central Option		W101 Alternative Eastern Option		E1 Alternative	
	Line Type	Length of Impact (feet)	Line Type	Length of Impact (feet)	Line Type	Length of Impact (feet)	Line Type	Length of Impact (feet)	Line Type	Length of Impact (feet)	Line Type	Length of Impact (feet)
Cable	OH[a] FO[b]	1,300	OH FO	4,185	OH FO	1,030	OH FO	1,030	OH FO	1,030		
			UG[c] cable	690	UG FO	1,340	UG FO	1,260	UG FO	1,890		
			UG FO	1,150	OH cable	1,770	OH cable	2,910	OH cable	1,585		
									UG cable	465		
Gas	7"[d]–10"	650	7"–10"	1,630	7"–10"	740	7"–10"	1,960	7"–10"	2,310	7"–10"	2,750
	17"–30"	540	17"–30"	635	11"–16"	930	11"–16"	1,920	11"–16"	1,765	11"–16"	1,575
					17"–30"	620	17"–30"	990	17"–30"	720		
Phone	CenturyLink	15,895	CenturyLink	17,885	CenturyLink	17,965	CenturyLink	13,705	CenturyLink	11,270	CenturyLink	22,585
	AT&T	605	AT&T	640	Sprint	750	Sprint	940	Sprint	1,160		
	Sprint	1,300	Sprint	840								
Power	OH SRP[e]	15,940	OH SRP	9,190	OH SRP	5,000	OH SRP	6,575	OH SRP	6,535	OH Western	830
	OH Western[f]	470	OH Western	1,200	OH Western	515	OH Western	490	OH Western	645	UG SRP	3,880
	UG SRP	1,300	UG SRP	1,630							OH SRP	1,175
	OH APS[g]	470									OH APS	400
Sewer	17"–30"	10,480			31"–48"	2,965	17"–30"	2,375	17"–30"	3,675	31"–48"	19,790
	>49"	3,200			>49"	8,290	31"–48"	5,715	31"–48"	7,940		
							>49"	10,270	>49"	7,990		
Water	11"–16"	4,760	11"–16"	5,570	11"–16"	1,560	11"–16"	9,760	11"–16"	8,370	11"–16"	1,355
			>49"	2,655							31"–48"	34,445
Irrigation	SRP siphons	3,235	SRP siphons	3,805	SRP siphons	4,200	SRP siphons	4,200	SRP siphons	4,200	SRP laterals	790
	SRP laterals	19,230	SRP laterals	23,115	SRP laterals	25,405	SRP laterals	24,045	SRP laterals	25,145		
	RID[h] canal	565	RID canal	1,210								

[a] overhead [b] fiber-optic [c] underground [d] inches [e] Salt River Project [f] Western Area Power Administration [g] Arizona Public Service [h] Roosevelt Irrigation District

Section 4(f) Resources

Trails near and adjacent to the proposed action would experience temporary closures or detours during construction for safety reasons. In the event of short-duration closure, the remaining portions of the trail would remain accessible.

No-Action Alternative

No construction-related impacts would result from this alternative.

CONCLUSIONS

Construction activities associated with a project the size and magnitude of the proposed action would create temporary impacts on human and natural environments. Throughout the Phoenix metropolitan area, ADOT and FHWA have demonstrated experience in the construction of projects like the proposed action. Similar measures outlined in this section and in previous sections of this chapter (e.g., *Topography*, *Geology*, *and Soils*, beginning on page 4-113) have been applied to those projects and have proven effective in reducing construction-related impacts.

Public awareness during construction

As projects transition into construction, ADOT maintains its dedication to communicating with the public. Public information meetings are typically held at the beginning of construction activities, informing communities of the upcoming improvements and work schedules. The public can also be kept informed through construction updates/newsletters, fliers, project information hotlines, Web sites, periodic meetings, project offices, and radio and newspaper advertising. See Chapter 6, *Comments and Coordination*, for additional information regarding public interaction for the proposed action.

MATERIAL SOURCES AND WASTE MATERIAL

The design of a large-scale project such as the proposed action requires careful consideration of how to balance earthwork needs with available fill material in the area. In some cases, the excavation of project facilities such as drainage basins produces fill material that can be used elsewhere on the project to support construction of raised facilities such as traffic interchanges. In cases where the project does not produce enough fill material to meet the needs of a project, other suitable sources of material must be found.

ENVIRONMENTAL CONSEQUENCES

Action Alternatives

The proposed action—including the freeway main line, system and service traffic interchanges, drainage channels, and drainage basins—was modeled to estimate earthwork quantities. Cut material is excess material generated as a result of project construction (e.g., from the excavation of a drainage basin). Fill material is the material needed to complete the project construction (e.g., to support a ramp leading to a bridge). The earthwork material deficit is an approximation of what would be needed to complete construction of the proposed project—in other words, the amount of borrow material that would be needed. Although the freeway would generally be aboveground throughout the corridor, construction of the freeway would generate material that could be used as fill material elsewhere on the project. Material that is not suitable to be used as fill material, or as waste material, would need to be disposed. Table 4-54 lists earthwork quantities needed for each action alternative.

Table 4-54 Earthwork Quantities, Action Alternatives

Action Alternative	Quantities (approximate millions of cubic yards)		
	Fill (material needed)	Cut (material generated)	Deficit[a]
Western Section			
W59 Alternative	9.70	5.90	3.80
W71 Alternative	8.25	8.00	0.25
W101 Alternative Western Option[b]	9.00–11.00	8.50	1.00–2.00
W101 Alternative Central Option[b]	11.00–13.00	10.00	1.00–2.00
W101 Alternative Eastern Option[b]	11.00–13.00	8.50	2.00–4.00
Eastern Section			
E1 Alternative	11.00	6.40	6.20

[a] Some of the deficits do not total correctly. This is because certain assumptions were used for material shrinkage, compaction, topsoil planting, overexcavation, and recompaction under embankments.
[b] Ranges are provided because these action alternatives have Partial and Full Reconstruction Options.

In the Western Section, the W71 Alternative would have the smallest deficit, needing approximately 0.25 million cubic yards of borrow material. The W101 Alternative Eastern Option would have the largest deficit, needing approximately 4 million cubic yards of borrow material.

The Eastern Section E1 Alternative would need approximately 6.2 million cubic yards of borrow material. The earthwork quantities for the E1 Alternative are highly dependent on the suitability of the cut material from the South Mountains.

With regard to project construction, major sources of cut material would include:

- mountain foothills near Desert Foothills Parkway
- cuts through the South Mountains
- large drainage basins and the semidepressed portion of the freeway at Dobbins Road
- a drainage channel and large drainage basin south of Broadway Road
- side slopes along I-10 (Papago Freeway)

Additionally, ADOT-approved material sources are located within and around the Study Area. The contractor would ultimately be responsible for locating material to meet the projected deficit and disposing of any unsuitable material. Material source locations would be selected by the contractor, although any selected source must be examined for environmental effects by the contractor, prior to use, through a separate environmental analysis in accordance with ADOT's *Standard Specifications for Road and Bridge Construction*, Section 1001 Material Sources (2008 Edition) (Stored Specification 1001.2 General).

No-Action Alternative

No borrow material would be needed for this alternative.

MITIGATION

Contractor Responsibilities

The contractor would use material sources from the ADOT *Contractor-Furnished Materials Sources List*. If the source that the contractor prefers to use is not on the ADOT list, then the contractor would complete ADOT EPG's Material Source Environmental Analysis Application in accordance with ADOT's *Standard Specifications for Road and Bridge Construction*, Section 104 Material Sources (2008 Edition) (Stored Specification 104.12 General) prior to using material from that source.

Contractor-furnished material sources must go through a process to obtain environmental clearance for use on ADOT projects. The material source owner or operator must submit a Material Source Environmental Analysis Application, with cultural survey and reports, to ADOT EPG. After receiving the completed application, ADOT EPG would initiate a cultural consultation process. Upon successful completion of this process, the material source would receive a tracking number and may be included on the ADOT *Contractor-Furnished Materials Sources List*.

CONCLUSIONS

Construction of the proposed project would need between approximately 6.45 million and 10.2 million cubic yards of borrow material, depending on the selected action alternative in the Eastern and Western Sections—if an action alternative were to be selected. In the Eastern Section, the needed amount would be approximately 6.2 million cubic yards of borrow material. In addition, depending on the action alternative chosen for the Western Section, the amount of borrow material would vary between 0.25 million and 4 million cubic yards. The W71 Alternative would need the least amount, at 0.25 million cubic yards, and the W101 Alternative Eastern Option would potentially need the largest amount—4 million cubic yards. These amounts are not considered excessive for a project of this size. The contractor would ultimately be responsible for locating additional material to meet the projected deficit and for disposing of any unsuitable material.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction and operation of the proposed action would involve a commitment of a range of resources, including construction materials, fuels, land, labor, and financial assets. Some resources would need an irreversible commitment during the life of the proposed action. Others would not be retrievable even beyond that time. Any of the action alternatives would need a similar commitment of these resources.

Land within the R/W would be unavailable for other purposes during the time that it is used as a highway facility. Conversion of land now used as farmland, commercial, industrial, residential, and other urban development into the proposed action would be irreversible. If a greater need arose for use of the land or if the freeway were to be no longer needed, however, the land could be converted to another use. There is no reason to believe that such a conversion would ever be necessary or desirable. In the event land were converted, a return to agricultural uses would be unlikely. Thus, the loss of farmland would be permanent and irretrievable.

Considerable expenditures for labor and consumption of energy and of highway construction materials, such as cement, aggregate, and bituminous material, would be needed in the construction of the project. Additionally, large amounts of labor and natural resources would be used in the fabrication and preparation of construction materials. This expenditure for labor and materials generally is considered not retrievable. Labor and materials for this type of project, however, are not expected to be in short supply, and the use of such labor and materials would not have an adverse effect on continued availability of these resources. The commitment of these resources is based on a public policy that the project would provide measurable benefits to area residents, including:

- improved accessibility within the community and to other portions of the greater Phoenix metropolitan area
- reduced traffic congestion and a corresponding increase in safety and time savings
- improved availability of community services
- improved opportunities for economic development and job creation

When constructing the proposed action, ADOT, or its agent, would commit to materials reuse, wherever appropriate and feasible. A substantial expenditure of public funds would be needed to construct the proposed action. These funds, which are derived from taxes imposed at different levels of government, would not be retrievable. Their use is determined, however, through national, statewide, regional, and local planning efforts and engaged by elected officials and area citizens. The expenditure of these funds would also create new opportunities for economic activities, such as new jobs, that would result in the generation of increased tax revenues.

The commitment of resources necessary to build and operate the proposed action would be based on the concept that residents and other users in the immediate area, region, state, and the country would benefit from the proposed transportation facility. These benefits would consist of improved accessibility and safety, reduced traffic congestion, and savings in time. These benefits would outweigh the commitment of resources.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Short-term adverse impacts would occur during construction of the proposed action. Such impacts would be similar for any of the action alternatives. Long-term impacts would occur over the life of the proposed action and would have a positive effect.

Impacts during construction (see the section, *Temporary Construction Impacts*, beginning on page 4-161) would include effects on air quality, noise, water resources, socioeconomic conditions, pedestrian and vehicular traffic, utilities, and visual resources. These effects would, however, be temporary, lasting only as long as the construction activity. Relocations of residents and businesses would occur under any of the action alternatives. Immediately preceding construction, the displacement of businesses could result in a lessening of economic activity in the immediate area. The consequence would be a temporary decrease in property and sales taxes. Potential tax losses should be offset by the construction jobs that would be created by the proposed action and by opportunities for new development, especially near the interchanges.

Long-term impacts would generally be beneficial. Accessibility between the immediate area and other parts of the metropolitan area would be enhanced (see Chapter 1, *Purpose and Need*). Traffic congestion would be reduced and safety improved. More efficient energy use and a decrease in vehicle emissions would result.

Completion and operation of the proposed action would serve future economic development in the area. The new development would create additional jobs and generate a substantial increase in sales and property taxes. On balance, the use of resources and the associated short-term impacts would lead to long-term benefits in the area. These benefits would accrue in both the Study Area and in the greater Phoenix metropolitan area.

SECONDARY AND CUMULATIVE IMPACTS

Phoenix has grown from a small agricultural town to a major metropolitan area (see the section, *Historical Context of the Proposed Action*, beginning on page 1-5). Growth is expected to continue and result in secondary and cumulative effects on the area's natural resources, communities, residents, infrastructure, and economic conditions.

OVERVIEW OF HISTORIC, EXISTING, AND FUTURE CONDITIONS

Demographics

Population in the Study Area is projected to grow by 76 percent from 2005 to 2035. From 1990 to 2000, population grew by more than 80 percent, so the trend of fast growth seen in recent decades is likely to continue (note discussion of recent economic downturn, on page 1-11). Employment is projected to grow by 112 percent from 2005 through 2035. In line with these projections, 144 development proposals, largely consisting of new residential subdivisions, were identified for the Study Area (see the section, *Development Plans*, on page 4-7).

Within the Study Area, minority populations account for 68 percent of the population, more than the average for Maricopa County (41 percent). Low-income population percentages are also above the Maricopa County average of 14 percent, with 16 percent of the Study Area population identified as low-income.

Land Use and Ownership

Much of the Study Area was converted to agricultural use prior to the 1950s. Urbanization generally began in the 1950s and has now reduced agricultural and undeveloped land to 21 and 12 percent of the Study Area, respectively.

Approximately 56 percent of the Study Area is developed, with residential (31 percent single-family and 2 percent multifamily), commercial (4 percent), industrial (14 percent), transportation (2 percent), or public/quasi-public land uses (3 percent). The I-10 (Papago Freeway) corridor is the most intensely developed portion of the Study Area. Moving south from I-10 (Papago Freeway), the Study Area is characterized by increasingly less dense development. Much of the Goodyear area included in the Study Area is undeveloped, attesting to the lower density of development west of the Phoenix metropolitan center (see the section, *Existing Land Use, Land Use Trends, and Ownership*, beginning on page 4-3, for related information). Analysis of secondary and cumulative impacts revealed little difference (with one exception) among the action alternatives. Therefore, except where noted, the impacts discussion focuses on the proposed action, which considers all of the action alternatives.

SECONDARY IMPACTS

Regulatory Basis

Secondary impacts (sometimes referred to as indirect impacts) are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Secondary impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 C.F.R. § 1508.8). An example is how the construction of a new highway interchange at a cross street can attract the building of a new gas station.

FHWA implements NEPA and CEQ guidelines under 23 C.F.R. § 771 (FHWA 1992). FHWA has interim guidance on secondary (indirect) and cumulative impact analysis (FHWA 2003). The FHWA interim guidance supplements the CEQ guidance; combined, they provide the primary basis for analysis. The information presented follows two principles outlined by the CEQ guidance (1997) in considering secondary and cumulative analyses: 1) focus only on the effects and resources within the context of the proposed action, and 2) present a concise list of issues that have relevance to the anticipated effects of the proposed action or eventual decision.

Analysis of Potential Impacts

Resources Not Subject to Secondary Impact Analysis

The relation of the proposed action to social, cultural, technical, economic, and natural components of the environment was reviewed to determine the potential for secondary impacts to occur. Based on this assessment, certain resources were excluded from analysis. The rationale for determining which resources would not be given further consideration for secondary impact analysis is presented in Table 4-55.

Resources Subject to Secondary Impact Analysis

The effects among action alternatives are anticipated to be comparable. Critical issues warranting secondary impact analysis are biological resources, water resources, air quality, cultural resources, land use, and economic conditions. (One secondary impact under economic conditions would result from the W101 Alternative and its Options. The direct impact of land conversion to a nontaxable land base by the alternative would lead to a substantial reduction in the City of Tolleson's tax revenues. The secondary effect would be sufficient to lead to possible reductions in the provision of public services to city residents. The impact is discussed further in the section, *Economic Impacts*, beginning on page 4-46). The resource, the proposed action impact, and reasonably foreseeable impact are presented in Table 4-56.

Induced Travel

Induced travel is a phrase used to describe observed traffic volume increases occurring on a new highway after it is opened. The observation is prominent in areas where congestion is already evident (the Phoenix metropolitan area is an example).

The proposed action would be constructed where existing traffic congestion has already decreased travel speeds throughout much of the Regional Freeway and Highway System and the major arterial street network.

Table 4-55 Resources Not Considered for to Secondary Impact Analysis

Resource	Rationale
Topography	While the proposed action would alter topography in the Study Area, the direct impacts from the proposed action are adequately presented in the *Topography, Geology, and Soils* section of this chapter. Therefore, no further consideration is given because the proposed action is not expected to cause topographic changes beyond direct impacts.
Energy	While construction and operation of the proposed action would result in the direct use of energy, the proposed action and its alternatives would not use energy at a magnitude or rate beyond consumption as determined if no action were undertaken. Therefore, no further consideration will be given because the proposed action is not expected to vary usage levels considerably from existing and projected traffic patterns.
Utilities	While construction of the proposed action would require the relocation and adjustment of utilities, no new utility projects are identified in the Study Area to support the proposed action. Therefore, no further consideration is given.
Environmental justice	The evaluation to determine whether disproportionate impacts on any environmental justice population would occur revealed that all action alternatives would have direct impacts on Title VI and environmental justice populations. The proposed action would be accessible to all populations in the Study Area, the impacts would not be disproportionately high on any population, and mobility benefits would occur. Benefits would include enhanced access to and from employment opportunities and enhanced movement of goods and services for improved access to such goods and services for all population segments. Therefore, no secondary impacts would occur.
Recreational land	Section 6(f) lands would not be affected by the proposed action and, therefore, no further consideration is warranted. The Section 4(f) process required consideration of direct and indirect impacts; therefore, the Section 4(f) evaluation performed for this project adequately considered secondary impacts, and no further consideration is given to recreational land.
Noise	Noise is an unwanted sound that can intrude on and have effects on the resources of the human and natural environments. The noise analysis conducted for the proposed action took into account projected future noise from traffic on the proposed action. No additional noise would be expected because of the proposed action; therefore, no further consideration is given.
Hazardous materials	Hazardous material sites are a byproduct of the human environment. The *Hazardous Materials* section of this chapter considered the direct and indirect potential for the proposed action to disturb such sites; therefore, no further consideration is given.
Demographics	Because this project and other transportation projects have been designed to respond to population forecasts (as opposed to encouraging population growth where it might not otherwise occur), no secondary impacts on demographics have been identified. Therefore, no further consideration is given.
Wild and scenic rivers	No wild and scenic rivers occur in the Study Area; therefore, no secondary impacts would occur. No further consideration is given.
Sole source aquifer	No sole source aquifers occur in the Study Area; therefore, no secondary impacts would occur. No further consideration is given.
Floodplains	The proposed action may cause changes in land development at select locations adjacent to its alignment. In some instances, such changes may be proposed within designated floodplains in the Study Area. Ultimately, however, incompatible use or development within floodplains would not be facilitated by the proposed action. Developments in the area must comply with State and local zoning and floodplain ordinances; therefore, no secondary impacts would occur.
Visual quality	The proposed freeway would be a part of the transition in land use from low-density, open uses to residential, commercial, and light industrial uses. This is a trend that is underway and would continue with or without the proposed freeway. The road cuts proposed for the western end of the South Mountains and the direct impacts from the proposed action are adequately presented in the *Topography, Geology, and Soils* section of this chapter and no additional impacts would occur; therefore, no secondary impacts would occur.

To avoid congestion, over time, some travelers have diverted to alternative routes, changed the time of day they make their trips, switched to different travel modes, traveled to other destinations, or decided not to make a particular trip at all. Because the proposed action would carry substantially more traffic before it would become congested, many of these travelers may switch to the new facility when opened to take advantage of decreased travel times. Some travelers using transit as a choice may also switch and, further, some may choose to travel to different (more distant) destinations (e.g., for shopping) or take a trip that they previously avoided altogether because it was previously "too much trouble" to make. The behavior triggering such a switch is often associated with drivers' perceptions of a decreased generalized cost of travel, including both travel time and out-of-pocket costs. It is commonly recognized, however, that the causes of this "switch" are more complex and involve various travel behavior responses, evolving individual needs, residential and business location decisions, and changes in regional population and economic growth.

Some induced travel would represent new trips. Most of the increase in traffic caused by induced travel, however, is expected to come from trips already being made before the proposed action would be put into operation (predictable traveler behavior accounted for in the travel demand forecasts conducted for the proposed action). The resulting traffic increase on the proposed freeway would also be expected to be largely offset by decreases in traffic volumes on parallel routes and at other times of the day. It is fully expected that the net effect on daily VMT in the region as a result would be minimal. Examples in the region where this phenomenon has been experienced include the openings of SR 101L (Pima Freeway) in Scottsdale and of SR 202L (Red Mountain Freeway) in Mesa.

SR 101L (Pima Freeway) was opened to traffic in 2002, from SR 202L (Red Mountain Freeway) to I-17. The section from the Red Mountain Freeway to Shea Boulevard was opened in 1999. On opening, changes in traffic volumes were experienced on Hayden and Scottsdale roads (both parallel the Pima Freeway 1 mile and 2 miles to the west, respectively). Both are major arterial streets with cross sections of four to six lanes.

Table 4-56 Secondary Impacts, Action Alternatives

Resource	Proposed Action Impact	Reasonably Foreseeable Impact
Biological	Habitat loss from direct conversion to transportation use	Habitat loss from urban development
	Vehicle-animal collisions	Wildlife population reduction
	Loss of native vegetation	Increased rate of land conversion
Water	Loss and/or alteration of natural drainage features	Loss from urban development
	Modification of groundwater tables from pumping to drain a depressed facility: eventual impact on the water table by removing this water from use	Groundwater drawdown from continued development
Air quality	Particulate matter attributable to construction activities	Construction activities related to continued rapid urban growth in the region
Cultural resources	Disturbance to known historic and prehistoric sites	Enhanced access to undisturbed land
	Discovery of previously unknown cultural resources	Discovery of previously unknown cultural resources related to ongoing urban development
Land use	Conversion of agricultural land to other uses	Ongoing residential, industrial, and commercial development
	Land use ownership and conversions	Conversion of zoned parcels to more intensive land uses
	Alteration of community character	Ongoing residential, industrial, and commercial development and its effect on community character
Economic conditions	Enhanced movement of goods, people, and materials; property value changes	Projected growth in land values and economic activity in Study Area

The analysis, conducted by the City of Scottsdale, illustrates a reduction in traffic along both major arterial streets after the freeway was completed. Traffic reduction on Hayden Road ranged from 13,900 to 48,300 vehicles per day (vpd), with an average reduction of 31,000 vpd. Scottsdale Road, which is farther away from the freeway, experienced a reduction of between 2,100 and 13,300 vpd, with an average reduction of 10,000 vpd.

The Red Mountain Freeway, from its interchange with SR 101L to Gilbert Road, was opened to traffic in 2002, and the extension to Higley Road was opened in 2003. On opening, changes in traffic volumes were experienced on McDowell, McKellips, and Brown roads (all generally parallel the Red Mountain Freeway 1, 2, and 3 miles to the south, respectively). All are major arterial streets with cross sections of four to six lanes.

The analysis, conducted by the City of Mesa, illustrates a reduction in traffic along all three major arterial streets after the freeway was opened. The traffic reduction on McDowell Road ranged from 6,300 vpd to 9,900 vpd, with an average reduction of 8,600 vpd. The traffic reduction on McKellips Road ranged from 2,300 vpd to 33,900 vpd, with an average reduction of 19,000 vpd. The traffic on Brown Road ranged from an increase of 300 vpd at the eastern end to a reduction of 9,700 vpd, with an average reduction of 4,500 vpd. The largest reduction was on the western end of the road, near Country Club Drive.

Both examples provide insight to general driver behavior. At the time of opening, both freeways represented driver savings in time and/or travel costs. Consequently, drivers moved from the arterial street network to the freeway system. Over the course of time, it would be expected that some drivers would return to the arterial street network as more vehicles traveled on the freeways. For the proposed action, a net reduction on the arterial street network would be anticipated through the design year of 2035 because traffic volumes on the arterial street network would be projected to be less with the proposed action in place than without the proposed action.

For the proposed action, the minimal contribution to overall traffic use by induced travel would be expected to have both positive and negative consequences (positive effects on the neighboring road network have been previously addressed). Changes in driving behavior leading to the use of the proposed action would be the result of perceived benefits, which could include reduced total daily travel time and cost or an increased value associated with a new destination (e.g., a previously "inaccessible" shopping area with more variety or lower prices).

As a negative consequence, each user of the proposed action would contribute to increased congestion on the freeway. As congestion increased on the new facility, the benefit attributable to potential travel time savings would be expected to decline. Congestion-related impacts (e.g., reduced air quality) would also increase over time. The overall contribution to projected traffic volumes on the proposed action, however, would be anticipated to be minimal (some of which is accounted for in regional traffic models).

It is important to consider that improvements proposed for any type of transportation system (e.g., a new bus route, rail transit line, commuter rail service) would likely lead to changes in travel behavior, which, in turn, would lead to increased use of the particular system. Improvements made to a given transportation system are meant to attract new users. If this were not a primary goal, the improvements would be neither effective nor

warranted. For the proposed action, a goal is to attract users of other segments of the Regional Freeway and Highway System and the local arterial street network, now and in the future, to the proposed action to optimize, in part, the entire regional transportation system (as outlined in the proposed action's purpose and need in Chapter 1). Further, it is important to consider that, as improvements are made to all transportation systems, cyclical benefits and impacts would occur. For example, as auto trips would be diverted to transit (either because of direct improvements or increased congestion), traffic congestion on parallel highway facilities may diminish, at least temporarily. The resulting reduction in highway traffic congestion may, in turn, attract additional highway trips, similar to an increase in highway capacity.

FHWA's position relative to induced travel is consistent with the consensus of the transportation planning and travel behavior research community: induced travel is neither more nor less than the cumulative result of individual traveler choices and land development decisions made in response to an improved level of transportation service. Many of the travel choice decisions are accounted for in current travel forecasting models or land use-transportation interaction models.

Induced Growth

Unplanned growth is often termed "urban sprawl." Generally, the reference is made in the context of rapid and uncontrolled urban growth onto previously undeveloped land—usually on the outskirts of an existing urban area. Construction of projects like the proposed action is often identified as a major contributor to urban sprawl. Freeway projects are often cited as making land at the urban fringe more accessible and, therefore, more attractive for development.

But, as with issues surrounding induced demand, the relationship between transportation improvements and land development is complex. Land accessibility in a particular area as a result of a freeway project may make land more attractive for development, but other factors, such as utility infrastructure, quality of public services, land acquisition and development costs, economic conditions, and entitlement costs, assume major roles in determining where and how development would occur. In fact, in many cases, new development being attracted to one part of a metropolitan region often represents development that has been redirected from other parts of the region.

Until the economic downturn that began in 2007, the past rate of growth and development far exceeded the ability of any major transportation infrastructure to keep pace. (Factors like affordable cost of living, employment opportunities, mild climate, reasonable accessibility, and a development-oriented regulatory environment will contribute to a resumption of a solid rate of growth.) Examination of data comparing population and land use between 1975 and 2000 suggests major transportation infrastructure projects like the proposed action are not major contributors to or inducers of growth in the region. For example, from 1975 to 2000, population increased by 211 percent from just over 1 million people to over 3.1 million people. The acreage of urban area increased from nearly 226,000 acres to just over 549,000 acres (143 percent increase). During this same time frame (and actually dating back to development patterns of the 1950s), population densities have remained constant at two households per acre. While newer development between 1991 and 2000 has generally been at four households per acre, the overall densities remain well below what transportation planners use as a rule of thumb for the minimum density needed to support a public transit-based network: seven households per acre. VMT have increased from 17 miles per day to approximately 21 miles daily (a 24 percent increase), and traffic delay and related congestion costs increased 350 to 360 percent in that same time period.

While the recession has dramatically slowed growth in the Phoenix metropolitan area—and theoretically provided an opportunity for transportation infrastructure to catch up with the demographic forces that have historically fueled high growth—it has also affected resources at all levels of government that are the sources of funding for expansion of the regional transportation infrastructure. Federal economic stimulus funding has benefited projects that were far along in the planning process. Locally, Proposition 400 funding for transportation development in the MAG region depends on revenues from a tax on retail sales, which have been substantially lower than prerecession projections. Nationally, revenues derived from the federal fuel tax and which in part provide funding for highway development have decreased since the recession began (FHWA 2009b). More fuel-efficient vehicles and overall lower vehicle use have also contributed to this national decline in revenues. Because transportation capacity seriously lags transportation demand in the Study Area, it can be assumed the proposed action would neither induce growth nor facilitate any increase in the rate of growth under current or projected growth environments.

The proposed action would be implemented in a historically quickly urbanizing area (most noticeably in the Western Section of the Study Area—note that a nationwide recession beginning in 2007 has slowed growth). On the eastern side of the Study Area, the proposed action abuts public parkland, Native American Community land, and a near-fully developed area and, therefore, any contribution to accelerated or induced growth is constrained. Historical and projected growth and the factors (including the proposed action) contributing to such growth are well-documented in Chapter 1, *Purpose and Need*, and in the sections, *Land Use* and *Economic Impacts*, beginning on pages 4-3 and 4-46, respectively. The proposed action would be built in an area planned for urban growth as established in local jurisdictions' land use planning activities for at least the last 25 years. If, on the other hand, the proposed action were to be located in rural or fringe areas, it would provide access to large tracts of undeveloped land. Some similar types of projects, in fact, in other parts of the country, were developed specifically to promote nonhighway economic development. In two such cases, FHWA is monitoring where a substantial highway improvement was completed whose purpose was to promote economic development. In the case of the proposed action, the purpose of the project is not to promote economic development but to respond to a growing need for additional transportation capacity as a result of regional growth occurring now and as projected.

CUMULATIVE IMPACTS

Regulatory Basis

Federal guidance defines *cumulative impacts* as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 C.F.R. § 1508.7). Cumulative impacts are considered direct effects, which are "caused by the action and occur at the same time and place" (40 C.F.R. § 1508.8). Put another way, cumulative impacts occur where several actions in an area combine to create an impact greater than any one individual activity.

Methodology

The cumulative impact analyses considered:

- environmental resources that would be directly affected by the proposed action
- the area in which effects of the proposed action would be felt
- impacts that would result from the proposed action
- other past, proposed, and reasonably foreseeable future actions that have had or could be expected to affect the same area
- expected impacts from other actions
- the overall expected impact if the individual impacts were allowed to accumulate

Parameters established to conduct the analyses were:

- Assess those critical, or at-risk, resources expected to substantially experience a cumulative impact. Logically, if the proposed action would not directly affect a particular environmental resource, the action would not contribute to a cumulative impact on that resource. This focused the analysis on critical, or at-risk, resources and fulfilled CEQ guidance (2005) that agencies should use scoping to focus on the extent to which information is "relevant to reasonably foreseeable significant adverse impacts" and is "essential to a reasoned choice among alternatives."
- During the analyses, follow two principles outlined by CEQ guidance (1997) in considering critical conditions: 1) focus only on the effects and resources within the context of the proposed action, and 2) present a concise list of issues that have relevance to the anticipated effects of the proposed action or eventual decision.
- Establish a geographic, or spatial, boundary for impact assessment. The size of the cumulative impact study areas varied depending on the critical resource.
- Determine time frames for which to assess cumulative impacts as driven by CEQ guidance to consider past, present, and reasonably foreseeable changes that could result in cumulative impacts when combined with the effects of the proposed action. The start of the general urbanization of the greater Phoenix metropolitan area beginning in the 1950s was established as the historic time limit. Although not a specific individual action, the Study Area's urbanization is noteworthy because it highlights the "current aggregate effects of past actions without delving into the historical details of individual past actions" (CEQ 2005). In addition, the design year (estimated time when the freeway would provide its intended traffic capacity) of 2035 was used as the future time limit.
- Identify past, existing, and proposed relevant actions. Relevant actions were identified to evaluate when—in combination with the proposed action and its associated impacts—they could result in cumulative impacts. Reasonably foreseeable changes were limited to projects currently planned and funded. The following types of activities that could contribute to cumulative impacts were:
  - other highway projects initiated by the proposed action
  - planned mass transit projects in the Study Area
  - other major infrastructure projects (e.g., utility expansion)
  - other general development patterns

Other proposed transportation projects within or near the Study Area include high-capacity transit on I-10, median and outside widening of I-10 (Papago Freeway) between SR 85 and SR 101L, SR 30 freeway, I-10 Local/Express lanes, SR 303L extension, I-17 expansion project, and the ARS project. No other major infrastructure projects were identified aside from local arterial street widenings to serve existing growth.

Analysis of Potential Impacts

Resources Not Subject to Cumulative Impact Analysis

The relation of the proposed action to social, cultural, technical, economic, and natural components of the environment was reviewed to determine the potential for cumulative impacts. Resources assessed and determined not to be subject to cumulative impact analysis are presented in Table 4-57.

Resources Subject to Cumulative Impact Analysis

The contribution to cumulative effects among action alternatives is anticipated to be comparatively the same. The following critical issues warranted cumulative impact analysis.

Biological Resources

Habitat Loss

Construction and operation of the proposed action would irrevocably convert existing natural habitat to a transportation use and, therefore, contribute to a reduction in the amount of wildlife habitat in the region (EPA 2004). From 1975 to 2000, the proportion of land in human-related uses (e.g., urban) increased by an estimated 15 percent (the rate of increase to human-related uses was greatest during the "pre-freeway" period of 1975 to 1986). During this period, natural land uses decreased by 5 percent. Ongoing planned and permitted residential, commercial, and transportation development would likely further this trend of habitat loss through direct conversion, habitat isolation (addressed below), and native plant loss (addressed below). Also, wildlife typically is displaced, causing either increased competition among species members and/or population reduction.

Table 4-57 Resources Not Considered for Cumulative Impact Analysis

Resource	Rationale
Energy	While construction and operation of the proposed action would result in the direct use of energy, the proposed action and its alternatives would not use energy at a magnitude or rate beyond consumption as determined if no action were undertaken. Therefore, no further consideration will be given because the proposed action is not expected to vary usage levels considerably from existing and projected traffic patterns.
Utilities	While construction of the proposed action would require the relocation and adjustment of utilities, no new utility projects are identified in the Study Area to support the proposed action. Therefore, no further consideration is given.
Hazardous materials	Hazardous materials are not considered a resource upon which impacts from the proposed action or from other known projects would occur. Instead, hazardous material sites are a byproduct of the human environment. The hazardous materials report prepared for the proposed action considered the direct and indirect potential for the proposed action to disturb such sites; therefore, no further consideration is given.
Demographics	Because this project and other transportation projects have been designed to respond to population forecasts (as opposed to encouraging population growth where it might not otherwise occur), no cumulative impacts on demographics have been identified. Therefore, no further consideration is given.
Economics	The proposed action would not induce economic growth nor facilitate any increase in the rate of growth under the growth environment because the proposed action provides only a portion of the capacity shortfall in transportation support infrastructure that has been experienced throughout the region and, in particular, in the southwestern Phoenix metropolitan area. In addition, growth is geographically constrained by the presence of the existing urbanized area, Community[a] land, and SMPP.[b] Therefore, no cumulative impacts would occur.
Wild and scenic rivers	No wild and scenic rivers occur in the Study Area; therefore, no cumulative impacts would occur. No further consideration is given.
Sole source aquifer	No sole source aquifers occur in the Study Area; therefore, no cumulative impacts would occur. No further consideration is given.
Floodplains	Incompatible use or development within floodplains would not be facilitated by the proposed action. Developments within the area must comply with State and local zoning and floodplain ordinances; therefore, no cumulative impacts would occur.

[a] Gila River Indian Community [b] Phoenix South Mountain Park/Preserve

Habitat Connectivity

Construction and operation of the proposed action would bisect existing natural habitat for the purposes of a transportation use and, therefore, would contribute to habitat isolation, inhibiting the movement of wildlife for life requirements. This effect would likely be most prevalent in the areas between the South Mountains and Sierra Estrella. Ongoing planned residential, commercial, and transportation development is reviewed and permitted by local jurisdictions on a case-by-case basis; however, most developments are too small to consider their individual contributing effects on habitat connectivity. However, when considered together, these ongoing developments would contribute to continued adverse effects on habitat connectivity. The provision of mitigation for the proposed action in the form of multiuse crossings to be situated in cooperation with federal and State wildlife officials would minimize impacts attributable to the proposed action.

Vehicle-animal Collisions

The movement of wildlife for life requirements in the Study Area suggests the construction and operation of the proposed action would increase the potential for vehicle-animal collisions in the region. This potential impact would likely be most prevalent along the segment of the freeway that would be between the South Mountains and Sierra Estrella. Ongoing planned and permitted development in this area would also contribute to an increase in collisions; however, this increase may be moderated by 1) slower travel speeds on the current and future local arterial street network, 2) lesser concentrations of wildlife in developing areas, and 3) the provision of mitigation for the proposed action in the form of multiuse crossings to be situated in cooperation with federal and State wildlife officials. Together, the proposed action and future projects (e.g., SR 30, ARS) would place high volumes of traffic near undisturbed areas along the Gila and Salt rivers. Therefore, these planned projects and the ongoing development would contribute to increasing numbers of vehicle-animal collisions. Over time, as the southwestern Phoenix metropolitan area develops, the incidence of this type of impact would likely diminish as habitat decreases and becomes less able to sustain large wildlife populations.

Native Plants

Ongoing conversion of natural areas to human-based development contributes to continued loss of native plants in the region. The proposed action would contribute to the loss of native plants because it would convert land known to have native plants to a transportation use (although the impact would be offset somewhat by project-specific proposed mitigation). Future residential, industrial, commercial, and transportation projects in conjunction with the proposed action can be reasonably expected to contribute to a loss of native vegetation, as defined and protected under the Arizona Native Plant Act (A.R.S. § 3-901 et seq.). Notably, the proposed action as currently planned would convert natural areas around the South Mountains to a transportation use.

Invasive Species

The introduction of nonnative species and noxious weeds has occurred since the 1950s as a result of agricultural, industrial, and residential uses. The native plant species within and adjacent to the Study Area would decrease in both number and diversity, which could have an impact on endemic animal species, especially songbirds, that depend on them for food, shelter, and nesting. Nonnative trees and shrubs tend to attract nonnative bird species such as the house sparrow, European starling, and rock dove, and these bird species compete with native species for resources. The nonnative species readily adapt to their new environments, and most have prospered around the Study Area for many years. This is not always the case with endemic species and, over time, competition can lead to the depletion of a particular native species. If individuals of a native animal species present in the Study Area have another habitat to move to, with more available food and shelter, they stand a better chance of survival. Areas such as Tres Rios, Rio Salado, SMPP, and the Sierra Estrella are viable areas for native birds and small mammals. Federally funded and State-funded transportation projects in Arizona would increase the spread of noxious plants. Future residential, industrial, and commercial development and transportation projects without federal or State funding can also be reasonably expected to contribute to the potential introduction and spread of invasive species.

Threatened and Endangered Species

Several other projects in the Study Area could contribute to cumulative effects on the Yuma clapper rail and yellow-billed cuckoo. The proposed SR 30 freeway, from SR 303L to SR 202L (proposed South Mountain Freeway), would be located between the Gila and Salt rivers and Lower Buckeye Road; NEPA requirements will be addressed in an environmental assessment for that federally funded project. Also, the Rio Salado Oeste and Tres Rios wetlands projects will help restore wetlands and riparian areas along the Salt and Gila rivers from 83rd Avenue to the west. The restoration of the Salt and Gila rivers' riparian and wetland habitat could improve habitat conditions for the Yuma clapper rail and yellow-billed cuckoo. Effects on the Yuma clapper rail and yellow-billed cuckoo would be addressed in NEPA documentation for these projects as well.

Piers for a proposed freeway bridge along the W59 (Preferred) Alternative would be placed in the riverbed of the Salt River through the eastern half of a 192-acre BLM parcel leased to the City of Phoenix under provisions of the Recreation and Public Purposes Act for inclusion in the proposed Rio Salado Oeste project. The City of Phoenix is aware of, has planned for, and has incorporated the proposed freeway in its *General Plan*. The City has designated the Rio Salado Oeste project as incorporating the proposed freeway. Although the lease does not include a reference to the proposed freeway, BLM would support working with the City of Phoenix to take the steps necessary to amend the lease in a manner that would allow the proposed freeway to pass through the property, if the W59 Alternative were identified as the Selected Alternative in the EIS and ROD. Both parties concurred with this approach in August 2005 (see Appendix 1-1). As a result of this coordination and cooperative planning, no impacts on the proposed uses of this land or other planned wetlands and riparian restoration projects would occur.

Cumulative impacts resulting from future State or private actions are anticipated to include noise impacts and general human disturbance resulting from continuing development. No critical habitat is designated within the Study Area for any listed species (within the limits of disturbance, the proposed action may affect individuals of the Sonoran desert tortoise population occurring in the Study Area).

Water Resources

Surface Water

Contaminants from Stormwater Runoff

Existing sources of water affecting water quality include drainage from the South Mountains through development areas, Gila Drain Floodway discharge, sand and gravel pit operations in and upstream of the Study Area, and the 91st Avenue WWTP treatment ponds. The proposed action, along with other planned roadway improvements (e.g., local arterial roadway widening and new roadway projects such as the proposed SR 30 and ARS), would contribute to cumulative impacts on water quality. Regionally, the presence of urban uses near water courses has increased by 8 percent from 1975 to 2000 (EPA 2004). Specifically, stormwater flow from other projects or other physical jurisdictions would combine with stormwater flow originating directly from the proposed action. Runoff from the freeway during infrequent rain storms would likely include lead, zinc, filterable residue, and total nitrogen. Other projects may include transportation, commercial, and residential development, which would result in less permeable surfaces to accommodate recharge and more impervious surfaces that act as pollution collection surfaces. This associated development would result in higher runoff volumes and a higher potential for pollutant discharges into receiving streams. However, these impacts would be minimized by providing BMPs during construction, following current design standards for detention facilities, and complying with federal and State permits for stormwater discharges.

Natural Drainage Features

Continued conversion of undisturbed land to human-based development in the region has altered surface drainage features, particularly ephemeral washes. The proposed action would contribute to such effects by altering natural drainage features immediately adjacent to the project (although the impact would be offset by project-specific proposed mitigation).

Future residential, industrial, commercial, and transportation projects would also modify natural drainageways. Unlike the proposed action, the ability to manage and mitigate impacts from some ongoing planned and permitted residential and commercial development would be limited and, therefore, less likely subject to regulatory compliance that could reduce effects.

Groundwater

Groundwater is a source of public water supply in Arizona. In 1995, groundwater withdrawal in the Phoenix AMA supplied 39 percent of the total consumption of 2.29 acre-feet (ADWR 1999). About

64 percent of the withdrawal was used for agriculture. The remainder was used for public water supply, industrial, domestic, and other purposes. Population growth has resulted in the retirement of agricultural land and the conversion of the intended use of groundwater supplies to urban uses. Issues created by groundwater overdraft include decreased water levels in aquifers and increased well drilling and pumping costs. Some wells in the Study Area displaced by the proposed freeway would have to be fully replaced in accordance with 2006 ADWR well spacing and well replacement rules. Known land development planned in the Study Area as presented in the *Land Use* section of this chapter would likely contribute to increasing demands on groundwater supply; the proposed action could place further demand on water supplies temporarily during construction and for maintenance purposes. These demands on supply would be likely offset through the application of water reuse BMPs.

The profile of the proposed action would be depressed in certain areas of the Study Area that have relatively high groundwater tables. Water falling on the freeway would be concentrated into low areas along depressed sections and would then drain by gravity from the depressed sections of the freeway to the river. With development ongoing in the areas where depressed freeway sections are being considered, it is possible the proposed action could contribute to reductions in groundwater supply. Because surface drainage from storms would drain by gravity to the river, it is expected the proposed action would have little cumulative effect on groundwater. These effects would be minimized by providing BMPs during construction, following current design standards for detention facilities, and complying with federal and State permits for stormwater discharges.

Water Availability

Ongoing planned and permitted residential, commercial, and industrial development in the region would likely continue to place a demand on water availability. The proposed action would have little cumulative effect on water availability.

Cultural Resources

The proposed action may contribute to cumulative cultural resources impacts. However, the proposed action and other major planned transportation projects would potentially create preservation in place (enhancement) opportunities not typically associated with private-sector development projects. The opportunity to preserve in place would be the result of federal and State regulations promoting preservation of such resources when associated with a publicly funded project; these federal and State regulations generally are not applied to privately funded projects. Although the types of impacts would be typical of those experienced in constructing and operating other parts of the region's freeway system, some of these impacts would be effectively mitigated through the implementation of enhancement and management plans and other strategies.

Land Use

The amount of agricultural land in the Phoenix metropolitan area has decreased from over 50 percent in 1975 to just over 35 percent in 2000 (EPA 2004). With the exclusion of reservation land and, possibly, ranches, Maricopa County in 2007 had only 8 percent of its land as farmland (National Agricultural Statistics Service 2009). After considering what is planned by local municipal zoning ordinances, only 12 percent of the Study Area is planned for future agricultural use. Urban growth in the Phoenix metropolitan area is contributing to the conversion of farmland to urban uses. The proposed action would contribute by converting farmland within the proposed R/W to a transportation use. Other planned transportation projects (e.g., SR 30, ARS, I-10 Widening) would also contribute to the farmland conversion. Future residential, industrial, and commercial development projects and local street improvements would also contribute to farmland conversion, most of which is planned for in local jurisdictions' planning documents.

The proposed action is considered a contributing factor to the cumulative impacts on residential and business displacements. Other primary contributors to displacement impacts would be other planned transportation projects (e.g., SR 30, ARS, and some arterial street widening projects). Future residential, industrial, and commercial development projects and local street improvements are not expected to result in substantial relocations because the vast majority of this development would occur within existing transportation R/W or on vacant parcels or agricultural land.

A transition from rural agricultural to moderate density homogeneous single-family residential use has continued to occur. Several factors contribute to the change: affordable cost of living, employment opportunities, mild climate, reasonable accessibility, and a development-oriented regulatory environment. Examination of data comparing population and land use between 1975 and 2000 suggests major transportation infrastructure projects like the proposed action are not major contributors to or inducers of growth in the region. For example, from 1975 to 2000, population increased by 211 percent from just over 1 million people to over 3.1 million people. The extent of urban area increased from nearly 226,000 acres to just over 549,000 acres (143 percent increase). During this same time frame (and actually dating back to development patterns of the 1950s), population densities have remained constant at two households per acre. While newer development between 1991 and 2000 is at four households per acre, the overall densities remain well below what transportation planners use as a rule of thumb for the minimum density needed to support a public transit-based network: seven households per acre. VMT and traffic delay and related congestion costs have increased in that same time period. Until the economic downturn that began in 2007, the past rate of growth and development far exceeded the ability of any major transportation infrastructure to keep pace. While the recession has slowed growth in the Phoenix metropolitan area—and theoretically provided an opportunity for transportation infrastructure to catch up with the demographic forces that have historically fueled high growth—it has also reduced governmental sources of funding for expansion of the regional transportation

infrastructure. Locally, Proposition 400 funding for transportation development in the MAG region depends on revenues from a tax on retail sales, which are substantially lower than prerecession projections. Nationally, the federal fuel tax, which in part provides funding for highway development, has decreased from 6 to 4 percent since the recession began (FHWA 2009b). The use of more fuel-efficient vehicles and overall lower vehicle usage has also contributed to the national decline in revenues. Because transportation capacity seriously lags transportation demand in the Study Area, it can be assumed the proposed action would neither induce growth nor facilitate any increase in the rate of growth under current or projected growth environments.

The proposed action would displace residences, businesses, public and quasi-public facilities; alter current access patterns; and introduce a major transportation facility where one does not currently exist. Other planned transportation projects (e.g., ARS) would have similar effects. The construction and operation of these projects would have a cumulative effect on the region's communities that maintain distinct characteristics. The planned projects, including the proposed action, could affect distinct communities' characteristics through displacements, noise intrusion, the introduction of a high-intensity land use that may conflict with more passive community land uses, and alteration of a community's sense of place and/or internal circulation.

Environmental Justice

The evaluation to determine whether there would be disproportionate impacts on any population with environmental justice characteristics revealed that all action alternatives would have direct but not disproportionate impacts on such populations. Considering the proposed action would be accessible to all populations in the Study Area, the impacts would not be disproportionately high, and mobility benefits would occur. Benefits would include enhanced access to and from employment opportunities and enhanced movement of goods and services for improved access to such goods and services for all population segments.

Some populations with environmental justice characteristics have specific needs associated with their identity being tied directly to geographic setting. For Native American populations near and adjacent to the proposed action, association with cultural values of the South Mountains is important to identity and is established through direct spiritual and visual access to the mountains. Land developments in the area have encroached on the South Mountains, and the proposed action would contribute to further encroachment on the southern side of the mountains. The contribution of the proposed action to this cumulative effect would be offset somewhat by the provision of freeway underpasses, allowing individuals from the populations to continue unrestricted access to the mountains, and by the provision of R/W fences along the border with the Community, which would prevent some of the unlawful trespass that currently occurs. Continued land development in the area also would contribute to a cumulative modification of visual access to the resource, and the proposed action also would contribute to the alteration of views of the mountains [although the effect would be offset by measures to be undertaken to minimize harm to the resource, as described in Chapter 5, *Section 4(f) Evaluation*].

Visual Resources

The area has experienced and will continue to experience a rapid transition in land use from low-density, open uses to residential, commercial, and light industrial uses. Large subdivisions have been developed in open agricultural land, and residential development has encroached onto the southern side of the South Mountains. These actions would all generally contribute to the continuation of the rapid development of the southwestern Phoenix metropolitan area from an agricultural-oriented past to a suburban- and urban-appearing present and future. The proposed freeway would be a part of this trend. The perception of open spaces with distant mountain backdrops would change to one of expanding suburban and urban development. The backdrop would remain, but the foreground and middle ground would change so substantially that the visual perception, over time, would change dramatically. This is a trend that is underway and would continue with or without the proposed freeway. Sensitive views along the E1 Alternative would be affected; however, the road cuts proposed for the western end of the South Mountains would be treated to ensure that the newly exposed rock faces would be characteristic of the adjacent natural rock features, including scale, shape, slope, and fracturing to the extent that could be practicable and feasible as identified through geotechnical testing and constructibility reviews. Rounding and blending of new slopes to mimic the existing contours to highlight natural formations and warping slopes at intersections of cuts and natural grades to transition with natural ground surfaces would be attempted. Because of the enactment of the Phoenix Mountain Preserve Act in 1990 [see Chapter 5, *Section 4(f)*], it is unlikely that additional impacts to the South Mountains of this magnitude would occur.

Recreational Land

Recreational lands and facilities are valued in the Phoenix metropolitan area. This value is established through identification of recreation as an important and key element in local and regional land use plans and through recognition of its role as an important component of the region's tourism industry. In the region, recreational resources take the form of a wide array of facilities such as neighborhood, community, and regional parks; active playfields (e.g., baseball fields); equestrian, bicycle, and multiuse trails; and mountain preserves and open space. In the past, some of these resources have been converted to residential, commercial, and transportation uses. The enactment of the Phoenix Mountain Preserve Act in 1990 [see Chapter 5, *Section 4(f) Evaluation*] was intended to curb the loss of mountain preserve resources from land development encroachment. The proposed action, by design, takes measures to minimize its contribution to further loss of recreational resources. With the exception of SMPP (where avoidance was determined not feasible), all recreational resources were avoided. Measures to minimize harm to SMPP, including the provision of

replacement lands as described in Chapter 5, would reduce impacts to the lowest level possible and would ensure that active recreational areas within SMPP would not be affected. As development continues in the Study Area and surroundings, it is reasonable to conclude that such developments (as permitted by local jurisdictions on a case-by-case basis) may use recreational land in the future. Conversely, many new residential developments are setting aside land for future park development, some of which may be transferred to public ownership and access. Transportation projects in the region have resulted in uses of some recreational facilities, but in many cases these projects have resulted in improved access or provided additional protection to recreational lands.

Noise

Noise is an unwanted sound that can intrude on and have effects on the resources of the human and natural environments. The noise analysis conducted for the proposed action considered potential impacts where they are likely to occur (within 1,000 feet of the proposed alignments) based on the increase over existing ambient levels and projected future levels attributable to the proposed action. The transportation demand model used to predict traffic volumes on the proposed freeway would redistribute traffic on regional freeways and arterial streets in response to the construction of the proposed action. Therefore, increases or decreases in traffic (and noise) on these facilities would also be predicted. With the planned growth and urbanization in the Study Area, noise levels would be expected to increase because of the increased density of human activities. To minimize noise impacts from construction activities, construction best practices (e.g., properly operating, maintaining, and shielding equipment noise from sensitive receivers) would be used as much as possible.

Air Quality

Air quality may be a local, regional, or global issue depending on the particular pollutants or issue. At the local and regional level, air quality issues are normally related to criteria pollutants for which national air quality standards have been established and to MSATs. Emissions of these pollutants (mostly derived from mobile sources) have generally decreased in the Phoenix metropolitan area over time. These decreases may largely be associated with cleaner fuels and lower-emission vehicles. More gains may be achieved, except that VMT will likely increase and may continue to offset the emissions decreases in the future. A future increase in overall traffic volumes can be expected in the region following construction of planned residential and commercial developments. The proposed action is intended to reroute existing traffic patterns and accommodate future traffic volumes (as opposed to generating additional volumes) and, therefore, is not expected to contribute to a cumulative impact on air quality. Transportation projects planned in the region would minimize subsequent increases in vehicular emissions by reducing congestion and vehicle idling. In heavily congested conditions, some emissions increase with decreased speeds. More fuel is consumed because automobile engines do not operate optimally at low speeds and more emissions may be emitted. Additionally, a vehicle's emissions control equipment is not as effective at low speeds as it is at typical freeway speeds. Future emission levels would also be reduced by the use of cleaner-burning fuels, technological advances in automotive design (including the greater use of alternative fuel vehicles), reformulated gasoline, gas can standards, stricter enforcement of emission standards during inspections, heavy-duty diesel engine and on-highway diesel sulfur control programs, and others.

Table 4-58 Representative Project-specific Mitigation Measures

Issue	Proposed Action Impact	Mitigation Measure
Biological resources	Habitat loss from direct conversion to transportation use	Construct wildlife crossings; salvage native plants; provide native plantings in right-of-way; implement measures to prevent the spread of invasive species in accordance with Executive Order 13112
	Habitat isolation and fragmentation	
	Vehicle-animal collisions	
	Loss of native vegetation	
	Introduction of noxious weeds	
	Threatened and endangered species	
Water resources	Increased runoff and flushed contaminants from impervious surfaces	Best management practices used; erosion control provided during and after construction; measures included in the Arizona Stormwater Pollution Prevention Plan and Arizona Pollutant Discharge Elimination System Permit
	Loss and/or alteration of natural drainage features	Fill in jurisdictional areas avoided or limited by narrowing the roadway width or by other means; compliance with Sections 404 and 401 permits
Land use	Residential and business displacements	Relocations conducted in accordance with federal and State guidance/regulations; land uses converted in accordance with applicable planning and zoning
	Alteration of community character and cohesion	Overpasses; architectural treatment of structures; and adherence to established design standards, general plans, and zoning
	Local traffic access pattern alteration; improved traffic flows during operation	Alternative access routes identified during construction as part of the traffic plan
	Public service access	ADOT[a] traffic plan to minimize construction impacts on existing routes
Economic conditions	Enhanced movement of goods, materials, and people; property value changes	Local governments to ensure development is consistent with local and regional planning

[a] Arizona Department of Transportation

At the global level, the potential change in GHG emissions is very small in the context of the affected environment. FHWA is working to develop strategies to reduce transportation's contribution to GHG emissions—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. In addition, construction best practices to be implemented represent practicable project-level measures that, while not substantially reducing global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

NO-ACTION ALTERNATIVE

If the proposed action were not implemented, the incremental effects contributed *solely* by the proposed action would not occur. The No-Action Alternative would not, however, preclude other activities from affecting resources in a similar manner. Most cumulative impacts would result from ongoing conversion of land to more intensive, human-based development. These effects, such as the permanent loss of cultural resources and the permanent loss of agricultural land, would occur without the proposed action in place.

MITIGATION

Disclosure of secondary and cumulative impacts does not require ADOT to propose and implement mitigation measures to address such impacts. Project-specific mitigation measures as proposed to address direct impacts inherently address reductions in such overall impacts as well. The disclosure primarily is for information purposes. By disclosing these types of impacts, those concerned are provided a mechanism to contact responsible parties either contributing to such impacts or having regulatory authority pertaining to such matters. For example, EPA has enacted rules to reduce vehicle emissions at national and regional levels. Local jurisdictions governing land development have enacted local zoning ordinances to control and regulate development.

Mitigation measures in Table 4-58 summarize project-specific measures already presented throughout this chapter. When implemented, the measures would help to offset the adverse secondary and cumulative impacts of the action alternatives.

CONCLUSIONS

The action alternatives would have comparable secondary and cumulative effects. The various activities affecting resources and people in the Study Area as well as the proposed action could have localized variations at the project level. When viewed cumulatively, however, a broader view of each resource should be considered, and, from this perspective, each action alternative would have comparable effects. All alternatives would occur in an already rapidly urbanizing area (most noticeably in the Western Section of the Study Area—note that the current recession has slowed growth), an area planned for urban growth as established in local jurisdictions' land use planning activities for the last 25 years. As such, the proposed action would not provide new or substantially improved access to a large, undeveloped geographic area. Therefore, the action alternatives are not expected to induce growth in the region. For the action alternatives, the minimal contribution to overall traffic use by induced travel is expected to have both positive and negative consequences.

Secondary and cumulative impacts from any of the action alternatives would occur. The proposed action may produce secondary impacts on biological resources, water resources, air quality, known historic and prehistoric sites, newly discovered historic and prehistoric sites, land use conversions and displacements and relocations, community character and cohesion, and on property value changes. As a result of the proposed action, cumulative impacts may occur on biological resources, water resources, cultural resources, land use, environmental justice, visual resources, noise, and air quality.

CONCLUSIONS

This chapter recounts the scientific and analytical basis for comparison of the alternatives. It focuses on elements necessary to support comparison of action alternatives to advance the decision-making process and identify possible mitigation measures. The chapter necessarily highlights differences in impacts among action alternatives. General conclusions drawn from the findings presented in this chapter are:

- The Western and Eastern Sections of the Study Area present distinctly different environmental conditions.
- None of the kinds and degrees of impacts identified are atypical for a project like the proposed action.
- For most environmental elements, the kinds and degrees of impacts are relatively similar among the action alternatives; some noteworthy differences among the action alternatives do exist.
- Because of historical and projected population, job, and housing growth in the area, impacts on resources of concern would occur under the No-Action Alternative. In some instances, impacts under the No-Action Alternative would be greater than those that would occur under the action alternatives. As a specific example, energy use—in terms of annual fuel consumption—would be greater under the No-Action Alternative than under any of the action alternatives.

The proposed action would contribute to cumulative impacts on resources of regional concern. Historic and projected growth in employment, population, and housing has, however, generated the need for the proposed action; the proposed action would contribute little to inducing growth in the region.

Design of the action alternatives was developed to a level that facilitated meaningful analytical comparison of alternatives. Quantified impacts (e.g., anticipated displacements and relocations) would be subject to changes as design would be further refined. Changes resulting from such design refinement would not diminish the value of the comparative analyses presented in this chapter. Typically, such refinements would occur when ADOT and FHWA determine that such refinements would result in cost savings and/or reductions in identified impacts.

Mitigation measures presented throughout the chapter would be effective in avoiding, reducing, or otherwise mitigating impacts from action alternatives.

Specific to the Western Section, noteworthy observations related to impacts among the action alternatives are:

- The W59 (Preferred) Alternative would result in the fewest residential displacements (733) when compared with either the W71 or W101 Alternative (the W71 Alternative would cause 825 displacements and the W101 Alternative would cause between 926 and 1,304 residential displacements).
- Implementation of the W59 Alternative would displace a greater number of businesses (41) than would implementation of either the W71 or W101 Alternative. The W71 Alternative would displace 22 businesses. The W101 Alternative would displace 14 to 30 businesses, and it would potentially displace the most employees, suggesting that relocation mitigation measures associated with the businesses affected by the W101 Alternative would be the greatest among the action alternatives in the Western Section.
- Each action alternative would cause property and sales tax revenue losses because of the conversion of taxable property to a public transportation use (a nontaxable property). Overall, the action alternatives' effects on the overall tax base for affected municipalities (the Cities of Phoenix, Avondale, and Tolleson) would be negligible, with one exception: Implementation of the W101 Alternative would reduce the City of Tolleson's tax base by between 14 and 17 percent annually. The reduction would be a substantial impact and would hinder the City's ability to provide public services.
- Implementation of any of the action alternatives would be consistent with the intent of the RTP by virtue of completing the southwestern leg of SR 202L. Because it most closely approximates the alignment adopted in the RTP, the W59 Alternative is the alternative most consistent with the adopted plan.
- The degree, magnitude, intensity, and context of impacts from implementation of any of the action alternatives in the Western Section would be comparable for air quality, noise environment, water resources, floodplains, jurisdictional waters, biological resources, topography, geology, soils, hazardous materials, visual resources, cultural resources, and social conditions. In all instances, the magnitude of impacts from implementation of any of the action alternatives in the Western Section would be negligible with respect to the overall quality and robustness of the resources.
- With implementation of any of the action alternatives in the Western Section, adverse impacts would occur on populations protected under Title VI and the environmental justice Executive Order; impacts would not, however, be disproportionately high or cause undue hardship when compared with such impacts on the general population.

In the Eastern Section, a comparative analysis of action alternatives was not undertaken because only one action alternative, the E1 (Preferred) Alternative, is under detailed study. Notable conclusions from the analyses of the E1 Alternative are:

- The alignment would pass south of Ahwatukee Foothills Village (replacing the existing four-lane Pecos Road) and would result in 138 residential displacements.
- While unlikely to substantially alter the community character and cohesion of Ahwatukee Foothills Village, the E1 Alternative would increase visual and noise intrusions into the area.
- Existing drainage patterns from the South Mountains involve the release of runoff onto Community land; these patterns and the timing of runoff releases would be altered. Where drainage currently enters Community land through a series of natural washes, detention basins as part of the proposed freeway's design would capture runoff and meter releases onto Community land.

- Implementation of the E1 Alternative would adversely affect recreational, visual, natural, and cultural values of resources in the South Mountains. Although such impacts would directly affect less than 1 percent of the SMPP acreage, the intensity of the impact would vary, depending on the resource. In some instances, it would not be possible to avoid resources, or impacts on resources, nor would it be possible to reduce or otherwise mitigate impacts.
- The E1 Alternative would alter topography through the South Mountains. Specifically, the freeway would cross the mountains through severe cuts through three mountain ridges.

With consideration of the content of this entire chapter [and the following Chapter 5, *Section 4(f) Evaluation*] and in consideration of recurring concerns expressed by the public, the key issues of concern regarding the primary function of the analyses in Chapter 4 relate to economic impacts, displacements and relocations, societal impacts relating to community character and cohesion, cultural resources impacts, South Mountains impacts, air quality impacts, and secondary and cumulative impacts. Table S-3, *Environmental Impact Summary Matrix, Proposed Action*, in the *Summary* chapter, further highlights similarities and differences among the alternatives. Table S-4, *Proposed Mitigation Measures, Arizona Department of Transportation, Action Alternatives*, also in the *Summary* chapter, presents a comprehensive list of measures proposed to mitigate impacts presented in this chapter.

The purpose of this conclusions section is not to summarize all the data and analyses presented throughout the chapter (such summary information can be found in Tables S-3 and S-4). It also is not intended to make a determination regarding the environmentally preferred alternative. Other factors—such as operational performance, design parameters, public and political acceptability, and conceptual construction, operation, and maintenance cost estimates—functionally interact with environmental conditions and play a role in the EIS process. Those factors, along with the content of this chapter, have led to the identification of a Preferred Alternative as described in Chapter 3, *Alternatives*.

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[1] includes Foothills Club West

[2] personal communication, representative of Holsum Bakery, 2004

[3] personal communication, representative of Bay State Milling Company, 2005

[4] The sampling of the residential data was stratified but random—stratified in the sense that houses of similar size and relatively new vintage were examined, but random in the sense that no consideration was given to the neighborhoods from which these samples were drawn. If the house was located in a lower socioeconomic part of town, it was weighted equally as one located in a higher socioeconomic neighborhood. Overall, this could bias the results downward because most neighborhoods in the Study Area are newly developed and are likely considered more desirable than average. As a result, the project team assumed residential values were adjusted upward to reflect this.

[5] Because of inflation, the value of a dollar now is greater than a dollar in the future. The discounted present value is the value *now* of a dollar in a future year (for this analysis, in 2035), discounted at a constant percentage rate to reflect its annual loss in value attributable to projected inflation. For this analysis, a discount rate of 3 percent per year was used.

[6] U.S. Environmental Protection Agency. "National Ambient Air Quality Standards." Agency Web site, <epa.gov/ttn/naaqs/>.

[7] Arizona Department of Environmental Quality. "Air Quality Monitoring: Air Quality Monitoring Links." Department Web site, <www.azdeq.gov/environ/air/monitoring/links.html>.

[8] U.S. Environmental Protection Agency. "Criteria Pollutants." Agency Web site, <www.epa.gov/oar/oaqps/greenbk/o3co.html>.

[9] correspondence with L. Seals, Maricopa County Air Quality Department, on September 9, 2010

[10] U.S. Environmental Protection Agency. "Ozone—Good Up High, Bad Nearby." Agency Web site, <www.epa.gov/oar/oaqps/gooduphigh/good.html>.

[11] U.S. Department of Labor, Occupational Safety and Health Administration. "Acrolein and/or Formaldehyde." Department Web site, <www.osha.gov/dts/sltc/methods/organic/org052/org052.html>.

[12] U.S. Environmental Protection Agency. "Acrolein." CAS#107028. Agency Web site, <www.epa.gov/ttn/atw/hlthef/acrolein.html>.

[13] U.S. Environmental Protection Agency. "Benzene TEACH Chemical Summary." <www.epa.gov/teach/chem_summ/BENZ_summary.pdf>.

[14] U.S. Environmental Protection Agency. 2006. "Control of Hazardous Air Pollutants from Mobile Sources; Proposed Rule." *Federal Register* 71(60):15803–963.

[15] Agency for Toxic Substances and Disease Registry. "Medical Management Guidelines for 1,3-Butadiene." Agency Web site, <www.atsdr.cdc.gov/MHMI/mmg28.html>.

[16] U.S. Environmental Protection Agency Integrated Risk Information System. "1,3-Butadiene (CASRN 106990)." Agency Web site, <www.epa.gov/iris/subst/0139.htm>.

[17] U.S. Environmental Protection Agency. 2006. "Control of Hazardous Air Pollutants from Mobile Sources; Proposed Rule." *Federal Register* 71(60)40:15803–963.

[18] California Office of Environmental Health Hazard Assessment. "Health Effects of Diesel Exhaust." Department Web site, <www.oehha.ca.gov/public_info/facts/dieselfacts.html>, Sacramento, California.

[19] U. S. Environmental Protection Agency. "Technology Transfer Network Air Toxics Web Site. Formaldehyde." <www.epa.gov/ttn/atw/hlthef/formalde.html>.

[20] Agency for Toxic Substances and Disease Registry. "Toxicological Profile for Formaldehyde (CAS# 5000)." Agency Web site, <www.atsdr.cdc.gov/toxprofiles/tp111.html>.

[21] U.S. Environmental Protection Agency. 2001. "Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements." *Federal Register* 66(12):5001–93.

[22] U.S. Environmental Protection Agency. Technology Transfer Network. "1996 National-Scale Air Toxics Assessment." Agency Web site, <www.epa.gov/ttn/atw/nata/>.

[23] U.S. Environmental Protection Agency. Technology Transfer Network. "1996 National-Scale Air Toxics Assessment; Emissions Data Tables." Agency Web site, <www.epa.gov/ttn/atw/nata/tablemis.html>.

[24] Calculated from data in U.S. Environmental Protection Agency's *Inventory of Greenhouse Gas Emissions and Sinks, 1990–2009*.

[25] Calculated from data in U.S. Energy Information Administration's *International Energy Statistics, Total Carbon Dioxide Emissions from the Consumption of Energy*, <www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8>, accessed September 12, 2011.

[26] Calculated from data in U.S. Energy Information Administration's Figure 104, <205.254.135.24/oiaf/ieo/graphic_data_emissions.html>, and U.S. Environmental Protection Agency's Table ES-3, <epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Executive-Summary.pdf>.

[27] From <www.epa.gov/otaq/models/moves/index.htm>. EPA's Motor Vehicle Emissions Simulator model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs). CO_2 is frequently used as an indicator of overall transportation-related GHG emissions because the quantity of these emissions is much larger than

that of all other transportation-related GHGs combined, and because CO_2 accounts for 90 to 95 percent of the overall climate impact from transportation sources. The model includes estimates of both emissions rates and vehicle miles traveled; these were used to estimate the Arizona statewide highway emissions in Table 4-37.

[28] Arizona emissions represent a smaller share of global emissions in 2035 because global emissions increase at a faster rate.

[29] Selected to represent a "worst-case" for purposes of this comparison; the Preferred Alternative may have a smaller contribution.

[30] For example, Figure 114 of the U.S. Energy Information Administration's *International Energy Outlook 2010* shows that future emissions projections can vary by almost 20 percent, depending on which scenario for future economic growth proves to be most accurate.

[31] When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency is required make clear that such information is lacking (40 C.F.R. § 1502.22). The methodologies for forecasting GHG emissions from transportation projects continue to evolve, and the data provided should be considered in light of the constraints affecting the currently available methodologies. As previously stated, tools such as the U.S. Environmental Protection Agency's Motor Vehicle Emissions Simulator model can be used to estimate vehicle exhaust emissions of carbon dioxide and other GHGs. However, only rudimentary information is available regarding the GHG emissions impacts of highway construction and maintenance. Estimation of GHG emissions from vehicle exhaust is subject to the same types of uncertainty affecting other types of air quality analyses, including imprecise information about current and future estimates of vehicle miles traveled, vehicle travel speeds, and the effectiveness of vehicle emissions control technology. Finally, there presently is no scientific methodology that can identify causal connections between individual source emissions and specific climate impacts at a particular location.

[32] For more information on fuel economy proposals and standards, see the National Highway Traffic Safety Administration's Corporate Average Fuel Economy Web site: <www.nhtsa.gov/fuel-economy>.

[33] Secondary maximum contaminant levels (SMCLs) are guidelines that identify acceptable concentrations of contaminants that cause unpleasant tastes, odors, or colors in the water. As guidelines, they are not enforceable. SMCLs are for contaminants that will not cause adverse health effects.

[34] personal communication, D. Owsiany, U.S. Army Corps of Engineers, Phoenix/Nevada Area Office, December 31, 2003

[35] personal communication, Tom Hildebrandt, Wildlife Program Manager, Arizona Game and Fish Department, 2004

[36] <www.fws.gov/southwest/es/arizona/Yuma_Rail.htm>

[37] <www.mbr-pwrc.usgs.gov/id/framlst/i3870id.html>

[38] <www.fws.gov/midwest/eagle/viewing/eaglepix.html>

[39] personal communication, Kenneth Jacobson, Arizona Game and Fish Department Bald Eagle Management Coordinator, with HDR Engineering, Inc., on April 21, 2010

[40] The latest list of restricted routes in Arizona was published in *Federal Register*, 65(233), December 4, 2000.