South Mountain corridor team

Floodplains Report

In support of the
Environmental Impact Statement

South Mountain Transportation Corridor in Maricopa County, Arizona

Arizona Department of Transportation
Federal Highway Administration
in cooperation with
U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
Western Area Power Administration

ADOT

November 2012

Federal-aid Project Number: NH-202-D(ADY)
ADOT Project Number: 202L MA 054 H5764 01L

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Abstract: This document assesses and describes the effects on floodplains that would occur as a result of the construction and operation of the proposed South Mountain Freeway as adopted in the 2003 *Regional Transportation Plan*. Contents of this document will be presented in Chapter 4 of the South Mountain Transportation Corridor Environmental Impact Statement.

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List of Acronyms and Abbreviations

ADOT	Arizona Department of Transportation
BFE	Base Flood Elevation
C	Central
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Community	Gila River Indian Community
E	Eastern
E1	E1 Alternative
EIS	environmental impact statement
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FR	Full Reconstruction
I-10	Interstate 10
MAG	Maricopa Association of Governments
PR	Partial Reconstruction
RID	Roosevelt Irrigation District
SEVRDS	Southeast Valley Regional Drainage System
SFHA	Special Flood Hazard Area
SMTC	South Mountain Transportation Corridor
SR	State Route
SRP	Salt River Project
TI	traffic interchange
UPRR	Union Pacific Railroad
W	Western
W101CFR	W101 Alternative, Central Option, Full Reconstruction
W101CPR	W101 Alternative, Central Option, Partial Reconstruction
W101EFR	W101 Alternative, Eastern Option, Full Reconstruction
W101EPR	W101 Alternative, Eastern Option, Partial Reconstruction
W101WFR	W101 Alternative, Western Option, Full Reconstruction
W101WPR	W101 Alternative, Western Option, Partial Reconstruction
W59	W59 Alternative
W71	W71 Alternative

Glossary

affected environment	Those elements of the Study Area that may be changed by the proposed alternatives. These changes might be positive or negative in nature.
alluvium	Deposits resulting from the flow of water associated with floodplains, rivers, and alluvial fans at the base of mountain slopes.
Arizona Department of Transportation (ADOT)	The State agency responsible for state roads and highways.
base flood	A flood having a 1 percent chance of being exceeded in any given year. The *base flood* is commonly referred to as the *100-year flood*.
base floodplain	The area subject to flooding by the base flood. The *base floodplain* is commonly referred to as the *100-year floodplain.*
cumulative impact	The impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 Code of Federal Regulations § 1508.7)
direct impact	Changes that are caused by the action and occur at the same time and same place as the action.
Eastern Section	The portion of the Study Area located east of 59th Avenue.
encroachment	With regard to floodplains, encroachment is an action within the limits of the 100-year floodplain.
environmental impact statement (EIS)	The project documentation prepared in accordance with the National Environment Policy Act when the project is anticipated to have a significant impact on the environment.
Federal Highway Administration (FHWA)	A branch of the U.S. Department of Transportation responsible for administering the Federal-aid Program. The program provides financial resources and technical assistance for constructing, preserving, and improving the National Highway System along with other urban and rural roads.
floodplain	The part of the ground surface inundated with water on a recurring basis, usually associated with the 1 percent recurrence interval (100-year) flow.
floodway	Defined with respect to flood control, the floodway is that portion of the floodplain in which construction would raise the water level during the 100-year flood by more than 30 centimeters (1 foot). As a general definition, the floodway is (1) a part of the floodplain, otherwise leveed, reserved for emergency diversion of water during floods and kept clear of encumbrances to facilitate the passage of floodwater and (2) the channel of a river or stream and those parts of the floodplains adjoining the channel that are reasonably required to carry and discharge the floodwater or flood flow of any river or stream.

geomorphology	A type of geology that examines the structure of features along the surface of the Earth.
habitat	Place where an animal and/or plant normally lives, often characterized by a dominant plant form or physical characteristic.
mitigation	An action taken to reduce or eliminate an adverse impact stemming from construction, operation, or maintenance of a proposed action alternative. Mitigation could reduce the magnitude and extent of an impact from a level of significance to a level of insignificance. Mitigation includes *avoiding* the impact altogether by not taking a certain action or parts of an action; *minimizing* impacts by limiting the degree of magnitude of the action and its implementation; *rectifying* the impact by repairing, rehabilitating, or restoring the affected environment; *reducing or eliminating* the impact over time by preservation and maintenance operations during the life of the action; and *compensating* for the impact by replacing or providing substitute resources or environments. (40 Code of Federal Regulations § 1508.20)
ordinary high water mark	The point on the bank or shore up to which the presence and action of the water is so continuous as to leave a distinct mark either by erosion, destruction of terrestrial vegetation, or other easily recognized characteristic.
regulatory floodway	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 the Federal Emergency Management Agency. It is normally the channel defined by the ordinary high water mark. Development in the floodway is allowed if it can be demonstrated that no rise in the base flood elevation will occur.
secondary impact	A change that is caused by the action and is later in time or farther removed in distance, but is 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, water, and other natural systems, including ecosystems.
Study Area	The geographic area within which action alternative solutions to the problem are developed.
Union Pacific Railroad (UPRR) floodplain	The floodplain within the area north of the Union Pacific Railroad tracks.
watershed	That part of the Earth's surface from which stormwater runoff flows to a single point.
Western Section	The portion of the Study Area located west of 59th Avenue.

1. Project Description and Purpose and Need

Project Description

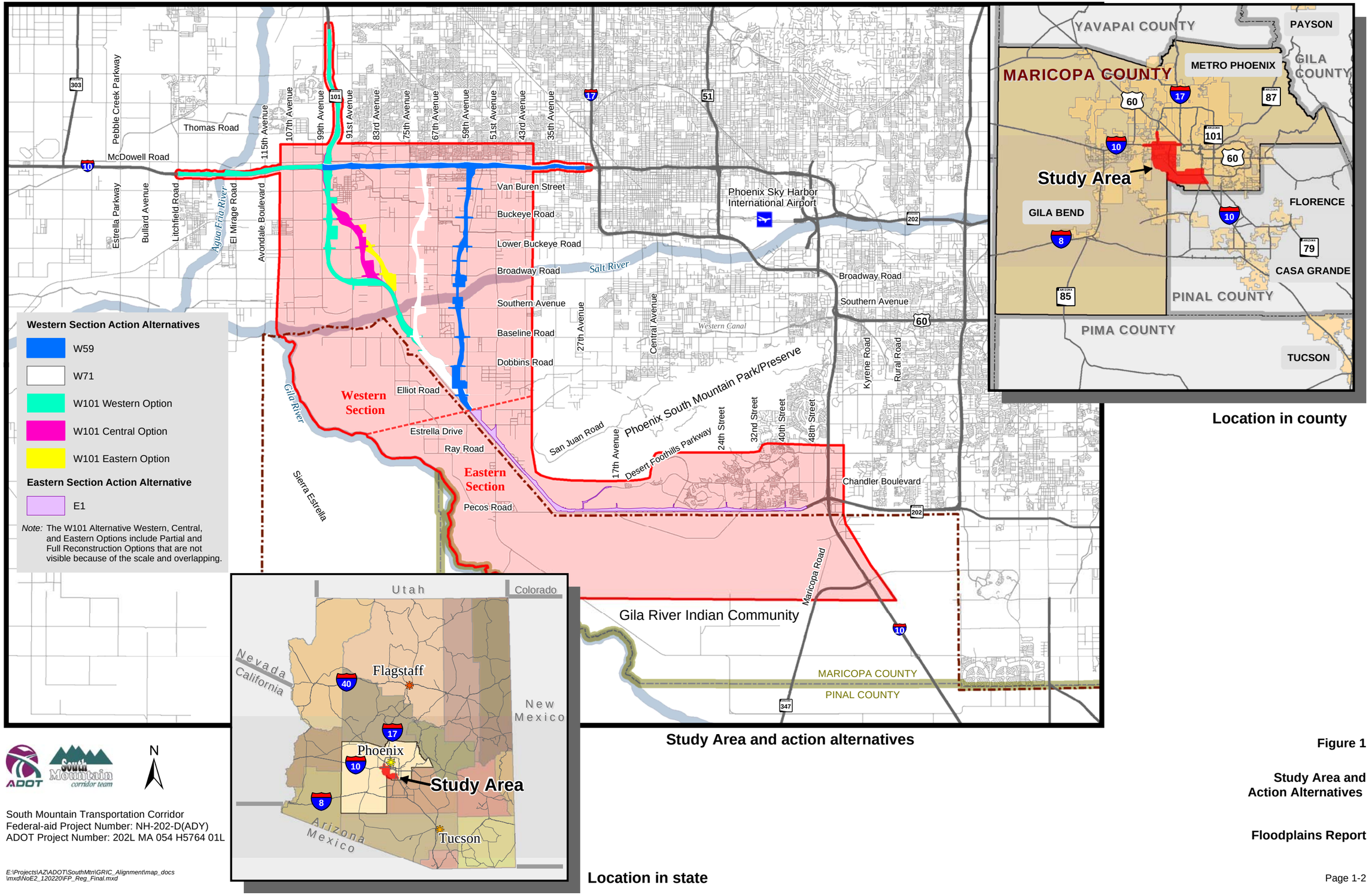
The Arizona Department of Transportation (ADOT) is studying the South Mountain Transportation Corridor (SMTC) in southern Phoenix, Maricopa County, Arizona. The South Mountain Freeway corridor was adopted into the Maricopa Association of Governments (MAG) regional freeway system in 1985 as part of the *MAG Freeway/Expressway Plan* (MAG 1985), at which time it was placed on the state highway system by the State Transportation Board. In 1988, ADOT prepared a design concept report and a state-level environmental assessment for the project, identified at that time as the South Mountain Parkway (ADOT 1988a, 1988b). As presented then, the project would connect Interstate 10 (I-10) (Maricopa Freeway) south of Phoenix with I-10 (Papago Freeway) west of the city, following an east-to-west alignment along Pecos Road through the western tip of the Phoenix South Mountain Park/Preserve, then north to I-10 between 59th and 99th avenues. Because of the time elapsed since those documents were approved and to secure eligibility for federal funding for a proposed project within this corridor, ADOT and the Federal Highway Administration (FHWA) are now preparing an environmental impact statement (EIS) in accordance with the National Environmental Policy Act. In November 2004, the MAG *Regional Transportation Plan* (2003) was placed before Maricopa County voters, who approved the sales tax funding the plan. The South Mountain Freeway was included in this plan.

Alternatives considered for the SMTC included past freeway proposals as well as transportation system management, transportation demand management, transit improvements, arterial street network improvements, and land use controls. A freeway facility was determined to best address the project purpose and need. Therefore, this report discusses the potential impacts of a proposed freeway in the SMTC.

The Study Area for the EIS encompasses more than 156 square miles and is divided into a Western Section and an Eastern Section at a location common to all action alternatives (Figure 1). The division between sections occurs just east of 59th Avenue and south of Elliot Road.

Within the Western Section, three action alternatives are being considered for detailed study. These are the W59, W71, and W101 Alternatives. The W59 Alternative would connect to I-10 at 59th Avenue, while the W71 Alternative would connect at 71st Avenue. The W101 Alternative would connect to I-10 at the existing State Route (SR) 101L (Agua Fria Freeway)/I-10 system traffic interchange (TI) and has six associated options. The W101 Alternative options vary geographically among the Western (W), Central (C), and Eastern (E) Options and would vary geometrically based on a Partial Reconstruction (PR) or a Full Reconstruction (FR) of the system TI.

Improvements to I-10 (Papago Freeway) would occur for each Western Section action alternative (W59, W71, and W101). Improvements to SR 101L would occur for each option associated with the W101 Alternative.



Study Area and action alternatives

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Figure 1

Study Area and Action Alternatives

Floodplains Report

Within the Eastern Section of the Study Area, one action alternative is being considered. The E1 Alternative would begin near Elliot Road and 59th Avenue and proceed to the southeast to Pecos Road, which it would follow to the east until connecting to I-10 (Maricopa Freeway) at the Pecos Road/I-10/SR 202L (Santan Freeway) system TI.

The action alternatives and options are summarized in Table 1.

Table 1. Action Alternatives and Options

Section	Interstate 10 Connection	Action Alternative	Option – Broadway Road to Buckeye Road	Option – State Route 101L/ Interstate 10 Connection Reconstruction	Option Name
Western	59th Avenue	W59	—[a]	—	—
	71st Avenue	W71	—	—	—
	State Route 101L	W101	Western	Partial Reconstruction	W101WPR
				Full Reconstruction	W101WFR
			Central	Partial Reconstruction	W101CPR
				Full Reconstruction	W101CFR
			Eastern	Partial Reconstruction	W101EPR
				Full Reconstruction	W101EFR
Eastern	Pecos Road	E1	—	—	—

[a] not applicable

The No-Action Alternative is being considered for the entire Study Area.

Purpose and Need

An analysis of population trends, land use plans, and travel demand shows that a considerable traffic problem in the Phoenix metropolitan area is projected for the future, resulting in the need for a new freeway in the SMTC. This traffic problem is likely to worsen if plans are not made to accommodate the regional travel anticipated. The purpose of a freeway within the SMTC is to support a solution to traffic congestion. Between the early 1950s and the mid-1990s, the metropolitan area grew by over 500 percent, compared with approximately 70 percent for the United States as a whole (MAG 2001). From 1980 to 2005, the Maricopa County population more than doubled, from 1.5 million to 3.7 million. The MAG region has been one of the fastest-growing metropolitan areas in the United States; Phoenix is now the fifth-largest city in the country, and the region ranks as the 12th-largest metropolitan area in the country.

Travel demand and vehicle miles driven in the metropolitan area are expected to increase at a faster rate than the population. MAG projections (conducted in collaboration with the Arizona Department of Economic Security) indicate Maricopa County's population will increase from 3.7 million in 2005 to 6.5 million in 2035 (MAG 2009). It is projected that in the next 25 years, daily vehicle miles traveled will increase from 101 million to 185 million.

Even with anticipated improvements in light rail service, bus service, trip reduction programs, and existing roads and freeways, vehicle traffic volumes are expected to exceed the capacity of Phoenix metropolitan area streets and highways by as much as 11 percent in 2035. A freeway within the SMTC would accommodate approximately 6 percentage points of the 11 percent of the unmet travel demand and would be part of an overall traffic solution.

2. Affected Environment

Background

This technical report has been prepared in accordance with Executive Order 11988, Floodplain Management (May 1977), and 23 Code of Federal Regulations (C.F.R.) Chapter 1, Part 650, Subpart A. Additional guidance was obtained from the FHWA Technical Advisory T 6640.8A, *Guidance for Preparing and Processing Environmental and Section 4(f) Documents*, dated October 30, 1987. Executive Order 11988 directs federal agencies to:

- avoid actions located in or adversely affecting floodplains unless there is no practicable alternative
- take action to mitigate losses if avoidance is not practicable
- establish a process for flood hazard evaluation based on the 100-year base flood standard of the National Flood Insurance Program

Guidelines developed by the Water Resources Council present the process required to meet the following basic requirements of Executive Order 11988:

- determine whether a proposed action is in the base floodplain
- provide for public review
- identify and evaluate practicable alternatives to locating the proposed action in the base floodplain
- identify the impacts of the proposed action
- minimize threats to life and property and to natural and beneficial floodplain values
- restore and preserve natural and beneficial floodplain values
- reevaluate alternatives
- issue findings and a public explanation
- implement the action

A base flood is commonly referred to as a 100-year flood, and the area where it occurs is referred to as the 100-year floodplain. An encroachment is defined as an action within the limits of the 100-year floodplain. The following definitions apply to the information presented in this report:

- The *base flood* is that flood having a 1 percent chance of being exceeded in any given year. The *base flood* is commonly referred to as the *100-year flood*.
- The *base floodplain* is that area subject to flooding by the base flood. The *base floodplain* is commonly referred to as 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 the Federal Emergency Management Agency (FEMA). It is normally the channel

defined by the ordinary high water mark. Development in the floodway is allowed if it can be demonstrated that no rise (no adverse impact) in the base flood elevation will occur (Association of State Floodplain Managers 2003).

To identify the locations and extent of the 100-year floodplains, two data sources were used. First, the FEMA Flood Insurance Rate Maps (FIRMs) were reviewed to determine the relationship of the proposed action to the boundaries of 100-year floodplains. In areas where FEMA floodplain mapping was not available, geomorphology was used to identify and delineate the 100-year floodplain (see the *Description of Geomorphology* section).

Description of Federal Emergency Management Agency Mapping

The FEMA 100-year floodplain FIRM includes a Special Flood Hazard Area (SFHA), which is defined as the area that will be inundated by the flood having a 1 percent chance of being equaled or exceeded in any given year. The 1 percent annual-chance flood is also referred to as the base flood, or 100-year flood. The SFHA is the area where the National Flood Insurance Program floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. An SFHA includes zones specifically defined as applicable to the SMTC and labeled as follows:

Zone A

Areas subject to inundation by the 1 percent annual-chance flood that are generally determined using approximate methodologies. Detailed hydraulic analyses have not been performed; therefore, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zone A99

Areas subject to inundation by the 1 percent annual-chance 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, and 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 BFEs nor depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zones AE and A1-30

Areas subject to inundation by the 1 percent annual-chance flood. BFEs derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Zone AH

Areas subject to inundation by the 1 percent annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance requirements and floodplain management standards apply.

Zone AO

Areas subject to inundation by the 1 percent annual-chance shallow flooding (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. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Moderate flood hazard areas, labeled Zone X, are also shown on the FIRM. These are areas between the limits of the base flood and the 0.2 percent annual-chance (or 500-year) flood. Other flood areas labeled Zone X are areas in which flood hazards are undetermined, but possible.

Description of Geomorphology

Geomorphology is a type of geology that examines the structure of features along the surface of the Earth. Geomorphology analysis provided an understanding of the basin and the associated response to imposed change such as the influence of vegetative cover patterns, streamflow changes, and erosional and depositional changes (Rosgen 1996). Because of the lack of FEMA floodplain mapping of the Gila River within the Gila River Indian Community (Community), geomorphology and aerial photography provided the best source of data for analysis. Review of historical geomorphology surveys and aerial photographs indicated a relatively stable Gila River channel profile over the last 90 years (Waters 2001).

Existing Floodplains

Three distinct and applicable 100-year floodplains are within the Study Area. They are located on the Salt River, Gila River, and an area north of the Union Pacific Railroad (UPRR) and the Roosevelt Irrigation District (RID) canal in the northwestern portion of the Study Area. The Gila Drain is an additional flood-prone area located within the southeastern portion of the Study Area (Figure 2).

Figure 2 illustrates FEMA-identified floodplains in the Study Area, which correspond with FIRM panel numbers presented in Table 2. FIRM panel number change dates (reflecting the most recent map update) in Table 2 were obtained from the Flood Control District of Maricopa County (FCDMC).[1]

Two federally mapped floodplains are located within the Western Section of the Study Area. These are the 100-year floodplains associated with the Salt River and the area north of the UPRR line and an irrigation canal (Figure 2). There are floodplains associated with the Gila River that are not federally mapped. Descriptions are presented below.

[1] personal communication, Flood Control District of Maricopa County, October 28, 2004

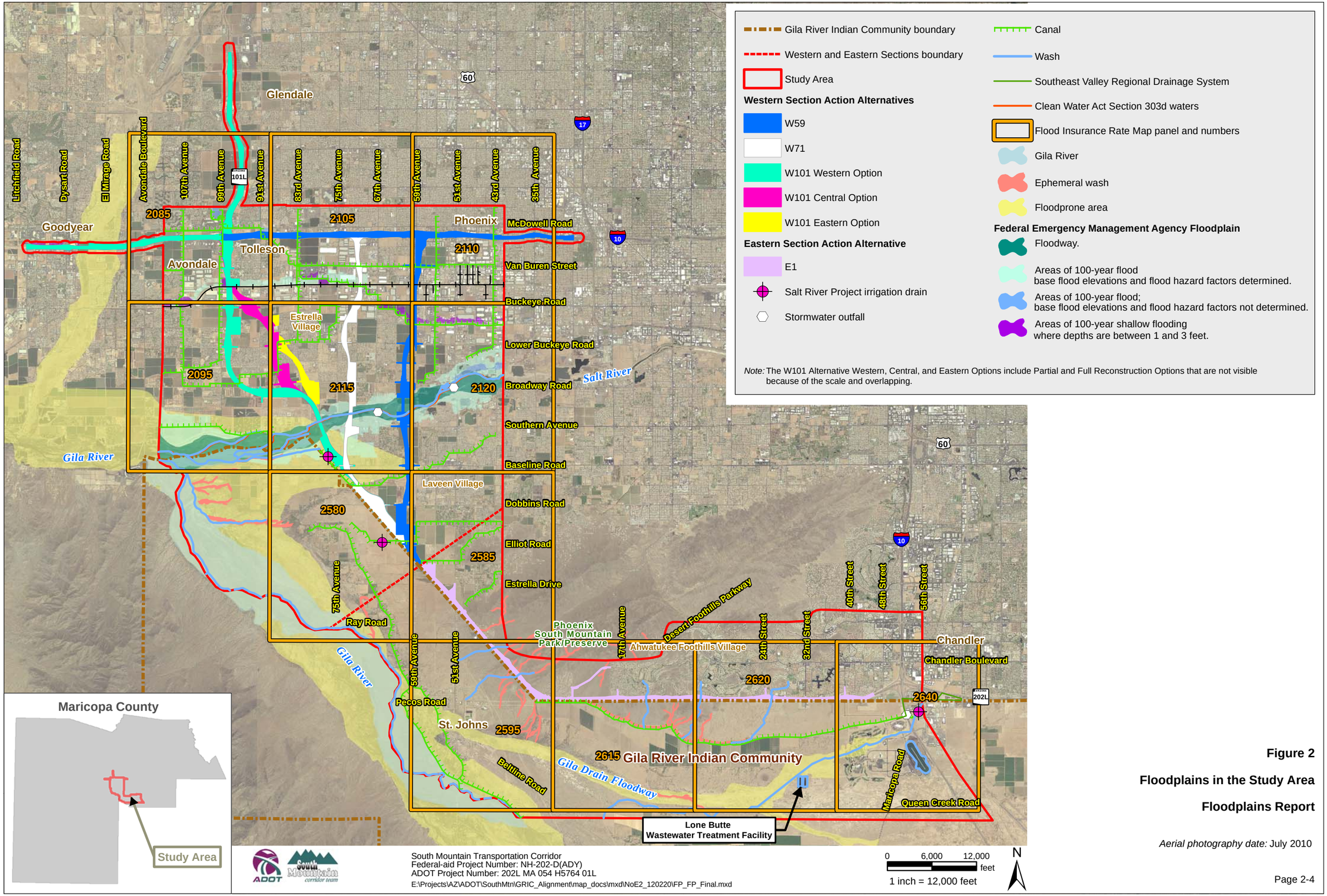

Figure 2

Floodplains in the Study Area

Floodplains Report

Aerial photography date: July 2010

Table 2. Flood Insurance Rate Maps in the Study Area

Flood Insurance Rate Map Panel Number[a]	Most Recent Letter of Map Change Number	Letter of Map Change Effective Date
04013C2085G	09-09-0381P	10/1/2005
04013C2095F	08-09-0655P	7/10/2009
04013C2105F	09-09-2661A	10/1/2009
04013C2110F	08-09-1773A	10/28/2009
04013C2115G	08-09-0614A	3/6/2008
04013C2120G	09-09-0140A	12/28/2008
04013C2580F	New map panels issued	9/30/2005
04013C2585F		
04013C2595F		
04013C2615F		
04013C2620F		
04013C2640G	06-09-0014X	10/1/2005

[a] The last four numeric digits of the Flood Insurance Rate Map (FIRM) panel numbers correspond with the panel numbers shown on Figure 2. All FIRM information in this column was updated on January 20, 2010.

Union Pacific Railroad and Roosevelt Irrigation District Canal 100-year Floodplains

UPRR runs east-to-west between Van Buren Street and Buckeye Road in the Study Area. A 100-year floodplain is located on the northern side of the railroad tracks between 107th and 69th avenues. This 100-year floodplain is considered an SFHA subject to inundation by the 1 percent annual-chance flood. The SFHAs associated with this 100-year floodplain include Zones AH, AE, and X.

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.

Salt River 100-year Floodplain

The Salt River is another feature that is part of the federally mapped floodplains in the Western Section of the Study Area. The Salt River is dry under normal hydrologic conditions due to dams and water diversions upstream from the Study Area (see the *Watercourse Descriptions* section). Floodplain width along the Salt River varies from 1,900 feet near 79th Avenue to over 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.

Gila River 100-year Floodplain

Areas of the Gila River downstream of its confluence with the Salt River (south of Baseline Road and west of 99th Avenue) are federally mapped and are within Zone D (areas in which flood hazards are undetermined, but possible). Those areas north of Baseline Road, within the Community, are within SFHA Zone AE. The Zone AE designation is attributable to flooding at the confluence of the Gila and Salt rivers. Areas downstream of the confluence of the Gila and Salt rivers—south of Baseline Road and west of 99th Avenue—are mapped as Zone D.

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 depicted in Figure 2. 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 due to limited information (which includes the *Surficial Geologic Map of the Gila River Indian Community, Arizona* [Waters 2001]), topographic information, and existing drainage studies.

The Gila Drain is a Salt River Project (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 (ADOT 1998).

Larger flows that cannot be contained in the Gila Drain can be expected to discharge into the Gila Drain Floodway. The Gila Drain Floodway watershed includes outflow from the 48th Street Basin, Southeast Valley Regional Drainage System (SEVRDS)/Santan Channel Detention Basin, and miscellaneous irrigation return water flows. The SEVRDS is part of a large watershed that intercepts the off-site flow from the East Valley of the metropolitan Phoenix area. Flows from the Gila Drain Floodway enter the Gila River west of the community of St. Johns (Komatke).

Watercourse Descriptions

The Salt and Gila rivers, the major watercourses in the Study Area, were perennial streams prior to construction of upstream water supply dams.

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. The Salt River enters the Gila River at the western edge of the greater Phoenix metropolitan area. At the confluence with the Gila River, the Salt River watershed is approximately 5,980 square miles. The Salt River was a perennial river prior to construction of upstream water supply dams. Historical records indicate the Salt River was a wide, braided channel that experienced annual floods prior to dam construction. Before April 1965, the Salt River was dry downstream of the dams for more than 20 years. Construction of the 91st Avenue Wastewater Treatment Plant resulted in the release of water into the Salt River. The Salt River above the confluence with the Gila River has an estimated 100-year and 500-year peak discharge capacity of 162,000 cubic feet per second (cfs) and 235,000 cfs, respectively (U.S. Army Corps of Engineers 2000).

The upstream water-supply and hydropower dams (six in total) are operated by SRP and control flows within the Salt River watershed throughout the Study Area (Figure 3). Currently, only the Roosevelt Dam on the Salt River has allocated flood control storage, which may be used to diminish peak flood flows by controlled releases. The other dams must release water in anticipation of flood flows to provide any attenuation. The Salt River remains dry most of the time downstream of the dams. 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. The development of Tempe Town Lake and the construction of the City of Phoenix 91st Avenue Wastewater Treatment Plant are two examples of where water has been reintroduced into portions of the Salt River. 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.

Gila River

The stretch of the Gila River upstream of where the Salt River enters into it and below the Coolidge Dam (San Carlos Reservoir) has a watershed characteristic of the basin and range lowlands province. At the confluence with the Salt River, the Gila River watershed (located in Arizona and New Mexico) is approximately 57,900 square miles. 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 River and the Gila River. Tat Momolikot Dam is a flood control facility located on Santa Rosa Wash above the confluence of the Santa Cruz River with the Gila River. The 100-year discharge capacity for the Gila River, downstream of the confluence with the Salt River, is estimated at 227,000 cfs (U.S. Department of the Interior 1989).

Summary of Flooding Risk and Flooding History

Several factors unrelated to the proposed action may affect flooding risk. These include the 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 the 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 flow occurs 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 flow may result from storms on the watershed downstream of dams. Hydrologic records indicate that the greatest floods have resulted from winter storms. This is supported by studies of rainfall and runoff relationships that show larger runoff quantities occur during the winter season.

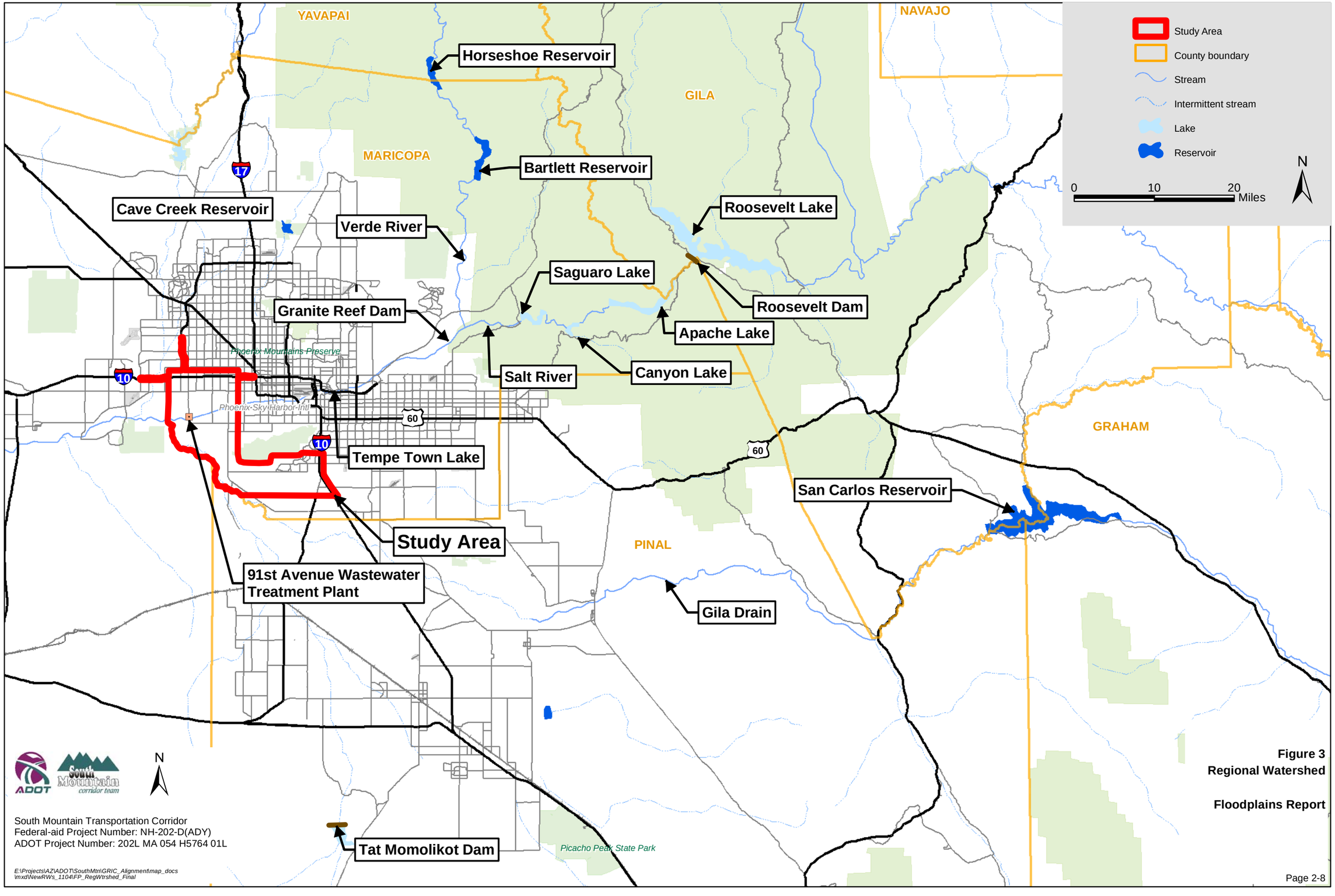

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Figure 3
Regional Watershed

Floodplains Report

Floods of record within the watershed include:

- 300,000 cfs in 1891 on the Salt River prior to completion of 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 the 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. Five floods have occurred in the Salt River with flows in excess of 100,000 cfs since 1978. They occurred in 1978 (two), 1980, 1983, and 1993. Flood damage potential has been reduced by the upstream dam improvements. Major 2004 winter storms on the Salt River watershed required SRP to release 30,000 cfs (in December 2004) 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 in 1999. 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.)

Holly Acres is a community along the confluence of the Gila and Salt rivers that has experienced numerous floods with property damage (through inundation and scouring effects).

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 rail bed and the RID Canal channel.

Habitat restoration and associated flows from the 91st Avenue Wastewater Treatment Plant are addressed through the U.S. Army Corps of Engineers, Los Angeles District, *Tres Rios Arizona Feasibility Report* (2000).

3. Environmental Consequences

Direct Impacts Associated with All Action Alternatives

Impacts on floodplains from action alternatives and options would occur in the Western Section of the Study Area; no impacts would occur in the Eastern Section. Two 100-year floodplains would be affected: the floodplains associated with the Salt River and within the area north of the UPRR tracks (referred to as the UPRR floodplain). FHWA policies and procedures for the location and design of hydraulic encroachments on floodplains are set forth in 23 C.F.R. Part 650. This section summarizes the evaluation of the proposed action in relation to the applicable provisions of those regulations, which include: flooding risks, impacts on natural and beneficial floodplain values, probable incompatible floodplain development, measures to minimize floodplain impacts, and measures to restore and preserve natural and beneficial floodplain values.

All action alternatives in the Western Section of the Study Area would have a lateral crossing of the Salt River and the UPRR floodplain. 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 feature from east to west across the Study Area. The action alternatives and options would result in limited encroachment on the floodplain and limited flooding risk.

The referenced floodplains are shown on Figure 2. The Salt River floodplain crossings would include bridges, and the UPRR floodplain could include bridges or flood mitigation structures such as basins and diversion structures. Minor design modifications are typically considered during the design process that could further mitigate floodplain impacts, if warranted.

Table 3 lists the acreage extent of each action alternative and option that would occur within the federally mapped floodplains. These estimates of encroachment include all the area within the proposed right-of-way of each action alternative and option; thus, more than just the project footprint (e.g., that area occupied by freeway structures and fill needed to create or stabilize those structures) is included. The floodway acreage is included in the Salt River floodplain total.

The E1 Alternative would not cross federally mapped floodplains and will not be discussed further.

The acreage estimates are the potential extent of encroachment if the freeway were completed entirely on embankment. The extent of encroachment impact is expected to be smaller than shown in Table 3, which would further reduce flooding risk in the Study Area.

Table 3. Floodplain Encroachment Impacts

Action Alternatives and Options	Salt River Floodplain Encroachment (acreage)[a]	Union Pacific Railroad Floodplain Encroachment (acreage)[a]	Total Floodplain Encroachment (acreage)
W59	53	4	57
W71	117	10	127
W101WPR	19	33	52
W101WFR	19	33	52
W101CPR	19	29	48
W101CFR	19	29	48
W101EPR	19	29	48
W101EFR	19	29	48

[a] based on right-of-way footprints

Risks Associated with the Action

Risks are defined as the consequences associated with the probability of flooding attributable to the encroachment. The mitigation measures described in this report would minimize the potential for property loss or hazard to life. Developments to the 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, thus, 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 moderation of floods, mining and industry, water quality maintenance, and groundwater recharge.

As described in the *Affected Environment* section of this report, 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 nearly year round. 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 recreation opportunities would be preserved. Because of urbanization adjacent to the Salt River and the continued sand and gravel mining operations, wildlife habitats in the affected areas are of low value. The ability for wildlife to freely move within the remaining habitat would continue (bridges associated with any of the action alternatives and options would not impede movement) and, therefore, the proposed action would not contribute to further diminished 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.

Support of Incompatible Floodplain Development

The 100-year floodplain associated with the Salt River is dominated by agriculture, mining, and undeveloped open space. Each 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 Arizona Revised Statutes §§ 48-3603 and 48-3609.

Further, the action alternatives and options are consistent with existing development plans of the City of Phoenix and Maricopa County (refer to the *Land Use Report*). The freeway would provide improved access to future development, which in turn would be consistent with floodplain regulations. The action alternatives and options would not contribute to incompatible floodplain development.

Measures to Minimize Floodplain Impacts

The measures described in the *Mitigation* section of this report would be effective in minimizing impacts associated with encroachments into the 100-year floodplain.

Alternatives to Encroachment

Encroachments into the 100-year floodplain are quantified in Table 3 and shown in Figure 2. Encroachments on the Salt River floodplain and the UPRR floodplain by any of the 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 of I-10 for any of the action alternatives and options.

Potential for Significant Encroachment

Significant encroachment, as defined in 23 C.F.R. Part 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 that is needed for emergency vehicles or one that provides a community's only evacuation route
- ► a significant risk
- ► a significant adverse impact on natural and beneficial floodplain values

The proposed action would not have the potential for interrupting or terminating transportation facilities needed for emergency vehicles or emergency evacuation routes. The proposed action would not create a substantial risk, nor would it adversely affect natural or beneficial floodplain values. Therefore, the proposed action would not have a significant encroachment on the floodplain.

Secondary and Cumulative Impacts

Secondary Impacts

Secondary effects are defined by the Council on Environmental Quality as impacts that are "caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable" (40 C.F.R. § 1508.8).

As presented in the *Support of Incompatible Floodplain Development* section, the proposed action would be consistent with existing development plans of the City of Phoenix and Maricopa County. The freeway would provide improved access to future development, which in turn would be consistent with floodplain regulations. The proposed action would not contribute to reasonably foreseeable incompatible floodplain development.

Cumulative Impacts

Cumulative effects are defined 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…" (40 C.F.R. § 1508.7). If a project does not directly affect a particular environmental resource, the project would not contribute to a cumulative impact on that resource.

Development of land in and around the Study Area is regulated by Maricopa County, the City of Phoenix, and the Community. Land use changes over several decades in the Phoenix metropolitan area indicate low-density land uses, such as agricultural uses, eventually redevelop into higher density development for residential and commercial activities. Higher density development is typically characterized by extensive use of low permeability or impervious building and paving materials, thereby increasing the amount of runoff that occurs as a result of storms. This has the potential to alter the extent of the 100-year floodplain. However, this proposed project would be designed to result in no change to the floodplain base flood elevation.

No-Action Alternative

Growth projections supported by affected jurisdictions' planning policies for the Phoenix metropolitan area indicate that land within the Study Area will be developed within the next 20 years. If a freeway is not constructed, it is expected that the floodplain would need to be crossed in several locations at major arterial streets to enable transportation in and out of the Study Area. Streets currently cross the Salt River at grade and can be closed due to minor flooding of the channel.

4. Mitigation

The following sections describe potential mitigation measures for ADOT to consider as future commitments to be implemented as part of the project to avoid, reduce, or otherwise mitigate environmental impacts associated with the project. The discussion of these measures in this report does not obligate ADOT to these specific measures. ADOT, along with FHWA, may choose to modify, delete, or add measures to mitigate impacts.

ADOT Design Responsibilities

The Maricopa County Floodplain Regulations define "floodway" as "the channel of a river or other watercourse and the adjacent land areas necessary in order to discharge the one hundred-year flood without cumulatively increasing the water surface elevation more than 1-foot." The floodway is the stream channel and the portion of the adjacent floodplain that must remain open to permit passage of the 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 do not contribute to a rise in floodwater elevation of more than 1 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 hydrology, hydraulics, sediment transport, and erosion analyses to minimize the impacts of encroachment. This would be done by ADOT during final design. As indicated in Section 505(a) of the Floodplains 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.

Development along the southern side of the South Mountains in the Eastern Section of the Study Area (E1 Alternative) consists of typical residential and commercial developments. The City of Phoenix generally requires retention of flows from the 2-hour, 100-year storm. The combination of residential and commercial development has increased stormwater flows, but the implementation of City of Phoenix retention requirements may reduce the stormwater flows similar to natural conditions assuming the retention facilities were constructed as part of ongoing development. Areas in the Eastern Section of the Study Area associated with the Phoenix South Mountain Park/Preserve continue to be undisturbed. The selected action alternative would require comprehensive drainage assessments regarding potential 100-year storm flood effects that would be determined during final design. Results from such assessments

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.

The drainage design criteria for on-site drainage would be based on the ADOT publications entitled: *Roadway Design Guidelines, Urban Highway Section – Design Procedures Manual* (2007) and *Highway Drainage Design Manual – Hydrology* (1993), and the FHWA publications entitled *Drainage of Highway Pavements* (1984) and *Urban Drainage Design Manual* (2001).

ADOT's *Roadway Design Guidelines* (2007) provides criteria to be used for off-site flows that would affect the proposed action:

- Culverts would be sized based on the design discharge of a 100-year flood (an event with a 1 percent chance of occurring in any 1 year).
- Culverts should be designed to encourage self-cleaning (section 611.3.D).
- Reinforced concrete box culvert and reinforced concrete pipe should be provided with adequate cover.

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