Dobson Road Bridge at Salt River

Design Concept Report

W.O. No. TT199

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FINAL - Volume 1 of 2

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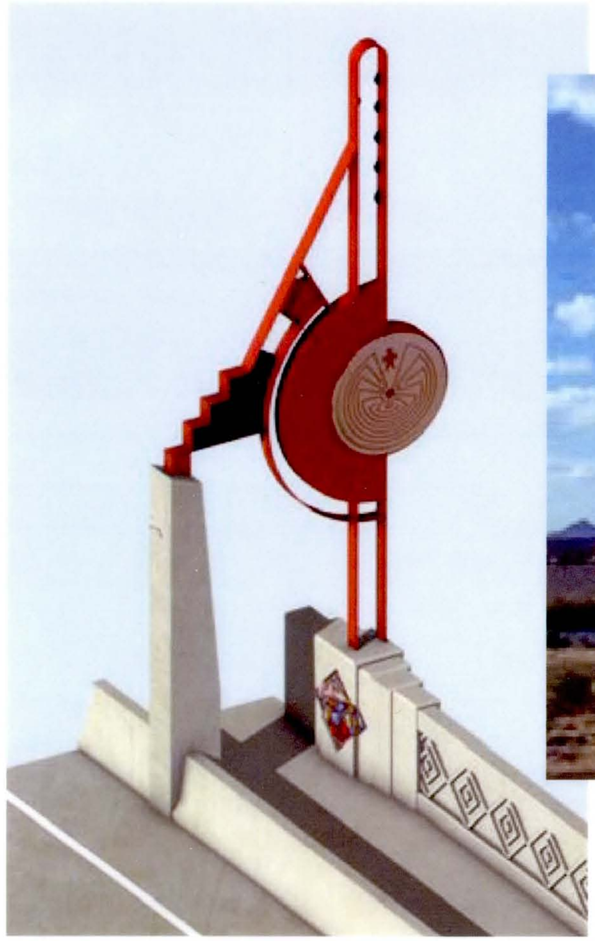

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Final Dobson Road Bridges Design Concept Report

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EXECUTIVE SUMMARY

- This project is a cooperative effort of the City of Mesa, the Salt River Pima-Maricopa Indian Community, and the Maricopa County Department of Transportation.

- The Dobson Road Bridges project includes three new bridges over the Salt River, as well as improvements to McKellips Road between SR101 and Alma School Road. The bridges would be located at Dobson Road (just north of the SR202 Interchange), Gilbert Road, and McKellips Road (just west of the SR202 Interchange). A project location map can be found in Figure 2-1 on page 5.

- All three bridges, as well as improvements to McKellips Road, would be constructed with three travel lanes in each direction. Preliminary roadway plans and bridge drawings can be found in Appendix K.

- The priorities for constructing these improvements would be 1) a new Gilbert Road Bridge, 2) a bridge for Dobson Road to connect with 92nd Street, 3) a bridge for McKellips Road, and 4) roadway improvements to McKellips Road between Alma School Road and SR101. See the Project Implementation Plan in DCR Chapter 20 on page 47 and the Project Priority Factor Evaluation Matrix in Appendix M.

- The environmental characteristics of the study area were inventoried and the potential impacts of constructing the projects were evaluated. Separate Environmental Assessments (and a Supplement to the existing Gilbert Road EA) are in preparation to document this process, assess the likely impacts, and develop appropriate mitigation measures. No environmental issues were identified that would prevent construction of the subject bridges and roadway improvements.

- The public was involved through a series of three open house public meetings: two were held on the SRP-MIC lands and one in the city of Mesa. The study's alignment alternatives were displayed for public comment at that time and the Preferred Alternative was identified for each of the four projects. Written comments were received from people who attended the meetings, but none was opposed to the projects.

- Alternative alignments were evaluated for each of the project areas. A single alignment is identified in this DCR as the Selected Alternative for each of the four project locations. Other alternatives considered can be viewed in Chapter 14. The Recommended Preferred Alternatives memorandum, dated September 27, 2008 can be seen in Appendix M.

- The total cost for these four elements is estimated to be $165,848,000 in 2009 dollars and $181,111,000 in 2011 dollars. The estimated cost of each project can be found in Chapter 18, page 45 of this document and detailed cost estimates can be found in Appendix L along with the preliminary cost estimates for all the study alternatives.

- The aesthetics of the structures were a major concern of this project. Guidelines were developed for bridge aesthetics and these are included in Appendix H.

- In 2001, MCDOT developed final plans for a new, longer Gilbert Road Bridge as well as for a bridge to replace the dry crossing at McKellips Road. The current project reevaluated the bridge lengths and significant reductions (about 1,000 and 300 linear feet) were made. These bridges are being redesigned accordingly.

1 INTRODUCTION

1.1 Problem Statement

Cities in the east valley have experienced explosive population growth over the last thirty years. Development in this area is outpacing the construction of transportation facilities, resulting in higher than projected traffic volumes on arterial streets. The East Valley area around SR202 has been the focus of significant development within the last five years. Projects such as Tempe Town Lake and Fine Arts Complex, Riverview Mall and commercial centers, and commercial development on SRP-MIC lands have all served to create a focal point for the east valley and enhance the quality of life for its residents and visitors.

The Dobson Road Bridges project will improve connectivity for developments north and south of the Salt River, streamline commercial access, and integrate communities of Maricopa County. This document is a single Design Concept Report (DCR) for three bridges to cross the Salt River: at Dobson, McKellips, and Gilbert Roads. The DCR also includes a fourth project, widening McKellips Road between Alma School Road and SR101 for a distance of about 2 miles.

1.2 Selected Alternatives

The locations for these projects have been selected based on an evaluation of a range of alternatives with the goals of:

- minimizing bridge span length;
- avoiding utility relocation, chiefly, high voltage transmission towers paralleling Salt River;
- remaining, to the extent possible, within the existing public right-of-way;
- minimizing impacts to private land, and minimizing shut-down of existing roadways;
- adhering to geometric requirements, mainly, achieving 55/45 mph design/posted speeds, locating bridges on tangent sections, and matching existing roadways on the two sides of the river; and
- compatibility with existing and planned land uses.

Early in the study process, several roadway alignment alternatives were identified for Dobson Road, McKellips Road, and Gilbert Road crossings as well as for widening McKellips Road. The comparison of different alignments was performed and the results were arrayed in an evaluation matrix. The No-Build Alternative was included in the analysis of each alignment. A preferred alignment was selected for each of the four project elements. At the conclusion of the DCR and environmental documentation process, these alternatives were then be termed "Selected" alternatives.

A principal focus of project development was to find engineering solutions for bridge crossings that would handle flood flows and make crossings functional under adverse conditions. The recommended solutions, subject to verification in Final Design, consist of a bridge at the Dobson Road crossing, a new bridge at the Gilbert Road crossing, a bridge at the existing McKellips Road dry crossing and widening of McKellips Road.

1.3 Purpose and Need

The four independent project areas each have specific purposes and needs that are addressed by the selected improvements.

1.3.1 Dobson Road Bridge

The need for better surface street roadways and transportation network is apparent in the MAG travel demand model for the increase in traffic at the SR 101L and SR 202L interchange. Indicating the number of short trips that need to use the freeway, the model shows that the current arterial network is constrained. The absence of a bridge crossing shows that the predicted path of drivers is to use the freeway as the crossing. Future development of the Mesa Riverview Wave Park and the recent Riverview Commercial center provide a strong destination on the south side of the river. The SRP-MIC is exploring plans for expansion of the casino to include more commercial and office use, plus a major multi-use development west of SR 101L in Section 12. Furthermore, as the mining activity is completed, the SRP-MIC plans show the area east of SR 101L and south of McKellips Road redeveloped as commercial /office.
The purpose of the Dobson Road Bridge over the Salt River and connection between SR 202L and McKellips Road is to reduce freeway congestion by removing short trips on the freeways and allowing them to use surface streets, directly connect destination areas for Mesa Riverview with the SRP-MIC casino and related developments including Section 12 multi-use development, and to create a north-south arterial waterway crossing at this strategic location.

1.3.2 McKellips Road Bridge

The need to replace the low water crossing with a bridged crossing concerns the major travel path and providing the all-weather crossing to provide satisfactory capacity for the future travel demand. As an east-west arterial, McKellips Road is the key arterial street in the area. McDowell Road terminates at Country Club Road and Brown Road does not exist due to the river. Only SR 202L provides parallel traffic capacity. The MAG demand forecasting model shows significant traffic using McKellips Road. The McKellips closure model run shows that when the Salt River flows in the future and causes McKellips Road to be closed, the traffic then is distributed mainly to the freeway, causing additional delay during the peak hours. The number of drivers impacted by the traffic delays produces a significant and negative effect on the freeways and additional costs to drivers due to increased delays.

The construction of McKellips Road Bridge reduces the delay costs, eliminates the maintenance costs of the low water crossing and traffic control during flood events, and provides redundancy if any of the other local bridges is closed such as the event when Alma School Road was closed due to flood erosion a the south abutment.

1.3.3 McKellips Road Widening

The MAG traffic demand model shows significant increases in traffic use on McKellips Road, with or without a bridge crossing. McKellips Road functions as a regional connecting roadway between Mesa and

Scottsdale, but it also functions as an interregional arterial roadway for the SRP-MIC southern area. As the SRP-MIC adjacent area develops, use of McKellips Road will increase, providing access to the Section 12 development, the casino, related developments, and the mine redevelopment areas. Those developments were added to the MAG model specifically for this project, and the traffic generated by those developments is significant.

The purpose of widening McKellips Road is to add the roadway capacity to meet the projected traffic volumes and provide a level of service commensurate with the MCDOT guidelines.

1.3.4 Gilbert Road Bridge

Gilbert Road is needed as an all weather crossing because it connects the SRP-MIC tribal areas and it is a main connection between eastern Mesa and SR 87 to the north and east. The Lehi area of the tribal lands is cut off from the main tribal lands and community center when floods force the closure of Gilbert Road or, like it is now, have the northbound roadway washed away by flooding. Tribal members have a circuitous route to reach other tribal destinations such as the civic center and tribal employment centers. Using the two-lane roadway for both travel directions creates a bottleneck during peak hours, increasing travel times and causing delays. Commuters are forced to travel three miles to the west to Country Club Drive to cross the river. Furthermore, trucks destined for the regional landfill also must travel over six miles out of their way to reach the landfill, costing the service companies in time, money, and additional maintenance on vehicles. Gilbert Road is the easternmost urban crossing over the Salt River and serves traffic from a large area.

The purpose of a new bridge over the Salt River along the Gilbert Road alignment is to create an all-weather crossing for this regionally significant route.

1.4 Summary of Project Cost

Cost estimates were derived from pro-rated costs from recent MCDOT projects and estimated quantities for road construction, pavement structures, utility relocation, irrigation relocation, and bridge construction. Subsequent development cost estimates will be developed based on quantities determined for the Dobson Road projects and unit costs. The 2011 dollar cost estimate for the lowest cost alternatives totals approximately $181,111,000.

The costs to construct these projects will be shared by the three project sponsors: the City of Mesa, the Salt River Pima-Maricopa Indian Community, and the Maricopa County Department of Transportation. Additional construction monies will come from the Maricopa Association of Governments (MAG).

2 PROJECT BACKGROUND

2.1 General Description

The Dobson Road Bridges project is located in Maricopa County near the north boundary of the City of Mesa and the south boundary of the Salt River Pima-Maricopa Indian Community (SRP-MIC) at the Salt River between SR101 on the west and Gilbert Road on the east. Figure 2-1 on page 8 shows the project's location.

The project consists of four parts or elements:

- Widening McKellips Road from SR101 to Alma School Road, for an approximate length of 1.93 miles.
- A McKellips Road Bridge over the Salt River with approaches, from Alma School Road to SR202, for an approximate length of 0.77 mile. This part includes bank protection between Alma School Road Bridge and McKellips Road Bridge.
- A Dobson Road Bridge over the Salt River with approaches, from McKellips Road to SR202, for an approximate length of 1.58 miles (this includes the roadway to McKellips Road).
- A Gilbert Road Bridge over the Salt River with approaches, for an approximate length of 1.60 miles.

2.1.1 McKellips Road, SR101 to SR202

McKellips Road is common to three of the four elements of this DCR project. It is an important transportation link between the cities of Mesa and Scottsdale and the SRP-MIC. It also serves as the primary access into the Casino Arizona Gaming Center. McKellips Road is classified as a principal arterial street in the MCDOT Street Classification Atlas. It is typically an un-curbed two-lane roadway with widening at major intersections. Completion of SR202 (1997) in this area initially greatly reduced the traffic demand on McKellips Road, thus leaving this arterial with a lane configuration with adequate capacity to handle near-term needs.

When ADOT first opened the initial segment of the SR202L in Mesa to McKellips Road, a large portion of the traffic that previously and regularly traveled the McKellips Road corridor began travelling on the new SR202L freeway. Consequently, traffic volume on McKellips Road suddenly dropped. However, traffic volume on McKellips Road continued to steadily increase. MAG's traffic models now indicate that future roadway expansion is now or soon will be necessary to accommodate all future traffic demands in the area in order to maintain level of service "C" or better for the public.

The traffic study determined the extent of improvements required for McKellips Road and evaluated whether/when it needs to be brought to the current MCDOT standard for a principal arterial (urban or rural typical section). Widening may affect Salt River Project (SRP) distribution lines and irrigation ditches, and potentially other utilities. The irrigation ditch crossing located west of Dobson Road will require upgrading which may include raising the street profile to meet current SRP irrigation criteria.

2.1.2 McKellips Road Bridge Crossing of the Salt River

McKellips Road currently crosses the Salt River at grade, on a reversing curve, starting at the intersection with Alma School Road and ending at the SR202 interchange with McKellips Road in the city of Mesa. When the Salt River flows, McKellips Road is closed, seriously disrupting traffic in the area. A bridge at this site has been considered and final plans had been developed, but the bridge has not been constructed primarily due to lack of funding. That set of plans was done in Metric and was for a substantially longer bridge than is currently proposed.

The Metric plans called for spanning the entire floodway, including the south channel. The hydraulic analysis that was done for the current project, however, shows that a shorter bridge will not worsen flooding impacts. As a result, the longer Metric bridge design was abandoned in favor of the shorter bridge design.

The proximity of the intersection with Alma School Road and the SR202 underpass for McKellips Road significantly restricts the geometric realignment possibilities for the new bridge. While limiting impacts to the previously disturbed alignment may simplify the environmental process, it complicates maintenance of traffic issues during construction.

2.1.3 Gilbert Road Bridge Crossing of the Salt River

The Gilbert Road Bridge project will involve a new six-lane bridge that will approximately parallel the existing two-lane bridge from Thomas Road to SR87. This project is a continuation of the Gilbert Road Widening Project that began in 1999. That project was to widen Gilbert Road between McDowell Road and SR87. Final plans and an Environmental Assessment were completed. Because of funding constraints, only the widening between McDowell Road and Thomas Road was completed. That project included a two-lane temporary detour because the new bridge would have been constructed on the old alignment.

This temporary roadway provided two additional lanes of capacity on Gilbert Road until it was washed out in January of 2008.

Alternatives for the current study evaluated the option of using the design and environmental clearance developed in 2001 or using a new alignment between the existing bridge and the temporary roadway. The current study included hydraulic analyses showing that a significantly reduced bridge length will not adversely affect the floodplain. As a result, the previous design was abandoned and a new and substantially shorter bridge is proposed in this project.

A transition from the existing five-lane section (three southbound, two northbound) to the new six-lane section is included in this DCR. Gilbert Road is typically closed when the bridge approaches are overtopped by floodwaters due to the lack of flow capacity beneath the existing bridge and low approach embankments.

2.1.4 Dobson Road Bridge Crossing of the Salt River

A new bridge crossing over the Salt River beginning at the Dobson Road/SR202 interchange and connecting to McKellips Road north of the Salt River is the fourth part of this project. The existing SR202 diamond interchange with Dobson Road is offset 1/4-mile east of the Dobson Road section line to provide adequate weaving distance from the SR101/SR202 system interchange. Alignment alternatives needed to be analyzed and evaluated to determine the preferred alignment to establish roadway system continuity by connecting Dobson Road to McKellips Road across the Salt River to the north. Constraints considered during roadway alignment evaluations included environmental impacts to the Salt River and wetlands, environmental permitting, river hydraulics, on-going commercial operations on the north bank of the Salt River (a gravel mining operation and a concrete batch plant), allottee and tribal right-of-way impacts, bridge type and length, geotechnical issues, groundwater issues, traffic study/street network connectivity (potential connection points at 92nd Street, Dobson Road, Longmore Road, ¼ mile locations or other), impacts to significant utilities (230 kV transmission, irrigation network), constructability and cost.

2.2 Project Area Planning

There are major developments in the planning and development stages within the project area. The following is a discussion of the most prominent of these.

2.2.1 Mesa Riverview

The City of Mesa has encouraged developers to build a large retail and entertainment center south of SR202 along Dobson Road. The project provides more than 1.2 million square feet of mixed-use development on 200 acres. There is currently a Cinemark multiplex theater open on the project site with small retail shops. Larger retail spaces have been constructed and are now open, and there is a major auto mall. Mesa Riverview's location has high visibility along SR202, and the extension of Dobson Road across the Salt River will be a critically important link between SRP-MIC, the cities of Scottsdale and Mesa, and this development.

2.2.2 Casino Arizona

Located on the west side of 92nd Street north of McKellips Road, east of SR101, Casino Arizona is a popular SRP-MIC gaming facility that uses McKellips Road as the primary access to 92nd Street. Connecting the Dobson Road alignment to McKellips Road at 92nd Street would provide a direct link between this major traffic generator, the SR202 and the Mesa Riverview project.

2.2.3 Va Shly'ay Akimel Restoration Project

The US Army Corps of Engineers (USACE) has been developing the Va Shly'ay Akimel Restoration Project to return significant areas of the Salt River to a more natural habitat. The local sponsors for this project, the City of Mesa and the SRP-MIC, are the same as for the Dobson Road Bridges Project. The project will establish approximately 200 acres of wetlands, 880 acres of cottonwood/willow stands, 380 acres of mesquite bosque, and 24 acres of Sonoran desertscrub shrub, using surface water currently owned by SRP-MIC or groundwater pumped from an existing or new well. Other features include removal of invasive vegetation, reshaping abandoned sand and gravel mining pits, reshaping some sections of the river channel to return water flow to a more natural pathway, a grade control structure, and a recreational trail system. This project is scheduled to begin construction in 2010. The Dobson Road Bridge over the Salt River will require close coordination with the Va Shly'ay Akimel Restoration Project.

2.2.4 Section 12/Pima Corridor Commercial Development

The SRP-MIC Master Land Use Plan, adopted in early 2007, designates commercial development flanking SR101 on lands immediately north of the Salt River to McKellips Road and between Pima Road and 92nd Street between SR202 and 90th Street. Over 26 million square feet of commercial floor space is planned for office, wholesale, retail, and recreational use, of which approximately one-third will be in the vicinity of the SR101/SR202 interchange.

Long-range planning for land uses north of the Salt River and east of SR101 shows commercial/office uses at moderate to high densities. Good to excellent accessibility will be essential for successful development at this location.

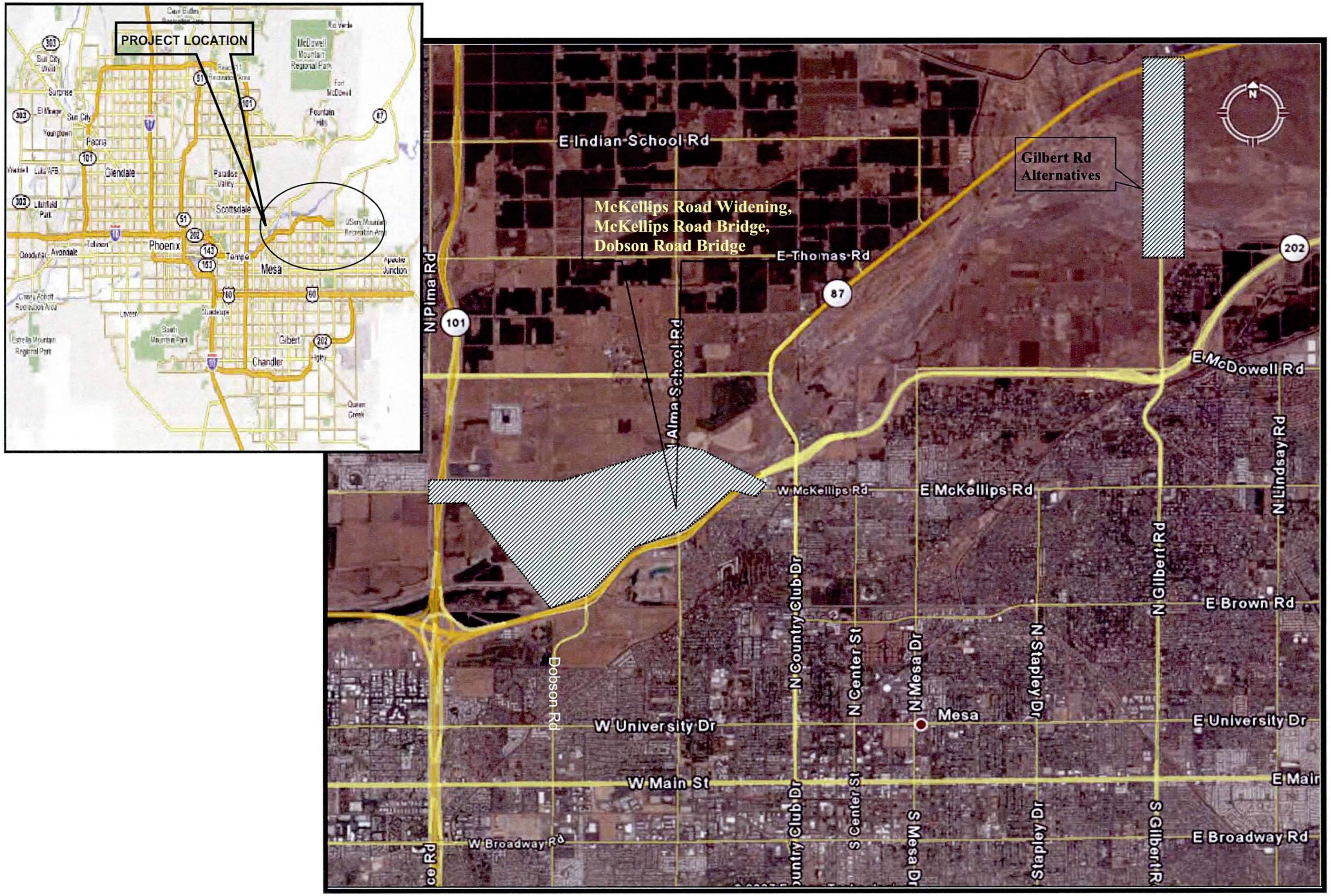


Figure 2-1 Project Location Map

3 TRAFFIC INFORMATION

3.1 Existing Signalized Intersection Level of Service and Average Delay

Table 1-1 in Appendix A Traffic displays the LOS and average delay for existing signalized intersections that were calculated utilizing Synchro 7 software.

3.2 Traffic Accident History Data Update

An updated traffic accident history data was obtained from ADOT Traffic Records for the Dobson Road, Gilbert Road and McKellips Road project locations from August 1, 2002 through July 31, 2007. The traffic accident history update was utilized to further evaluate each project location crash history experience.

A more specific and comprehensive tabulation of Traffic Accident Histories, as well as each of the detailed Crash Summary tabulations for Dobson Road, Gilbert Road and McKellips Road can be found in Appendix A Traffic.

3.2.1 McKellips Road

Along McKellips Road, between State Route 101 and State Route 202 there were 44 total accidents; 4 of which involved fatalities, 18 resulted in injuries and 22 caused property damage only.

The McKellips Road and SR101L intersection has experienced 1 rear end accident in 5 years; 0 involved fatalities, 0 resulted in injuries, 1 resulted in property damage only and occurred during hours of darkness.

The McKellips Road and 92nd Street intersection has experienced 1 non-fatal left turn accident in 5 years which involved non-incapacitating injuries and occurred during daylight hours.

The McKellips Road at Dobson Road intersection, as well as each intersection leg, has experienced 7 traffic accidents in five years; 4 of which resulted in fatalities, 4 involved single vehicles (of which 3 were single vehicle fatal crashes). All the single vehicle collisions were late evening/early morning incidents. There was also 1 non-incapacitating injury accident, 1 possible injury accident, 1 property damage only accident, 1 sideswipe opposite direction accident, 1 angle accident, 1 accident involved other causes, 1 involved an overturned vehicle, 1 involved a pedal cyclist collision, 1 involved a pedestrian collision, 4 occurred during hours of daylight and 3 occurred during hours of darkness. The ratio of the accidents occurring in the daytime, compared to those accidents occurring during hours of darkness is 1.33. ADOT Traffic HES Section utilizes a general rule-of-thumb indicating that traffic accident history data at a particular location, resulting in a light to darkness accident ratio of less than 2.0, is considered a suitable candidate for further detailed examination, as well as the installation of construction mitigation countermeasures.

The McKellips Road and Longmore Road intersection (not illuminated) has experienced 2 accidents in 5 years; neither of which resulted in fatalities, 1 resulted in possible injuries, 1 resulted in property damage only and 2 of which occurred during hours of darkness.

The McKellips Road and Alma School Road intersection has experienced 30 accidents in 5 years; 0 involved fatalities, 2 resulted in incapacitating injuries, 7 resulted in non-incapacitating injuries, 4 resulted in possible injuries, 17 resulted in property damage only, 24 occurred during hours of daylight, 4 occurred during hours of darkness, 2 occurred during hours of dawn or dusk, 2 involved single vehicles, 8 involved left turning movements, 8 involved rear ends, 5 involved sideswipes in the same direction, 5 involved angle collisions and 1 involved backing.

The McKellips Road and SR202L intersection has experienced 3 accidents in 5 years; of which 0 resulted in fatalities, 1 resulted in non-incapacitating injuries, 2 resulted in property damage only and 3 occurred during hours of daylight.

The McKellips Road corridor is handling ever increasing traffic loading, and traffic accidents are increasing as well. Accordingly, Parsons recommends the installation of upgraded roadway lighting improvements along McKellips Road from SR101L to SR202L to help improve driving conditions for the traveling public.

3.2.2 Gilbert Road

The Gilbert Road and SR87 intersection, as well as each intersection leg, has experienced 53 traffic accidents in five years (see updated traffic accident crash history in Appendix A). While there were 0 fatality crashes, an examination of updated accident data indicates that the vast majority of 17 single vehicle collisions were involved in late evening/early morning incidents, 12 involved livestock collisions, 1 involved a collision with wild game, 24 were rear-end accidents, 4 were sideswipe same direction accidents, 2 were left turn movement accidents, 2 were angle accidents, 1 was a sideswipe opposite direction accident, 1 was a head-on collision accident, 1 was a backing accident and 1 was the result of other causes. The ratio of all accidents occurring in the daytime, compared to all accidents occurring during hours of darkness is 1.53. ADOT Traffic HES Section uses a general rule-of-thumb indicating that traffic accident history data at a particular location, resulting in a light to darkness accident ratio of less than 2.0, is considered a suitable candidate for further detailed examination, as well as the installation of construction mitigation countermeasures.

The Gilbert Road and Thomas Road intersection has experienced 9 accidents in 5 years. none of which was fatal. Of the nine, 3 resulted in non-incapacitating injuries, 6 resulted in property damage only, 2 involved livestock animals, 6 were single vehicle accidents, and 2 involved overturned vehicles. Five of these accidents occurred during hours of daylight while four occurred during hours of darkness.

Because there is no history of fatal crashes along Gilbert Road, and the roadway segment between Thomas Road and SR87 is situated in a rural setting, Parsons does not recommend that roadway lighting be installed at this time. However, Parsons recommends that the installation of roadway fencing along the right-of-way lines be considered in close collaboration with the SRP-MIC and the City of Mesa.

3.2.3 Dobson Road

The new Dobson Road alignment will proceed north from the existing Dobson Road intersection at SR202L, crossing the Salt River over the new Dobson Road Bridge, curving west and then north to the McKellips Road at 92nd Street intersection.

Dobson Road at SR202L has experienced 14 accidents in 5 years; 0 of which involved fatalities, 1 resulted in incapacitating injuries, 1 resulted in non-incapacitating injuries, 1 resulted in possible injuries, 10 resulted in property damage only, 5 were single vehicle accidents, 4 were rear ends, 3 were sideswipe same direction, 2 were angle accidents, 11 occurred during hours of daylight, 2 occurred during hours of darkness and 1 occurred during hours of dusk or dawn.

The new Dobson Road alignment will be constructed between SR202 and McKellips Road. Motorists will be traveling from an urban setting on the south to a newly developing urban setting on the north. As a result, Parsons recommends that roadway lighting be installed along Dobson Road from SR202 to McKellips Road.

3.3 Current Traffic Composition and Retail Development

Commuter traffic comprises the majority of the traffic utilizing roadway networks during the work week morning and evening peak hours. Casino Arizona is the only development within the project area that currently attracts a large amount of vehicle traffic. New retail developments opened during summer 2007, including the Tempe Marketplace and Mesa Riverview. Both have direct access to State Route 202 and therefore will not adversely affect McKellips Road and Gilbert Road.

3.4 Future Traffic Demands

The Maricopa Association of Governments (MAG) traffic model was used to estimate the future traffic demands of the proposed roadway network. MAG provided the Design Year 2030 traffic forecasts as well as the Year 2006 traffic volumes. Last updated in 2003, the MAG model uses information on population, land use, employment, and housing for Maricopa County. Currently, East Thomas Road ends at Gilbert Road, but resumes its alignment again just east of State Route 202. The MAG traffic model assumes that by the year 2030 Thomas Road will be connected on both sides of Gilbert Road. Using the Design Year 2030 MAG model data, the future daily traffic along McKellips Road is projected to be approximately 40,000 vehicles per day (vpd). Future traffic along the proposed Dobson Road connection between SR202 and McKellips Road is projected to be approximately 14,800 vpd. Traffic on Gilbert Road between Thomas Road and SR87 will be approximately 34,200 vpd. Employing the 2030 Design Year data, Synchro 7 traffic modeling software was used to analyze proposed roadway and intersection designs, as well as determine the Level of Service for each design location. The proposed roadway and intersection improvements are noted in Table 1-2 in Appendix A Traffic.

3.5 Proposed Roadway Improvements

Dobson Road, SR202 to McKellips Road - A new roadway will be constructed, six lanes wide, with a left-turn median connecting Dobson Road from Loop 202 to McKellips Road, new traffic signals installed at both intersections and new roadway lighting.

McKellips Road, SR101 to SR202 - The existing roadway will be widened to three lanes in each direction with left-turn medians and new roadway lighting constructed throughout the entire project length.

Gilbert Road, Thomas Road to SR87 - The existing roadway will be widened to three lanes in each direction with a left-turn median, new traffic signals installed at both intersections and upgraded roadway lighting installed at Gilbert Road and Thomas Road.

3.6 Proposed Intersection Improvements

The following intersection improvements are recommended:

- McKellips Road at Northbound SR101 - Dual right turn lanes along westbound McKellips Road and an additional through lane along eastbound McKellips Road.
- McKellips Road and 92nd Street Intersection - Right turn lane and dual left turn lanes along northbound Dobson Road connection at 92nd Street, additional right turn lane along southbound 92nd Street, additional right turn lane along eastbound McKellips Road, and the addition of a third through lane in each direction along McKellips Road.
- McKellips Road and Dobson Road - Additional through lanes along McKellips Road in each direction.
- McKellips Road and Alma School Road - Additional through lanes along McKellips Road in each direction.
- McKellips Road and SR202 - Additional through lanes along McKellips Road in each direction.
- Gilbert Road and SR87 Intersection - Dual northbound to westbound left turn lanes and dual right turn lanes northbound to eastbound along Gilbert Road. Additional storage length to the westbound to southbound left turn movement will be a key improvement to the capacity of this intersection.
- Gilbert Road and Thomas Road - Additional through lanes along Gilbert Road along with dual left turn lanes in the southbound to eastbound direction. In addition, dual right turn lanes along eastbound Thomas Road to southbound Gilbert Road will be needed.

The implementation of the above-mentioned improvements combined with future traffic forecasts provides the LOS and delay as noted in Table 1-2, Year 2030 Signalized Intersection Level of Service and Average Delay and found in Appendix A Traffic.

3.7 Traffic Signal Timing Basis

Traffic signal cycle length, phase sequence, and phase length for the intersections within the project area were based upon optimizing current signal timings used by Maricopa County Department of Transportation (MCDOT) and Arizona Department of Transportation (ADOT) for each agency's respective signals.

3.8 Future Projects

ADOT has opened HOV (High Occupancy Vehicle) lanes along SR101 and will be adding them to SR202 within the next five years. Even with the addition of more lanes to each of these regional freeways, it is recommended that capacity improvements be added to McKellips, Gilbert, and Dobson Roads in order to avoid negative impacts to the existing transportation network. The proposed Dobson Road Bridges project improvements will accommodate the 2030 design year traffic volumes, and provide three reliable, all-weather crossings of the Salt River during flow events that currently interrupt traffic.

3.9 Traffic Study Appendix Information

The entirety of the traffic study, including existing and future peak hour volumes, LOS analysis, and recommended minimum storage lane lengths details is included in Appendix A Traffic.

4 DESIGN CRITERIA

4.1 Roadway

Construction of all roads presented in this DCR will conform to MCDOT design criteria. The standard MCDOT typical section used for the concept design and a summary of the major features for the proposed roadways can be found in Table 4.1 in Appendix B, Design Criteria. Attached in Appendix K are the typical sections for the project.

The four proposed roadway improvements are for Dobson Road from SR202 to McKellips Road, McKellips Road from SR101 to Alma School Road, McKellips Road from Alma School Road to SR202, and for Gilbert Road from Thomas Road to SR87.

Currently, Dobson Road does not cross the Salt River and ends at a full interchange with SR202, even though the north leg of Dobson Road has not yet been constructed. The proposed roadway will include a bridge to span the Salt River and a roadway north of the river that ties into McKellips Road. Seven alternatives (D1, D1a, D1b, D2, D2a, D3, and D3a) were evaluated for the best connection with McKellips Road. Each alternative would consist of a six-lane urban section with raised median and sidewalks. Profiles for each selected alternative can be found in Appendix K.

McKellips Road between SR101 and Alma School Road is currently a four-lane undivided rural road. The proposed improvements will make this stretch of McKellips Road a six-lane road with a raised median and sidewalks as per MCDOT's Urban Principal Arterial Road section. There will be new pavement throughout. Alternatives for widening either to the north or to the south or equally on both sides were considered.

The Cities of Mesa and Tempe are currently developing plans to continue the shared use path along the Salt River south bank from Tempe into Mesa. The initial concept was to have the trail obtain access through the COM maintenance tunnel west of Dobson Road. However, this future phase will also likely have access at grade at the Dobson/SR 202L interchange. As the Dobson Road Bridge and the shared use path plans develop, they should be closely coordinated.

The existing McKellips Road crossing at the Salt River between Alma School Road and SR202 is a four-lane at-grade crossing. A new bridge and adjacent roadway will replace the current crossing with a six-lane roadway. A paved center turn lane will be included for the entire stretch of roadway and on the bridge. The bridge will span the river between the bank protection structures proposed for the north and south banks of the river. The locations of these improvements are shown in three alternatives (M1, M2 and M3). The roadway profile will match existing just east of the Alma School Road intersection and tie-in to the existing grade just west of the SR202 intersection. Widening will continue through to SR202L in order to continue the six-lane width into the existing roadway section.

Gilbert Road has been widened between SR202 and Thomas Road. The existing roadway south of Thomas Road in this section is a six-lane urban section with a paved center turn lane. North of Thomas, Gilbert Road splits into two separate two-lane roadways. Until a washout in the winter of 2007/2008, the northbound lanes continued at grade across the Salt River while the southbound lanes used the existing bridge crossing. Currently, northbound and southbound use the existing two-lane bridge. The project ends at SR87, with through traffic going north to the landfill. The proposed improvements would create a single six-lane roadway and a new larger bridge crossing. The new roadway will require minor modifications to the Thomas Road intersection on the north side. The three alternatives discussed in this report evaluate the location of the new road north of Thomas to SR87 (G1, G2 and G3). One alternative would construct the bridge between the existing bridge and the low flow crossing. The other alternatives would be located either over the existing bridge or the low flow crossing.

4.2 Intersections/Cross Streets

The paved streets that intersect Dobson Road within the project limits are the SR202 (Red Mountain) Freeway and McKellips Road, classified as a Principal Arterial.

The paved streets that intersect McKellips Road within the project limits are the SR101 Freeway; 92nd Street, classified as a Local Street; Dobson Road, classified as a Minor Arterial north of McKellips Road and a Principal Arterial south of SR202; Longmore Road, classified as a Minor Arterial; Alma School Road, classified as a Principal Arterial; and the SR202 (Red Mountain) Freeway.

The paved streets that intersect Gilbert Road within the project limits are Thomas Road, classified as a Minor Arterial, and SR87 (the Beeline Highway).

4.3 Pedestrian, Bicycle and Equestrian Facilities

MCDOT facilities in urban areas typically include provisions for pedestrian and bicycle access along each side of a roadway or bridge. For pedestrians, the typical section for an Urban Minor Arterial provides a 5-foot paved sidewalk physically separated from the roadway by 7 feet and a raised curb. On a bridge, the sidewalk is widened to 6 feet, located adjacent to the roadway, and separated from the roadway by a traffic barrier 2½ feet high. Bicyclists are provided a 5½-foot striped and signed travel way along the paved shoulder adjacent to the outside curb/barrier. Coordination of pedestrian and bicycle facilities will be required between several agencies: MCDOT, SRP-MIC and the City of Mesa.

4.4 Utilities

The Salt River is a major utility corridor throughout the Phoenix metropolitan area. Overhead and buried power lines cross the project area north-south and east-west. There are also storm drains, sewer lines, water transmission and distribution lines, irrigation pipes, reclaimed waterlines, natural gas lines, cable and telephone conduits, and street lights and traffic signal lights in the project area. Some of these utilities will require relocation, depending on the alternatives that are eventually selected for construction.

Further information about utilities in the project area is provided in Chapter 16 of this DCR. Each alternative alignment was evaluated for its potential effect on utilities.

5 DRAINAGE INFORMATION

5.1 General

This section documents the hydraulic study and bridge scour analyses regarding the three proposed bridges over the Salt River at Dobson Road, McKellips Road and Gilbert Road. The on-site pavement drainage of the proposed two-mile widening improvements of McKellips Road is also included.

The Salt River bridge hydraulic analysis was performed with HEC-RAS (Hydraulic Engineering Center River Analysis System) Software, developed by the USACE (United States Army Corps of Engineers). Several models were prepared based on different data sources as explained in the details of Section 5.3, "Bridge Hydraulics." Additional evaluation was conducted using the Finite Element Surface Water Modeling System (*FESWMS*) 2-D (two dimensional) model, developed by the Federal Highway Administration (FHWA), and integrated within the Surface Water Modeling System (SMS) software. The results of the hydraulic study and scour analyses were used as part of the bridges length and foundation design analyses. The study area and the location of the three bridge sites are displayed on Figure C-1., "Project Location Map" in Appendix C.

As shown in Figure C-1., "Project Location Map" in Appendix C, this project reach of the Salt River has an on-going history of large-scale sand and gravel mining operations. Although the most significant current mining activities are located outside of the main channel in the overbank area and separated from the main channel by levees, some mining activities continue within the main channel, particularly, downstream of the Gilbert Road Bridge. This particular location is critical, since there are some mining pits within a relatively short distance from the proposed Gilbert Road Bridge. The scour depth analysis at this location will include pit scour and head-cutting/tail-cutting assessment to account for potential impacts from these mining pits.

5.2 Hydrology

USACE completed a hydrologic evaluation of water control plans for the modified Roosevelt Dam in 1996 and documented the study results in the report titled "Gila River Basin, Arizona, Section 7 Study for Modified Roosevelt Dam, Arizona, Hydrological Evaluation of Water Control Plans, Salt River Project to Gila River at Gillespie Dam". The USACE report documents the estimated peak discharges for different return periods at selected locations for two situations: 1) *with the dam modification project* (will be referred as *post-Roosevelt*) and 2) *without the dam modification project* (will be referred as *pre-Roosevelt*). Table C-1., "Discharge Frequency Values from USACE Section 7 Study, Peak Discharges (ft^3/sec) in Salt River, Recommended Plan (P6OP2) Versus W/O Project" in Appendix C, lists the peak discharges for different flood frequencies with and without the dam modification project.

The consequential FEMA (Federal Emergency Management Agency) study, completed in 1999, adopted the post-Roosevelt peak discharges for the floodplain delineation of both the Salt River and Gila River. However, the hydraulics and sedimentation reports for the Red Mountain Freeway and the Salt River bank protection design, prepared for ADOT (Arizona Department of Transportation) between 1994 and 1996, used the pre-Roosevelt 100-year peak discharge of 220,000 cfs, which was adopted by the previous (1993) FEMA study since the Roosevelt Dam Project had not yet been completed.

The Roosevelt Dam Project is now complete. Consequently, the 100-year post-Roosevelt peak discharge will be used for the design of the bridges, and the 500-year post-Roosevelt peak discharge will be used as the extreme event for scour and bridge stability modeling for this project. The peak discharges used in this project are tabulated in Table C-2., "Design Peak Discharges used in HEC-RAS Models for Bridge Hydraulics" in Appendix C.

5.3 Bridge Hydraulics

The Salt River bridge hydraulic study was conducted using the HEC-RAS modeling, which was further supplemented with a 2-D model using the FESWMS under the SMS environment. The results of the hydraulic study provided key hydraulic parameters for the scour analyses. Both the hydraulic study and the scour analyses were used for the bridge length and foundation design analysis.

5.3.1 Topography

Two sets of topographical information were used in the hydraulic study. The first, Table C-1., "Discharge Frequency Values from USACE Section 7 Study, Peak Discharges (ft^3/s) in Salt River, Recommended Plan (P6OP2) Versus W/O Project" in Appendix C, was the current FEMA model provided by FCDMC, which includes topographical information from three separate time frames: 1991-92, 1993 and 1997. The vertical control for the 4-foot contour interval mapping is NGVD29 (National Geodetic Vertical Datum of 1929). The second set of topographic information, Table C-2., "Design Peak Discharges used in HEC-RAS Models for Bridge Hydraulics" in Appendix C, is from a 10-Foot Contour DTM (Digital Terrain Map), the countywide 10-Foot Contour mapping (flight date: 2000 to 2001), which was provided by FCDMC (Flood Control Division of Maricopa County). The vertical control for the 10-Foot Contour DTM is NAVD88 (North American Vertical Datum of 1988). Additionally there is a 2007 survey involving data points for this project. However, it covers only localized areas around the three bridge sites.

The two topographies were compared by converting the 2001 10-Foot Contour DTM from NAVD 88 to NGVD 29. During the comparison work, it was discovered that the two topographies generally have up to 4 feet of difference. The 10-Foot Contour DTM elevations are typically higher than those used in the FEMA model covering the river and floodplain area and there appear to be no obvious, apparent reasons for this discrepancy.

Nevertheless, during a subsequent meeting with FCDMC, it was decided that both topography information sets should be utilized for the project. The HEC-RAS modeling will continue using the modified FEMA model to determine the impacts of the bridges on the FEMA floodplains, and the 2-D modeling and HEC-RAS modeling for the bridge design would be based upon the 10-Foot contour DTM.

5.3.2 HEC-RAS Modeling

The water surface profiles were created using the HEC-RAS computer program, Version 3.1.2, developed by the USACE. The purposes of the HEC-RAS modeling for the three proposed bridges are to:

- Evaluate the impacts of the proposed bridges on the FEMA base flood elevations,
- Evaluate different bridge strategy alternatives and associated construction work such as closing the south channel of the Salt River at the McKellips Road Bridge, and
- Provide effective and accurate hydraulic parameters for the bridge scour analyses.

Several HEC-RAS models were developed and/or modified to obtain water surface elevations and other hydraulic parameters for both the 100-year and 500-year flood events under each of the situations presented in Table C-3., "Different HEC-RAS Models Adopted for this Study" in Appendix C.

5.3.3 Modification of FEMA Model for Existing Condition

A base HEC-RAS model, referred to as MFE (Modified FEMA Existing), as shown in Table C-4., "Comparison between Modified FEMA Existing Model and Original FEMA Model" in Appendix C, was set up by modifying the original FEMA 1999 HEC-RAS model to incorporate the existing structures not shown in the initial FEMA model. Split flow modeling was performed to determine the peak discharges for the Salt River north and south channels at Alma School Road for all the flow events modeled in this project. The roughness coefficient was modified for some of the local areas based on field visit evaluations. Ineffective flow areas were modified to accommodate higher water surface elevations caused by peak discharges greater than the 100-year post Roosevelt discharge.

5.3.3.1 Combine FEMA Reach 4 and Reach 5 Models

The FEMA 1999 HEC-RAS model Reach 4 begins at Cross Section 214.14 and ends at Cross Section 225.30. Reach 5 begins at Cross Section 225.30 and ends at Cross Section 237.65. Although all three proposed bridge sites are found within Reach 5, the proposed Dobson Road Bridge will be situated just upstream of the most downstream cross-section of Reach 5. To ensure that the hydraulic conditions were correctly modeled at Dobson Road Bridge, the two separate reaches were combined into a single reach.

5.3.3.2 North Bank and Alma School Road Grade Control Structure

The FEMA 1999 HEC-RAS model does not include the existing North CSA (Cement Stabilized Alluvium) Bank (hard bank) from the Pima Freeway to a location approximately 2,800 feet west of the Alma School Road Bridge, nor does it include a CSA grade control structure at the Alma School Road Bridge. Both the hard bank and the grade control structure were constructed after the FEMA study. Accordingly, a base HEC-RAS model was made by modifying the FEMA HEC-RAS model. This modification included adding the North CSA Bank, based on as-built information obtained from the SRP-MIC (Salt River Pima-Maricopa Indian Community), and the Alma School Road Bridge grade control structure, based on as-built information obtained from MCDOT (Maricopa Department of Transportation). The levee option in HEC-RAS was used to ensure that flows were limited to discharges within the confines of the embankment unless they happened to overtop the levee.

5.3.3.3 Split Flow Modeling

A significant flow split regularly occurs at the existing McKellips Road at-grade crossing of the Salt River. The flow splits out of the main flow channel into a much smaller channel and travels for a distance of about 4,000 feet before rejoining the main flow channel. The main flow channel is referred to in this project as the North Channel, and correspondingly, the smaller channel that flows south of the main channel is referred as the South Channel. The 1999 FEMA study performed split flow modeling using an energy-balance based method. The flows in the split were considered balanced when the calculated differences between the energy grade elevations at the two upstream cross-sections of the two channels was less than 0.1 feet. The FEMA study determined that under a post-Roosevelt 100-year peak discharge of 172,000 cfs, the flow that splits into the South Channel would be 16,000 cfs, and the flow remaining in the North Channel would be 156,000 cfs.

What occurs at each of these points could change the flow split condition, consequently, changing the peak discharge at each channel. As a result, the flow split was remodeled in this project using HEC-RAS with the same energy-balance based method. The tolerance of energy balance used is HEC-RAS's default value of 0.02 feet.

Although a CSA hard bank is proposed as a part of this project to close the flow to the South Channel and divert all flow to the North Channel, the split flow analysis was performed primarily to determine the impact of closing the South Channel on the water surface elevation. Consequently, it was found that an insignificant rise to the water level in the Salt River had occurred upstream.

5.3.3.4 Roughness Coefficient

The roughness coefficients (Manning's "n" values) for this reach of the Salt River were obtained from the FEMA study. Downstream of the Dobson Road Bridge site, the representative values are 0.03 to 0.035 for the main channel and 0.035 to 0.05 for the floodplain areas. Upstream of the Dobson Road Bridge site, the representative values are 0.028 for the main channel, and 0.032 to 0.043 for the floodplain areas. The Manning's "n" value will be re-evaluated, based on the growth of heavier vegetation at some points throughout the river section.

5.3.3.5 Boundary Condition

The dominant fluid regime of the Salt River is sub-critical water flow. Downstream boundary conditions were necessary to establish the starting water surface elevations of the river system. The FEMA boundary condition of a known water surface elevation at the downstream end of Reach 4 was adopted as the boundary condition for the pre-Roosevelt 100-year discharge modeling. For the other design discharges mentioned in Section 5.2, "Hydrology," the boundary water surface elevations were estimated using a simplified method by assuming that the flows are at their normal depths for all of the proposed bridges.

5.3.3.6 Ineffective Flow Areas

Ineffective flow areas modeled in the original FEMA model were revised to accommodate a higher pre-Roosevelt flow condition used for the Dobson Road Bridge modeling and the 500-year peak discharges.

5.3.3.7 Water Surface Profile Comparison

The HEC-RAS results for the modified FEMA model were obtained for post-Roosevelt conditions and for both the 100- and 500-year peak discharges. Detailed HEC-RAS results for the modified FEMA model are included in Appendix C.

For the post-Roosevelt 100-year peak discharge, water surface elevations obtained from the modified FEMA model are generally higher than the base flood elevations from the original FEMA model. The maximum increase of water surface elevation is 1.62 feet at Cross Section 225.73, which is about 2,000 feet upstream of the proposed Dobson Road Bridge. Table C-4., "Comparison between Modified FEMA Existing Model and Original FEMA Model" in Appendix C, presents the comparison results at the proposed bridges and at the existing Alma School Road Bridges.

At the Dobson Road Bridge location, the water surface elevations from the modified model rise about 1 foot above the FEMA base flood elevations. The increase in water surface elevation is caused by the addition of the existing north bank, which is located within the active floodplain area.

The proposed McKellips Bridge will cross the north channel of the Salt River diagonally. At this bridge, the water surface elevations rise 0.66 feet to 0.95 feet from the upstream to the downstream end, due to the impacts of adding the north bank, as well as the Alma School Road grade control structure.

The impacts of adding the north bank and the grade control structure on the existing Alma School Road Bridge were closely examined, because the water surface elevation at this bridge is critical to the proposed closure of the south channel. By adding the north bank and the grade control structure, the water surface elevation at the bridge is raised approximately 0.9 feet.

The change in the post-Roosevelt 100-year water surface elevation at Gilbert Road Bridge, which is caused by the previously mentioned modifications to the FEMA model, is insignificant.

5.3.4 Development of the HEC-RAS Model from the 10-Foot Contour DTM

As discussed in Section 5.3.1, "Topography," the 2001 10-Foot Contour DTM for the Salt River, obtained from FCDMC, is generally 2 to 4 feet higher than the topography used in the FEMA model in the river and floodplain area. It was decided during a coordination meeting with FCDMC held on March 6th, 2007 that the HEC-RAS modeling for the bridge design would be based on the 10-foot Contour DTM, since it is the most recent overall topography available for the project at this time. The 10-Foot Contour information obtained from FCDMC covers the entire project area along the Salt River. To ensure that the 10-Foot Contour DTM model is comparable with the Modified FEMA model, the following procedure was used.

Developing the new model starts with the cutting the cross-sections based on the 10-Foot Contour DTM, using the same cross-section locations as those used in the original FEMA model. After obtaining new cross-section data, the modified FEMA model is revised by replacing the FEMA cross-section ground data with the new cross-section data and keeping all other parameters such as the Manning's "n" value, bridge data, levee data and ineffective flow area data unchanged. Since the two topographies use different datum, namely NGVD29 and NAVD88, the new cross-sections that were cut using the 10-Foot Contour DTM were converted to NGVD29 datum by subtracting 1.8 feet before the replacement, so comparisons between bridges and other data used in the modified FEMA model would be possible.

Because the two models have significant differences, even after the datum conversion, an effort was made by Parsons to improve the consistency of the data and to make it more consistently comparable with recent 2007 Project Survey Data points. This was achieved by comparing several common points between the 10-Foot Contour DTM and the Project DTM resulting in an adjustment factor of 3.73 ft to be subtracted from the 10-Foot Contour DTM so that it would match the Project survey data. The final step was to add the 2007 Project Survey data to the adjusted combined data and replace the older data at the bridge locations. The final result is a single set of consistent topographic data with a NAVD29 datum, which will be referred to as the *Final Combined Topographic Data*. The *Final Combined Topographic Data* was used in the analysis of Gilbert Road length determination by running several scenarios with different Bridge lengths in order to select an appropriate and cost-effective Bridge length without significant changes in the water surface elevation upstream and downstream the Bridge.

5.3.5 Impacts of the Proposed Bridges and Related Construction

As described earlier in Section 5.3.2, "HEC-RAS Modeling," the MFE Model represents the addition of the existing condition that was not shown in the original FEMA model. Consequently, the MFE model will be adopted as the *basis* for evaluating the effect of the proposed bridges and related construction such as closure of the south channel on the water surface elevations.

5.3.5.1 Dobson Road Bridge

The MFP (Modified FEMA Proposed) HEC-RAS model was developed from the MFE model. The model included the proposed Dobson Road Bridge. The results were compared to the MFE model's results. Table C-5., "Comparison of Conditions with and without Dobson Road Bridge," in Appendix C, shows the water surface elevation comparison at the cross-sections upstream of Dobson Road Bridge for the post-Roosevelt 100-year peak discharge conditions As can be seen from the table and based on HEC-RAS modeling, the Dobson Road Bridge would have no significant impacts on the water surface elevations.

5.3.5.2 Closure of the South Channel

The closure of the south channel of the Salt River at the proposed McKellips Road Bridge was also modeled in the MFP Model, and the results were compared with those of the MFE model. Table C-6., "Comparison of Conditions with and without Closure of the South Channel," in Appendix C, shows the water surface elevation comparison at the cross-sections of the proposed McKellips Road Bridge and the existing Alma School Road Bridge for the post-Roosevelt 100-year peak discharge condition.

Due to the closure of the south channel at the proposed McKellips Road Bridge pier locations, the water surface would rise by approximately 1 foot. On the other hand, at the upstream face cross-section of the existing Alma School Road Bridge, the closure of the south channel will cause the water surface elevation to rise by 0.47 feet to reach an elevation of 1199.56 feet. Since the bridge's low cord elevation at the north abutment is about 1201.10 feet, a freeboard elevation of 1.54 feet will be realized at that location.

5.3.5.3 McKellips Road Bridge

In addition to the closure of the south channel in the MFP HEC-RAS model, the proposed McKellips Road Bridge was developed. The results of this model were compared with the results of the MFE model. Table C-7., "Impacts of Constructing McKellips Road Bridge and Closing the South Channel," in Appendix C, shows the water surface elevation comparison at the proposed McKellips Road Bridge pier locations for the post-Roosevelt 100-year peak discharge condition.

5.3.5.4 Gilbert Road Bridge

The proposed Gilbert Road Bridge would be about 400 feet longer than the existing bridge with a length of 1684 feet. The existing Bridge north abutment will be removed to provide a wider Salt River flow channel under the new Bridge. It is anticipated that this channelization will continue downstream of the new Bridge with the installation of a dyke on the north side to separate the main channel from the current mining activities. However, the future channelization and/or dyke installation have not been included in this project, and the most current conditions of the channel bed downstream of the proposed Gilbert Road Bridge were represented by using the 2007 DTM topographic data of the project site. This data was incorporated into the 10-FTP model to obtain what is referred to as the Gilbert Road Proposed Bridge Model (GRPB) based on the Final Combined Topographic Data as explained in Section 5.3.4. Several different lengths of the Gilbert Road Bridge were considered to minimize the impact of the proposed new bridge on the water surface elevation upstream of the structure. The GRPB HEC-RAS model includes also a proposed grading on the downstream side of the bridge. The results of this model were compared with the results of the MFE model. Table C-8., "Conditions before and after Construction of the Proposed Gilbert Road Bridge," in Appendix C, shows the water surface elevation comparison at the proposed Gilbert Road Bridge location for the post-Roosevelt 100-year peak discharge. As can be seen from Table C-8, there will be a drop in the water surface elevations, both upstream and downstream of the proposed Gilbert Road Bridge, when compared to the existing conditions of the MFE model.

5.3.6 Two Dimensional (2-D) Modeling

Two-dimensional modeling was conducted to supplement the bridge hydraulic study by using the Finite Element Surface Water Modeling System (FESWMS) developed by the Federal Highway Administration (FHWA), which was run under the Surface Water Modeling System (SMS) environment. The FESWMS package include the FST2DH (Flow and Sediment Transport) module Version 3.2.2, which is a two-dimensional finite element surface water computer program that can compute the direction of flow and water surface elevations in a horizontal plane. FST2DH has the ability to model hydraulic structures including bridges, culverts, weirs, roadway embankments, and drop-inlet spillways.

FST2DH simulates the movement of water and non-cohesive sediments in rivers, estuaries, and coastal waters by applying the Galerkin finite element method to solve steady-state or time-dependent systems of differential equations that describe two-dimensional depth-averaged surface-water flow and sediment transport.

The SMS (Version 9.2) was used as a Graphical User Interface (GUI) for pre- and post-processing of the FESWMS data/results.

The 2-D models were developed for the 100-year post-Roosevelt discharge to obtain the water surface elevation and velocity distribution, based upon use of the following:

- 10-Foot Contour DTM obtained from FCDMC;
- HEC-RAS water surface elevations at the downstream limits of the 2D models as the boundary condition;
- Same consistent flow rate in the HEC-RAS model as the upstream boundary condition;
- Applied a slip condition to the bank boundary.

The 2-D models were created for the three proposed bridges at their corresponding locations. As the computer time required for the 2-D modeling is relatively long, the models were set up separately, one model for each bridge. Thus, three models were developed. The 2-D modeling and comparison with HEC-RAS results are also presented below to help understand the differences between the two models.

5.3.6.1 Dobson Road Bridge

The proposed 2-D modeling area for the Dobson Road Bridge spans from HEC-RAS River Sta. 225.00 to Sta. 225.63 and includes 8,019 elements and 26,303 nodes as its mesh system. Generally, the size of the elements is about 50 ft x 50 ft, but for the area around the bridge, the mesh is much denser and the general size of the element is 10 ft x 10 ft. Figure C-2., "Dobson Road Bridge, System Mesh Map," in Appendix C, presents the 2-D element mesh system created for the Dobson Road Bridge. This mesh system shows the 2-D modeling area, element shape, sizes, distributions and the boundary conditions. The topographic, bed material and hydraulic features are assigned to each element. The hydraulic results include water surface elevations and velocity vectors, which were calculated for all of the nodes.

A downstream water surface elevation of 1179.64 was entered based on HEC-RAS model results at the same location. The discharge used for this model was the post-Roosevelt 100-year discharge of 172,000 cfs. The computation starts from an initial water surface elevation provided by the modeler at the downstream boundary and then gradually proceeds until convergence takes place and all boundary conditions are met.

Figure C-3., "Dobson Road Bridge, Water Surface Elevation Map," in Appendix C, provides graphic 2-D modeling results of water surface elevations. The water surface elevation is illustrated with different colors ranging from blue to red, red representing the highest water surface elevation. Boundaries of the color ranges are also shown in a legend on the figure.

Figure C-4., "Dobson Road Bridge, Water Depth Map," in Appendix C, presents graphic water depths that are illustrated in color with contours. The graph shows that the general water depth at the Dobson Road Bridge location is about 20 feet. There is also a local low area just downstream of the proposed bridge location, which has a water depth that is deeper than 30 feet.

Figure C-5., "Dobson Road Bridge, Velocity Map," in Appendix C, is a velocity distribution map. Velocity vectors are illustrated with arrow and in color with contours. The graph shows that the flow squeezes through the individual bridge piers. It also displays how the water velocity increases between the piers and decreases around the sides of the piers.

Table C-9., "Comparison between the HEC-RAS Modeling and 2-D Modeling for Dobson Road Bridge," in Appendix C, presents a comparison of the 2-D modeling results with HEC-RAS results at three cross section locations. Due to its inherent feature of one-dimensional modeling, HEC-RAS modeling can only provide one water surface elevation at each cross-section, while the 2-D modeling program is able to provide water surface elevation changes along an entire cross-section. The table shows that water surface elevations along the south bank are approximately 0.2 feet higher than those along the north bank near the bridge location, where a river bend can be observed from the maps. The higher water surface elevation can be explained as the water's super-elevation along the outside bend of the river. The super-elevation caused by the river bend should be accounted for in the design of the bridge deck profile.

As illustrated in Table C-9., "Comparison between the HEC-RAS Modeling and 2-D Modeling for Dobson Road Bridge," in Appendix C, at the downstream boundary of the 2-D modeling, the water surface elevations for both models is the same. At the cross-section immediately downstream of the bridge, the water surface elevation resulting from using the 2-D model is slightly lower than that obtained using the modified FEMA model. The difference between the 2-D model water surface and the modified FEMA model water surface elevation ranges from 0.05 to 0.36 feet. However, at the cross-section upstream of the bridge, the water surface obtained using the 2-D model is significantly higher than that obtained using the modified FEMA model. The difference between the 2-D model water surface and the modified FEMA model water surface elevation ranges from 0.42 to 0.56 feet. The elevation differences show that the 2-D modeling considers higher energy or momentum loss through the bridge.

At the most upstream cross-section of the 2-D modeling, the water surface elevation of the 2-D model is again much higher than that found in the HEC-RAS results. By closely examining the 2-D water surface elevation map, we could discover that the local higher elevation at the north bank could be caused by a local uneven ground and river boundary condition, which would create energy loss and momentum loss.

The velocity obtained using the 2-D model seems to be much higher than that obtained using the HEC-RAS model. At the cross-section downstream of the bridge, the difference in velocity ranges from 1.26 to 4.34 ft/s. At the cross-sections upstream of the bridge, the difference between the 2-D model and the modified FEMA model velocities becomes smaller.

5.3.6.2 McKellips Road Bridge

The proposed 2-D modeling area for the McKellips Dobson Road Bridge spans from HEC-RAS River Sta. 226.79 to Sta. 227.17 and includes 10,518 elements and 26,943 nodes as its mesh system. Generally, the size of the elements is about 50 ft X 50 ft, but for the area around the bridge, the mesh is much denser and the general size of the element is 10 ft X 10 ft. Figure C-6., "McKellips Road Bridge, System Mesh Map" in Appendix C, presents the 2-D element mesh system created for McKellips Road Bridge. This mesh system shows the 2-D modeling area, element shape, sizes, distributions and the boundary conditions. The topographic, bed material and hydraulic features are assigned to each element. The hydraulic results include water surface elevations and velocity vectors will be calculated for all of the nodes.

The downstream water surface elevation of 1203.72 is input based on HEC-RAS model results at the same location. The discharge used for this model is the post-Roosevelt 100-Year discharge of 172,000 cfs. The computation starts from an initial water surface elevation provided by the modeler at the downstream boundary and then it will be gradually adjusted to meet the set downstream boundary condition.

Figure C-7., McKellips Road Bridge, Water Surface Elevation Map" in Appendix C, provides graphic 2-D modeling results of water surface elevations. The water surface elevation is illustrated with different colors ranging from blue to red with red representing the highest water surface elevation. Boundaries of the color ranges are also shown in the figure.

Figure C-8., "McKellips Road Bridge, Water Depth Map" in Appendix C, presents graphic water depths that are illustrated in color with contours. The graph shows that the general water depth at the McKellips Road Bridge location is approximately 15 feet.

Figure C-9., "McKellips Road Bridge, Velocity Map" in Appendix C, is a velocity distribution map. Velocity vectors are illustrated with arrow and in color with contours. The graph shows that the flow squeezes through the piers. The velocity increases between the piers and decreases around the piers.

Table C-10., "Comparison between HEC-RAS Modeling and 2-D Modeling for McKellips Road Bridge" in Appendix C, presents a comparison of the 2-D modeling results with HEC-RAS results at three cross-section locations. Due to its inherent feature of one-dimensional modeling, HEC-RAS modeling could only provide one water surface elevation at each cross-section, while the 2-D modeling is able to provide water surface elevation changes along a cross-section.

5.4 Bridge Scour

Bridge scour analysis was performed for the three proposed bridges to provide information on the bridge's foundation design. The scour depths were estimated for both the 100-year and 500-year flow events. The post-Roosevelt peak discharges were adopted for the hydraulic study of the three bridges as required by the Flood Control District of Maricopa County.

The bridge's local scour estimate basically follows the 2001 FHWA HEC No.18 procedure, and the general scour estimate followed the U.S. Department of the Interior Bureau of Reclamation Technical Guideline for Computing Degradation and Local Scour. The Draft Drainage Design Manual for Maricopa County, Chapter 11-Sedimentation, was referenced throughout the scour analysis process to make sure that the procedures used comply with the County's requirements.

The following components of vertical incisement of the channel bed were considered for the total scour:

1. Long-term degradation of the river bed (Z_{deg});
2. General scour for a specific reach of the river (Z_{gs});
3. Scour induced due to a bend in the river (Z_{bs});
4. Local scour - pier and abutment scour (Z_{ls});
5. Bed-form trough depth (Z_{bf});
6. Scour due to low-flow incisement (Z_{lf}).

$$Z_{Tot} = Z_{ls} + FS\ (Z_{deg} + Z_{gs} + Z_{bs} + Z_{bf} + Z_{lf})$$

Where, FS is a safety factor for non-local scour components

5.4.1 Bridge Scour Equations

The General Scour and the Local Bridge Scour and their equations are discussed in the following sections. Other components of the Total Scour will be discussed separately for each Bridge.

5.4.1.1 *General Scour*

General or mainly "Contraction" Scour occurs when the flow area of a stream at flood stage is reduced, either by a natural contraction of the stream channel or by a Bridge. The contraction of flow at a bridge can be caused by either a natural decrease in flow area of the stream channel or by abutments projecting into the channel and/or piers blocking a portion of the flow area. Contraction can also be caused by the approaches to a bridge cutting off floodplain flow. There are some other general scour causes as documented in HEC-18.

The General Scour was estimated by computing the average of three regime equations, namely, the Blench Zero Bed-Sediment Transport Equation, Eq. (2), Lacy Equation, Eq. (3) and Neill Equation, Eq. (4) as displayed in Appendix C. This method was developed by the US Bureau of Reclamation and it provides a multipurpose approach for estimating depths of scour due to bends, piers, grade-control structures and vertical rock banks or walls.

When floating debris is lodged on the pier, the effect of the debris in increasing scour depths is taken into account by adding a width, W_d, to the sides and front of the pier. Two scenarios were considered:

(1) No debris, i.e. $W_d = 0$

(2) Debris width is 2 feet on each side of the pier, i.e. $W_d = 4$ feet, and lodged up to the top 12 ft of the pier length based on the ADOT Bridge Design Guidelines.

Figure C-10, "Impact of Debris on Local Pier Scour" in Appendix C, a) No Debris, b) Debris lodged to the whole depth V1 and c) Debris lodged to the top 12 ft only, shows three schematics of possible river flow scenarios. For each bridge, the most appropriate scenario was selected based on the geometric and hydraulic conditions and/or the Flood Control District of Maricopa County recommendations.

5.4.1.2 *Impact of Debris on Local Pier Scour*

Debris lodged on a pier can increase local scour at the pier. The debris may increase pier width and deflect a component of flow downward. This increases the transport of sediment out of the scour hole.

5.4.2 *Scour at Dobson Road Bridge*

The bridge at Dobson Road is curved. It was assumed that there would be 9 piers, each composed of three 10-foot columns aligned parallel to the flow direction, with 140 feet between each pier (net flow width). Alternative D3, as shown in Figure C-11, "Dobson Road Bridge" in Appendix C, was selected as the Recommended Preferred Alternative for the Salt River Bridge at Dobson Road. Cross sections just upstream and downstream of the Bridge location are shown in Figure C-12, a and b, "Upstream cross section at Dobson Road Bridge" and "Downstream cross section at Dobson Road Bridge" in Appendix C. Peak discharges after the Roosevelt Dam modifications were used for Dobson Road Bridge.

5.4.2.1 *Local Scour*

The Local Scour has been also calculated using a HEC-RAS built-in Scour Analysis routine. The computation of scour at bridges within HEC-RAS is based upon the methods outlined in the Hydraulic Engineering Circular No. 18 (HEC No. 18, FHWA, 2001), which uses the CSU's equation (Eq. 5) for the local scour calculations as explained before.

It should be mentioned that the local scour subroutine in HEC-RAS sets the K_3 value, a correction factor for the bed condition, to 1.10 for Clear Water computations. Accordingly, the Bed-form trough depth component can be disregarded when calculating the Total Scour depth.

5.4.2.2 *Long-Term Degradation*

Simons, Li & Associates, Inc. (SLA) conducted a sediment transport and scour analysis for the reach of the Salt River from Dobson Road to the Pima Freeway, and they published an equilibrium slope of 0.00047 ft/ft in the Hydraulic and Sediment Transport Analysis Report, Salt River Bank Protection Design, South Bank Upstream of Pima Freeway, Bank STA 33+00 to 73+00, April 1994. This equilibrium slope was pivoted about Grade Control #5, which is located just downstream of McClintock Drive, approximately 2.35 miles downstream of Dobson Road Bridge.

Using this equilibrium slope and the elevation of the existing grade control structure of 1151.95 feet, the ultimate elevation at Dobson Road Bridge was calculated to be 1157 feet, which is higher than the current minimum channel elevation of 1147.0 at Dobson Road Bridge's location. We therefore anticipate that there will not be any long-term scour occurring at the bridge location. In other words, Z_{deg}=0.

5.4.2.3 *General Scour and Bend Scour*

For the proposed Dobson Road Bridge, both General Scour and Bend Scour were computed using Equations (2), (3) and (4) presented in section 5.4.1.1., "General Scour." An average value of the results obtained from the three equations was calculated. The General Scour estimated for Dobson Road Bridge is 10.59 feet for the 100-year event, and 12.60 feet for the 500-year event.

5.4.2.4 *Bed-form Trough Depth*

Since the flow at Dobson Road Bridge is within Lower Regime Flow, the dune trough depth was estimated using the equation documented in the draft Drainage Design Manual for Maricopa County. The dune trough depth was estimated to be 1.3 feet for the 100-year flow event and 1.7 feet for the 500-year event.

5.4.2.5 *Local Scour at Piers*

The Pier's local scour has been calculated using HEC-RAS built-in scour Analysis routine and it was estimated as 14.7 ft for the 100-year flow event and 15.9 ft for the 500-year flow event.

5.4.2.6 *Local Scour at Abutments*

No abutments are planned for construction in the main channel of the Salt River at this time. Therefore, no local scour at abutments was calculated.

5.4.2.7 Low-Flow Incisement

The Flood Control District Maricopa County (FCDMC) recommended using 1.5 feet as the future low-flow incisement.

5.4.2.8 Total Scour Depth and Elevation

A safety factor of 1.3 was applied to the non-local scour components of the calculated total scour. The final total scour for Dobson Road Bridge was found to be 31 feet for the 100-year flow event and 35 feet for the 500-year flow event. Scour measurement should be counted from the bottom of the existing low-flow channel. As shown in Table C-13., "McKellips Road Bridge" in Appendix C, the scour elevation for the Dobson Road Bridge was set at 1118 ft (NAVD88) for the 100-year storm event and 1114 ft for the 500-year storm event.

5.4.3 Scour at McKellips Road Bridge

Alternative M1, as shown in Figure C-13., "McKellips Road Bridge" in Appendix C, was selected as the Recommended Preferred Alternative for the McKellips Road Bridge crossing of the Salt River. We assume that there are 8 piers groups, each of which is composed of three 10-foot columns aligned parallel to the flow direction, with 150 feet between each pier (net flow width). Peak discharges after the Roosevelt Dam modifications were used for calculations concerning McKellips Road Bridge. Since the proposed McKellips Bridge is a curved bridge with a skewed alignment, multiple cross-sections were cut along the piers column groups to represent the bridge in HEC-RAS model. Three cross-sections are shown in Figure C-14a., "Upstream Cross-section of the US Piers Group at McKellips Road Bridge," Figure C-14b., "Downstream Cross-section of the US Piers Group at McKellips Road Bridge," and in Figure C-14c., "Upstream Cross-section of the Middle Piers Group at McKellips Road Bridge" in Appendix C.

As can be seen from Figure C-14d., "Downstream Cross-section of the middle Piers Group at McKellips Road Bridge," Figure C-14e., "Upstream Cross-section of the DS Piers Group at McKellips Road Bridge," Figure C-14f., "Downstream Cross-section of the DS Piers Group at McKellips Road Bridge," in Appendix C, the Salt River at McKellips Road crossing has a comparatively uniform cross section with the lowest riverbed elevation at about 1187.20 ft, and the average bed elevation at this cross-section is about 1189.0 ft. The lowest channel bed elevation will be used to determine the scour elevation.

Note that no future lowering of the sand/gravel mining pits elevations which lie downstream of the bridge is anticipated, as the SRP-MIC will suspend mining activities* for Phase I of the project (between SR101/SR202 and McKellips Road) along the Salt River. However, any upstream mining activities within about 1000 feet upstream of the bridge may need to be suspended as well to mitigate possible tailcut from the upstream mining pits on the McKellips Bridge.

5.4.3.1 Long-Term Degradation

Downstream of McKellips Road, a grade control structure was constructed at Alma School Road to limit the impact of the sand and gravel mining downstream of the Alma School Road Bridge. The top elevation of the grade control structure is 1184.98 feet, which is about the same as the minimum channel elevation at the most upstream pier location of the McKellips Road Bridge. Therefore, we anticipate that there will not be any long-term scour occurring at this bridge location. In other words, $Z_{deg}=0$.

5.4.3.2 General Scour

The General Scour was calculated using equations (2), (3) and (4) presented in section 5.4. No significant contraction existed at the proposed bridge location, thus contraction scour is neglected at McKellips Road Bridge. The largest General Scour estimated for McKellips Road Bridge is at the most downstream piers at Sta. 226.835 with 8.4 feet for the 100-year event and 10.1 feet for the 500-year event.

5.4.3.3 Bed-form Trough Depth

Since the flow at McKellips Road Bridge is within Lower Regime Flow, the dune trough depth was estimated using the equation documented in the draft Drainage Design Manual for Maricopa County. The largest dune trough depth was estimated to be 0.32 foot for the 100-year flow event and 0.29 foot for the 500-year event at the piers at Sta. 226.835.

5.4.3.4 Local Scour

The Pier's local scour has been calculated using HEC-RAS built-in scour analysis routine and it was estimated as 24.58 ft for the 100-year flow event and 26.64 ft for the 500-year flow event.

5.4.3.5 Local Scour at Abutments

No abutments are planned to be constructed in the main channel of the Salt River at this time. Therefore, no local scour at abutments was calculated.

5.4.3.6 Bend Scour

There is no significant bend at this bridge.

5.4.3.7 Low-Flow Incisement

The Flood Control District of Maricopa County (FCDMC) recommended using 1.5 feet for the future low-flow incisement.

5.4.3.8 Total Scour Depth and Elevation

A safety factor of 1.3 was applied to the non-local scour components of the calculated total scour. The final total scour for McKellips Road Bridge was found to be 38 feet for the 100-year flow event and 42 feet for the 500-year flow event. Scour measurement should be counted from the bottom of the existing low-flow channel. As shown in Table C-12., "Summary Results for McKellips Road Bridge Scour Analysis" in Appendix C, the scour elevation for the McKellips Road Bridge was set at 1151 ft (NAVD88) for the 100-year storm event and 1147 ft for the 500-year storm event.

*Source: Based on a letter from SRP-MIC Council to USACE and City of Mesa, dated December 3, 2008.

5.4.4 *Scour at Gilbert Road Bridge*

Alternative G1, as shown in Figure C-15., "Gilbert Road Bridge" in Appendix C, was selected as the Recommended Preferred Alternative for the Salt River Bridge at Gilbert Road. Cross-sections just upstream and downstream of the Bridge location are shown in Figure C-16a., "Upstream Cross-section at Gilbert Road Bridge" and Figure C-16b., "Downstream Cross-section at Gilbert Road Bridge" in Appendix C.

The Salt River at this location has two defined channels, namely the North Channel and the South Channel as shown in Figure C-15. As can be seen from Figure C-16 a and b, the lowest channel bed elevation between upstream and downstream of the Bridge cross section is about 1227.0 ft, which is the elevation of the South Channel bottom. For the North Channel, the average bed elevation at this cross section is about 1242.0 ft. The lowest elevation of 1227 will be used to determine the scour elevation.

5.4.4.1 *Long-Term Degradation*

In view of the fact that the proposed Grade Control Structure at the downstream side of Gilbert Bridge may not be endorsed or may be constructed at some later time after the construction of the Bridge, an *additional arbitrary 10 ft* scour depth will be added to the Total Scour depth to account for any long–term degradation process that might take place in the Salt River bed, In other words, Z_{deg}=10 ft.

The 10 ft value was selected based on the results from HEC-6 Sediment transport Model for the Va Shly' Ay Akimel Salt River Ecosystem Restoration Project. This model has been prepared by JE Fuller for the US Army Corps of Engineers, May 2008. The model simulated the change of bed elevations over a 105 year period and it was found that at Gilbert road the Salt River bed would be lowered about 10 ft. Appendix C provides a graphical results for the HEC-6 Model results at Gilbert Road.

5.4.4.2 *General Scour*

For the proposed Gilbert Road Bridge, General scour was calculated by using Equations (2), (3) and (4) presented in section 5.4, "General Scour," as shown in Appendix C. An average value of the results obtained from the three equations was calculated. The estimated general scour for Gilbert Road Bridge was found to be 5.17 feet for the 100-year event, and 6.11 feet for the 500-year event.

5.4.4.3 *Bed-form Trough Depth*

Since the flow at Gilbert Road Bridge is within the lower regime flow, the dune trough depth was estimated using the equation documented in the draft Drainage Design Manual for Maricopa County. The dune trough depth was estimated to be 0.25 feet for both the 100-year and 500-year flow events.

5.4.4.4 *Local Scour at Piers*

As mentioned before the local scour was calculated according to equation (5) in Section 5.4 in Appendix C. As the flow depth is in the range of 12 ft, scenario (2) of adding 2 ft of debris on each side of the pier was adopted as explained in Appendix C. The computed scour depth at the piers was 30.26 feet for the 100-year peak discharge and 32.07 feet for the 500-year peak discharge.

5.4.4.5 *Local Scour at Abutments*

No abutments are planned for construction in the main channel of the Salt River at this time. No local scour at abutments was calculated.

5.4.4.6 *Bend Scour*

There is no significant bend present at this bridge.

5.4.4.7 *Low-Flow Incisement*

The Flood Control District of Maricopa County (FCDMC) recommended using 1.5 feet for future low-flow incisement.

5.4.4.8 *Pits Headcut/Tailcut Calculations*

Due to the fact that the Salt River within the project corridor has several mining activities, some of which are in the channel bed upstream and/or downstream of the proposed Bridges, pit scour analysis has become a concern for this project.

A pit scour analysis has been performed at Gilbert Road Bridge location using the Pit Scour 1.0.2 (Beta Version) developed by the Flood Control District of Maricopa County (FCDMC). This program uses the methodology developed by Simons & Li in 1989 for the Arizona Department of Transportation (ADOT) to calculate the profile of the mining pit's headcut/tailcut for both sand- and gravel-bed channels. The program requires pit's dimensions, inflow hydrograph and channel slope as inputs.

The following procedures were performed to calculate pit scour:

1. The inflow hydrograph was provided by the FCDMC that was taken directly from the HEC-6T model for the City of Phoenix, Tres Rios Wetlands project.
2. The hydrograph was scaled by multiplying its ordinates by a factor of 1.43 so that its peak discharge matches the FEMA 100-year flow rate of 175,000 cfs.
3. The input hydrograph was scaled by the pit width so as to only account for the amount of water that actually flows into the pit.
4. Pit dimensions were measured from a recent aerial photo as 536 ft long, 460 ft wide and about 50 ft deep. Pit side slopes were assumed as 3:2.
5. Channel slope downstream of Gilbert Road Bridge was calculated from HEC-RAS profile as 0.0024.

The program was run for the gravel-bed calculations and the output calculation is shown in Table C-13., "Summary Results for Pit Scour Analysis Downstream of Gilbert Road Bridge" in Appendix C. The pit headcut profile is shown in Figure C-17., "Pit Headcut Profile Downstream of Gilbert Road Bridge" in Appendix C.

The pit scour analysis results show that there will be a headcut with a length of approximately 230 ft with a corresponding depth of only 0.42 ft.

Additional assessment of the pit scour was conducted following the method presented by Chen 1980 in his report titled "Investigation of Gravel Mining Effects- Salt River Channelization Project at Sky Harbor International Airport". In this report Chen modified the physical model, which was constructed for evaluating the Salt River Channelization Project at Sky Harbor International Airport, to assess the gravel mining effects on the stability of the Salt River channelization system and the I-10 channel in the Salt River.

Chen developed several figures, which can be used as guidelines to locate and size gravel pits in the riverbed below the south levee. He also found that the pit size would affect the headcutting length but would not significantly affect headcutting depth and profile, as shown in Figure C-17., "Pit Headcut Profile Downstream of Gilbert Road Bridge" in Appendix C.

Although Chen's flow rates and experimental conditions were different than those of this project, his most pertinent experimental runs and results are summarized in Table C-14., "Summary Results for Pit Scour Analysis of Chen's Experimental Work 1980" in Appendix C, as guidelines.

Chen's physical model experiment shows that, for instance, a 40-foot deep pit with dimensions of 1000-foot X 500-foot and flow rate of 92,000 cfs would cause a headcutting of approximately 2000 feet in length. Surprisingly, the Pit Scour software would compute a headcut of only 260 ft long for the same experimental conditions and using the Tres Rios Wetlands project hydrograph after scaling it.

It appears that the headcut lengths computed from the Pit Scour software are much smaller than those measured from the figures developed by Chen 1980. To be on the conservative side and as recommended by the FCDMC, Chen's Chart will be used to estimate the headcut scour depth for this project.

Since the closest mining pit is about 1100 ft away from the Proposed Gilbert Road Bridge, and reading from the Chart in Figure C-18, "Pit Headcut Profile for Chen's Physical Model" in Appendix C, a value of approximately 9 ft can be estimated as the headcut depth at the Gilbert Road Bridge piers. This headcut scour depth will be added to the total scour at Gilbert Road Bridge.

5.4.4.9 Total Scour Depth and Elevation

Since the long-term scour and the pit headcut scour depths were estimated using conservative assumptions, no safety factor will be applied to them. However, a safety factor of 1.3 has been applied to the other non-local scour components of the calculated total scour. The final total scour for Gilbert Road Bridge is 47 feet for the 100-year flow event and 50 feet for the 500-year flow event. All Scour measurements should be counted from the bottom of the existing thalweg point in the cross section.

As shown in Table C-15, "Summary results for Gilbert Road Bridge Scour Analysis" in Appendix C, the scour elevation for the Gilbert Road Bridge was set at 1182 ft (NAVD88) for the 100-year storm event and 1179 feet for the 500-year storm event.

5.5 Pavement Drainage

5.5.1 General

The on-site (pavement) drainage system consists of a system of inlets such as catch basins, curb openings and scuppers located as necessary to meet the allowable spread criteria with pipes and downdrains/spillways to convey the flows to a drainage outfall.

Pavement drainage analysis and design has been performed along McKellips Road in the segment between Alma School Road and SR101L. The majority of the existing McKellips Road does not have curb and gutter and no storm drain system is installed. Only for a short segment of about 1000 feet west of Alma School Road, storm pipes were installed and drained to a 72-inch trunk pipe existing along Alma School Road.

As described in previous section, the Alternative MR1 was selected and recommended as the Preferred Alternative for the widening of McKellips Road between Alma School Road and the SR101 interchange with McKellips Road. This alternative involves widening both sides of the existing McKellips Road.

The pavement drainage design was also performed for the new roadway with alignment (D3), which is designed to connect the proposed Dobson Road Bridge with the existing 92nd Street. This new roadway will have a curb and gutter with a raised median.

A short segment along Gilbert Road just north of Thomas Road and the proposed Gilbert Road Bridge will be designed as a typical MCDOT urban section with curb & gutter.

5.5.2 Proposed On-site Drainage System

MAG curb inlets will be installed to collect gutter flow and carry it to the storm drain system. Pavement inlets are designed in accordance with the method outlined in the Drainage Design Manual for Maricopa County and MCDOT Roadway Design Manual. The Drainage Design Manual's procedures and equations are based on the Federal Highway Administration Hydraulic Engineering Circular No. 12 (HEC-12), Drainage of Highway Pavements (USDOT, FHWA, 1984).

5.5.2.1 Onsite Drainage Criteria

Drainage areas were determined utilizing the proposed roadway improvement plans for this project. At the time of this drainage analysis, the roadway data was generally at 40% level of completion. Assumptions to establish drainage areas were based on the best available information. Currently the drainage facilities for the roadway improvements are being designed with the following drainage criteria:

- The design storm is the storm associated with the governing return period for longitudinal street flow. Both 10-year and 100-year storm events need to be checked to determine which condition governs.
- Catch basin locations were selected such that flow depths in the gutter do not overtop the curb and/or are not allowed to pond more than one lane (Spread limit), while maintaining at least one dry lane in each direction for the 10-year storm, whichever controls. Roadway sag points utilize flanker inlets placed per FHWA criteria.

- Standard MAG catch basins and construction details were utilized where possible and inlet spacing was limited to a maximum of 660 feet.
- Curb openings were sized using a clogging factor of 0.8. Grated type openings are not utilized.
- Super elevation rollover locations or gore areas shall not release more than 0.2 cfs of sheet flow across the rollover or gore.
- Storm drain lateral connector pipes shall be 18-inches or greater.
- Storm drain trunk lines shall be 24-inches or greater.
- Manhole spacing shall be:
    - 300 ft or less for 30-inch pipe, and utilized at bends.
    - 400 ft or less for 30- to 48-inch pipe, and utilized at bends
    - 500 ft or less for 48- to 72-inch pipe, and utilized at bends.

In addition to the above criteria, any storm drain systems that discharge roadway drainage directly to the Salt River shall include a first flush basin or an oil/water separator structure to treat the first flush (1/2 inch of rain). This is to comply with the Arizona Department of Environmental Quality's (ADEQ) general permit, which dictates a predetermined Best Management Practices (BMPs). Primatech recommends that oil/water separator structures contain a "bypass" system to allow storm water flows in excess of the first flush to pass through the separator structure without causing excessive backwater.

5.5.2.2 Rational Method

The Rational Method is recommended for use with watersheds having a total area less than 160 acres. This method calculates peak runoff based on the basin size, a runoff coefficient, and storm intensity. The equation used with this method is:

$$Q = C\,I\,A$$

where:

Q	=	peak discharge of the return period in cfs
C	=	runoff coefficient based on land use and soil type
I	=	average rainfall intensity of the calculated rainfall duration for the selected rainfall return period, in inches/hour, and
A	=	watershed area, in acres

5.5.2.3 Storm Drain System Design

The Storm Drain System was designed with the aid of Manning's equation and applying loss coefficients to the velocity head at structures. XP-SWMM (Wastewater and Storm water Management Model) software was used to model the storm drain system. XP-SWMM allows each structure to be assigned a loss coefficient. Head loss coefficients for manholes and catch basins were assigned values using the FHWA HEC-22 recommended values, which are integrated within the software (typically 0.15 and 1, respectively). At minor bends and/or pipe collars, the loss coefficients were input directly and estimated to be about 0.02. Design details and supporting calculations sheets are provided in Appendix C.

See Figure C-19., "Schematic Diagram of the Storm Drain System" in Appendix C, along McKellips Road and the New Connector Road (Dobson Road). The drainage plans are integrated in the roadway 40% plans.

6 RIGHT-OF-WAY

MCDOT recommends an overall right-of-way width of 130 feet (65 feet on each side), symmetric to the roadway centerline for all Urban Arterial roads, and 150 feet (75 feet on each side) for all Rural Principal Arterial roads. The proposed improvements will be designed to meet these right-of-way widths. Along the deep cut areas on either side of the river, additional right-of-way may be required to accommodate cut limits. Building the guide banks and grade control structures in the river bed, as well as any channel grading, will require easements or additional right-of-way. Along the deep cut areas caused by river bed mining adjacent to the river (particularly at Dobson Road), additional fill will also require more right-of-way.

The amount of time needed to acquire the necessary right-of-way for these projects will be an issue that must be taken into consideration. Time requirements will vary depending on the ownership status of the land. Private lands are subject to eminent domain, but Tribal lands are not. Moreover, portions of the SRP-MIC lands are held in common, and portions have been allotted to families or individuals. These types of lands are known as allotments. Each parcel can have many owners, or allottees.

MCDOT has project history indicating that Tribal lands can take a minimum of 2 to 2½ years to obtain right-of-way clearance and obtain the required easements. Allotments, however, can take considerably longer.

6.1 Existing Right-of-Way

Existing right-of-way ownership details along Dobson, Gilbert and McKellips Roads are displayed in Table 6-1, Existing Right-of-Way, in Appendix D, Right-of-Way.

6.2 Proposed Right-of-Way

Proposed Dobson Road right-of-way ownerships that are affected by project alternative alignments are shown in Table 6-2, Alternative D1, D1a, D1b, D2, D2a, D3 and D3a Proposed Right-of-Way in Appendix D, Right-of-Way.

Proposed McKellips Road right-of-way ownerships that are affected by project alternative alignments are shown in Table 6-3, Alternative M1, M2 and M3 Proposed Right-of-Way in Appendix D, Right-of-Way.

6.3 Right-of-Way Requirements

Proposed right-of-way requirements are shown in tabular form by alternative in Appendix D Right-of-Way.

Alternatives G1, G2, and G3 are all within existing Maricopa County Department of Transportation right-of-way. This right-of-way was part of an Intergovernmental Agreement (IGA) for the Gilbert Road widening project that was constructed in 2005 or which the two-lane bypass was built and functioned as the northbound roadway until it was washed out in January 2008. The current project will require no additional right-of-way. The existing right-of-way will be reduced to that required for the new bridge and appurtenant structures.

An estimate of $3 million has been identified for the Gilbert Road right-of-way. However, this will be negotiated between the SRP-MIC and MCDOT.

6.4 Frontage by Jurisdiction

Frontage by jurisdiction for all the alternatives is shown in tabular form in Appendix D, Right-of-Way.

7 SOCIOECONOMIC OVERVIEW

This section describes the existing social and economic context of the project area and potential impacts from the Dobson Road Bridges project. The discussion of the socioeconomic environment of the study area includes an overview of the jurisdiction and ownership, existing land use, zoning and development, and demographic composition of the area. Planning documents and maps prepared by Maricopa County were used to identify jurisdiction, land use, zoning criteria, and future planning activities. Title VI of the Civil Rights Act of 1964 and Environmental Justice considerations were reviewed using the U.S. Department of Commerce, Bureau of the Census 2000 Census of Population and Housing.

7.1 Jurisdiction and Ownership

For the purposes of this overview, jurisdiction refers to the authority to regulate land uses. Land ownership is identified in terms of public or private ownership. The study area falls mostly within the jurisdictional boundaries of Maricopa County. However, the Salt River Pima-Maricopa Indian Community (SRP-MIC) also has jurisdiction over part of the project area, in particular, on land north of the Salt River. The SRP-MIC lands also, for the most part, include the riverbed. Private land and the City of Mesa are found south of the Salt River and south of SR202.

7.2 Existing Land Use

Land use is a representation of existing occupation and/or a physical use of land. Land uses in the project area were verified using aerial photography and a "windshield" survey of the study area. Existing land uses within the study area include agricultural, residential, industrial, and vacant lands. These are mapped in Figure 7-1. Planned land uses for the project area are shown in Appendix E.

However, the greatest single land use is in the riverbed which functions as open space and wildlife habitat. Table 7-1 presents the acreages and percentages of land uses in the various categories. The acreages are for ¼ mile on either side of the centerline of each alignment.

Note: Industrial lands consist of both private and public properties. The public industrial land uses within the project area are the City of Mesa Wastewater Treatment Plant near Dobson Road and the SRP-MIC sanitary landfill north of Gilbert Road at SR87. The private industrial land uses are primarily sand and gravel mining operations.

Land uses in the immediate vicinity of each project area are discussed in the following sections.

7.2.1 *McKellips Road Area*

Agricultural/vacant and sparse residential uses exist from SR101 to Dobson Road on both the north and south sides of McKellips Road. From Dobson Road to just east of Alma School Road, the existing land use is industrial on the south side of McKellips Road with sand and gravel mining operations. The north side of McKellips Road along this segment is agricultural/low density residential with a police dispatch center (governmental land use). Also north of McKellips Road along Alma School Road to SR202, there is a small area of commercial mixed uses on the south side of McKellips Road and vacant land/open space on the both the north and south sides of McKellips Road. There is also a small area of agricultural/low density residential just east of Alma School Road on the north side of McKellips Road.

The SRP-MIC Demonstration Wetlands Project is located along the southern boundary of Salt River Materials Group. This wetlands project is immediately adjacent to and south of the area of potential effect for Alternative D3a (see Figure 13-3).

The majority of the land in the right-of-way is undeveloped with the exception of a few businesses located immediately adjacent to McKellips Road. These businesses include Arizona Propane located at 10225 East McKellips Road (south side of McKellips Road between Longmore Road to the west and Alma School Road to the east), and Saddleback Telecommunications located at 10190 East McKellips Road (north side of McKellips Road between Longmore Road to the west and Alma School Road to the east). The Salt River Maricopa Indian Corn is located on the west side of Alma School Road, north of McKellips Road. From Alma School Road to Loop 202, there are no businesses located immediately adjacent to McKellips Road.

South of McKellips Road, on the east side of Alma School Road, CEMEX has a plant. (CEMEX is a large, Mexican-owned cement and aggregate producer.) The northern part of this facility is located within the area of potential effect for the project. Currently, stockpiles of gravel are located within the area of potential effect.

7.2.2 *Gilbert Road Area*

The existing land use immediately adjacent to the Gilbert Road right-of-way is primarily open space on the east and west sides of Gilbert Road. There is a small residential area of several homes on large lots located on the east side of Gilbert Road at SR87. Just north of the Salt River on the east and west sides of Gilbert Road is undeveloped desert tribal land. On the east side of Gilbert Road south of the Salt River, the land is also largely undeveloped, with open space on the west side of Gilbert Road. There is a commercial use just north of Thomas Road on the east side of Gilbert Road.

There are two commercial land uses located immediately adjacent to the project. One is located on the northeast quadrant of the intersection of Gilbert Road and Thomas Road. This is a contractor's materials storage and equipment yard. The other facility, the Salt River Landfill, is located in the northeast quadrant of the intersection of Gilbert Road and SR87 (Beeline Highway). A few residential structures are located several hundred feet east of Gilbert Road. The rest of the area is undeveloped.

7.3 Zoning and Development

Except for minor parcels of Maricopa County land (often termed "county islands"), lands within the project area are planned and zoned by the SRP-MIC and the City of Mesa. Figures 7-1 through 7-3 in Appendix E depict existing and planned land uses as well as zoning for these two jurisdictions.

There are three major developments planned for the project area. A large retail and entertainment center south of SR202 along Dobson Road has been constructed by private developers with City of Mesa incentives. The project provides more than 1.3 million square feet of mixed-use development on 200 acres and will be implemented in two phases. There is currently the Cinemark 16 Theaters complex open on the project site with small retail shops and restaurants, several "big box" retail stores, and a major auto mall. Planned for the site is a half million square feet of office space. In addition, a Hyatt hotel will be built to serve the area.

Mesa Riverview's location has high visibility along SR202, and the extension of Dobson Road across the Salt River will be a critically important link between SRP-MIC, Scottsdale, the City of Mesa, and this development.

Located on the west side of 92^{nd} Street north of McKellips Road and east of SR101, Casino Arizona is a popular SRP-MIC gaming facility. Connecting the Dobson Road alignment to McKellips Road at 92^{nd} Street would provide a direct link between this major traffic generator, SR202, the Mesa Riverview project, and the city of Mesa to the south.

The U.S. Army Corps of Engineers (USACE) has been developing the Va Shly'ay Akimel Restoration Project to return significant areas of the Salt River to a more natural habitat. The project will establish about 200 ac. of wetlands, 880 ac. of cottonwood/willow stands, 380 ac. of mesquite *bosque* (woodland), and 24 acres of Sonoran desertscrub shrub, using surface water currently owned by SRP-MIC or groundwater pumped from an existing or new well. Other features include removal of invasive vegetation, reshaping abandoned sand and gravel mining pits, reshaping some sections of the river channel to return water flow to a more natural pathway, a grade control structure, and a recreational trail system. The proposed bridge crossing designs in the Dobson Road Bridges at Salt River Project will require close coordination with the Va Shly'ay Akimel Restoration Project.

7.4 Economy and Demographic Composition

The Arizona Department of Commerce community profile for the SRP-MIC indicates that the community is attracting many new businesses as a result of its proximity to intense urbanization, accessibility to major highways, and availability of land for commercial and industrial use. The SRP-MIC economic base consists of agriculture, government, education, and retail. The ADC community profile for the city of Mesa indicates that Mesa's economic base consists of aerospace/aviation, agribusiness, automotive, business, education, electronics, health, manufacturing, retail, and transportation services. Businesses located within the project area include cement and aggregate manufacturing companies. Refer to Section 7.2, Existing Land Use, for further information regarding businesses located within the project area.

In 2000, The Arizona Department of Economic Security and the U.S. Census estimated the Salt River Pima-Maricopa Indian Community (SRP-MIC) population at 6,405 and the city of Mesa population at 396,375. The demographic composition of the project area was researched using the U.S. Census Bureau 2000 online database. Census tracts are small, relatively permanent statistical subdivisions of a county used for tallying census information; they do not cross county boundaries. They are delineated with the intention of being maintained over a long period of time, allowing longitudinal statistical comparisons. The size of census tracts varies depending on the density of settlement. Each census tract contains a minimum of one block group and may have a maximum of nine block groups. Block groups are geographic subdivisions of census tracts that primarily provide a geographic summary unit for census block data. A block group comprises a reasonably compact and contiguous cluster of census blocks, the smallest subdivision used by the census.

Portions of the project area within the vicinity of the Dobson Road and McKellips Road Bridges lie within Census Tract 202.02, Block Group 1; Census Tract 4212.01, Block Group 1; and Census Tract 4211.01, Block Group 1 (Figure 7-4 of Appendix E). Portions of the project area within the vicinity of the Gilbert Road Bridge lie within Census Tract 202.02, Block Group 2; and Census Tract 4204, Block Group 1 (Figure 7-5 in Appendix E.). The boundaries of these census tracts and block groups extend beyond the project area; therefore, the exact population and demographic characteristics of the project area may vary from the data detailed in the following sections and in the data tables in Appendix E.

7.5 The Racial and Ethnic Composition of the Project Area's Population

The five block groups contain 9,839 persons. Within the Dobson and McKellips Road Bridges portion of the project area, Census Tract 202.02, Block Group 1, the White percentage of the population is higher than that for the SRP-MIC. This block group also has a higher Native American percentage of the population compared with those for the nearby city of Mesa and surrounding Maricopa County. Within this block group, the percentages of the population that identify with two or more races or that identify as "other" are higher than those for the surrounding SRP-MIC, the city of Mesa, and Maricopa County. Census Tract 4211.01, Block Group 1, has a higher percentage of the population that identify as "other" than that for the city of Mesa and a higher Hispanic percentage of the population than those for the SRP-MIC and the city of Mesa.

Within the Gilbert Road portion of the project area, Census Tract 202.02, Block Group 2, the White percentage of the population is higher than that for the SRP-MIC. Census Tract 202.02, Block Group 2, has a higher Native American percentage of the population compared with those for the nearby city of Mesa and surrounding Maricopa County. Within this block group, the percentages of the population that identify with two or more races or that identify as "other" are higher than those for the surrounding SRP-MIC, the city of Mesa, and Maricopa County. Census Tract 202.02, Block Group 2, has a higher Native American percentage of the population than those for the city of Mesa and Maricopa County and a higher Asian percentage of the population than those for the SRP-MIC, the city of Mesa, and Maricopa County.

When combined, all block groups within the project area have a higher Native American percentage of the population than those for the city of Mesa and Maricopa County (see Table 7-2 in Appendix E). This is attributable to the project location being within the SRP-MIC.

7.6 Title VI/Environmental Justice Populations

According to the Federal Highway Administration, there are three fundamental environmental justice principles:

- 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.

Title VI of the Civil Rights Act of 1964 and Executive Order 12898 give guidance on identifying sensitive populations to assure that individuals are not excluded from participation in, denied the benefit of, or subjected to discrimination under any program or activity on the basis of race, color, national origin, age, sex, or disability. Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (1994) reaffirms the principles of Title VI and related statutes. The executive order requires the consideration of minority, elderly, low-income, disabled, and female head of household populations. A minority person refers to a person who is racially classified as African American, Asian American, Native American or Alaskan Native, or anyone who racially classifies himself or herself as "other." Hispanics are also considered minorities regardless of their racial affiliation.

Elderly refers to individuals 60 years of age and older. Low-income households include those households whose incomes are below the established poverty level. Noninstitutionalized individuals who are 16 years of age and older are considered to be disabled if they report a mobility disability, or a self-care limitation, or are work disabled. Female heads of household are calculated from family households in which there is a female with no spouse present, regardless of whether she has any children younger than 18 years of age. Project area data were compared with the data for the SRP-MIC, the city of Mesa, and Maricopa County to assess whether minority, elderly, low-income, disabled, or female head of household populations are disproportionately represented near the project area (see Table 7-2 in Appendix E). A portion of Census Tract 4212.01, Block Group 1, is within the project area, but this census tract is not populated.

Within the Dobson and McKellips Bridges portion of the project area, Census Tract 202.02, Block Group 1, minority, disabled, and female head of household percentages are higher than those for the city of Mesa and Maricopa County. Census Tract 4211.01, Block Group 1, has a higher minority percentage of the population than that for the city of Mesa and higher disabled and female head of household percentages of the population than those for the city of Mesa and Maricopa County. The elderly percentage of the population in Census Tract 202.02, Block Group 1 is higher than those for the SRP-MIC, the city of Mesa, and Maricopa County. Within the Gilbert Road portion of the project area, Census Tract 202.02, Block Group 2, minority, disabled, and female head of household percentages are higher than those for the city of Mesa and Maricopa County. The low-income percentage of the population of Census Tract 202.02, Block Group 2, is higher than those for the SRP-MIC, the city of Mesa, and Maricopa County.

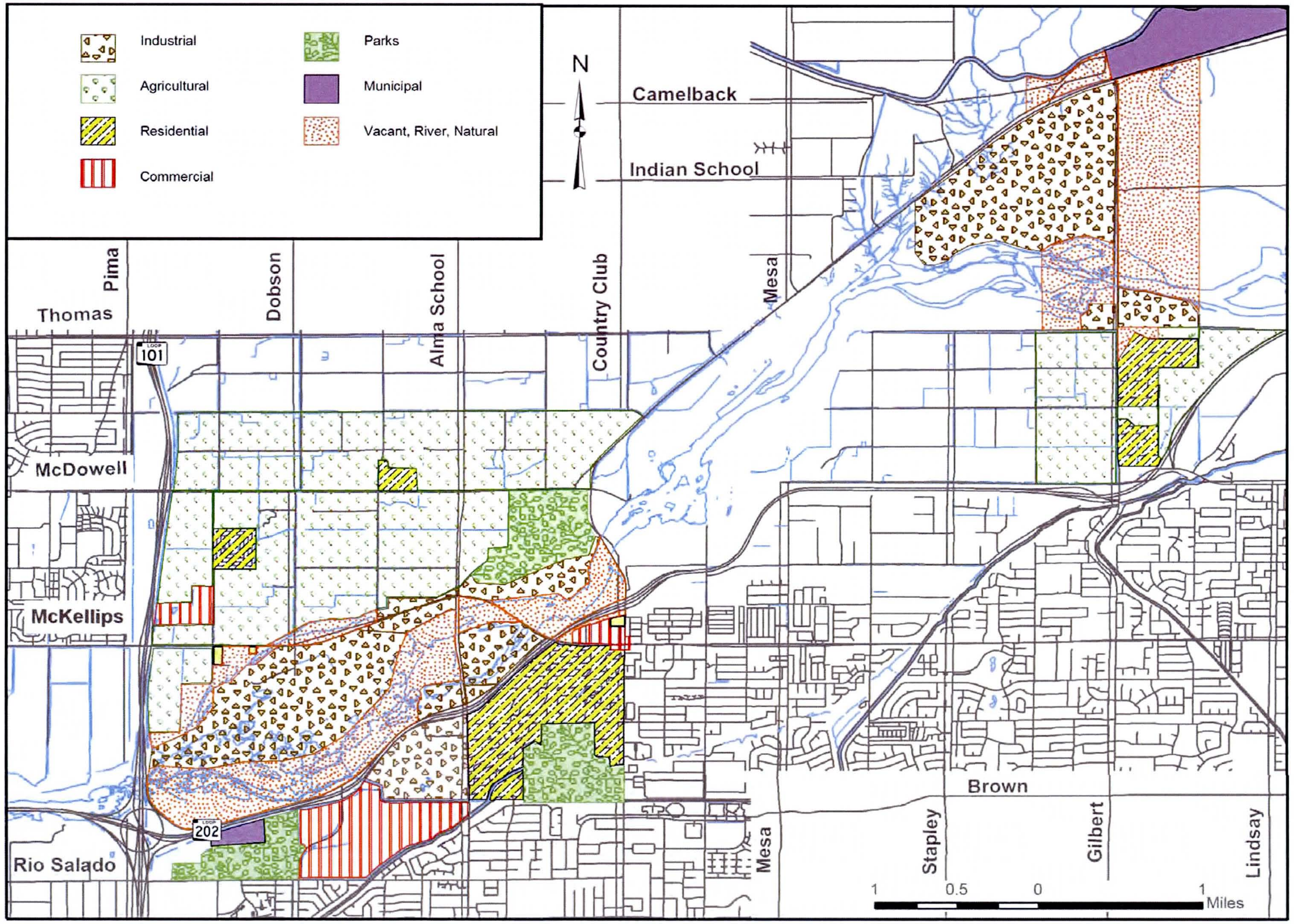
7.7 Summary of Socioeconomic Evaluation

When combined, all block groups within the project area have higher minority, elderly, female head of household, disabled and low-income percentages of the population than those for the city of Mesa and Maricopa County.

Table 7-1

Land Uses in the Project Area Acreages and Percentages by Land Use Category		Dobson D3	McKellips MR1	McKellips M1	Gilbert G1
Land Use Category					
Industrial	Acres	244.4	193.8	85.6	228.5
	%	44.1%	29.6%	24.8%	39.7%
Agricultural	Acres	99.8	320.3	11.5	26.1
	%	18.0%	48.9%	3.3%	4.5%
Residential	Acres	5.6	7.4	88.9	8.3
	%	1.0%	1.1%	25.8%	1.4%
Commercial	Acres	57.8	27.7	24.9	0.0
	%	10.4%	4.2%	7.2%	0.0%
Parks	Acres	0.0	0.0	19.8	0.0
	%	0.0%	0.0%	5.7%	0.0%
Municipal	Acres	0.0	0.0	0.0	5.7
	%	0.0%	0.0%	0.0%	1.0%
Vacant/River /Natural	Acres	146.8	105.5	114.6	307.2
	%	26.5%	16.1%	33.2%	53.4%
Totals	Acres	554.4	654.6	345.2	575.8
	%	100.0%	100.0%	100.0%	100.0%

Land Uses within Project Area



8 ENVIRONMENTAL OVERVIEW

The overview describes the environment of the project area in terms of its physical, natural, and cultural resource contexts. (The socio-economic characteristics of the project area are discussed in Chapter 7 of this document.)

This chapter of the DCR presents the findings of studies conducted for the DCR that are relevant to the evaluation and selection of the alternative alignments. The remainder of the Environmental Overview can be found in Appendix F. This environmental overview is not intended to meet the requirements of the National Environmental Policy Act. Instead, a series of separate environmental documents is being produced for that purpose.

The information presented is based on existing data sources from municipal, county, state, and federal agencies, field work by the project team, and on available aerial photography of the study area.

8.1 Topography/Physiography

The project area is within a broad desert river system, consisting of the Salt River channel, its floodplain, and associated river terraces and uplands. Near Dobson Road, the river's channel has been artificially constrained by levees and other flood control measures such as concrete stabilized dikes. What's more, the channel has been significantly altered throughout most of the project area as a result of sand and gravel mining. Those activities are on-going and characterize much of the project area today. Outcrops of bedrock, so prominent several miles downstream at Tempe, are not present in the project area.

Upstream of Alma School Road, there are some artificial flood control devices in the river, but the floodplain becomes wider and more gently sloping with a less well-defined channel approaching Gilbert Road.

8.2 Biotic Communities and Wildlife

This project lies within the Lower Colorado Subdivision of the Sonoran Desert. Vegetation is sparse and scattered with only a small amount of riparian habitat present where there is permanent water. All of the riparian habitat can be found in the vicinity of the Dobson Road crossing. In addition to shallow groundwater filling the ponds, an outfall on the south side of the channel provides a steady supply of water to the wetland and ponds. Water from the outfall fills several ponds and continues to flow westward toward the Tempe Marsh and Tempe Town Lake.

Wildlife habitat of much lower quality occurs along McKellips and Gilbert Roads within the project area because the lack of surface water produces sparse vegetation and low structural diversity. Most of the land adjacent to McKellips Road is used for agricultural and commercial purposes, including a large and active materials source pit. The brushy edges of agricultural lands along McKellips Road and 92nd Street provide a small amount of habitat for wintering sparrows and raptors, such as American Kestrels.

Several small water infiltration basins are located near the western end of the project area and these provide short-term habitat for wintering waterfowl and shorebirds.

8.3 Sensitive Species

Searches of Arizona Game and Fish Department and U.S. Fish and Wildlife Service databases of threatened and endangered species identified species with the potential to occur within the project. However, the lack of sufficient habitat and disturbances due to mining and other extractive activities preclude there presence at this time.

8.4 Water Resources

Water resources include Waters of the United States (WOUS), including wetlands, U.S. Army Corps of Engineers (USACE) regulatory jurisdiction under the Clean Water Act, sole source aquifers, unique waters, and floodplain considerations. There are no sole source aquifers or unique waters within the study area, so no further consideration of these resources is included here.

Within the project area, the Salt River and its 100-year floodplain are considered WOUS. The Federal Emergency Management Agency (FEMA) has mapped the 100-year floodplain of the Salt River and these maps are shown in Appendix F.

Projects seeking to modify and/or fill portions of the WOUS must obtain a Section 404 Permit from the USACE.

8.5 Visual Character

The terrain in the Dobson Road and McKellips Road Bridges area is relatively flat, and the landscape is dominated by the large gravel, sand, and rock mounds associated with the aggregate and cement companies adjacent to the Salt River. At the northwest corner of the project area there are several single-family residences, numerous junk automobiles, and several active farm fields.

The Salt River is the notable natural feature in the project area; its channel is characterized by large river cobbles and a few areas of dense riparian vegetation, including cottonwoods and cattails. There are several ponds in the channel. Wastewater treatment ponds are visible to the south and highly disturbed desert can be seen to the east. Low, scattered shrubs, predominately creosote bush, are characteristic of the desert in this area. Overhead power lines and metal support towers are distinct man-made features in the project area.

The landscape in the Gilbert Road Bridge area is characterized by gently rolling terrain where the Salt River is a more prominent feature. Unlike the western part of the project area, no riparian vegetation is associated with the river. Overhead power lines and metal support towers, along with industrial development, are distinct man-made features visible to the west from the Gilbert Road Bridge area.

Distant views from the project area include the McDowell Mountains to the north, the Mazatzal Mountains to the northeast, the Superstition Mountains to the east, and the Phoenix Mountains and Papago Buttes to the West.

8.6 Air Quality

These projects are located in the Phoenix Metropolitan Non-Attainment Area, meaning that air quality in the region does not meet National Ambient Air Quality Standards for ozone, carbon monoxide and particulates

(O_3, CO and PM10.). These projects are regionally significant, capacity-enhancing projects; therefore a conformity finding is required. The projects will need to be included in the approved Transportation Improvement Program (TIP), at least one year, and no more than 3 years prior to construction. That TIP will have to be approved by FHWA and EPA as conforming to the State Implementation plan and Federal Implementation plan to be found in conformity.

The Federal Clean Air Act of 1970 established National Ambient Air Quality Standards (NAAQS) for six pollutants. These pollutants, referred to as the "Criteria Pollutants", include carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead. Carbon monoxide is a colorless, odorless gas that primarily affects the cardiovascular system; vehicular emissions are a major source. Nitrogen dioxide is a gas with a yellowish-orange to reddish-brown appearance, depending upon its concentration, which impairs the respiratory system; major sources are power plants an vehicular emissions. Ozone is created through a complex reaction of hydrocarbons and oxides of nitrogen with sunlight as the primary catalyst; ozone affects the respiratory system. Sources of the ozone precursors include vehicle emissions, power plants, and service stations. Particulate matter refers to small aerosols which are suspended in the atmosphere and may cause irritation and damage to the respiratory system; vehicular emissions and the resuspension of road dust by vehicular activity are sources. Sulfur dioxide is a colorless gas generated by the combustion of sulfur-containing fuels, primarily affecting the respiratory system; major sources are coal and oil-fired power plants. Lead and its compounds damage the cardiovascular, renal, and nervous systems; the primary source was vehicular emissions associated with the use of leaded gasoline.

In 1987, the standard for particulate matter was revised by EPA from total suspended particulate matter (TSP), aerosols with diameters up to approximately 45 micron, to those aerosols with aerodynamic diameters of 10 micron or less. This new standard was referred to as PM10 The EPA later revised the PM10 standard, added standards for particulates with diameters of 2.5 micron or less (PM2.5) and also revised the method for the determination for exceedances. For ozone, the 1-hour standard was replaced with an 8-hour standard. In addition, the level of the ozone standard was lowered from 0.12 parts per million (ppm) to 0.08 ppm, and the method for the determination of exceedances was also revised. The effective date of these final rules was September 16, 1997. To ensure an effective transition to the new standards, the existing standards will remain in effect until it is determined that they have been met. The State of Arizona Standards are identical to the NAAQS.

The Clean Air Act amendments of 1990 authorized the EPA to designate those areas that have not met the NAAQS as nonattainment and to classify them according to their degree of severity. States that fail to attain the NAAQS for any of the criteria pollutants are required to submit State Implementation Plans (SIPS) which outline those actions which will be taken to attain compliance. The project area lies within a nonattainment area for carbon monoxide (CO) and ozone (O3) and a nonattainment area for particulate matter (PM10).

Since 1977 Federal agencies and Metropolitan Planning Organizations (MPO) have been required by Section 176c of the Clean Air Act to ensure that all transportation projects conform with the approved air quality State Implementation Plans. The Clean Air Act Amendments enacted in 1990 defined conformity to a SIP as meaning "conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards (NAAQS)" (Federal Register, November 30, 1993). The conformity determinations for Federal actions related to transportation projects must meet the requirements of 40 CFR Parts 51 and 93.

During a construction project, disturbance of the soil by heavy equipment would increase fugitive dust, if uncontrolled, which would affect local air quality. In addition, construction related traffic delays, combined with exhaust emissions from construction-related equipment may elevate levels of pollutants. Such impacts would be temporary and eliminated once construction was complete. Any construction activity located within Maricopa County must adhere to the local air quality rules and ordinances, including Maricopa County Rule 310 and 310.01 for control of fugitive dust emissions.

8.7 Noise

MCDOT follows the FHWA criteria for all Type I projects, which call for consideration of noise mitigation when the predicted design year traffic noise levels equal or exceed an hourly Leq of 67 dBA or 72 dBA (Category B and C, respectively as defined below) with the following two conditions:

1) Mitigation will only be considered for areas that support a developed MCDOT adopted a Noise Abatement Policy in April 2001 (Revised 2008) to set guidelines to determine the need, feasibility, and reasonableness of noise abatement measures for all roadway projects. For all construction projects, MCDOT is committed to identifying any potential noise receptors, ascertain existing conditions, nature of the project and its potential to impact those potential noise receptors. It is intended that, when possible, the MCDOT noise abatement policy will be in agreement with federal policy and guidelines as stated in 23 CFR Part 772. The main objective of 23 CFR Part 772 is "to provide procedures for noise studies and noise abatement measures to help protect the public health and welfare, to supply noise abatement criteria, and to establish requirements for information to be given to local officials for use in the planning and design of highways approved pursuant to Title 23, United States Code."

   If it is likely that the predicted noise level will approach or exceed the noise abatement criterion, or cause a substantial (15dBA) increase over the existing traffic noise level, MCDOT will evaluate the impacted properties for possible abatement.

   Noise abatement measures must be reasonable and feasible. Feasibility deals primarily with engineering considerations (e.g., can a barrier be built given the topography of the location; can a substantial noise reduction be achieved given certain access, drainage, safety, or maintenance requirements; are other noise sources present in the area, etc.) The reasonableness of any noise abatement measure will be discussed with the affected property owner and mutual agreement is required for construction of a barrier.

2) Mitigation will only be considered after such factors as cost of mitigation, design requirements or constraints, and any adverse impacts on the surrounding property owners have been evaluated.

3) Categories B and C land uses are defined as follows:

   Category B Land Uses--Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.

   Category C Land Uses--Commercial, office, industrial and other developed lands not included above.

Whenever a noise barrier is proposed, an attempt should be made to achieve a minimum attenuation of 5 dBA. Where such a barrier is not feasible or desirable, open graded asphalt rubber should be used as the primary noise abatement measure.

There are no receptors that will be affected by these projects; therefore no noise analysis has been conducted.

8.8 Cultural Resources

Several federal, state, and local laws have been enacted to preserve cultural resources. The National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470 et seq.) requires that projects defined in 36 CFR § 800.16 (y) as federal undertakings be evaluated for their impacts to historic properties. Section 106, which is implemented under 36 CFR Part 800 of the NHPA, defines a process of consultation that federal agencies follow to evaluate impacts on historic properties. NEPA (40 CFR § 1500) requires projects with a federal action to be evaluated for impacts to the human and the natural environment. Other laws, including the Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm), the Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001-3013), the American Indian Religious Freedom Act (42 U.S.C. § 1996 and 1996a), and Section 4(f) of the Department of Transportation Act of 1966 (23 U.S.C. § 138) also ensure the proper treatment of cultural resources for projects that occur on federal lands, are funded by federal monies, or that require a federally issued permit. Similarly, Arizona Revised Statutes (A.R.S.) sections 41-841 through 41-847 and 41-861 through 41-881 have been enacted to protect cultural resources and Native American graves during undertakings in Arizona that do not fall under federal jurisdiction. The Arizona State Historic Preservation Act of 1982 directs state agencies to consider impacts that their projects or funding may have on historic properties owned or controlled by the agency.

8.8.1 Cultural Resources Inventory

Cultural resources inventory data include records of prehistoric and historic properties that are greater than 50 years old. Prehistoric and historic properties are classified as sites, buildings, structures, or objects. Properties that possess a significant concentration, linkage, continuity, or that are united historically or aesthetically by plan or physical development may be formally recognized as a district. The National Register of Historic Places (NRHP) documents the appearance and importance of properties significant in our prehistory and history. To be listed in the NRHP, a property or district must be demonstrably significant under at least one of four criteria, and must possess a combination of seven aspects of integrity. The criteria of consideration for the NRHP are association with an important historic event (Criterion A) or person (Criterion B), embodiment of an important design or method of construction (Criterion C), or the potential to yield scientifically important information about prehistory or history (Criterion D). The aspects of integrity are location, design, setting, materials, workmanship, feeling, and association. Depending on the property type and criteria, some aspects of integrity are weighted greater than others when nominating a property to the NRHP.

When future undertakings are identified that may affect specific historic properties that are already listed in the NRHP (including those not currently listed but are eligible for the NRHP) under Criterion A, B, or C, avoidance will be recommended. Consultation under Section 4(f) of the Department of Transportation Act of 1966 (23 U.S.C § 138) will also be required for such properties if the FHWA is involved in funded roadway improvements. When future projects are identified that may affect specific historic properties that are eligible for listing in the NRHP under Criterion D, avoidance will be recommended, but construction impacts can be mitigated through archaeological testing and data recovery.

8.8.2 Summary of Inventory Results

The Maricopa County Department of Transportation (MCDOT) project improvements extend north from Dobson Road to include McKellips Road and Gilbert Road construction activities. Much of the work, including all of the proposed McKellips Road improvements, occurs on the Salt River Pima-Maricopa Indian Community (SRP-MIC). Approval for preliminary cultural resources investigations was granted under the authority of the SRP-MIC Cultural Preservation Program and in consultation with the Bureau of Indian Affairs (BIA). Archaeological Consulting Services, Inc. (ACS) is retained by MCDOT as an on-call cultural resources consultant, and has been assigned responsibility for the Dobson Road Bridges project.

In response to stipulations advanced by the SRP-MIC Cultural Preservation Program, project archaeological locations and data remain secure. These inventory data form the basis of recurrent consultation between the SRP-MIC, BIA, MCDOT and the ACS consultants. At a future date interagency consultation will extend to other government agencies, such as the State Historic Preservation Office, as necessary.

The first phase of the project cultural resources inventory was completed by ACS in October 2007. The preliminary records and literature search by ACS revealed that both SRP-MIC and the City of Mesa administer project area land. Based on locational data and inventory records ACS conducted a Class III (100%) survey of non-allotted land within the SRP-MIC.[1] Several SRP-MIC allotted parcels within the project area await archaeological survey, subject to landowner consent.

Pedestrian surveys of the allotted lands will take place during right-of-way acquisition, which is expected to be a two-year process. Cultural resource evaluations will reference SRP-MIC criteria on tribal land and in the event of disinterred human remains, and be subject to provisions of the Arizona Antiquities Act (ARS § 41 841-865), Arizona Historic Preservation Act (ARS § 41 511), and National Register of Historic Places criteria (36 CFR 800) as appropriate.

8.8.3 Recommendations

Generally, lands will not require an intensive pedestrian survey for cultural resources if they have been surveyed since 1990. In the areas that have not been previously surveyed, pedestrian surveys for cultural resources that meet ASM and SHPO standards for Class III cultural survey will need to be completed prior to construction. Any cultural resources identified during future investigations that may be affected by construction should be documented and assessed to determine whether they are eligible for the NRHP. If it is not possible for the project to proceed without impact to cultural resources that are NRHP-eligible, the resources should be treated consistent with the Secretary of the Interior's Guidelines for the Treatment of Historic Properties and applicable state laws. Note: Should federal monies be used for these projects in the future, all relevant aspects of Section 106 (of the NHPA) consultation process will apply. An evaluation of Traditional Cultural Properties should also be undertaken with all interested Native American tribes.

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[1] Archaeological Consulting Services (ACS), *Cultural Resources Survey for the Proposed Dobson Road Bridge Alignments over the Salt River, Non-Allotted Lands, Salt-River Pima-Maricopa Community, Maricopa County, Arizona*, October 2007, Report on File, Maricopa County Department of Transportation, Environmental Planning Branch, Phoenix AZ.

8.9 Hazardous Materials

Hazardous materials are regulated by the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). ADEQ implements CERCLA, commonly known as the Superfund, and its amendment, the Superfund Amendments and Reauthorization Act (SARA) of 1986. The inherent environmental concerns associated with hazardous materials and solid waste landfills require a preliminary investigation into the location of permitted and non-regulated hazardous material sites and solid waste facilities within the study area.

A review of State and Federal hazardous materials databases was conducted for each of the four sites of the project. The findings of these searches are summarized below:

- Salt River Sand and Rock Dobson Plant, Dobson Road and McKellips Road, Mesa, AZ, 85201. This site is listed as RCRA Small Quantities Generator of hazardous waste. No violations or incidents have been reported. This site is located within the APE for the proposed project.

- There are four Federal wells located within the proposed project's APE. One is located on the south side of McKellips Road just west of 92nd Street. Another well is located south of McKellips Road just west of Longmore Road. A third well is located south of McKellips Road and west of Alma School Road. The fourth well is located further south on Alma School Road on the west side of Alma School Road. No violations or incidents have been reported at any of these well sites.

- City of Mesa, Salt River and Alma School Road, Mesa, AZ. This site is a State Spills Sites located within the proposed project's APE. The spill occurred on July 26, 1990 on private property. The spill quantity is unknown. The material spilled was hydrochloric acid. No spill response date was available. No other information is available about this site.

During the site reconnaissance, it was discovered that an existing landfill is located immediately adjacent to the proposed project's APE. The Salt River Landfill is located at 13602 N. Beeline Highway (SR87), on the northeast corner of the intersection of SR87 and Gilbert Road. The Salt River Landfill accepts the following types of wastes: solid waste (garbage), construction and demolition debris, yard or green waste, dirt, rocks, and appliances. The following types of wastes are prohibited: tires, paint, chemicals, used oil, PCB-containing waste, biomedical waste, lead-acid batteries, bulk liquids, and friable asbestos. The landfill site is projected to have capacity until at least 2015.

No hazardous materials concerns were identified that would affect the proposed project at either McKellips or Gilbert Roads.

9 BRIDGE TYPE SELECTION

A bridge alternatives evaluation study has been prepared as a key part of this DCR. The final Bridge Type Selection Report (BTSR) is included as Appendix G of the Final DCR. Bridge substructure and foundation recommendations are based on site specific borings results from the "Geotechnical Report" prepared for this DCR by NCS Consultants, Appendix I. In addition, due to the high importance of bridge aesthetics associated with each of the project corridors, a Bridge Aesthetic Guidelines report was prepared, Appendix H, to complement the DCR and the BTSR.

The purpose of the BTSR is to evaluate alternative bridge types and configurations that would be structurally, aesthetically and economically feasible for crossing the Salt River at the following three locations in Maricopa County: Dobson Road, McKellips Road and Gilbert Road. Construction costs, overall constructability, construction traffic control, and short and long-term maintenance requirements are some of the main issues considered in the type selection process.

Historically, due to the flood prone nature of many Arizona rivers, including the Salt River, bridge superstructure types that require construction on false work supported within floodway typically do not satisfy an owner's risk/reward profile. Bridges crossing the Salt River are predominantly precast pre-stressed concrete girder (PPCG) bridges. The main advantage to PPCG bridges is in the reduction of construction false work that they require. In addition, PPCG bridges are cost-effective to construct and maintain, durable, and their construction techniques are familiar to most local bridge contractors. Their main disadvantages are the somewhat limited aesthetic options that are available to soften and blend their somewhat industrial appearance to more closely mimic the appearance of cast-in-place concrete structures.

Current establishments such as Casino Arizona and future planned development projects such as Mesa Riverview and Va Shly'ay Akimel Restoration Project will have a significant impact on the development of the bridge architecture and aesthetic treatments at the various project sites, especially the Dobson Road Bridge. A summary of the content of the Bridge Aesthetic Guidelines is included in the respective bridge location sections of this report. Due to the high importance of bridge aesthetics associated with each of the project corridors, a Bridge Aesthetic Guidelines report was prepared, Appendix H, to complement the DCR and the BTSR.

Various roadway alignment configurations have been evaluated and one alignment at each of the crossing locations has been recommended for final design and construction. In an effort to provide optimum structural solutions, the BTSR evaluated several alternative bridge types and configurations and recommends one for the selected roadway alignment at each crossing location. A brief description of the locations, pertinent site conditions impacting bridge construction, bridge superstructure and bridge aesthetic treatments are described below.

9.1 Dobson Road

The proposed new Dobson Road crossing of the Salt River is a horizontally curved bridge alignment with a total length of approximately 1496 feet. The proposed bridge/roadway cross-section, shown in Figure 1.1 below, will contain six 12-0" travel lanes, two 6'-0" barrier protected sidewalks, and a 14'-0" median. The bridge is aligned on a constant 2125' radius horizontal curve. The proposed new bridge varies in width from approximately 157'-3" at station 87+65.54 where it ties into the existing Dobson Road Geometry, tapers to 113'-5 ½" at station 80+94.18 and then continues at this constant width to its northern terminus at station 72+69.59.

This alignment is located in a reach of the Salt River that can be expected to exhibit heavy scour and large stream flow velocities during the 100 yr. and 500 yr. flood events. For these reasons foundation alternatives are limited to large-diameter drilled concrete shafts. Foundation alternatives that include smaller diameter concrete shafts were initially considered but the presence of large cobbles, indicated in the preliminary geotechnical report, preclude the construction of such shafts at depths sufficient to mitigate the scour conditions.

Several Bridge Superstructure types were considered for this location and will include AASHTO Type VI PPCG, AASHTO Type Super VI PPCG, AASHTO Type Super VI Spliced PPCG, and Post Tensioned Segmental Concrete Girders. This bridge location, as is the case with the other bridge locations, is anticipated to receive extensive aesthetic treatments due to it being an important link between the SRP-MIC and the City of Mesa Riverview development.

9.2 McKellips Road

The proposed new McKellips Road crossing of the Salt River is a horizontally curved bridge alignment with a total length of approximately 1595 feet. The proposed bridge/roadway cross-section, shown in Figure 9-1 below, will contain six 12-0" travel lanes, two 6'-0" barrier protected sidewalks, and a 14'-0" median. The bridge is aligned on a constant 1800' radius horizontal curve. The proposed new bridge is constant width for its full length.

This alignment is located in a reach of the Salt River that can be expected to exhibit heavy scour and large stream flow velocities during the 100 yr. and 500 yr. flood events. For these reasons foundation alternatives are limited to large-diameter drilled concrete shafts. Foundation alternatives that include smaller diameter concrete shafts were initially considered but the presence of large cobbles, indicated in the preliminary geotechnical report, preclude the construction of such shafts at depths sufficient to mitigate the scour conditions.

Bridge superstructure types considered at this location included AASHTO Type VI PPCG, AASHTO Type Super VI PPCG, AASHTO Type VI Spliced PPCG, and Steel Plate Girder with a composite concrete deck.

9.3 Gilbert Road

The proposed new Gilbert Road crossing of the Salt River is a tangent bridge alignment with a total length of approximately 1685 feet. The proposed bridge/roadway cross-section, shown in Figure 1.1 below, will contain six 12-0" travel lanes, two 6'-0" barrier protected sidewalks, and a 14'-0" median. The new bridge is located approximately 100' east of the existing bridge at this location. The proposed new bridge is constant width for its full length.

This alignment is located in a reach of the Salt River that can be expected to exhibit heavy scour and large stream flow velocities during the 100 yr. and 500 yr. flood events. Foundation alternatives are limited to large-diameter drilled concrete shafts. Foundation alternatives that include smaller diameter concrete shafts were initially considered, but the presence of large cobbles, indicated in the preliminary geotechnical report, preclude the construction of such shafts at depths sufficient to mitigate the scour conditions.

Bridge superstructure types considered at this location included AASHTO Type VI PPCG, AASHTO Type Super VI PPCG, AASHTO Type VI Spliced PPCG, and Steel Plate Girder with a composite concrete deck.

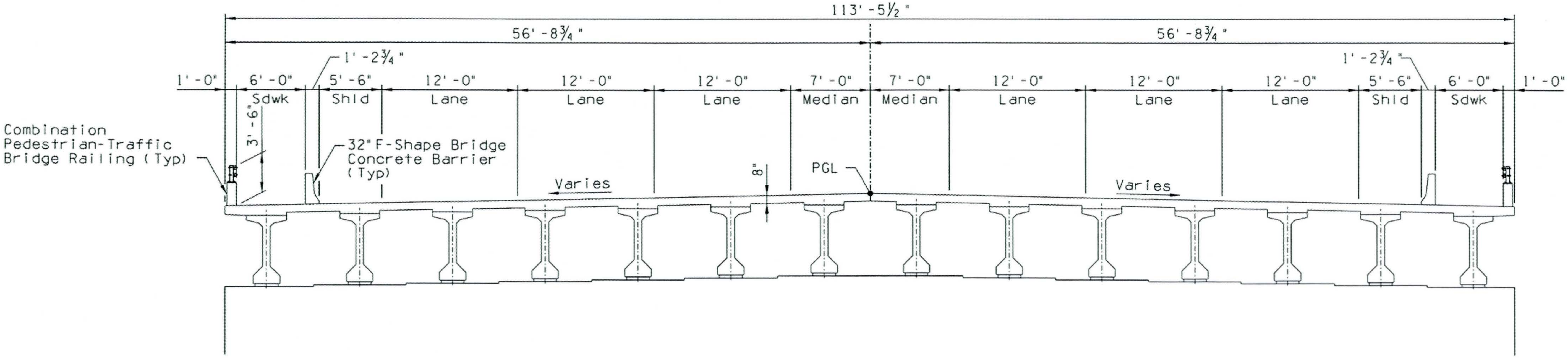


Figure 9-1 Typical Bridge Section

10 AESTHETICS

The eventual appearance of the bridges of this project is of particular concern to the communities. Goals were developed early in the project to address bridge aesthetics:

- Create a vital commerce link between the SRP-MIC and the city of Mesa that supports local and regional economic development.
- Reduce traffic through residential areas.
- Establish gateways linking the communities.
- Blend design and management activities of the Dobson Road Bridges project with the natural landscape setting and historic context of the surrounding area.
- Protect and enhance scenic, cultural, natural, and recreational resources by implementing thoughtful planning, design, development and long-term maintenance practices of this project.
- Ensure the project is developed through an inter-community and interdisciplinary process from start to finish.
- Design projects that can be constructed within the available budget.

The project team included a nationally-known bridge architecture firm, Touchstone Architecture, which developed guidelines for the design and construction of the bridges. This report is reproduced in Appendix H.

The Design team met with the SRP-MIC Design Review Committee (DRC) on March 26, 2009, to review the aesthetic treatments for the Dobson Road Bridge Project. During this meeting the design team presented the design elements that are outlined in the Architectural Design Guidelines for the project including railings, form liners for barriers, lighting and monument designs. The Design Review Committee provided very positive feedback and requested that some refinements be made in the following areas:

1. Form Liner Treatments - Replace the diamond pattern design with a pattern that reflects a water theme.

2. Lighting - Use a light pole that reinforces a water theme for the project.

3. Sidewalk- Examine the use of textures and colors to provide a sidewalk surface that is tied to the water theme for the project.

4. Friendship Monument at Overlook - Examine the use of a sculptural form which speaks the long standing cooperation between the communities.* The Design Review Committee also suggested that the City and the Community should work together to develop these concepts in their final form.

5. Gateway Monuments - Allow the monuments to be free-standing elements. The design of the gateway monuments should speak to the shared relationships of the communities as well as their individuality.* The DRC wants to change the type of monument from the symbol that is shown to something more natural and softer. They are looking to get away from the bold colors.

6. Pier Caps - Look at ways to soften the pier caps in order to reinforce the water theme of the bridge.

* Parsons recommends that an art committee be formed during final design of the bridges. The committee would consist of representatives from SRP-MIC, MCDOT, and the City of Mesa with the bridge designer, bridge architect, and a selected artist providing support to the committee. The bridge design will provide a pedestal for the monuments and constraints will be assigned limiting the size, weight, and cost.

11 GEOTECHNICAL ENGINEERING AND PAVEMENT DESIGN

NCS Consultants, LLC (NCS), prepared a geotechnical report and a pavement memorandum with bridge substructure and foundation recommendations. The following paragraphs summarize the detailed report which can be found in Appendix I.

There are four distinct elements of the project for which geotechnical recommendations were developed. These include the three bridges over the Salt River and the pavement reconstruction related to widening of McKellips Road. The subsurface conditions of each of these bridge locations are briefly described below.

11.1 McKellips Road Bridge

A geotechnical investigations program was conducted by ATL, Inc. of Phoenix, Arizona in 2000. No additional investigations were performed by NCS. The soils encountered consisted predominantly of dense to very dense gravels with varying amounts of sands, cobbles and fines having USCS classifications of GP, GW, GW-GC and GC. Below approximately El. 1,095, the soils were more clayey and distinctly softer. The water table was encountered approximately at El. 1,100.

The data developed by ATL was of limited use for development of foundation recommendations using the LRFD methodology. Therefore, additional investigations will be necessary during final design.

11.2 Gilbert Road Bridge

Kleinfelder, Inc. of Phoenix, Arizona performed a geotechnical investigations program in summer and fall of 2000. The soils encountered to the full depth of investigation consisted predominantly of sand and gravel with varying amounts of cobbles, silt and clay having USCS classifications of GP, SP, SM and SC. The deposits were generally nonplastic and dense to very dense. Weak to moderate cementation was recorded in several of the samples. The groundwater table was encountered between approximately El. 1,175 and El. 1,235. The soils encountered in the borings above the groundwater table were typically described as slightly moist to moist.

Due to the deeper scour depths anticipated at Gilbert Bridge locations, the existing borings are not deep enough to provide subsurface information for a depth of 20 ft below the anticipated shaft foundation tip elevation. Based on the foundation configurations selected as part of the DCR process it is anticipated that additional investigations will be required during final design.

11.3 Dobson Road Bridge

A limited geotechnical investigations program was conducted by NCS Consultants between April 16 and May 18, 2007 consisting of 5 borings ranging from 120ft to 200ft in depth. The soils encountered to the full depth of investigation consist mainly of interbedded layers of gravels with sand, silty-sand, clayey-sand and well-graded sands, and lean to fat clays. The soil profile within the riverbed and beyond the north and south banks is somewhat different as discussed below:

Within the riverbed: The groundwater within the riverbed was encountered between El. 1,126 and El. 1,148. The soils between the surface of the riverbed at approximately El. 1,160 and above approximately El. 1,100 were predominantly very dense gravels and mixtures of sands, silts and gravels. Below approximately El. 1,100, the soils ranged from lean (CL) to fat (CH) clays with interbedded thin layers of granular soils such as SM, SP, and SP-SM. The soils between approximately El. 1,100 and El. 1,000, were typically very stiff to hard or medium dense to dense. Below El. 1,000 the soils continue to be predominately clays (CL, CH) with interbedded layers of granular soils (SW) and silts (ML) and mixtures of sands and clays, e.g., SC and SW-SC. However, the soils below approximately El. 1,000 were distinctly harder or very dense.

Beyond the North Bank: The groundwater beyond the north bank was encountered between approximately El. 1,140 and El. 1,145. The soil conditions are generally similar to those within the riverbed except that a distinctly softer clay layer was encountered between El. 1,090 and El. 1,060. This clay layer has low dry density of 100 pcf and could be a significant source of short-term and long-term settlements depending on the type of foundations and/or configuration of fills used in this area.

Beyond the South Bank: No geotechnical investigations were performed by NCS beyond the south bank due to permitting issues. However, some geotechnical information was available for the nearby SR202 Bridge over Dobson Road through work done by AGRA in 1996. Based on AGRA's data, the location of the groundwater beyond the south bank varied significantly between El. 1,155 and El. 1,100 with the shallowest level being closest to the river. Between the ground surface at approximately El. 1,195 and El. 1,080, the soils are predominately gravelly with USCS designations ranging from GP-GM, GP-GC to GP. The deepest boring extended to approximately El. 1,065 and it appeared that below approximately El. 1,080 the soils tend to become more clayey, similar to the soils at these elevations within the riverbed.

The investigations performed by NCS were preliminary and additional investigations will need to be performed during final design based on the selected configuration of the bridge structure.

11.4 Foundation Alternatives

Scour depths at the three bridge sites range from approximately 40ft to 65ft below existing channel grades. Therefore, shallow foundations are not considered feasible within the riverbed. Shallow foundations may be feasible beyond the soil cemented banks of the river. However, enough information regarding the foundation configuration and loads is not available at this time to evaluate whether or not shallow foundations are feasible beyond the soil-cemented banks. Therefore, only deep foundations are recommended at this time.

Within the deep foundation category, driven piles will be difficult to construct given the dense nature of the subsurface soils and the presence of cobbles. Hence, drilled shafts are considered the only feasible foundation alternative for all three bridge structures.

During the final design, test shafts are recommended to evaluate constructability of drilled shafts. Load tests are also recommended at each of the three bridge sites in order to take advantage of larger resistance factors in the LRFD approach that can make the drilled shaft configurations more cost-effective. It should be noted that the subsurface conditions at each of the three bridge locations are sufficiently different such that the test shaft and/or load test information cannot be reliably extrapolated from one site to the other.

11.5 McKellips Road Widening

NCS Consultants performed 24 borings, 5-ft deep, along McKellips Road between SR202L and SR101L to provide recommendations in support of the pavement design. The soils along the project corridor consisted predominantly of sand with varying amounts of silt and clay or silts and clays with varying amounts of sand having USCS classifications of CL, ML, CL-ML, SC, SM, SP-SM, and SW-SM. Groundwater was not encountered in any of the pavement borings at the time of investigations. Pavement recommendations are provided in NCS' Pavement Design Memorandum.

12 FIELD SURVEY INFORMATION

Field survey information and topography for this project is based on aerial mapping completed by Southwest Mapping Technologies Inc., with flight dates from December 2006 and January 2007. Horizontal and vertical control was provided by Dibble Engineering under the direct supervision of Randall Bilyeu, RLS. Vertical elevations are based on the National Geodetic Vertical Datum of 1988. Horizontal control uses Arizona State Plane coordinates based on the 1983 North American Datum.

13 CONCEPTUAL ALTERNATIVES

The orderly growth of the area consisting of the City of Mesa and the SRP-MIC, between SR101 on the west and Gilbert Road on the east, may depend on the adequacy of the roadway system connecting communities on both sides of the Salt River.

Embankments and levees exist at the Dobson Road crossing point, but are lacking at the McKellips Road and Gilbert Road crossings, which close when the Salt River flows. All-weather crossings of the Salt River by means of bridges and bank protection will improve the roadway system at the three mentioned road locations.

The potential roadway alignments for each road are constrained to two or three locations determined by several engineering factors, such as minimizing the overall bridge span, reducing the relocation of existing utilities, following geometric requirements for 55 mph design speed, and matching tie-in and alignment of existing roads.

Alternatives for the project were developed to prevent flooding of the roadways while minimizing closures during the project implementation period. The following is a discussion of the alternatives under consideration.

13.1 Dobson Road Bridge Alternatives

A Dobson Road Bridge beginning at the Dobson Road/SR202 interchange (Figure 13-1) would connect to McKellips Road north of the Salt River. Three primary alignments were considered under this alternative:

- Roadway ties-in to McKellips Road at Longmore Road or west of Longmore Road (Alternatives D1, D1a, and D1b)
- Roadway ties-in to McKellips Road at Dobson Road (Alternatives D2 and D2a)
- Roadway ties-in to McKellips Road at 92nd Street (Alternatives D3 and D3a)

All the study alignments would connect with the existing Dobson Road at SR202 and to the Dobson Road intersection south of Salt River (Figure 13-2). The roadway length and the location of the intersection with McKellips Road, however, vary depending on the alternative.

Figure 13-1 Dobson Road - South

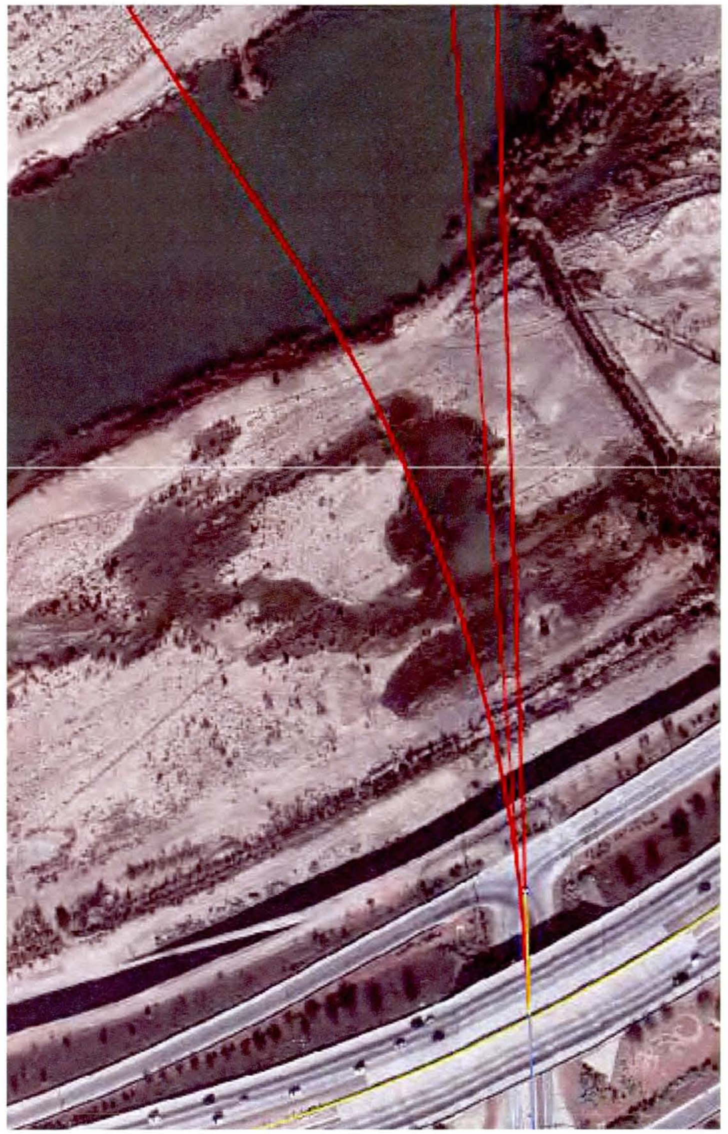


Figure 13-2 Dobson Road at SR202 – Dobson Bridge tie-in South of Salt River

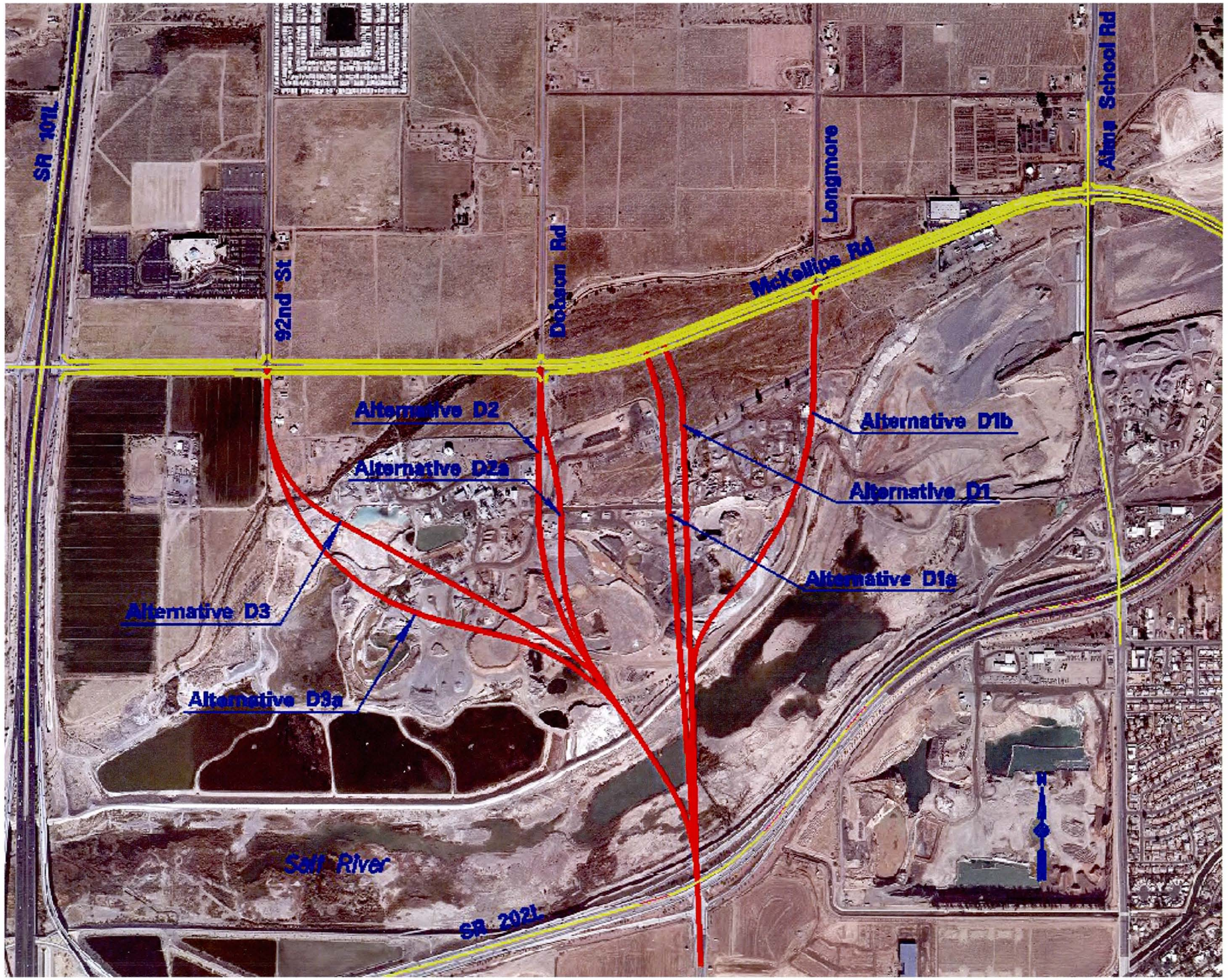


Figure 13-3 Dobson Road Alignment Alternatives

13.2 Gilbert Road Bridge Alternatives

The Gilbert Road Bridge component of the project proposes a crossing between Thomas Road and SR87 that will replace the existing bridge crossing and at grade crossing with a single bridge structure and adjacent roadway. Because of the adjacent gravel mining operations, grade control structures are being considered for both this site and for the Va Shly'ay Akimel Restoration Project. Three alternatives, G1, G2 and G3, have been evaluated, as depicted below in Figure 13-4.

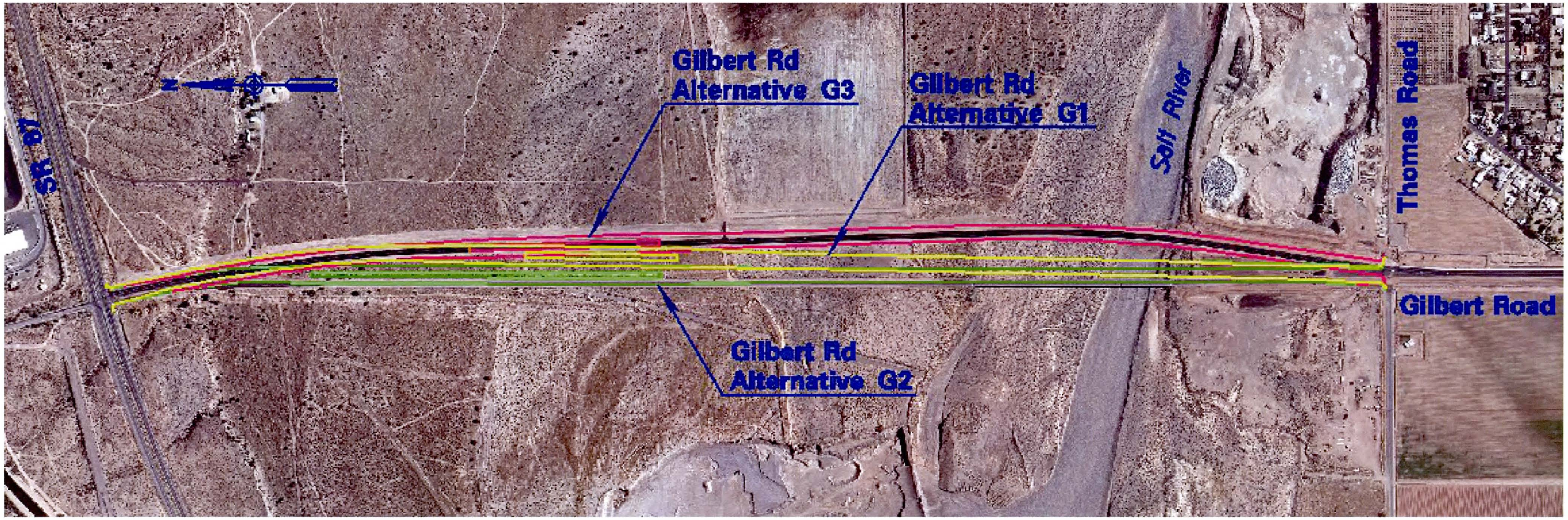


Figure 13-4 Gilbert Road Bridge Alignment Alternatives

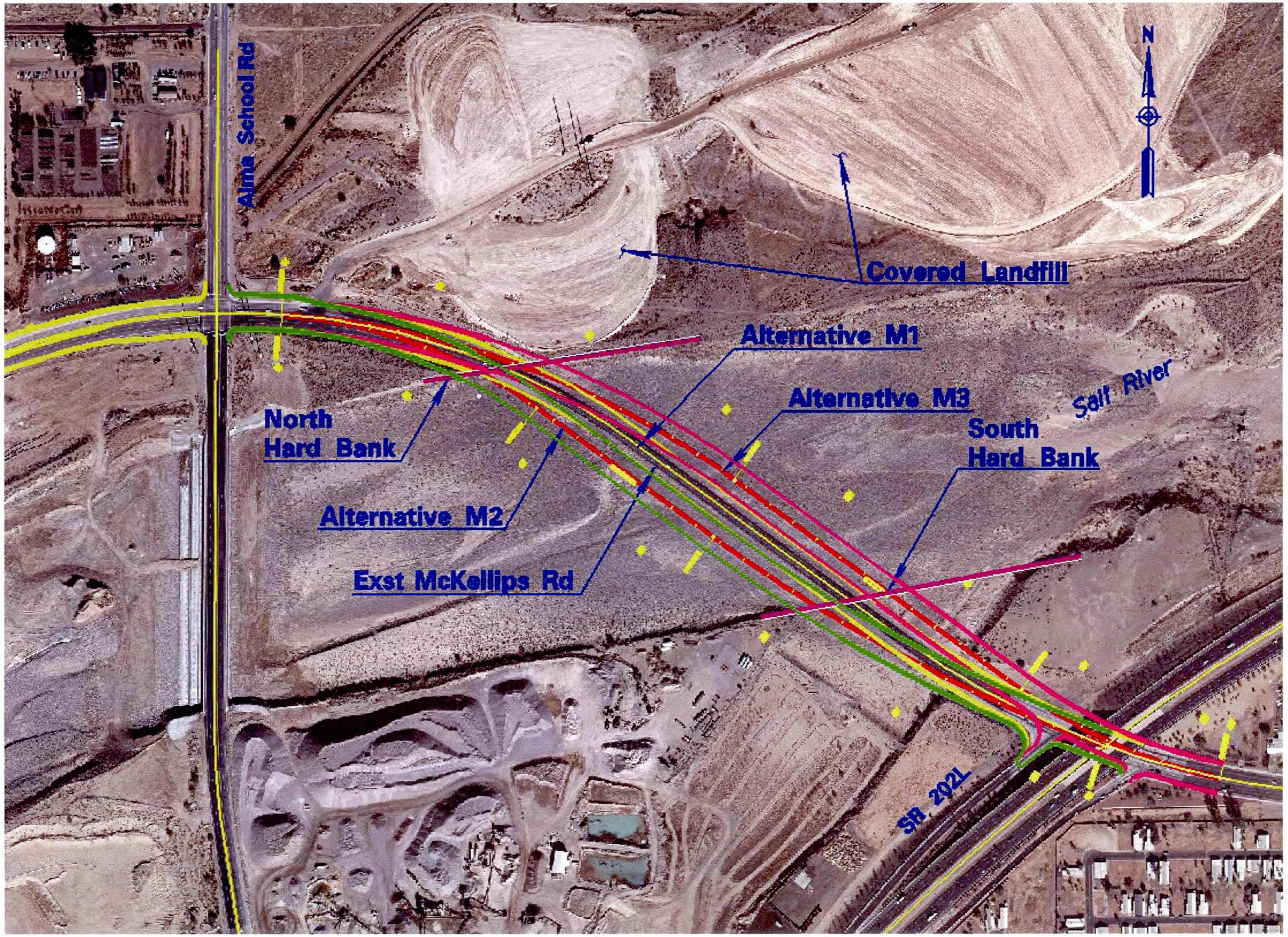


Figure 13-5 McKellips Road Alternatives

Figure 13-6 McKellips Bridge tie-in to McKellips Road at Alma School Road

13.3 McKellips Road Bridge Alternatives

The McKellips Road Bridge component of the project will the replace the existing at-grade crossing at McKellips Road between Alma School Road and the SR202 with a new bridge structure. Hard banks will also be placed along the north and south edges of the Salt River in order to redirect the flow in the river. To do this, three alternatives are proposed to cross the river while connecting to the existing intersections at Alma School Road and the SR202, Alternatives M1, M2 and M3.

13.4 McKellips Road Widening Alternatives

The McKellips Road widening component of the project will widen McKellips Road from a four-lane roadway to a six-lane roadway including a center raised median and sidewalks between the SR101 intersection and Alma School Road. To do this, three alternatives were evaluated: Alternatives MR1, MR2 and MR3.

13.4.1 Alternative MR1

Alternative MR1 would widen McKellips Road between the SR101 and Alma School Road symmetrically about its existing centerline. New right-of-way requirements would be about equal from both sides of McKellips Road. The widening could consist of using the existing pavement as a base and widening with new pavement. Cost estimates developed for this project have assumed that new pavement will replace the existing pavement.

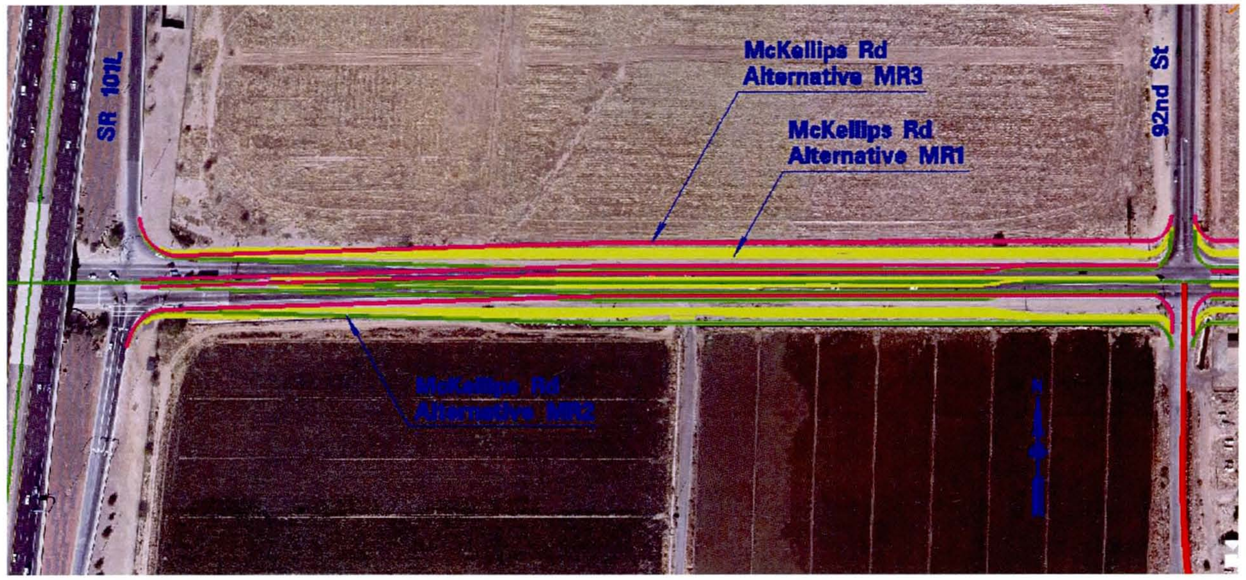
Figure 13-7 McKellips Bridge tie-in to McKellips Road at SR202

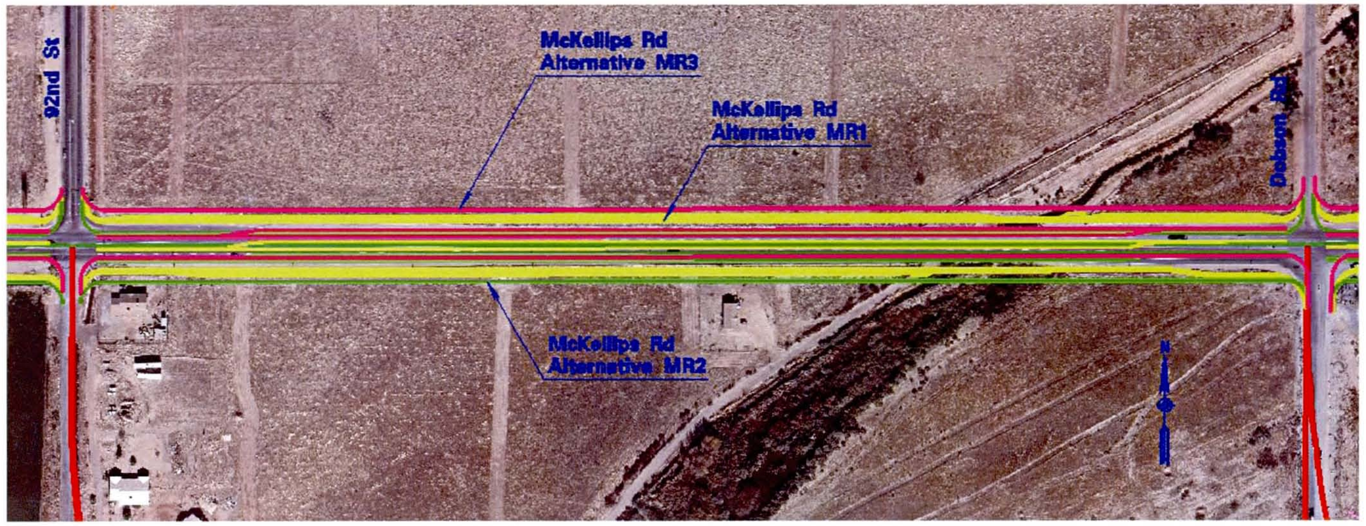
13.4.2 Alternative MR2

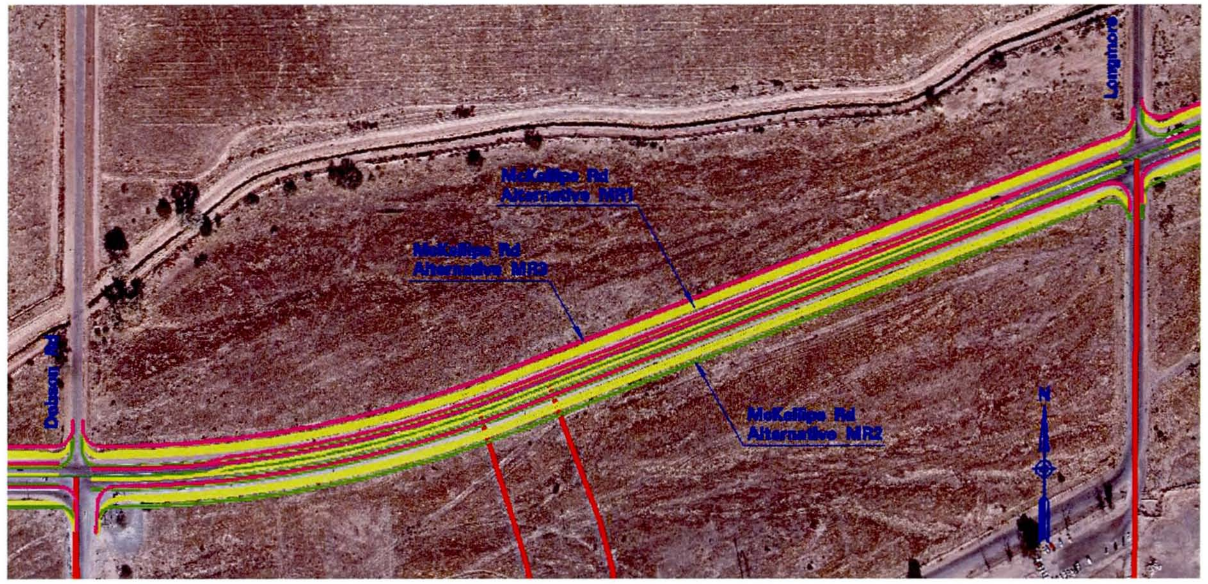
Alternative MR2 would widen McKellips Road between the SR101 and Alma School Road asymmetrically with all of the widening to the south. Any new right-of-way requirements would occur on the south. This would shift the existing alignment centerline south approximately 26 feet. This widening to keep the crown of the road would require pavement removal and replacement.

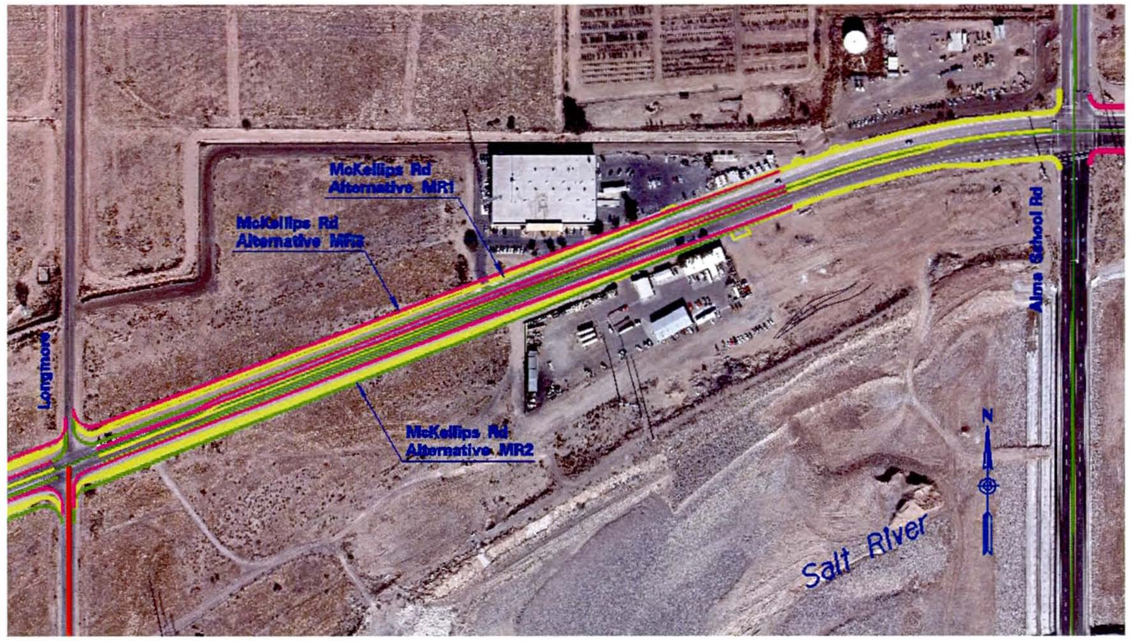
13.4.3 Alternative MR3

Alternative MR3 would widen McKellips Road between the SR101 and Alma School Road asymmetrically with all of the widening to the north. Any new right-of-way requirements would occur on the north. This would shift the existing alignment centerline north approximately 26 feet. This widening to keep the crown of the road would require pavement removal and replacement.









SR101 to 92nd Street (upper)

92nd Street to Dobson Road (lower)

Dobson Road to Longmore Road (upper)

Longmore Road to Alma School Road (lower)

Figure 13-8 McKellips Road Widening Alternative Alignments

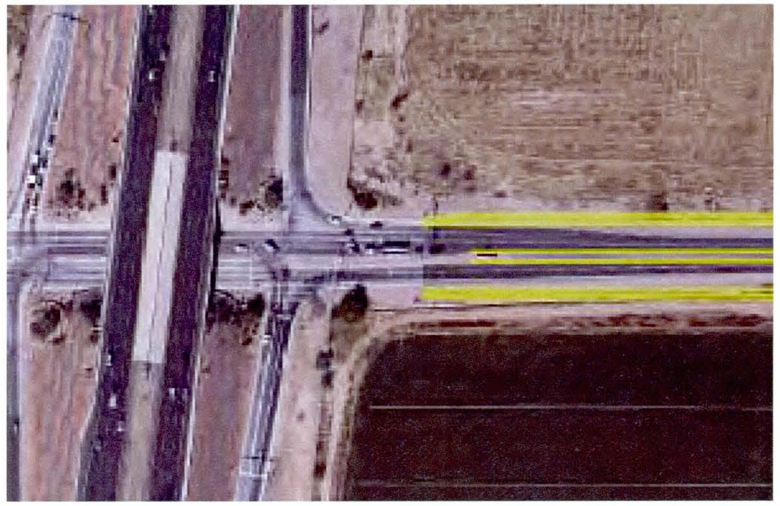


Figure 13-9 McKellips Road at SR101

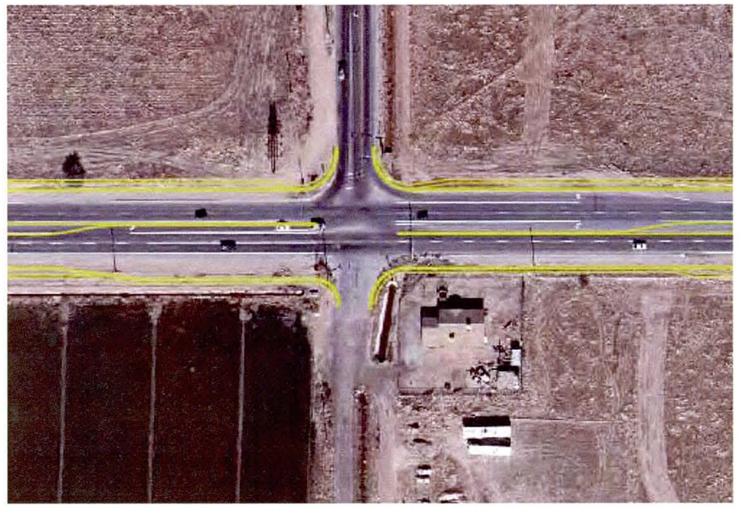


Figure 13-10 McKellips Road at 92nd Street

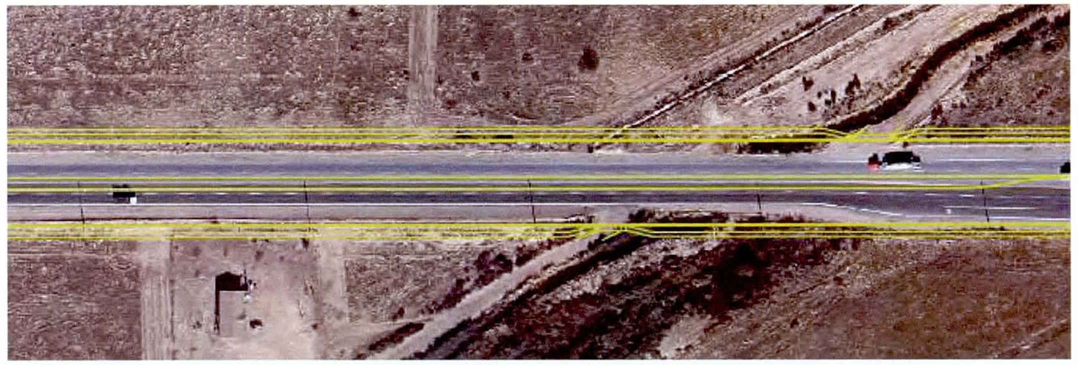


Figure 13-11 McKellips Road between 92nd Street and Dobson Road

Figure 13-12 McKellips Road at Dobson Road

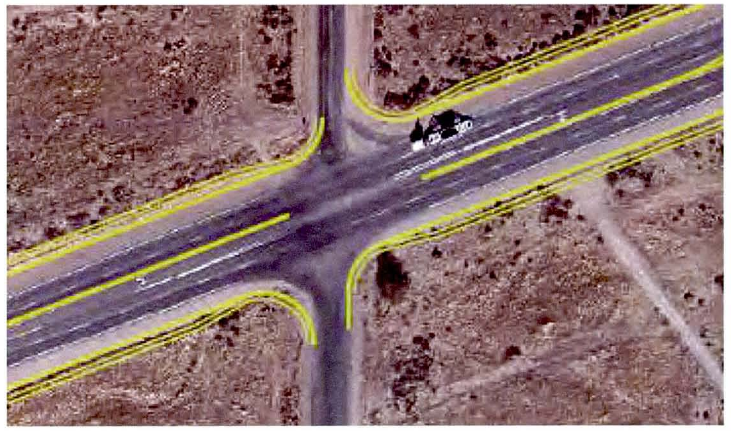


Figure 13-13 McKellips Road at Longmore Road

Figure 13-14 McKellips Road between Alma School and Longmore Roads

Figure 13-15 McKellips Road at Alma School Road

14 DISCUSSION OF ALTERNATIVES

The alternatives for each of the three bridges are discussed below.

14.1 Dobson Road Bridge Alternatives

Seven alternatives are proposed for the Dobson Road Bridge on three main alignments: east (D1, D1a, and D1b), west (D3 and D3a), and through the center (D2 and D2a) of the existing SRMG operations between the existing Dobson Road south of the Salt River and McKellips Road north of the Salt River.

Each alternative was evaluated using several engineering criteria, such as minimizing the overall bridge span, reducing relocation of existing structures and utilities, following geometric requirements, matching tie-in and bearing location of existing roads, and future land use of project area.

Alternatives D1, D1a, and D1b all pass through the eastern half of the SRMG land. All three would require a very similar bridge that is tangent across the Salt River but longer due to the skew of the river. Once north of the river, though, the alignments differ. While alignments D1 and D1a continue north, D1b turns east. This allows D1b to avoid most SRMG operations, avoiding many existing structures. Unlike D1b, D1 and D1a would pass through SRMG operations which would directly affect the existing asphalt pavement mix plant. Alternative D1a would avoid these by angling west.

D1 and D1a would both terminate between existing intersections along McKellips Road. This creates traffic operations issues along McKellips Road. D1b would tie-in at Longmore Road, an existing intersection.

The alignments for D1 and D1a are both tangent for most of the alignment and would only require curvature and superelevation in order to tie-in at McKellips Road. The alignment for D1b would require tighter curves and larger superelevation. Alternatives D1 and D2 would require an underpass to prevent SRMG and Dobson Road traffic conflicts.

Alternatives D2 and D2a both pass through the center of the SRMG operations. The bridge would be on a curved alignment which would shorten the bridge across the Salt River. As with alternatives D1, D1a, alternatives D2 and D2a would split the existing SRMG operations and would require an underpass. While avoiding many of the operation's buildings, D2a's alignment would require tight reversing curves and superelevation transitions that are not preferred.

Both D2 and D2a would terminate at the existing intersection of McKellips Road and Dobson Road. This would allow continuous traffic flow along Dobson Road to north of McKellips.

Alternatives D3 and D3a require the same bridge as alternatives D2 and D2a. The impact alternatives D3 and D3a would have on the existing land use would be minimal when compared to the other alternatives. They, like alternative D1b, would avoid these impacts by going around the existing mining operations. Though, unlike alternative D1b, D3 and D3a would route future traffic to the west along 92nd Street, which is more compatible with existing and future land uses.

While D3 and D3a would not bisect the existing SRMG mining operations as the D2 alternatives would, D3 would affect the existing materials sorting and stockpiling equipment. D3a would avoid this by having a small impact on the percolation ponds located on the southwest corner of the project area.

Both D3 and D3a would have a large amount of super-elevated curved roadway.

Table 14-1 Dobson Road Bridge Alternatives Comparison

EVALUATION CRITERIA	D1 DISCUSSION	D1a DISCUSSION	D1b DISCUSSION	D2 DISCUSSION	D2a DISCUSSION	D3 DISCUSSION	D3a DISCUSSION
Bridge Alignment	Straight	Straight	Straight	Curved on One End	Curved on One End	Curved on One End	Curved on One End
Roadway Alignment	Straight	Straight	Undesirably Curved	Curved	Undesirably Curved	Curved	Curved
Adverse Travel Distance	No	No	Yes	No	No	No	No
McKellips Road Tie-in Location	Tee Intersection	Tee Intersection	Intersection At Longmore	Intersection at Dobson Road	Intersection at Dobson Road	Intersection at 92nd Street	Intersection at 92nd Street
Utility Impacts	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Impacts SRMG Operating Facilities	Yes	Yes	Minor Amount	Yes	No	Yes	Minor Amount
Impacts City of Mesa Ponds	No	No	No	No	No	No	Yes
Impacts Wetlands	No	No	No	No	No	No	Yes
Promotes Increased Traffic to Interior SRP-MIC Street System	No	No	Yes	Yes	Yes	No	No
Compatibility with Current Land Uses	No	Yes	No	No	Yes	No	Yes
Compatibility with Future Land Uses	Yes	Yes	No	Yes	No	Yes	No
Right-Of-Way Allottee Acquisition	No	No	No	No	No	Yes	Yes
Cost Estimate	$59,210,107	$58,554,637	$60,161,309	$55,134,388	$55,422,799	$62,547,981*	$62,028,364

* Updated cost from the original evaluation is $57,981,000.

14.2 Gilbert Bridge Alternatives

Three alternatives were evaluated for Gilbert Road: the construction of a new bridge between the new and old existing roadways (G1), the construction of a new bridge above the existing northbound alignment (G2), and removing the existing Gilbert Road Bridge and replacing it with a new structure (G3).

Table 14-2 Gilbert Road Bridge Alternatives Comparison

EVALUATION CRITERIA	G1 DISCUSSION	G2 DISCUSSION	G3 DISCUSSION
Bridge Alignment	Straight	Straight	Straight
Maintenance Of Traffic	Only for Roadway	Need to Close 1 Way and Reduce Traffic to 1 Lane each Direction	Need to Close 1 Way and Reduce Traffic to 1 Lane each Direction
Cost Estimate	$68,797,574*	$69,804,115*	$69,860,403*

*Cost estimates were based on a longer bridge than currently being considered. The current cost estimate for G1 is $45,618,000.

14.3 McKellips Road Bridge Alternatives

Three alternatives were evaluated for the McKellips Road bridge crossing between Alma School Road and the SR202, M1, M2 and M3. All three would require the replacement of the existing at-grade roadway with a new bridge crossing along with the construction of hard banks on the north and south banks of the Salt River.

The controlling difference between the three alternatives is maintenance of traffic on McKellips Road between Alma School Road and the SR202 during construction. Alternative M1 would not allow this because it would replace the existing roadway with a bridge crossing along the existing alignment. McKellips Road would either need to be closed between Alma School Road and the SR202 intersection or a detour road would need to be built for traffic flow during construction.

Alternatives M2 and M3 would allow the new bridge to be built while the existing roadway is kept open. This will keep the impact on the existing traffic to a minimum with the need for construction phasing when building the approaching roads. Alternative M3 would require bridge work to be done to the SR202 interchange, thus making it impractical.

Table 14-3 McKellips Road Bridge Alternatives Comparison

EVALUATION CRITERIA	M1	M2	M3
	DISCUSSION	DISCUSSION	DISCUSSION
Bridge Alignment	Straight, with Curve on North	Curved	Straight, with Curve on North
Roadway Alignment	Curved	Curved	Curved
Impacts to SR202 Interchange	Small Impact	No	Major Impact--North Abutment
Impacts to McKellips Road East of SR202	Yes	Yes	Yes
Maintenance of Traffic	Needs Detour Road until Hardbank Construction requires complete closure	Needs Detour Road until Hardbank Construction requires complete closure	Needs Extensive MOT to Keep SR202 Open
Permanent Right-Of-Way Needed	Yes	Yes	Yes
Temporary Right-Of-Way Needed	Yes	Yes	Yes
Cost Estimate	$33,671,340*	$34,082,340	Not Estimated

* Updated cost from the original evaluation is $43,913,000.

14.4 McKellips Widening Alternatives

Three alternatives were evaluated for the McKellips Road widening between SR101 and Alma School Road: MR1, MR2 and MR3. Each alternative widens the existing McKellips Road section from a four-lane roadway with no curb and gutter or center median to a six-lane urban section with a center raised median and sidewalks.

Each alternative will require new right-of-way. Currently there are very few businesses or homes along this stretch of McKellips Road with the exception of the Alma School Road intersection. Alternatives MR2 and MR3 would avoid any unnecessary impacts from the widening by shifting all of the widening to one side of the existing road, either north or south. This would require the realignment of the centerline alignment along with a tapered shift to match existing conditions at the SR101 and Alma School Road intersection.

Businesses located just west of the Alma School Road intersection would be adversely affected by MR2 or MR3, depending on the direction of the alignment shift. Using the existing alignment for the new McKellips Road would produce the fewest adverse impacts.

Table 14-4 McKellips Road Widening Alternatives Comparison

EVALUATION CRITERIA	MR1	MR2	MR3
	DISCUSSION	DISCUSSION	DISCUSSION
Roadway Alignment	Same as Exist	CL shifted 10 feet North	CL shifted 10 feet South
Right-Of-Way Impact to North	10 feet	20 feet	none
Right-Of-Way Impact to South	10 feet	none	20 feet
Impacts to Property to North	New R/W has minor affects to Parking lot	New R/W has major affects to Parking lot	none
Impacts to Property to South	New R/W abuts Property Fence	none	Relocate property fence and significant impacts to building access
Cost Estimate	$17,201,810*	$17,812,810	Not Estimated

* Updated cost from the original evaluation is $18,366,000.

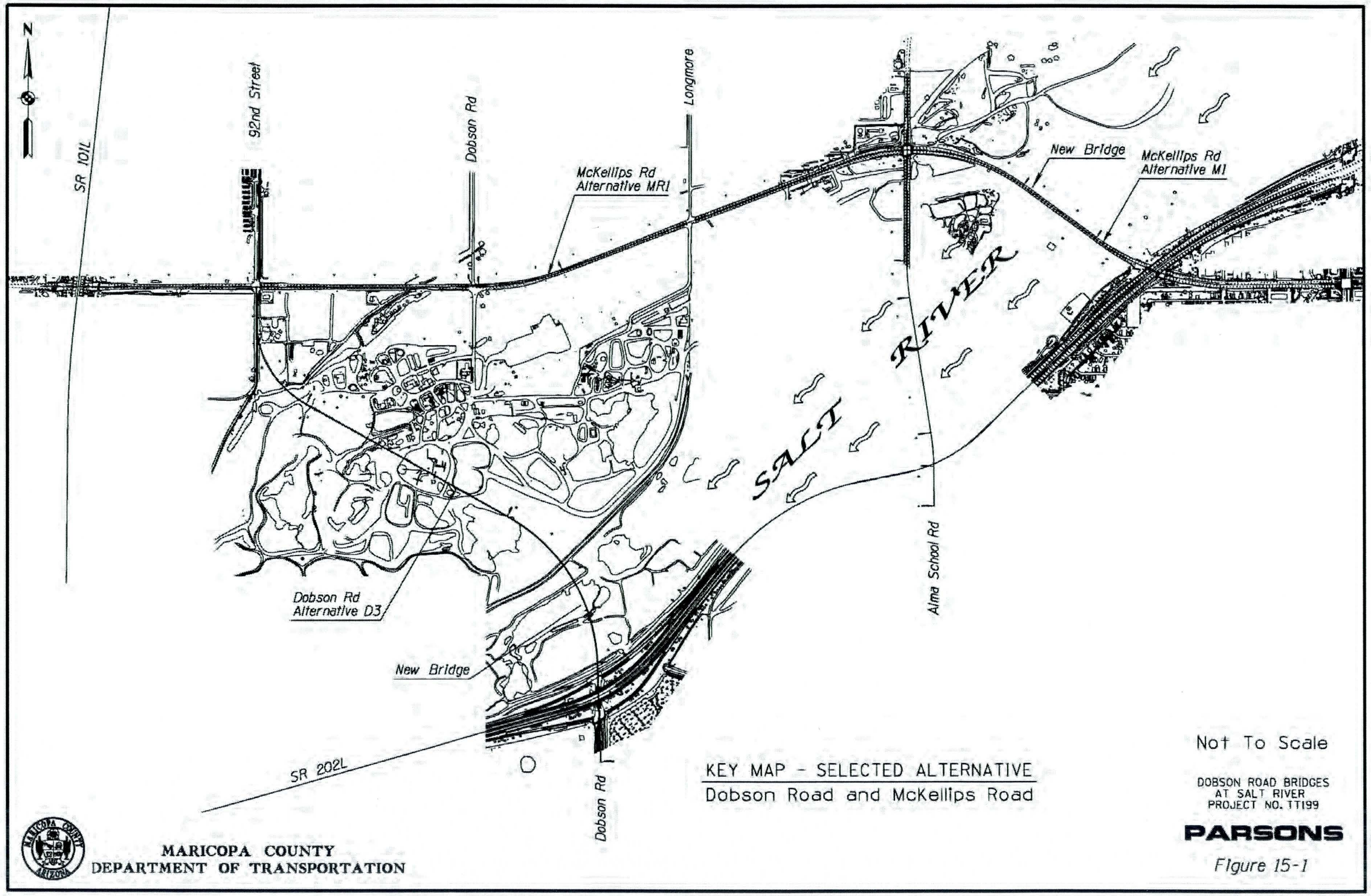
15 SELECTED ALTERNATIVES

Additional crossings of the Salt River at Dobson, McKellips, and Gilbert Roads will provide a safe way to cross the river during and after storm events. The foregoing evaluation matrix in Chapter 14 was used to compare the alternatives evaluated in this study.

15.1 Dobson Road Bridge

Following the evaluation of eight alternative alignments, the Dobson Road Bridge alignment D3 is selected because it would have the least impact to on-going mining operations, it would result in minimal environmental effects, it would reduce cut-through traffic, and it would best link the existing (new) commercial development in Mesa with planned commercial and office development by the SRP-MIC north of the Salt River. Figure 15-1 depicts the Selected Alternative for the Dobson Road Bridge and the McKellips Road Bridge.

Although Alternative D3 has impact on the gravel processing operations, this alignment provides more developable land to the south and west than the D3a alignment when those operations are completed.


N
SR 101L
92nd Street
Dobson Rd
Longmore
McKellips Rd
Alternative MR1
New Bridge
McKellips Rd
Alternative M1
SALT RIVER
Alma School Rd
Dobson Rd
Alternative D3
New Bridge
SR 202L
Dobson Rd
Not To Scale
KEY MAP - SELECTED ALTERNATIVE
Dobson Road and McKellips Road
DOBSON ROAD BRIDGES
AT SALT RIVER
PROJECT NO. TT199
PARSONS
Figure 15-1
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION

15.2 McKellips Road Bridge

After the review of three alternative alignments for the McKellips Road Bridge, Alternative M1 is selected because it would use the existing centerline of the roadway and provide a more efficient linkage with Alma School Road. The selected alternative is shown in Figure 15-1.

15.3 Gilbert Road Bridge

From the assessment of three alternative alignments Gilbert Road Bridge Alternative G1 is selected because there would be the least disruption to traffic. Moreover, this alternative is located between the existing bridge and the low-flow crossing and is slightly less expensive as well. The selected alternative is shown in Figure 15-2.

15.4 McKellips Road Widening Alternatives

From the assessment of three alternative alignments McKellips Road widening Alternative MR1 is selected because it would widen to both sides of the existing roadway, thus affecting the landowners on both sides of the roadway equally. This alignment would also result in the least impact to businesses located near Alma School Road.

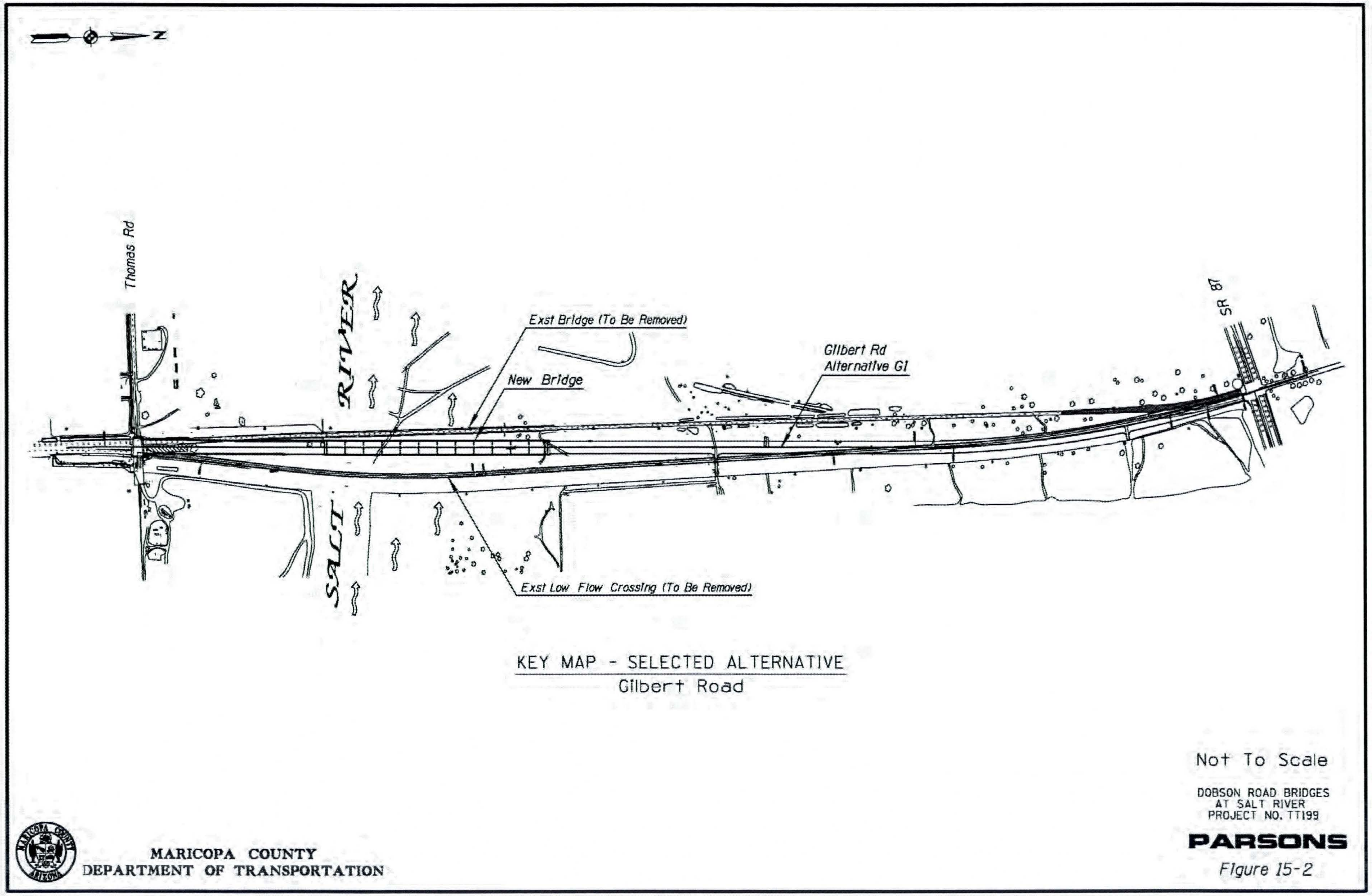

N
Thomas Rd
SALT RIVER
Exst Bridge (To Be Removed)
New Bridge
Gilbert Rd
Alternative GI
SR 87
Exst Low Flow Crossing (To Be Removed)
KEY MAP - SELECTED ALTERNATIVE
Gilbert Road
Not To Scale
DOBSON ROAD BRIDGES
AT SALT RIVER
PROJECT NO. TT199
PARSONS
MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION

Figure 15-2

16 UTILITY INFORMATON

16.1 Existing Utilities

Underground and overhead utilities cross the project area in many locations. With the assistance of the Arizona Blue Stake one call center, all of the utilities or agencies that own or maintain facilities adjacent to the project area were identified. All of the utility companies identified, along with the point of contact for this project, are listed in Table 16.1 – Utility Contact Information.

Table 16.1 – Utility Contact Information

Utility	Contact Name	Address	Contact Information
Arizona Department of Transportation	Joe Salazar	205 S. 17th Ave. Phoenix, AZ 85007	Telephone: (602) 712-7357 Fax: (602) 712-8001 E-mail: jsalazar@azdot.gov
City of Mesa	Joan Lasher	20 E. Main St. 5th Floor Mesa, AZ 85211	Telephone: (480) 644-2882 Fax: (480) 644-3392 E-mail: Joan.Lasher@mesaaz.gov
City of Phoenix Water Services Dept.	Larry Smith	200 W. Washington Street 8th Floor Phoenix, AZ 85003	Telephone: (602) 261-8231 Fax: (602) 495-5843 E-mail: Larry.smith@phoenix.gov
Cox Communications	Rod Bassett/ Brent Lee	1550 W. Deer Valley Rd. Phoenix, AZ 85027	Telephone: (602) 328-3626 Fax: (602) 322-0524 E-mail: Rod.bassett@cox.com Brent.lee@cox.com
Maricopa County Department of Transportation	Tom Larson	2901 W. Durango St. Phoenix, AZ 85009	Telephone: (602) 506-8600 Fax: (602) 506-4750 E-mail: tomlarson@mail.maricopa.gov
Qwest Communications	Linda Cockrell/ Albert Soto	135 S. Orion Ave. Room 100 Tempe, AZ 85283	Telephone: (480)768-4510 (480)768-4572 Fax: (480) 831-0239 E-mail: Linda.cockrell@qwest.com Albert.Soto@qwest.com
Saddleback Communications	Paul Kezmoh	10190 E. McKellips Rd. Scottsdale, AZ 85256	Telephone: (480) 362-7071 Fax: (480) 362-7010 E-mail: pkezmoh@saddlebackcomm.com
SRPMIC Water & Sewer	Gerard Johnson	10005 E. Osborn Rd. Scottsdale, AZ 85256	Telephone: (480) 850-4741 Fax: (480) 850-7393 E-mail: Gerard.Johnson@SRPMIC-nsn.gov
Southwest Gas	Gene Florez	5705 S. Kyrene Road Tempe, AZ 85283	Telephone: (480)730-3841 Fax: (480)730-3606 E-mail: Gene.Florez@swgas.com
SRP Electric	Richard Rummler	XCT341 PO Box 52025 Phoenix, AZ 85072	Telephone: (602) 236-0452 Fax: (602) 236-2737 E-mail: Richard.Rummler@srpnet.com
SRP Irrigation	Susana Ortega	PAB106 PO Box 52025 Phoenix, AZ 85072	Telephone: (602) 236-5799 Fax: (602) 236-2737 E-mail: Susana.Ortega@srpnet.com

Once all of the utility stakeholders were identified, each was contacted to obtain as-built maps and/or quarter section maps. The approximate location of each of these utilities is listed in Table 16.2 – Existing Utilities Locations. Based on as-builts and quarter section maps received from each utility company, the facilities were placed on the preliminary design plans. The confidence in the horizontal location of the utilities shown on the plans is categorized as Utility Quality Level D (See Table 16.2) per the *2003 ASCE Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data.* Utility Quality Level D states that the information shown on the plans was derived from existing records or oral recollections.

Table 16.2 Utility Depiction Reliability

Utility Quality Level	Definition from ASCE Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
A	Precise horizontal and vertical location of utilities obtained by the actual exposure and subsequent measurement of subsurface utilities.
B	Information obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position to subsurface utilities.
C	Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to quality level D information.
D	Information derived from existing records or oral recollections.

16.2 Utility Locations and Relocation Issues

New construction within existing utility easements will require permits. Final design documents will need to verify utility company prior rights for each utility company with facilities within the project area. Coordination with individual utility companies for the identification and relocation of facilities within the project limits will be conducted during the final design phase of this project.

Tables listing specific utility locations and potential utility relocation issues along the Selected Alternatives are shown in Appendix J. Also shown in Appendix J are the utilities associated with the non-selected alternatives.

17 PUBLIC INVOLVEMENT

17.1 Outreach Efforts

A range of methods was used to inform the public about the project. There were media releases and newspaper articles describing the proposed components of the project. There were also mailings to identified stakeholders, such as the affected utilities.

Finally, a series of three meetings was held with the public to describe the individual component projects and to elicit comments. The public was notified by the MCDOT web site, by mailings to residents, and by mailings to the SRP-MIC community. In addition, fliers and public meeting posters were displayed at civic/community buildings.

The meetings occurred at a time in the process so that the results of the engineering and environmental studies could be displayed for each of the projects. Graphics, aerial photographs, and display exhibits depicting the alternative alignments and attendant issues were arrayed for comments and questions at each meeting. Project information fact sheets and comment forms were given to all attendees. Representatives of the sponsoring agencies were in attendance as was the consultant team to answer questions.

Two public meetings were held within the SRP-MIC: September 8, 2008 and September 15, 2008. The first of these was held at the Lehi Community Center and the second was held at the Salt River Community Center.

The third public meeting occurred at Lehi Elementary School in the city of Mesa on September 9, 2008.

17.2 Results

Attendance at all three meetings was light. Comments, both verbal and written, were generally favorable and none was against the project. Many people commented that they wanted to see the bridges constructed soon.

18 COST ESTIMATES

Preliminary cost estimates were developed for each of the study alternatives. Once the study alternatives were narrowed to a Selected Alternative for each of the components of the project, the cost estimates for these alignments were further refined. Table 18-1 presents the cost estimate for each of the Selected Alternatives. The preliminary cost estimates for the non-selected study alternatives can be found in Appendix L.

Table 18-1

2009 SUMMARY COST ESTIMATES (2011 Dollars)						
COST CATEGORIES	Cost Factors	ALTERNATIVES				
		No Build	D3	G1	M1	MR1
ROADWAY CONSTRUCTION						
Roadway		$0	$7,953,813	$4,396,018	$3,626,938	$10,542,342
River Improvements		$0	$0	$696,000	$622,622	$0
Roadway Construction SubTotal		**$0**	**$7,953,813**	**$5,092,018**	**$4,249,560**	**$10,542,342**
STRUCTURES						
Bridges		$0	$27,666,737	$25,469,044	$26,157,610	$0
Bridge Aesthetics	2.5%	$0	$691,668	$636,726	$653,940	$0
Structures SubTotal			**$28,358,405**	**$26,105,770**	**$26,811,550**	**$0**
Roadway & Structures SubTotal		**$0**	**$36,312,218**	**$31,197,788**	**$31,061,110**	**$10,542,342**
DESIGN	10%	$0	$3,631,222	$3,119,779	$3,106,111	$1,054,234
CONSTRUCTION MANAGEMENT	15%	$0	$5,446,833	$4,679,668	$4,659,167	$1,581,351
ADMINISTRATION	10%	$0	$3,631,222	$3,119,779	$3,106,111	$1,054,234
RIGHT-OF-WAY						
Roadway and Bridge ($5/sq. ft.)		$0	$4,528,365	$3,000,000	$1,258,815	$2,567,485
Relocations		$0	$750,000	$0	$0	$20,000
Slope Easement		$0	$2,513,515	$0	$0	$0
Temporary Easement		$0	$167,625	$0	$471,190	$15,600
Right-of-Way Subtotal		**$0**	**$7,959,505**	**$3,000,000**	**$1,730,005**	**$2,603,085**
UTILITIES						
Utility Relocation		$0	$1,000,000	$500,000	$250,000	$1,500,000
Alternatives Total		**$0**	**$57,981,000**	**$45,618,000**	**$43,913,000**	**$18,336,000**
TOTAL PROJECT COST	**$165,848,000 ($181,111,000)**					

19 BENEFITS/COSTS

19.1 Methodology

Maricopa County Department of Transportation uses a mathematical Benefits/Cost model (StratBENCOST) for estimating travel time savings and vehicle operating benefits associated with roadway improvement alternatives and comparing quantifiable benefits with estimated roadway development costs. The model uses the length of roadway, number of travel lanes, traffic volumes, speeds, intersection geometry, and level of service to estimate travel time and vehicle operating costs. Roadway development costs include design, construction, right-of-way acquisition and construction management. Both travel time/cost and roadway development costs are input over time during the expected life of the project.

All County roadway projects are evaluated and compared with the benefit/cost of other projects as a basis for recommendation for capital improvement programming. A benefit/cost ratio greater than 1.0 indicates the project is financially beneficial, while a ratio less than 1.0 indicates quantifiable benefits do not equal estimated cost. Several factors which affect the results of the benefit/cost comparison for the Dobson Road Bridges are:

- There currently is no bridge over the Salt River at Dobson Road, so that travel time and cost for travel around the Dobson location must be factored into the analysis. Current disbenefits (costs) of north-south travel in the Dobson Road Corridor become a baseline for comparison with benefits of Dobson Bridge alternatives.
- Current dry crossings of the Salt River at McKellips Road and Gilbert Road can flood and become impassable at certain times of the year. The existing Gilbert Road Bridge may also be closed during high water because the roadway embankments are too low and rare event flows can overtop the roadway. Based on County Flood Control data, this disbenefit of traveling around the corridor during wet conditions is factored into the benefit/cost for those alternatives.
- Because of infrequent flooding, the calculated benefits/cost are very low for these critical links.

19.2 Results of Benefits/Cost Analysis

Resulting Benefits/Cost Ratios for Dobson Road/Bridge are as shown in Table 19-1.

Table 19-1 Benefits/Cost Ratios Dobson Road/Bridge

Alternative	Discounted Cost	Gross Benefits	Net Benefits	Benefits/ Cost Ratio
D1 - Dobson Rd (L202 to McKellips between Dobson and Longmore)	59,538,500	103,821,300	44,282,800	1.74
D1a - Dobson Rd (L202 to McKellips between Dobson and Longmore)	59,162,200	103,820,900	44,658,700	1.75
D1b - Dobson Rd (L202 to McKellips at Longmore)	59,070,500	92,430,800	33,360,300	1.56
D2 - Dobson Rd (L202 to McKellips at Dobson)	55,909,200	104,894,700	48,985,500	1.88
D2a - Dobson Rd (L202 to McKellips at Dobson)	55,496,900	104,894,300	49,397,400	1.89
D3 - Dobson Rd (L202 to McKellips at 92nd St)	61,429,800	88,586,800	27,157,000	1.44
D3a - Dobson Rd (L202 to McKellips at 92nd St)	61,217,000	88,586,600	27,369,600	1.45

Resulting Benefits/Cost Ratios for McKellips Road Widening are as follows:

Table 19-2 Benefits/Cost Ratios for McKellips Road Widening

Alternative	Discounted Cost	Gross Benefits	Net Benefits	Benefits/ Cost
M1 - McKellips Rd (Alma School Rd to Loop 202)	28,246,700	9,841,800	(18,404,900)	0.35
M2 - McKellips Rd (Alma School Rd to Loop 202)	28,598,800	9,841,800	(18,757,000)	0.34

Resulting Benefits/Cost Ratios for the McKellips Road Bridge are as follows:

Table 19-3 Benefits/Cost Ratios for McKellips Road Bridge

Alternative	Discounted Cost	Gross Benefits	Net Benefits	Benefits/ Cost
M1 - McKellips Rd (Alma School Rd to L202)	12,932,800	4,876,000	(8,056,800)	0.38
M2 - McKellips Rd (Alma School Rd to L202)	13,364,400	4,876,000	(8,488,400)	0.36

Resulting Benefits/Cost Ratios for Gilbert Road Bridge are as follows:

Table 19-4 Benefits/Cost Ratios for Gilbert Road Bridge

Alternative	Discounted Cost	Gross Benefits	Net Benefits	Benefits/ Cost
G1 - Gilbert Rd (Thomas Rd to SR87)	58,600,100	29,083,200	(29,516,900)	0.50

20 PROJECT IMPLEMENTATION

20.1 Introduction

Traffic demand forecasting indicates that all the projects will eventually need to be constructed. The availability or timing of funding may not meet the total estimated cost for all the projects and may require a delay in implementing some projects until funding is available. Projects may also have to wait for right-of-way acquisition and environmental processes to be completed. Priorities for construction have been recommended using input from SRP-MIC, the City of Mesa and the public. Implementation of the project will also be based on the timing of funding, rights-of-way clearance and project delivery time.

It should be noted that the SRP-MIC has a requirement for cultural and environmental training when working on community lands. This training requirement applies to any work on these lands, ranging from utility relocations to roadway and bridge construction.

20.2 Matrix Evaluation of Project Priority

The evaluation matrices (see Project Implementation Appendix M) clearly indicate that construction at the Gilbert Road Bridge project has the highest priority. The Gilbert Road Bridge had been part of another project that had been fully cleared for construction and partially implemented. The right-of-way and environmental process are significant elements that building the Gilbert Road Bridge first is necessary due to the condition of the existing bridge and inability of bridge and roadway embankment to remain open during high flow events, provide community connectivity between the Lehigh area and the SRP-MIC community resources, the need to support increasing traffic volumes and the need to establish a dependable, all-weather crossing connection across the Salt River.

Construction of the Dobson Road Bridge with the connection to McKellips Road has the second highest overall ranking and is preferred to be constructed first by the City of Mesa.

Because there are 4-lanes of existing pavement that carry traffic when the river is not flowing, the McKellips Road Bridge has the third priority followed closely by McKellips Road Widening.

20.3 Funding Availability

The total cost estimate for the four DCR project locations exceed the level of financial resources presently available for funding construction from RARF, STP-MAG funding with the remaining funds coming from MCDOT, SRP-MIC and City of Mesa. The total funding for all of the projects is significant and may not be available at the same time due to other project commitments or other reasons.

20.4 Project Delivery Method

Each of the projects can be implemented using several different Project Delivery methods other that the traditional Design-Bid-Build method. Selection of the delivery method is based on several factors the most significant of which is the time that the project needs to be constructed. Funding sources and timing of the availability of funds is the most critical item.

The Gilbert Road Bridge project needs no new right-of-way and there are few, if any, utilities in the area that require relocation. This site already possesses an approved environmental clearance document, which is being updated with the selected . It is anticipated that this project could enter the construction phase in as soon as funding becomes available.

The Dobson Road Bridge project requires acquisition of considerable SRP-MIC right-of-way, and parts of several allottee parcels. This project could take from two and one half to three years to purchase all the property needed for construction. In that time, development and approval of an Environmental Assessment can occur.

The McKellips Road Bridge project requires acquisition of some SRP-MIC right-of-way, but there are few, if any, area utilities that require relocation. It is anticipated that this project could enter the construction phase in about two and one half to three years. In that time, development and approval of an Environmental Assessment can occur.

The McKellips Road Widening project requires acquisition of some SRP-MIC right-of-way, including parts of several allottee parcels, as well as an approved Environmental Assessment. It is estimated that this project could take from two and one half to three years to purchase all necessary SRP-MIC right-of-way. In that time, development and approval of an Environmental Assessment can occur. If the McKellips Road Bridge is constructed after 2015, a temporary detour road will need to be constructed. The McKellips Road Bridge may also need to be constructed in stages.

The most likely Project Delivery method will be the Design-Bid-Build method. Should funding be available, alternative Project Delivery methods can be utilized.

20.4.1 Design-Bid-Build

The traditional Design-Bid-Build (DBB) project delivery process is well-known by Owners, Contractors, Designers and government entities. It is generally accepted as the fairest way to select the lowest bidder and achieve the lowest overall cost. However, it is the method that takes the longest time to deliver a project. (see Project Implementation Method Advantages, Disadvantages and Problems in Appendix M).

20.4.2 Design-Build

The Design-Build (DB) project delivery process provides the Owner with a delivery method that fixes the price of the project before construction and final design begins by including the design effort with construction. The contractor and designer bid on a project using 40% plans. This adds risk to the contract which adds cost to the project. Because the final Designer is hired by the Contractor to collaboratively work together, the construction duration is significantly shortened as construction can occur on some project elements while design is progressing on other elements.

DB project delivery speed is faster Design-Bid-Build (DBB) but there is a contractual layer between MCDOT and the design team. Experience has shown having this extra layer is usually not a significant concern. (see Project Implementation Method Advantages, Disadvantages and Problems in Appendix M).

20.4.3 CMAR

The Construction Manager At-Risk (CMAR) project delivery process has the Owner select a Contractor based on qualifications, not price. The owner separately selects and contracts with the final designer. After selection the Contractor takes preliminary 40% plans, negotiates with the owner and develops a guaranteed maximum Price. At the same time the Contractor is participating in the final design on constructability and cost saving items. While a CMAR contract price is typically higher than a lot of the standard project development delivery methods, it tends to produce projects with high quality. The CMAR process also delivers a project faster than DBB method. The DB and CMAR project require some preliminary plans to start the process with but these plans can be of a preliminary nature. Generally, there is a higher price for a DB project that uses preliminary plans because of the uncertainties in the design. Because the price is negotiated on a CMAR project, prices can be lower than a DB project. CMAR is currently an experimental process requiring FHWA approval should Federal funds be used to construct the project (see Project Implementation Method Advantages, Disadvantages and Problems in Appendix M).

20.4.4 Project Delivery Method Recommendations

If funds are immediately available or within 9 months of funding commitment, a project can use either a CMAR or DB project delivery method. If the commitment is longer, design can be initiated to use a normal DBB project delivery process. If the commitment is less than 4 months and Federal funds are not needed, only a CMAR project can be used. With the extensive time requirement needed for R/W acquisition, only the Gilbert Road Bridge project would need to use an alternative delivery method if funds are immediately available.

GLOSSARY

Terms and Acronyms Used in the DCR

AASHTO	American Association of State Highway and Transportation Officials
ACS	Archaeological Consulting Services, Inc.
ADC	Arizona Department of Commerce
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
aesthetics	concerning how beautiful an object looks or is perceived
alluvial	eroded materials, such as sand or gravel, which were deposited by running water.
APE	Area of Potential Effect
ASCE	American Society of Civil Engineers
ARS	Arizona Revised Statutes
ASM	Arizona State Museum
at-grade	ground level
Average Delay	time (seconds) through traffic is delayed at a roadway intersection
BIA	Bureau of Indian Affairs
BMP	Best Management Practice
bosque	Spanish word meaning "woodland"
BTSR	Bridge Type Selection Report
CH	high plasticity clay
CL	roadway centerline
CL	clay soil
CL-ML	silty clay
constructability	a measure of the ease of construction
county islands	small county areas that are land-locked inside a city or a town
datum	a standard level that elevations are taken from
DB	Design-Build
DBB	Design-Bid-Build
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CSA	Cement Stabilized Alluvium
CMAR	Construction Manager At-Risk
CO	Carbon Monoxide
dBA	sound pressure level, decibels ambient (on all sides)
DCR	Design Concept Report
Design Year	the year until the project improvements are designed to function
DRC	SRP-MIC Design Review Committee
DTM	Digital Terrain Map (or Model)
dyke	a long natural or artificial bank built to contain water
EA	Environmental Assessment
e.g.	Latin for *exempli gratia* "for the sake of example"
El	elevation above sea level
elements	essential parts
energy balance	a process of balancing incoming water energy flow and outflow water energy flow with hydraulic equations that are set up determine water surface elevations at all relevant project drainage locations
EPA	U.S. Environmental Protection Agency
et seq.	Latin, "and the following one"
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
FESWMS	Finite Element Surface Water Modeling System
FHWA	Federal Highway Administration
floodplain	nearly flat land adjacent to a stream or river that experiences periodic flooding
floodplain delineation	the process of determining the floodplain limits along a stream or river
floodway	an area of a river channel carrying flood flows and lying within the flood plain
FST2DH	Flow and Sediment Transport module Version 3.2.2
ft3/sec	Cubic Feet per Second
fluid regime	a set of conditions describing fluid movement
Galerkin finite element	a mathematical method of variation designed to assist the reduction of complex equations down to real-world, understandable applications, such as river flows, by Russian mathematician, Boris Galerkin
GC	clayey gravel
GP	poorly graded gravel
GP-GC	poorly graded to clayey gravel
GP-GM	poorly graded to silty gavel
grade control structure	flat horizontal concrete structure designed to control river erosion
GRPB	Gilbert Road Proposed Bridge
GUI	Graphical User Interface
GW	well graded gravel
GW-GC	well to poorly graded gravel
hard bank	a steep rise of earth or gravel from a river floodway to adjacent higher ground
HEC	Hydraulic Engineering Center
HEC-RAS	Hydraulic Engineering Center River Analysis System
HES	Highway Enhancements for Safety
horizontal plane	a perfectly flat imaginary surface
IGA	Intergovernmental Agreement
incapacitating injuries	a motor vehicle accident with injuries requiring transport to emergency treatment facilities
incisement	water erosion resulting in a vertical cut through the river channel
interchange	the intersection of two or more freeways, along with various frontage roads, under passes, fly-over-ramps, on-ramps and off-ramps
invasive vegetation	non-native vegetation that crowds out or kills native plant life
kV	kilovolt

leq	Equivalent Continuous Noise Level
levee	a long natural or artificial bank built to contain water
LRFD	Load and Resistance Factor Design
LOS	Level of Service
low-flow crossing	a location where a roadway crosses a water course
MAG	Maricopa Association of Governments
MCDOT	Maricopa County Department of Transportation
mesh system	a horizontal view of a 2-D Analysis drainage system of water flow that is displayed by a mesh or netting, representing small segments of a river to more easily calculate water velocity and flow quantity energies in two directions, both horizontally and vertically
MFE	Modified FEMA Existing
MFP	Modified FEMA Proposed
ML	silt
mph	miles per hour
MPO	Municipal Planning Organization
NAVD88	North American Vertical Datum of 1988
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NGVD29	North American Vertical Datum of 1929
NHPA	National Historic Preservation Act
No Build	an alternative that recommends "Do Nothing"
nodes	points on a network or mesh
non-incapacitating injuries	a motor vehicle accident where injuries not requiring transport to emergency treatment facilities occur
NRHP	National Register of Historic Places
O_3	Ozone
outfall	a water discharge point
pavement drainage analysis	a mathematical method for determining how much rainwater water flows off a roadway and into a storm drainage system at any given point
P6OP2	discharge Frequency Values from USACE Section 7 Study, Peak Discharges (ft^3/sec) in Salt River, Recommended Plan Versus W/O Project
PCB	Polychlorinated Biphenyls
pcf	pounds per cubic foot
PGL	Pavement Grade Line
phase length	a rational approach regarding the selection of the most appropriate amount of time (seconds) required for each traffic signal phase to control traffic volume and movements through a given roadway intersection
phase sequence	a rational approach regarding the selection and sequencing of the most safe and orderly phasing that can control traffic movements through a given roadway intersection
PM2.5	Particulate Matter, 2.5 microns in diameter
PM10	Particulate Matter. 10 microns in diameter
possible injuries	an accident where injuries may or may not have occurred
PPCG	Precast Prestressed Concrete Girder (Bridge)
ppm	parts per million
property damage only	a motor vehicle accident without any injuries occurring
raptors	birds of prey, such as hawks and eagles
RARF	Regional Area Road Fund
RCRA	Resource Conservation and Recovery Act
reversing curve	a horizontal roadway curve in one direction followed immediately by a horizontal roadway curve in the other direction
Riparian	referring to vegetated areas along water courses
RLS	Registered Land Surveyor
roughness coefficient	a term in a hydraulic equation that is a measure of the roughness of the river channel and the resistance to water flows downstream
R/W	Right-of-Way
safety factor	designing project with a safety factor means the object, such as a roadway. has an extra degree of safety included to insure safe operation at normal, everyday levels of expected use
SARA	Superfund Amendments and Reauthorization Act of 1986
SC	clayey sand
schematic	a diagram
Scour	the removal of sand, gravel and rocks around the perimeter and immediate vicinity of concrete bridge piers, caused by swiftly moving flood waters
Shld	Shoulder
Sdwk	sidewalk
Section 4(f)	part of the US Transportation Act of 1966
Section 404 Permit	a part of the US NEPA (National Environmental Policy Act of 1969) that provides an acceptable set of parameters for the handling of proposed roadway improvements that will intrude into, across and/or border the Water of the United States (WOUS)
SHPO	State Historic Preservation Office
sideswipe	a motor vehicle accident where one moving vehicle brushes up, scrapes along or collides against the side of another moving vehicle in the same or the opposite direction
SIPs	State Implementation Plans
skewed alignment	the positioning of a bridge or a highway across a river or another highway, which crosses at an angle less than 90 degrees
SM	silty sand
SMS	Surface (Water) Monitoring System
SP	poorly graded sand
SP-SM	poorly graded to silty sand
sq ft	Square Feet
SRP	Salt River Project
SR87	State Route 87

GLOSSARY—Page Three

SR101	State Route 101L
SR202	State Route 202L
SRP	Salt River Project
SRP-MIC	Salt River Pima-Maricopa Indian Community
SRMG	Salt River Materials Group
STP	Surface Transportation Program
subroutine	a portion of a computer program that performs a specific task
Superelevation	Instead of a nearly flat roadway, the entire existing pavement surface is tilted slightly to one side to help drivers maintain better control of their vehicles as they travel around curves. A tilt in the roadway surface also helps to reduce the chance of vehicle hydroplaning when stormwater drains off the pavement surface.
SW	well graded sand
SW-SC	well graded to clayey sand
SW-SM	well graded to silty sand
Synchro 7	computer software utilized to model highway traffic capacities
Thalweg	The deepest continuous line along a watercourse that conducts the fastest water flow.
TIP	Transportation Improvement Program
topographic	a description of the Earth's surface shapes and features on maps
Traffic signal cycle length	the time (seconds) it takes a traffic signal to allow all movements from all directions to proceed through a roadway intersection
Tres Rio Wetlands Project	A City of Phoenix Salt River Restoration Project at 91st Ave. and the Salt River
TSP	Total Suspension Particulate (Matter)
Typ	typical
typical section	a plotted view of a horizontal cut across a planned roadway that displays the travel lanes, passing lanes, shoulders, parking areas, medians, sidewalks and landscaping elements
2-D	Two-Dimensional
urban section	a plotted view of a horizontal cut across a planned roadway in an urbanized, developed setting that displays travel lanes, passing lanes, shoulders, parking areas, medians, sidewalks, landscaping elements and curbs and gutters
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
U.S.C.	United States Code
USCS	Unified Soil Classification System
Va Shly' Ay Akimel	An SRP-MIC Salt River Restoration Project
velocity vectors	schematic representations of the velocity and direction of water flow on a schematic, map or drawing as arrows or other symbols
vpd	vehicles per day
weir	a small overflow-type dam commonly used to raise the level of a river
wetlands	land whose soil is saturated with moisture either permanently or seasonally
WOUS	Waters of the United States
XP-SWMM	Wastewater and Storm Water Management Model

Dobson Road Bridges Final DCR - CD Appendices Data File List

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  - Storm Drain Inlet Spacing Table 10-Year
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- Flood Control District-Provided HEC-RAS Model – Dobson Area