

6.0 MAJOR DESIGN FEATURES

6.1 Introduction

This section describes the major design features used to develop the alternatives. All of the alternatives meet the ADOT design standards in the ADOT Roadway Design Guidelines.

6.2 Design Controls

The following design controls were used in the development of the alternatives:

- Design Year: 2025
- Design Speed:

<u>Roadway Type</u>	<u>Terrain</u>	<u>Design Speed</u> (Desire. / Min.)
Controlled Access Hwy	Flat/Rolling	75 / 70 mph
Rural Divided Hwy	Rolling	65 / 60 mph
Rural Divided Hwy	Mountainous	60 / 50 mph
Urban Fringe Arterial	Rolling	60 mph
Rural Local Road	Rolling	45 mph

- Shoulder and Lane Widths: (see Typical Sections, Appendix A):
 - Travel Lane Width: 12-feet
 - Center Left-Turn Lane: 12-feet
 - Outside Travel Lane (Urban) 16-feet
 - Shoulder Width:
 - Outside Shoulder: 10-feet (Rural divided highway)
 - Outside Shoulder: 8-feet (Urban fringe highway)
 - Inside Shoulder: 4-feet
 - Drainage Ditch Offset: 15-feet for Urban Sections (from edge of pavement to ditch centerline)
20-feet for Rural Sections
- Slope Criteria: ADOT Standard Detail C-02.10 and Figure 306.2 (Rural Divided Highway)
ADOT Standard Detail C-02.20 and Figure 306.3 (Urban-Fringe Arterial)
ADOT Roadway Design Guidelines Figure 306.4A (Urban Arterial)

- Gradient:
 - 4% Maximum (Rural Divided Highway, Rolling Terrain)
 - 6% Maximum (Rural Divided Highway, Mountainous Terrain)
 - 6% Maximum (Urban-Fringe Arterial, Rolling Terrain)
 - 7% Maximum (Urban Arterial, Rolling Terrain)
 - 0.5% Minimum
- Ramp Gradient
 - 6% Absolute Maximum
 - 4% Desirable maximum upgrade
 - 5% Desirable maximum downgrade
- Maximum Superelevation: 0.10 ft/ft (Rural Hwy)
0.06 ft/ft (Fringe Urban Fwy)
0.04 ft/ft (Urban)

Maximum Curvature (based on max. superelevation rate of 0.10 ft/ft):

• Design Speed (mph)	• Degree of Curvature
• 75	• 3°00'
• 70	• 3°30'
• 65	• 4°15'

Maximum Curvature (based on max. superelevation rate of 0.06 ft/ft):

• Design Speed (mph)	• Degree of Curvature
• 65	• 3°30'

Maximum Curvature (based on max. superelevation rate of 0.04 ft/ft):

• Design Speed (mph)	• Degree of Curvature
• 50	• 6°00'
• 60	• 3°45'

- All other roadway features are per current ADOT Roadway Design Guidelines.
- Median crossovers associated with the divided roadway alternatives were provided at locations of obvious need (major intersections, turnouts to developed properties) and are shown on the

recommended design concept alternative plans in Appendix B. Access points in addition to those shown should be consistent with the provisions noted in Section 6.4, Control of Access

- Guardrail: Provide per ADOT Criteria and/or AASHTO Roadside Design Guide.

6.3 Horizontal and Vertical Alignments

The existing horizontal and vertical alignment for US 60 will be used as much as possible where the design criteria (as defined by the requirements of the 1996 RDG) is met for the design speeds listed in Section 6.2. There are 28 horizontal curves in the existing roadway, which comprises over 60 percent of the roadway length from Florence Junction to Superior. 20 of these curves do not meet the minimum superelevation rate for the design speed. However, none of the curves exceed the recommended degree of curvature for the desired design speeds. At some time, the existing US 60 roadway will require reconstruction in these locations to provide the adequate superelevation rates.

There are 58 vertical curves on US 60 within the study limits. The stopping sight distance of eight of these vertical curves is currently less than the required distance for the design speeds listed in Section 6.2 as defined by the requirements of the 1996 RDG. Five of these locations will be improved with the proposed reconstruction of the preferred alternatives. The remaining three vertical curves that do not meet the recommended design speed will require reconstruction at some time in the future. These locations include:

- MP 216.4 West of Dromedary Peak Road
- MP 221.1 West of Picket Post Trailhead Turnoff
- MP 222.9 West of Queen Creek Bridge (Approach)

Utilizing the existing roadway in the new roadway sections is desirable for the following reasons:

- Enhances maintenance of traffic during construction
- Mitigates the impact on the environment by minimizing the construction area
- Maintains existing access to adjoining properties
- Reduces the cost of the proposed improvements

Vertical clearance requirements are as follows:

SR 79:	16’-6” (State Highway)
Queen Valley Road	16’-6” (Only access into development)
Magma Arizona Railroad	23’0” (Railroad)
Stone Avenue (Superior)	15’-6” (Local Access)

6.4 Access, Control of Access

Control of access is recommended along US 60 to enhance traffic operations and safety as well as to preclude uncontrolled future access and random strip development. Developing an access control plan involves providing access to private and public property while simultaneously preserving the flow of traffic on the roadway system in terms of safety, capacity, and speed. Within the study limits, three distinct forms of development exist. Generally rural, undeveloped private properties and State Lands exist between the western project limits at MP 211.7 to MP 217.3. TNF land exists between MP 217.3 (forest boundary) to the Town limits of Superior. Finally, developed, urban properties exist within the Town of Superior from MP 225 to the eastern project limits at the intersection with SR 177 (MP 226.8).

On the private and developable State Lands, the Transportation Board has already designated the portion of US 60 from Apache Junction to the TNF western boundary as a fully access controlled highway. The proposed improvements, with divided roadways and grade separated interchanges at major access points, is consistent with the access control plan. Within the forest limits, the divided roadway concept provides partial access control by limiting left turns to locations where crossovers are provided. In concert with the Forest Service, the transportation board should consider designating the corridor within the forest as access controlled as well, restricting any future access points from being developed. As a minimum, direct access onto the roadway should be restricted to a minimum of 1-mile spacing within the National Forest lands. Within the Town of Superior, access should be restricted to existing turnouts. If additional development should occur on private lands outside the formal limits of the town, frontage roads should be provided to serve as collector roads to convey traffic to already proposed intersections on the divided highway.

Maintaining full access control through the private/State land areas would give preference to through-traffic by providing access connections only at identified, grade-separated intersections with selected major cross streets. While designated as access controlled, ADOT still needs to acquire all rights of access from abutting property

owners. Some locations, such as the Dromedary Peak Road intersection, do not warrant the cost of construction and additional right-of-way required for a grade separated interchange, based on the local traffic volumes at this time. Provisions shall be made during the final design to accommodate the future interchange, however.

The major access changes associated with the recommended alternative are summarized as follows:

- **Alternative A-1:** Full access control. Grade separated interchanges are proposed at Florence Junction (US 60 / SR 79), and at Queen Valley Road. Access to State Lands on the east side of the Magma railroad tracks will need to be maintained by constructing a frontage road / connector from the access to the relocated Queen Valley Road.
- **Alternative B-2a:** Full access control is proposed to the Forest Boundary. As noted above, while full access control at the intersection of Dromedary Peak Road is not justified at this time, construction of the ultimate facility should be required from the future developers as growth occurs. Until the development occurs, an at-grade intersection and median crossover is proposed. The balance of the alternative may have turn-outs to access the El Paso Natural Gas Line, but no median cross-over are proposed.
- **Alternative C-1a:** Limited access is proposed in this segment by virtue of the divided highway, and limited access points. The only median crossover is proposed at the Picket Post turnout. EB motorists wishing to access the Forest Road 295 near MP 221.0 will need to make a U-turn at the Picket Post turnout and return 0.5-miles back to the access road. Ultimately, the road may be closed by the Forest Service as access can be made from Hewitt Station Road. No other access points are proposed.
- **Alternative D-2:** Several private access points exist on this segment. Nearly all access west of the Silver King Wash will be confined to the existing US 60 roadway that will be realigned with Hewitt Station Road to provide access to surrounding properties. The intersection with US 60 will initially be an at-grade intersection providing direct access to Hewitt Station Road. Provisions should be made, however, to develop a grade-separated interchange in the future when warranted, such as when the divided highway is completed to the Globe/Miami area. East of the Silver King Wash, the roadway section is transitioned to an undivided, five-lane section. It is recommended that access to US 60 not be allowed within the transition from a divided roadway to a five-lane

section. Access east of the transition should be restricted to a ¼-mile spacing, with 660-ft separations as the absolute minimums.

- **Alternative E-1:** Access through town will be maintained using current permitting policies of the Globe District. New access points should be restricted to a desirable ¼-mile spacing, with 660-ft separations allowed only as the absolute minimum.

6.5 Right-of-Way

Approximately 40 percent of the study route is located on TNF land by Special Use Permit. The width of right-of-way varies between 100 ft and 200 ft about the centerline of the existing roadway. After completion of the study documents, the Forest Service will provide additional right-of-way required on National Forest land for the preferred alternative at no cost. The process will require a revision to the Highway Easement Deed records to document the change. This action will be initiated by notifying and submitting preliminary design plans to ADOT Right-of-Way.

The study route abuts State Land on the western project limits. The remainder of the corridor abuts private land consisting of developed and undeveloped residential, commercial, and range land property.

The preferred alternatives will require additional right-of-way from private property, State Land, and the Forest Service. Table 6-1 lists the County Assessor’s parcel numbers and the estimated quantity of additional right-of-way required for the various design concept alternatives.

Alt. Name	Plans Ref.	Parcel Number			Owner	Approx Take (Acres)
		BK	MP	PG		
A1	A100	104	32	1	Concord Casualty Ltd	8.4
A1	A101	104	32	3	State Of Arizona	1.7
A1	A102	104	31	1A	State Of Arizona	0.5
A1	A103	104	31	1B	Flojo Llc	18.2
A1	A104	104	31	1C	Flojo Llc	2.6
A1	A105	104	31	2C	Junction Investment Inc	0.3
A1	A106	104	32	0	State of Arizona	116.3
B2	B100	104	30.3	0	State of Arizona	31.5
B2	B101	104	33	0	US Dept. of Agriculture	66.4
B2a	B102	104	30.3	0	State of Arizona	31.5
B2a	B103	104	33	0	US Dept. of Agriculture	81.9
C1a	C100	104	35	0	US Dept. of Agriculture	104.7

Table 6-1: ESTIMATED NEW RIGHT-OF-WAY

Alt. Name	Plans Ref.	Parcel Number			Owner	Approx Take (Acres)
		BK	MP	PG		
C2	C101	104	35	0	US Dept. of Agriculture	14.3
D2	D100	104	34	0	US Dept. of Agriculture	64.0
D2	D101	104	34	1	Southwestern Arboretum	1.3
D2	D102	104	34	2	James C & Phyllis Herron	0.0
D2	D103	105	13	1	Richard C & Tina R Rose	1.7
D2	D104	105	13	12A	Charles P & Beverly M Trimble	0.5
D2	D105	105	13	4	Daniel D & Gloria J Avendano	0.1

The desirable R/W width per ADOT standards for a rural divided highway (ADOT Roadway Design Guidelines [RDG], Figure 306.2) is 100 feet from the centerline of the each roadway. The entire median width will be required for ADOT use, access and maintenance, so the wider the separation between the roadway sections, the more total R/W will be required. The existing R/W, according to ADOT as-built plans, varies from 100 to 200 feet half-width. Additional R/W will be required.

In urban fringe areas, the desirable R/W recommended by ADOT (RDG, Figure 306.3) for a 5-lane undivided section is 110 feet half-width measured from the roadway centerline. The existing R/W from ADOT as-built plans varies from 75 to 200 feet half-width. The desirable R/W width is not met in the 75- to 100-foot half-width locations, but meets/exceeds the minimum ADOT half width of 75 feet (RDG, Figure 306.3). No new R/W is recommended for the urban-fringe 5-lane sections.

The ADOT desirable R/W half-width for a curbed 5-lane undivided section is 65 feet (RDG, Figure 306.4A). The existing R/W half-width for the urban section in Superior varies from 75 to 100 feet. No new R/W will be required within the Town limits for the urban 5-lane section.

When design level mapping or surveying is completed, there may be a need to acquire slope easements or additional R/W for the final cut and fill slopes, especially in the mountainous areas.

6.6 Drainage

Drainage conditions have been evaluated in a separate drainage report prepared for this study, entitled: *US 60 Florence Junction to Superior, Drainage Memorandum, February 1999.*

6.6.1 Existing Conditions

The US 60 roadway is oriented primarily East-to-West. The overall watershed covers 83.9 square miles and ranges in elevation from 1880 to 3060 feet (See Figure 6-1). The area can generally be divided into four main watersheds:

- The watershed between Florence Junction and Gonzales Pass is located primarily to the north of the highway, and the Magma Arizona Railroad forms the northern boundary of the western watershed. The predominant direction of flow is to the southwest in these basins.
- The watershed between Gonzales Pass and the un-named wash west of Superior is located primarily on the south side of US 60. The mountains to the south of the road form the southern boundary of the watershed in this area. The predominant direction of flow is to the north in these basins.
- The final watershed between the un-named wash west of Superior and the Town of Superior is located on both sides of US 60.
- The mountains located 5 miles north of US 60 and east of Superior, form the northern watershed boundary. In this portion of the watershed, all of the basins north of the road contribute runoff to individual culverts and Bridges 3 – 6. These flows discharge at several points into Queen Creek, and ultimately contribute to the flow at the bridged crossing of the un-named wash west of Superior.

The southern sub-basins of the Queen Creek watershed are bounded on the south by the mountains 7 miles to the south of US 60. All of these flows collect in Telegraph Canyon and Arnett Canyon, which join Queen Creek as it flows westward on the south side of US 60.

6.6.2 Vegetation

The range of vegetation varied from 10-percent in the burned areas of Gonzales Pass to 50-percent in the upper mountain slopes. Large barren areas were evident around the Town of Superior. The following designations were given to vegetation in this watershed:

- Desert Brush — Creosote, Desert Broom, Cat-claw acacia, small varieties of cactus, assorted desert or prairie grasses, and where

noted, Palo Verde trees on hillsides and Mesquite trees along the streambeds;

- Mountain Brush — Medium to Dense stands of Manzanita, Live Oak, Desert Holly, Jojoba, and where noted intermittent Juniper trees.

6.6.3 Existing Culverts and Bridges

There are 106 existing cross-drainage structures along US 60, within the study limits. The breakdown of structures is as follows:

- Six bridges for streambeds, one underpass bridge for Stone Avenue;
- 19 concrete box culverts (RCBC);
- 80 corrugated metal pipe (CMP) culverts;
- One structural plate, arch culvert; and
- Several CMP and steel pipe casing type culverts (diameter 18-inches or less)

Three of the box culvert crossings, and 21 of the CMP culverts will experience overtopping with a 50-year frequency storm (See the initial drainage report for locations). The preliminary analysis indicates no overtopping of the six bridge sites during a 50-year storm.

6.6.4 Hydrology and Hydraulics Methodology

• Hydrology

U.S. Geologic Survey Mapping and ADOT aerial mapping of the corridor were used to delineate drainage basin boundaries. The ADOT Highway Drainage Design Manual, Hydrology, was used for the drainage analysis. This analysis included using the Rational Method for drainage areas less than 160 acres and the Corps of Engineers’ HEC-1 hydrologic computer modeling software for larger watersheds. The peak flows from each drainage basin have been summarized in Appendix E. This information was taken from the Initial Hydrology Report, US 60– Florence Junction to Superior, Project No. 060 PN 211, TRACS No. H 4662 02L.

• Hydraulics

Culvert sizing was based upon inlet control due to the steep gradients common to the majority of the drainage crossings. Culvert Master hydraulic software was used to determine preliminary selections for culvert sizing based on the computed 50-year-runoff rate. Exceptions

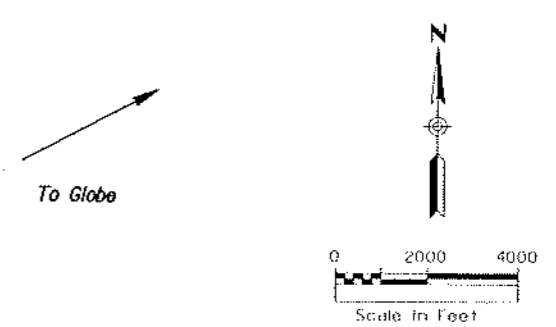
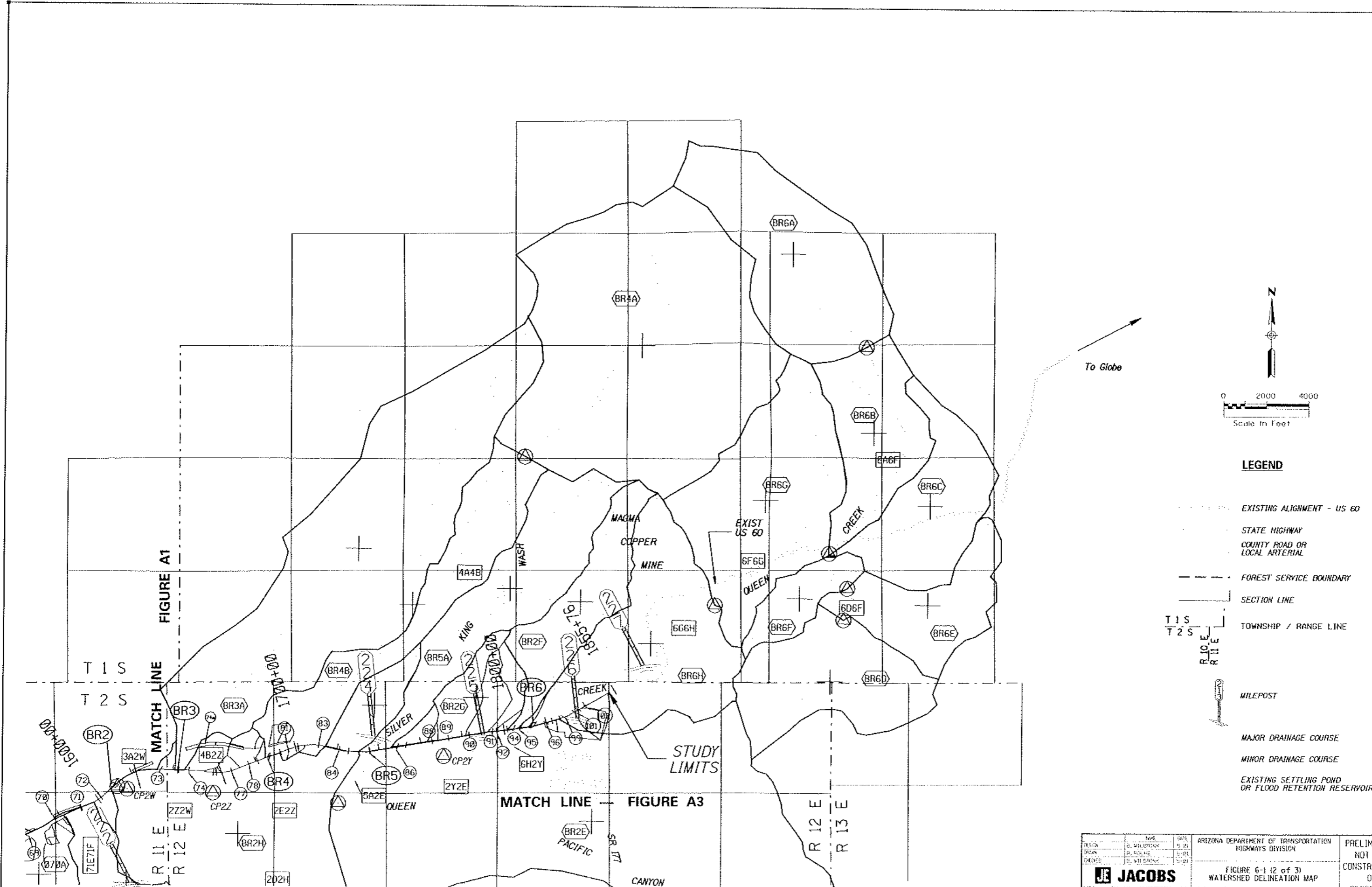
to the culvert sizing were at cattle crossings where oversized box culverts were used.

6.6.5 Drainage Requirements

Appendix E summarizes the drainage structures required for each of the design concept alternatives. These structures were only designed for the offsite drainage requirements. The culvert quantities and project estimates do not include specific provisions for onsite culverts or special ditches as these features are assumed to be included with the contingency estimate. **Note: The hydraulics analysis for this report is preliminary in nature. A final hydraulic study will be required for the final design of the selected alternative.**

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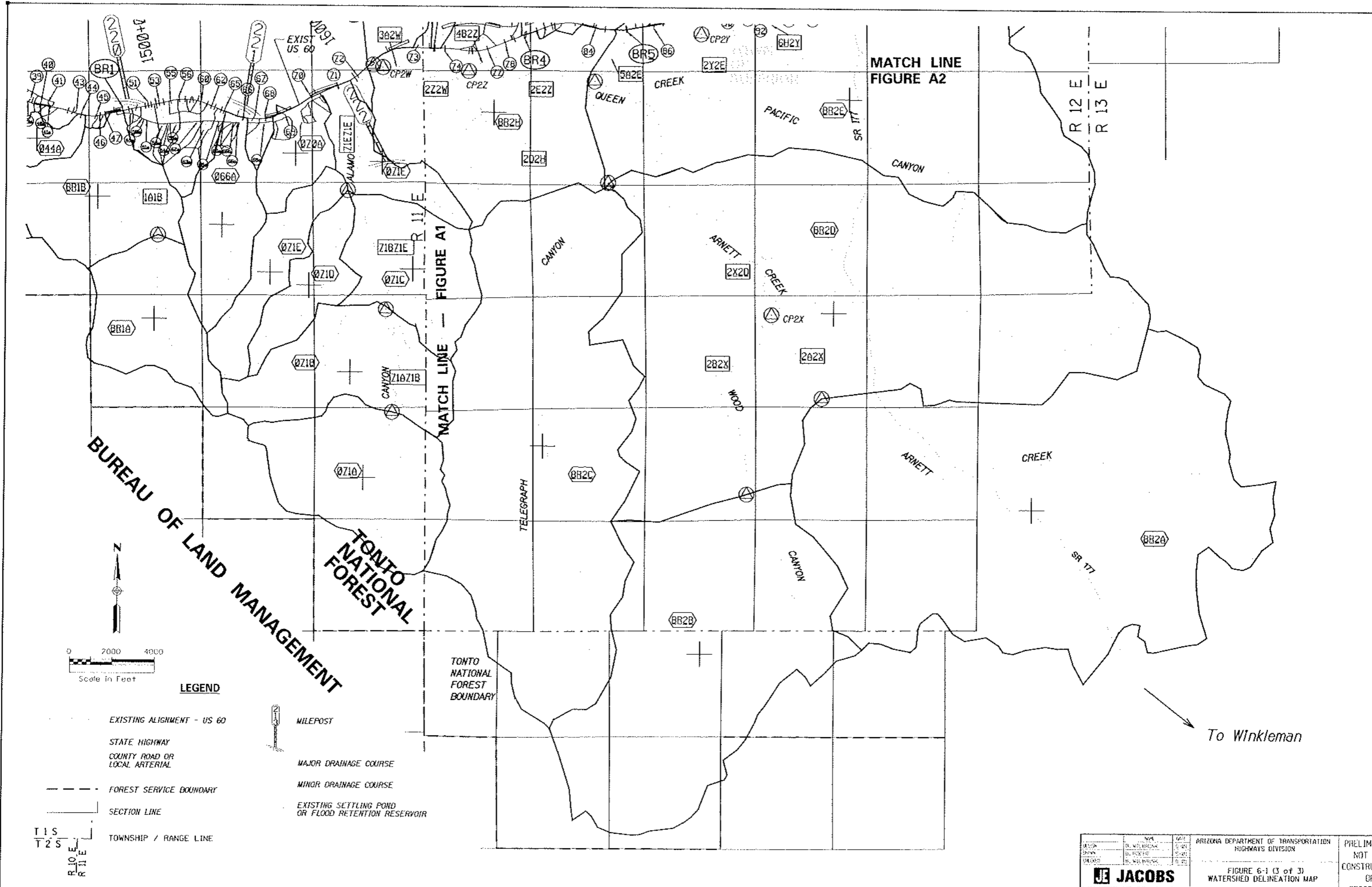


- LEGEND**
- EXISTING ALIGNMENT - US 60
 - STATE HIGHWAY
 - COUNTY ROAD OR LOCAL ARTERIAL
 - FOREST SERVICE BOUNDARY
 - SECTION LINE
 - TOWNSHIP / RANGE LINE
 - MILEPOST
 - MAJOR DRAINAGE COURSE
 - MINOR DRAINAGE COURSE
 - EXISTING SETTLING POND OR FLOOD RETENTION RESERVOIR

DESIGN	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
DRAWN	DATE	FIGURE 6-1 (2 of 3) WATERSHED DELINEATION MAP	
CHECKED	DATE		
DATE			
US 60		FLORENCE JUNCTION TO SUPERIOR	SHEET 2 OF 3

Plotted By: jacob
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DATE	LOCATION	REVISIONS



LEGEND

- EXISTING ALIGNMENT - US 60
- STATE HIGHWAY
- COUNTY ROAD OR LOCAL ARTERIAL
- FOREST SERVICE BOUNDARY
- SECTION LINE
- TOWNSHIP / RANGE LINE
- MILEPOST
- MAJOR DRAINAGE COURSE
- MINOR DRAINAGE COURSE
- EXISTING SETTLING POND OR FLOOD RETENTION RESERVOIR

		ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAYS DIVISION	PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING
US 60		FIGURE 6-1 (3 of 3) WATERSHED DELINEATION MAP	SHEET 3 OF 3
FLORENCE JUNCTION TO SUPERIOR			

To Winkelman

6.7 Section 404 of the Clean Water Act

Coordination with the U.S. Army Corps of Engineers (COE) during project design will be necessary to ascertain the need for any nationwide or individual permits required under Section 404 of the Clean Water Act. Any deposition of fill material or excavation waterward of the ordinary high water mark will require a permit. Construction activities that will require permits include, but are not limited to, bridge pier construction, culvert installations, replacements, and/or extensions requiring excavation and placement of fill material, and roadway embankment widening.

Based on information received from the COE, 54 streams and washes are crossed by the various design concept alternatives that must be investigated for a Section 404 permit. The following table lists the streams and washes along each recommended alternative by Milepost (MP) (refer to plan and profile sheets in Appendix B) that fall under COE jurisdiction.

**Table 6-2
CORPS OF ENGINEERS
JURISDICTIONAL STREAMS AND WASHES**

Design Concept Alternative	Location	Description
A-1	213.78	36 CMP within Un-Named JD Wash
A-1	214.11	6x7 CBC within Un-Named JD Wash
A-1	214.81	24 CMP within Un-Named JD Wash
A-1	214.97	(4)10x6 CBC within Un-Named JD Wash
B-2/2a	215.21	6x7 CBC within Un-Named JD Wash
B-2/2a	216.98	30 CMP within Un-Named JD Wash
B-2/2a	217.17	NA within Un-Named JD Wash
B-2/2a	217.66	4x4 CBC within Un-Named JD Wash
B-2/2a	217.76	24 CMP within Un-Named JD Wash
B-2/2a	217.99	48 CMP within Un-Named JD Wash
B-2/2a	218.17	24 CMP within Un-Named JD Wash
B-2/2a	218.41	42 CMP within Un-Named JD Wash
B-2/2a	218.67	30 CMP within Un-Named JD Wash
B-2/2a	218.84	24 CMP within Un-Named JD Wash
B-2/2a	218.93	30 CMP within Un-Named JD Wash

**Table 6-2
CORPS OF ENGINEERS
JURISDICTIONAL STREAMS AND WASHES**

Design Concept Alternative	Location	Description
B-2/2a	219.03	42 CMP within Un-Named JD Wash
B-2/2a	219.22	30 CMP within Un-Named JD Wash
B-2/2a	219.45	4x4 CBC within Un-Named JD Wash
B-2/2a	219.52	8x7 CBC within Un-Named JD Wash
B-2/2a	219.87	BRIDGE within Reymert Wash
C-2	219.95	30 CMP within Un-Named JD Wash
C-2	220.02	24 CMP within Un-Named JD Wash
C-2	220.10	36 CMP within Un-Named JD Wash
C-2	220.13	(2)36 CMP within Un-Named JD Wash
C-2	220.23	5x4 CBC within Un-Named JD Wash
C-2	220.27	24 CMP within Un-Named JD Wash
C-2	220.33	24 CMP within Un-Named JD Wash
C-2	220.51	24 CMP within Un-Named JD Wash
C-2	220.67	24 CMP within Un-Named JD Wash
C-2	220.71	6x7 CBC within Un-Named JD Wash
C-2	220.74	30 CMP within Un-Named JD Wash
C-2	220.83	6x7 CBC within Un-Named JD Wash
C-2	221.02	(2)10 x 8 CBC within Un-Named JD Wash
C-2	221.22	48 CMP within Un-Named JD Wash
C-2	221.67	10 x 10 CBC within Un-Named JD Wash
C-2	221.92	(3)12x12 CBC within Un-Named JD Wash
C-2	222.12	42 CMP within Un-Named JD Wash
D-2	222.26	BRIDGE within Queen Creek
D-2	222.93	NA within Un-Named JD Wash
D-2	223.01	BRIDGE within Happy Camp Wash
D-2	223.04	NA within Happy Camp Wash High Flow
D-2	223.17	NA within Un-Named JD Wash
D-2	223.28	NA within Un-Named JD Wash
D-2	223.43	NA within Un-Named JD Wash
D-2	223.44	NA within Un-Named JD Wash
D-2	223.55	NA within Un-Named JD Wash

**Table 6-2
CORPS OF ENGINEERS
JURISDICTIONAL STREAMS AND WASHES**

Design Concept Alternative	Location	Description
D-2	223.64	NA within Un-Named JD Wash
D-2	223.78	NA within Un-Named JD Wash
D-2	223.95	BRIDGE within Un-Named JD Wash
D-2	224.37	14x9 CAC within Un-Named JD Wash
D-2	224.64	BRIDGE within Un-Named JD Wash
E-1	224.90	(2)36 CMP within Un-Named JD Wash
E-1	224.97	36 CMP within Un-Named JD Wash
E-1	225.38	8x7 CBC within Un-Named JD Wash
E-1	225.56	6x5 CBC within Un-Named JD Wash
E-1	225.77	8x4 CBC within Un-Named JD Wash
E-1	225.81	24 CMP within Un-Named JD Wash
E-1	225.96	(2)6x6 CBC within Un-Named JD Wash
E-1	226.12	BRIDGE within Un-Named JD Wash

6.8 Constructability and Traffic Control

Maintenance of traffic through the work zone is a critical element associated with any improvement of US 60, as alternate routes are not available. The only segment of US 60 where a possible “detour” is possible is where Hewitt Station Road bypasses a portion of US 60 between Queen Valley Road and the Queen Creek Bridge (MP 222.25). It would require significant upgrade to function as a detour road for the project. It would also impact about 15 to 20 homes along this route. While possible, Hewitt Station Road is not likely to be an acceptable option for traffic control. Therefore, maintenance of traffic and traffic control during construction will frequently determine the overall phasing and local staging of construction.

However, since most of the existing roadway will be retained for continued use in the future, the improvements for the most part can be easily constructed through minor staged construction techniques. No major detours are anticipated with the construction of the any of the alternatives. Some minor detours may be necessary to complete replacement or extension of the culverts and bridge widening. Once the new portion is

completed, traffic will be shifted to that roadway while any portions of the existing roadway that require reconstruction are improved.

6.8 Earthwork

The excavation, embankment, and balance values shown in Table 6-3 are a result of applying the slope criteria listed in Section 6.2. to USGS topographic files, producing very rough earthwork volumes. While Segments A and E have constraints that prohibit balanced earthwork projects, the remainder of the corridor can achieve a balanced earthwork design by minor adjustments to the profile grade or side slopes. A true balance of earthwork was not possible at this time because of the unavailability of both detailed geotechnical and topographic information.

**Table 6-3
EARTHWORK SUMMARY
Cubic Yards [cy]**

Design Concept Alternative	Excavation cy	Embankment cy	Balance cy
A-1			
Eastbound	146,700	499,700	-353,000
Westbound	114,000	463,200	-349,200
Total	260,700	962,900	-702,200
B-2A			
Eastbound	362,400	432,900	-70,500
Westbound	428,900	429,700	-800
Total	791,300	862,600	-71,300
C-1A			
Eastbound	341,300	354,100	-12,800
Westbound	66,600	33,000	33,600
Total	407,900	387,100	20,800
D-2			
Eastbound	308,000	121,100	95,900
Westbound	215,900	184,200	31,700
5-Lane	44,900	37,600	7,300
Total	568,800	433,900	134,900
E-1			
5-Lane	206,400	38,500	167,900
Total	206,400	38,500	167,900

An extensive geotechnical investigation will be required during final design of the recommended alternative to:

- Establish site-specific shrink and swell factors based on field investigation and testing;
- Establish cut/fill slope requirements based on a field investigation of materials; and

- Prepare detailed geologic mapping to predict areas of potential slope failure in deep cuts.

6.9 Utilities

All known utility companies within the project limits were contacted and information was requested regarding utilities and an indication of possible conflicts with the alternative roadway improvements under study. A summary of the results follows:

- El Paso Natural Gas Company has a 6-inch natural gas line that crosses US 60 near MP 216.5 and follows the roadway alignment to the west side of Superior. It crosses US 60 several times, but is generally located on the north side of US 60. Portions of this pipeline will be in conflict with the new roadways and the drainage improvements. The contact person for this utility is:
El Paso Natural Gas Company
John McNeely
77765 Pointe Parkway West, Suite 185
Phoenix, Arizona 85044
Phone: (602) 438-4214
- Southwest Gas has a number of crossings of US 60 in the study area. The contact person for this utility is:
Southwest Gas Company
Ron Aragon.
5440 South Russell Road
Globe, Arizona 85502
Phone: (928) 425-6934
- Qwest has both overhead and underground facilities along US 60 from Florence Junction to Superior. There is an overhead line on the north side of US 60 from Florence Junction to Queen Valley Road, another overhead line is located on the south side of the roadway from the Boyce Thompson Southwestern Arboretum to Superior. They maintain a buried cable located in the Magma Arizona Railroad right-of-way. The contact person for this utility from Superior to Hewitt Station Road is:
Qwest Communications.
Kevin Wells
6350 South Maple Avenue
Tempe, Arizona 85283
Phone: (480) 768-4231

Arizona Water Co. has various waterlines in the Town of Superior that cross US 60 and a 12” water line that follows the Magma Arizona Railroad tracks from SR 79 to Superior. The waterline crosses under US 60 at Queen Valley Road. The contact person for this utility is:

Arizona Water Company
Coordination & Water Rights:
Freddy Rios
422 Sullivan Street
Miami, Arizona 85539
Phone: (928) 473-4433
Superior Division
Angel Gomez
20 North Magma Avenue
Superior, Arizona 85273
Phone: (520) 689-2312

- Arizona Public Service Company has overhead power lines near Florence Junction, near the Boyce Thompson Southwestern Arboretum, and in the Town of Superior. The contact person for this utility is:
APS.
Frank Castillo
1992 North hwy 188
P.O. Box 2600
Globe, Arizona 85502
Phone: (928) 425-8031
- Salt River Project Electric has transmission lines in the area and crosses US 60 near Superior. The contact person for this utility is:
Bill Phillips, SRP Transmission Design
998 West Washington, Building 36
Tempe, Arizona 85281
PO Box 52025 XCT 315
Phoenix, Arizona 85072-2025
Phone: (602) 236-8092
- BHP Copper operates the Magma Arizona Railroad that crosses US 60 adjacent to the Queen Valley Road intersection. The railroad is also adjacent to the proposed improvements within Segment D. The contact person for this utility is:
BHP / San Manuel Arizona Railroad Company
Kent R. Fletcher, Railroad Supervisor
200 South Redington Road
PO Box M
San Manuel, Arizona 85631
Phone: (520) 385-3456

6.10 Bridges

New bridges will be required at five drainage crossings, three traffic interchange locations, and one overcrossing as described in the following discussion. None of the existing bridges are structurally or hydraulically deficient, and do not require replacement at this time. Where the highway improvements keep the existing roadway geometry, the existing bridges can be reused or widened depending on the requirements of the roadway section. Bridge rail/barrier not meeting current standards should be replaced.

The Forest Service and AZ Game and Fish Department have determined that there is not enough significant wildlife in this area to justify the need for special wildlife crossings. Some of the box culverts and bridge structures, however, are used by local ranchers for livestock crossings. As such, the erosion and scour protection at these structures should not prohibit the crossing of livestock.

Structure types proposed for the new alignments at the wash crossings are used for estimating purposes only. The exact structure type will be determined in final design.

Reymert Wash: The existing bridge over Reymert Wash, structure number 286, is located at milepost 219.85. The bridge was constructed in 1930, widened in 1947 and had the barrier modified in 1984. It is a 43'-6" long, 43'-0" wide, two span cast-in-place concrete slab bridge. The bridge is supported on wall piers with spread footings, which are approximately 5' below the bottom of the channel. The existing bridge has adequate freeboard so no adjustment in the roadway profile is required.

Design Concept Alternatives B-2 and B-2a parallel the existing US 60 profile in the Reymert Wash area and crosses approximately 100 feet either to the north or south of the existing bridge. This option reuses existing US 60 for one direction of travel and the bridge will be located at station 1484+00. The preliminary drainage analysis indicates that removal of the center pier will allow a better hydraulic capacity and performance of the channel. Therefore, the use of wall piers in the new structure is not recommended since they tend to create scour problems. In order to maintain the low vertical profile, a three span cast-in-place concrete bridge with a 30'-40'-30' span arrangement with a total length of 100' is proposed. Rail bank protection will run under the bridge. The proposed pier design includes circular columns supported on drilled shaft foundations as the columns and shafts have performed better in scour conditions.

Queen Creek: The existing bridge over Queen Creek, structure number 296, is located at milepost 222.25. The bridge was constructed in 1947 and had the barrier modified in 1982. It is a 175'-0" long, 34'-0" wide three span steel I-girder bridge with a 30 degree left skew angle. The bridge is supported on wall piers with spread footings, which vary from 4 to 10 feet below the bottom of the channel. The span arrangement is 54' - 67' - 54' and the superstructure consists of four steel plate girders with a 7 ½" slab.

Design Concept alternative D2 parallels the existing US 60 alignment in the Queen Creek area and crosses approximately 110 feet to the south of the existing bridge. This option reuses existing US 60 for the West bound lanes and the new bridge will be at station 1611+00. The hydraulic performance of the existing bridge is adequate and the new bridge will use the same span arrangement of 54'-67'-54' for a total length of 175'. An AASHTO girder Type III prestressed girder bridge can be used for the new crossing. The depth is similar to the existing steel bridge so little or no modification to the profile is needed. With the addition of the rail bank protection, stub type abutments on drilled shafts can be used with the current 3-span configuration. For the center piers, circular columns are proposed instead of wall piers and drilled shaft foundations are proposed instead of spread footings. The columns and shafts have performed better in these conditions in preventing scour problems.

Happy Camp Wash: The existing bridge over Happy Camp Wash, a previously un-named wash structure, structure number 288, is located at milepost 222.25. The bridge was constructed in 1930, widened in 1947 and had a barrier modified in 1984. It is a 53'-6" long, 43'-0" wide three span cast-in-place concrete slab bridge. The bridge is supported on wall piers with spread footings, which are approximately 6 feet below the bottom of the channel.

Design Concept alternative D2 realigns US 60 approximately 850 feet to the north and bypasses the existing bridge. There will be a new east bound and west bound 2 lane section and the bridges will be at station 1650+00. While a bridge crossing currently exists at Happy Camp Wash, hydraulic computations suggest that the new alignment does not require a bridge; as such a box culvert crossing is proposed.

Silver King Wash: The existing bridge over Silver King Wash, structure number 318, is located at milepost 223.70. The bridge was constructed in 1945 and the barrier was modified in 1992. It is an 80'-5 ¼" long, 43'-0" wide three span cast-in-place concrete slab bridge. The bridge is supported on wall piers with spread footings.

Design Concept alternative D2 realigns US 60 approximately 250 feet to the north and bypasses the existing bridge. The new bridges will be at station 1700+00. The initial drainage report shows that a four span, cast-in-place concrete slab bridge will provide the necessary area for drainage flow for both the east bound and west bound US 60. A span arrangement of 22'-28'-28'-22' for a total length of 100' will be used. Rail bank protection will run under the bridges on both sides. For the center piers, circular columns are proposed instead of wall piers, and drilled shaft foundations are proposed instead of spread footings. The columns and shafts have performed better in these conditions in preventing scour problems.

Unnamed Wash: The existing bridge over Unnamed Wash, structure number 319, is located at milepost 224.64. The bridge was constructed in 1935, widened in 1949 and the barrier was modified in 1992. It is a 32'-3 1/8" long, 43'-0" wide two span cast-in-place concrete slab bridge with a 7 degree 15 minute right skew angle. The bridge is supported on wall piers with spread footings.

Design Concept alternative D2 widens US 60 equally on each side at this location. The existing bridge, at station 1737+00, can be widened using the same type of superstructure and 45 degree wingwalls added at the inlet and outlet. The substructure type will be refined in the final design stage. The maintenance reports from ADOT list this bridge as scour critical and in need of corrective action, but the initial drainage studies indicate that bedrock appears to be close to the surface. If this is correct, spread footings may be a viable option. If scour is a problem at this location, several alternatives can be investigated in the final design phase. The channel could be lined to prevent scour and protect the existing structure and new widening, the existing structure could be retrofitted with new foundations, or the widening could be built to support the entire structure in the case of severe flooding.

Queen Creek: The existing bridge over Queen Creek, structure 436, is located at milepost 226.14. The bridge was constructed in 1955 and the barrier was modified in 1988. It is a 147'-4 ¼" long, 47'-0" wide four span cast-in-place concrete slab bridge with a 45-degree right skew angle. The bridge is supported on wall piers with spread footings.

Design Concept alternative E1 widens US 60 equally on each side at this location. The existing bridge, at station 1814+00 can be widened using the same type of superstructure. The substructure type will be refined in the final design stage. The maintenance reports from ADOT list this bridge as scour critical and in need of corrective action but the

initial drainage studies indicate that bedrock appears to be close to the surface. If this is correct, spread footings may be a viable option. If scour is a problem at this location, several alternatives can be investigated in the final design phase. The channel could be lined to prevent scour and protect the existing structure and new widening, the existing structure could be retrofitted with new foundations, or the widening could be built to support the entire structure in the case of severe flooding.

Stone Avenue Overpass: The existing bridge over Stone Avenue, structure 437, is located at milepost 226.62. The bridge was constructed in 1955 and the barrier was modified in 1989. It is an 86'-0 5/8" long, 44'-0" wide three span cast-in-place concrete slab bridge with a 24 degree right skew angle. The bridge is supported on wall piers with spread footings. A 6'x4' box culvert is adjacent to the east side of Pier 2 and runs under Stone Avenue on the north side of the bridge.

Design Concept alternative E1 widens US 60 equally on each side at this location. The existing bridge, at station 1841+00 can be widened in kind. However, the existing bridge has a 14' clearance over Stone Avenue. The ADOT Bridge Practice Guidelines require a height of 15'6" unless the road is surfaced with Portland cement concrete and then a clearance of 15'-0" may be used. Any widening of the structure will result in a further reduction in the clearance. If the bridge is widened, the existing box culvert will need to be rerouted north of the bridge in order to allow for the foundations of the pier to be built.

New Traffic Interchange Overpasses: Two new traffic interchanges will be constructed on the corridor; one at the intersection of US 60/SR 79 (Florence Junction, already completed), and the other at Queen Valley Road. Two separate bridges will carry EB and WB US 60 traffic over the crossroads. While the bridges will initially be designed to carry 2-lanes of traffic each, they should also be designed for ease of future widening, as the areas to the east continue to expand into commuter communities.

While cast-in-place post tensioned box girders and steel girder bridges should be investigated, the precast AASHTO girder bridge is likely to be the best selection for these sites for several reasons, including how future widening of the bridge decks will be relatively simple, and AASHTO girder bridges are typically cost competitive. At Florence Jct., the bridges can be constructed without falsework thereby simplifying maintenance of traffic on SR 79 (initially and during future widening). At Queen Valley Road, post-tensioned box girder bridges could be easily constructed without impacts to highway traffic, but

constructing the box girder over the railroad would be difficult. If widening is required over Queen Valley Road, the AASHTO girder continues to be the preferred construction choice.

Foundations could be either drilled shaft or spread footing, depending upon the geotechnical data. Each substructure and superstructure type will be evaluated with respect to cost, constructability, future widening, construction staging, and traffic control.

6.11 Design Exceptions

Two design exceptions are anticipated for the proposed improvements at this time. They include:

Florence Jct TI: The EB US 60 mainline over SR 79 will not achieve a stopping sight distance in accordance with the ADOT RDG. Of concern is the available horizontal stopping sight distance (SSD) for the inside eastbound lane adjacent to the longitudinal bridge barrier. The horizontal curve is a 1°35' curve. The lanes are 12-ft wide, and the shoulder adjacent to the bridge barrier is 6-ft (a 4-ft shoulder + 2-ft of additional shy separation). With this design, the available SSD for the inside lane is currently 590-ft. This distance does not meet the SSD standards of ADOT's RDG for a 65 mph roadway. It does, however, meet AASHTO's standard for a 65 mph design speed as their horizontal SSD table uses a range of values for this computation (Table III-1, AASHTO, 1990 English Ed., Pg 120).

To achieve an SSD = 725-ft (65 mph), using a standard 6-ft inside shoulder and a 12-ft travel lane, the roadway centerline would need to be flattened to a 1°02'45" (Radius = 5480.066') curve. That size curve will not fit within the constraints of the intersection. The alternative is to widen the shoulder provide the SSD. The shoulder required to provide a SSD of 725-ft on the currently designed alignment, in front of the bridge barrier, is 12.17-ft. This expansion seems excessive and costly (estimated to be \$100,000). A design exception was therefore requested and approved by ADOT in October, 2001 to allow the horizontal stopping sight distance to be determined by the AASHTO manual for a 65-mph roadway. The 590-ft available at this site meets this AASHTO criteria, falling within the acceptable SSD range of 550- to 725-ft for a 65 mph mainline design speed.

Stone Avenue: The existing US 60 mainline structure has only 14'-0" clearance over Stone Avenue. While the structure can be widened, the added width will only reduce the vertical clearance, already below the ADOT recommended value of 15'-6" for a local street overcrossing. The structure is used by many pedestrians to cross the highway, including school children. Vehicles with clearance requirements greater than 13-ft can use several alternative crossings of US 60, as all other intersections with the highway are at-grade.

At this time, the mainline improvements do not require the roadway profile to be adjusted at this location for US 60 traffic. Since raising the profile of the mainline at this location would cause problems with other intersecting roadways and driveways, a design exception may be required to allow the existing bridge to be widened at the current profile and cross slope. As this structure does not create a traffic problem to the mainline traffic, and local traffic has alternative routes nearby, no immediate correction is recommended. The District is working with the Town and various agencies to address this issue as a separate District Minor Project. A separate Project Assessment may be prepared for this crossing if the Superior mainline improvements are not scheduled for some time. If the Superior improvements are programmed in the near future, the final design must address whether a design exception of reconstruction of the bridge is warranted.