

*Volume III of III
Appendices D-I*



CAREFREE DRAINAGE MASTER PLAN

Prepared for

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

CONTRACT NO: FCD 2000C037



Prepared by



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September 2003

Final Report

**Volume III of III
Carefree Drainage Master Plan
Appendices D through I**

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May 2004



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**Volume III of III
Carefree Drainage Master Plan
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Submitted to
Flood Control District of Maricopa County

May 2004



CH2MHILL

Appendix D
Engineering Design Guidelines



ENGINEERING DESIGN GUIDELINES

Carefree Drainage Master Plan

Prepared for



Prepared by



CH2MHILL

February 2003

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Acronyms

ADWR	Arizona Department of Water Resources
ARS	Arizona Revised Statute
CFR	Code of Federal Regulations
cfs	cubic feet per second
CSA	soil cement
DMP	Drainage Master Plan
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Association
fps	feet per second
MAG	Maricopa Association of Governments
MCDDM	Maricopa County Drainage Design Manual
NFIP	National Flood Insurance Program
SS	State Standard

SECTION 1

Introduction

The Flood Control District of Maricopa County contracted with CH2M HILL in June 2001 to complete the Carefree Drainage Master Plan (DMP) study (FCD Contract No. 2000C037). The Carefree DMP study area encompasses the entire Town of Carefree (Town), which contains approximately 20 square miles. The purpose of the Carefree DMP is to identify ways to reduce the potential damage to property or loss of life from storm runoff. The DMP study includes identifying existing and potential flooding problems within the Town of Carefree, evaluating erosion and sedimentation, and gathering and distributing information regarding flooding, sedimentation, and erosion problems.

The purpose of these Engineering Design Guidelines is to provide the criteria and procedures for the evaluation, planning, and design of preferred stream corridor and stormwater management alternatives developed as a part of the Carefree DMP. The main goal of these guidelines is to provide protection and public safety from flooding and erosion hazards while maintaining natural resources and habitats and the unique environmental characteristics of the region. The guidelines should facilitate the planning, review, and design policies during the development and design process to ensure that this goal is met.

This document provides a list of issues that must be addressed in the development and design process. Additional and detailed information on hydrology, hydraulics, sedimentation, and geomorphic studies; biological, historical, and cultural resources; and multi-use opportunities and floodplain/erosion hazards can be found in the *Technical Data Notebook* and *Drainage Master Plan* for the Carefree study area (CH2M HILL, 2002).

Design Guidelines

3.1 Floodplain Delineations

In addition to other applicable Code of Federal Regulations (CFR) and Arizona Revised Statute (ARS) citations, one rule governing floodplain delineations is ARS 48-3605 A, which gives the Director of ADWR the authority to establish State Standard (SS) 2-96 for use in floodplain management in Arizona. SS 2-96 states that floodplain delineations shall occur on all watercourses officially recognized by the Federal Emergency Management Association (FEMA) as a part of the National Flood Insurance Program (NFIP). All watercourses that have been identified by a local floodplain administrator as having significant potential flood hazards, or watercourses with drainage areas more than 0.25-square mile or having a 100-year estimated flow of more than 500 cubic feet per second (cfs), fit into this criteria.

Floodplain delineations in the Town shall be conducted in conformance with the most recent NFIP regulations, State Standards, and Flood Control District of Maricopa County (FCDMC) guidelines.

3.2 Erosion Hazard Zone Delineations

The Maricopa County Floodplain Ordinance and Drainage Regulations, and ARS 48-3605 A, which gives the Director of ADWR the authority to establish a standard for identification of and development within erosion hazard areas, govern erosion hazard zone delineations. The ARS 48-3605A guidelines are outlined in SS 5-96, "Watercourse System Sediment Balance." Erosion hazard areas limited to, as defined by FEMA as part of the NFIP, all watercourses, which have been identified by local floodplain administrators as having significant potential flooding hazards, or all watercourses with drainage areas more than 0.25-square mile, or a 100-year discharge of more than 500 cfs.

Erosion Hazard Zone Delineations in the Town shall be conducted in conformance with SS 5-96 guidelines and MCDDM Volume II-Hydraulics guidelines.

SS 5-96 provides three levels of erosion hazard analysis: Level I, Level II, and Level III. Level I is a first-level procedure to be applied in normal conditions. However, the Level I methodology for erosion hazard analysis has been determined not to be applicable for use within the Carefree DMP study area.

Level II was a second-level procedure for use in demonstrating the erosion resistance of existing materials. Level II analysis in the Carefree DMP study area, focused on minimizing or eliminating future modifications of the floodplain and reducing the impact of new construction on the floodplain.

Level III procedures shall be applied to all major streams due to the potential for avulsions and historical disturbance, including:

- Galloway Wash (all branches and tributaries)
- Andora Hills Wash
- Rowe Wash
- Grapevine Wash
- Stagecoach Pass Wash
- Windmill Wash
- Eastern Pima Wash
- Ocotillo Wash
- Unnamed Tributary to Cave Creek

Figure 1 contains a map showing the approximate locations of the aforementioned washes.

A typical scope for a site-specific detailed erosion hazard analysis may include an evaluation of channel stability or the potential for lateral migration. This evaluation should include a geomorphic, historical, field, and hydraulic analysis and sediment transport

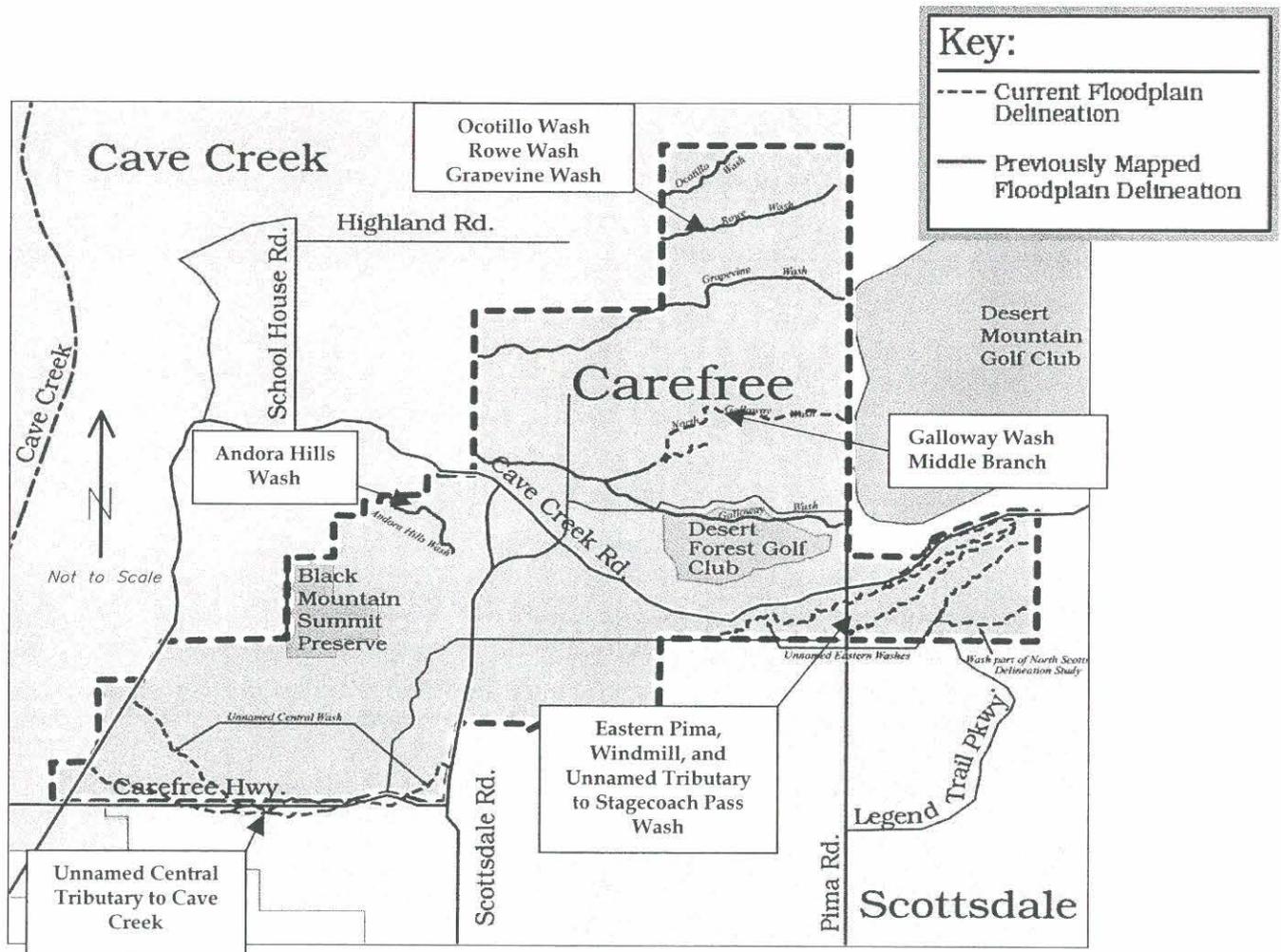


FIGURE 1 - WASH LOCATIONS

modeling, sediment yield, and gradation analysis.

3.3 Floodplain Encroachment

Floodplain encroachment should be avoided. However, in situations where it meets low-impact criteria, no short-term or long-term offsite impacts to channel stability are determined. Where encroachment is adequately protected from erosion and flooding, and a long-term maintenance and inspection program is in place, floodplain encroachment may be allowed. Where structures encroach into the floodplain fringe, foundations shall extend below the calculated scour depth of the wash per SS 5-96.

3.3.1 Low-Impact Structural Alternatives

Activity within the floodway fringe or erosion hazard zone that does not significantly alter the natural form and function of the watercourse is defined as a "low-impact" development alternative. To meet "low-impact" criteria, an alternative must not significantly increase velocities; the average 10-year velocity in the channel or overbank should not change (+/- zero feet per second [fps]), and the average 100-year velocity in the channel or overbank should not increase or decrease more than 10 percent or 1.0 fps, whichever is less. The 10-year water surface elevation should not change (+/- zero feet), and the 100-year water surface elevation should not change by more than +/-0.1 foot. The bankfull width of the main channel should not decrease; no excavation or deepening of the streambed in the main channel is allowed. No permanent removal of bank vegetation or relocation of low-flow channel is allowed within the floodplain. Erosion, sedimentation, or flood impacts are prohibited to adjacent properties without the written consent of affected property owners, and engineering and geomorphic analysis is required to demonstrate no short-term, long-term, or 100-year offsite impacts. The natural landscape characteristics and habitat must be preserved within the floodplain.

3.3.2 Channelization

Any engineered channel with alteration of the natural watercourse or banks, bank

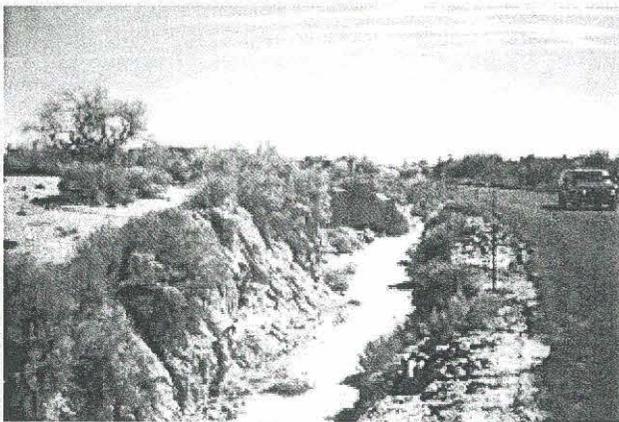


FIGURE 2. EXAMPLE OF EROSION CAUSED BY CHANNELIZATION REQUIRING MITIGATION

protection, and/or grade controls is by definition "channelized." Channelization impacts channel stability by increasing velocities, thereby altering sediment transport rates and increasing erosion potential (Figure 2). Channelization usually increases flow depths and scour depths, and it increases peak discharges downstream. Channelization is prohibited in washes with greater than 50 cfs during the 100-year storm event, unless it is necessary to mitigate existing problems (threat of damage or flooding to an existing structure or improvement). Approval of the Town Engineer is necessary for any

proposed channelization project.

Using engineered channels abolishes most of the floodplain and natural habitat and oftentimes requires mitigation. Bank protection in engineered channels upsets the natural sediment balance of the stream increasing the likelihood of downstream erosion. Culvert crossings and channelized outlets, regardless of whether or not the crossings are at-grade or raised bridges or culverts, create instabilities due to changes in velocity, sediment balance, and flow. These instabilities create the potential for lateral erosion, scour, sediment deposition, and overbank flooding. Even paving over the crossing increases the incidence of downstream scour due to alterations of sediment transport capacity. Engineered channels require maintenance and inspection, and eventually they will need to be replaced.

For the reasons discussed above, channelization is not recommended as a development alternative. The Town does not allow channelization in any wash where flows are equal to or greater than 50 cfs for the 100-year storm event for new development. However, in washes with less than 50 cfs, where it can be demonstrated that no short-term or long-term offsite channel stability impacts will occur, that downstream reaches are adequately protected from flooding and erosion, and an inspection and maintenance program is in place, then channelization may be allowed. Additionally, in washes that have floodplain delineations, the floodplain must be reanalyzed to determine the effects of the channelization on the floodplain elevations.

Concrete is prohibited as a channelization material. Any rerouting or channelization of washes (less than 50 cfs) must mimic natural conditions, including the degree of sinuosity. Natural materials, such as large boulders, must be used for deflection of flow (see Section 3.4, Aesthetic Design Guidelines). In the Carefree DMP study area, sedimentation and erosion problems are centered on the channelized (urbanized) stream segments. Development has altered the natural channel and floodplain characteristics, natural processes of channel movement, degradation, aggradation, and sediment transport of the streams. Because of the dynamic sediment environment in the Town, channels should be designed with additional freeboard for aggradation, and additional toe down depths for degradation. Additionally, where channelization must occur, steps shall be taken to ensure minimal impact to the natural environment.

3.3.2.1. Bank Protection

Bank protection is discouraged within the Town and should only be used to remedy existing problems. Flexible bank protection should be considered in place of rigid bank protection where feasible. Flexible bank protection can be revegetated, modified to account for streambed aggradation or degradation, and can blend into the natural character of the stream corridor. Bank protection shall be designed according to SS 7-98.

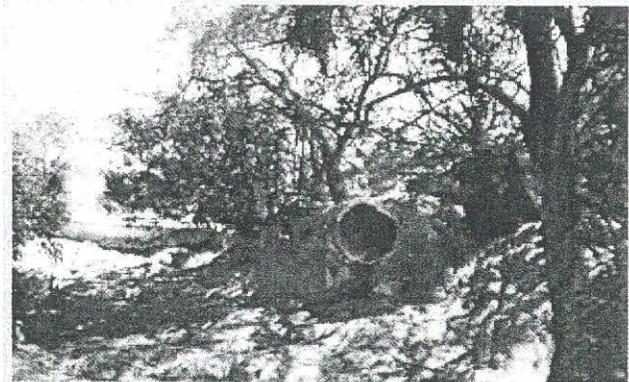


FIGURE 3. EXAMPLE OF SCOUR AT CULVERT OUTLET DUE TO LACK OF OUTLET PROTECTION

3.3.2.2. Outlet Protection

Outlet protection should be designed to reduce impacts of high exit velocities and scour potential downstream of culverts (Figure 3). The design of outlet protection, including adequate size and bedding material, is required in compliance with MCDDN Volume II-Hydraulics.

3.3.2.3. Grade Control Structures

Grade control structures should only be used in areas to prevent damage to structures or improvements, or to control existing wash degradation. Due to the amount of mobile sediment within the Town, installation of grade-control structures may upset the natural sediment balance of the stream and affect floodplain elevations. An extensive analysis of the wash is required where grade control structures are proposed. Additionally, in washes that have floodplain delineations, the floodplain must be reanalyzed to determine the effects of the grade control structures on the floodplain elevations.

Grade control structures should be designed in conformance with MCDDM Volume II-Hydraulics. Hard basin, baffle chutes, and vertical drops are discouraged, and natural materials should be used whenever possible. Drop heights should be limited to 2 feet or less. Rock sills (buried rock of sufficient size and width across entire wash width) are recommended where progressing headcuts are present. Additionally, pedestrian and equestrian access concerns must be addressed during grade control design, allowing either a bypass route or through-pass route.

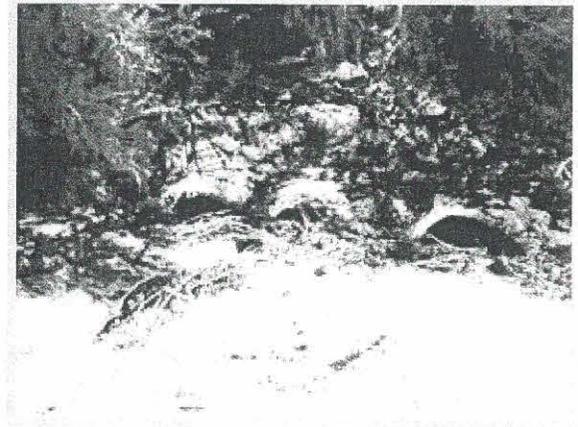


FIGURE 4. EXAMPLE OF SEDIMENTATION IN CAREFREE

3.3.3 Roadway Crossing Drainage Structures

Scour and sedimentation problems (Figure 4) are most likely to occur where natural channel conditions are most disturbed. Crossings that widen or narrow the natural channel induce scour on the downstream side of the crossing, regardless of whether or not the crossing is at-grade or is a raised bridge or culvert.

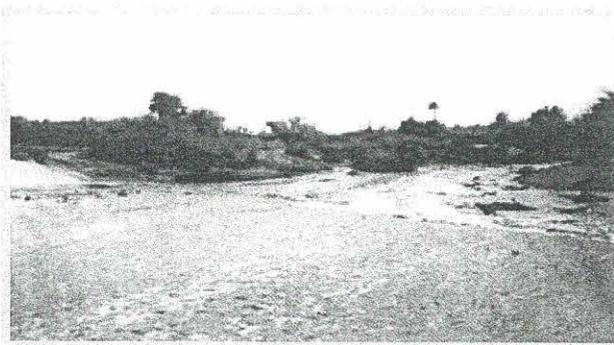


FIGURE 5. AT-GRADE CROSSING:
 FLOW OVER THE ROAD DURING RUNOFF EVENT

3.3.3.1. At-Grade Crossings

At-grade crossings (Figure 5) usually only have localized or minimal impacts on channel stability, such as pavement erosion, deposition of sediment on upstream side, scour holes on downstream side, and downstream degradation. Paving the crossing increases downstream scour due to changes in velocity and sediment transport capacity over the paved section. Steep slopes, sandy bed material, and frequent

supercritical flow regime of the channels in the Carefree DMP study area are especially susceptible to scour at road crossings.

Roadway geometry of the at-grade crossing shall match existing wash geometry where possible. The crossings shall be perpendicular to the main channel flow direction. The wash shall not be constricted or expanded at roadway crossings. Riprap protection shall be provided at the downstream side of the crossing and shall extend until the wash velocities have returned to the predevelopment, natural condition. The riprap material shall be designed per MCDDM Volume II-Hydraulics (HEC-11 design method). The roadway cross slope shall match the existing wash cross slope, and normal crowned roadways are not allowed. Cut-off walls shall be provided at the pavement edges per Maricopa Association of Governments (MAG) Standard Detail 552.

3.3.3.2. Culverts

When properly designed, culvert crossings should take into account impacts to the channels natural conditions, long-term function, and maintenance and public safety. Design criteria should include the natural channel and floodplain morphology, size and discharge relationship, sediment transport capacity, clogging, and scour potential. Minimum culvert rise should be as high as the average main channel bank height. The installation of a culvert cannot raise the 100-year water surface elevation over 1 foot above the existing 100-year water surface elevation, and cannot cause problems to upstream or adjacent properties, such as inundation or erosion. Additionally, in washes that have floodplain delineations, the floodplain must be reanalyzed to determine the effects of the culvert on the floodplain elevations.

Culverts shall be aligned parallel to the natural main channel. Multiple culverts may be required at a single crossing in braided flow conditions.

A culvert that is undersized creates a channel obstruction and results in a headwater ponding condition. This condition often leads to sediment deposition (Figure 6), overbank flooding, avulsions, and long-term degradation due to sediment transport imbalances. Undersized culverts also accelerate velocities, which in turn increase scour potential at the outlet. Outlet protection shall be provided at all culverts per MCDDM Volume II-Hydraulics. Mitigation requirements for undersized culverts usually include increasing height or width of the channel, providing relief structures, and outlet erosion protection.

Oversized culverts that actually increase the natural width and height of a stream can lead to long-term aggradation due to changes in sediment transport capacity. Oversized culverts lead to deposition of sediment in widened channel sections, thereby decreasing the channel and culvert capacity. This decreased capacity can lead to flooding of adjacent properties. Culverts that widen the main channel should be avoided. Where wider culverts are needed for conveyance, the design should be modified to prevent widening of the low-flow

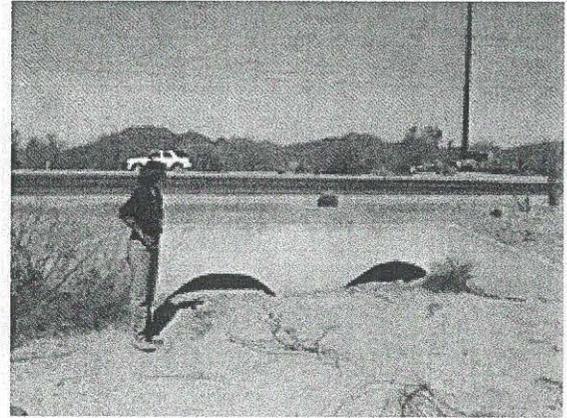


FIGURE 6. EXAMPLE OF SEDIMENTATION OF CULVERTS IN CAREFREE

channel. For example, the cells outside the main channel could be elevated above the main channel invert to prevent widening. Where a lack of field evidence exists, the low-flow channel can be defined as that which carries the 5-year runoff event.

3.3.3.3. Bridges

Bridge crossings, if properly designed, have no significant impact on channel stability. Bridge crossings should be designed to span the entire floodplain or, at a minimum, the channel or floodway and area, and they are preferable to culverts. The addition of a bridge cannot raise the 100-year water surface elevation over 1 foot above the existing 100-year water surface elevation, and cannot cause problems to upstream or adjacent properties, such as inundation or erosion

Bridges are cost prohibitive for most smaller crossings. Relief structures should be provided at bridge crossings of multiple or braided streams to maintain overbank flow paths and sediment balance. Erosion protection should be provided, when needed, and a regular inspection and maintenance plan should be implemented to assure satisfactory structure performance. Additionally, in washes that have floodplain delineations, the floodplain must be reanalyzed to determine the effects of the bridge on the floodplain elevations.

3.3.4 Utility Crossings

Utility construction may impact channel stability if proper precautions are not taken to minimize bank and floodplain vegetation disturbances and utilities are not buried at the proper depth within the stream. Vegetation removed or damaged during construction should be replaced immediately to avoid potential erosion or scour. Irrigation, inspection, and maintenance may be required to ensure survival of replanted vegetation. The underground utilities should be buried below the 100-year storm general scour depth in the main channel plus the long-term scour depth, and at this same depth in overbank areas. The

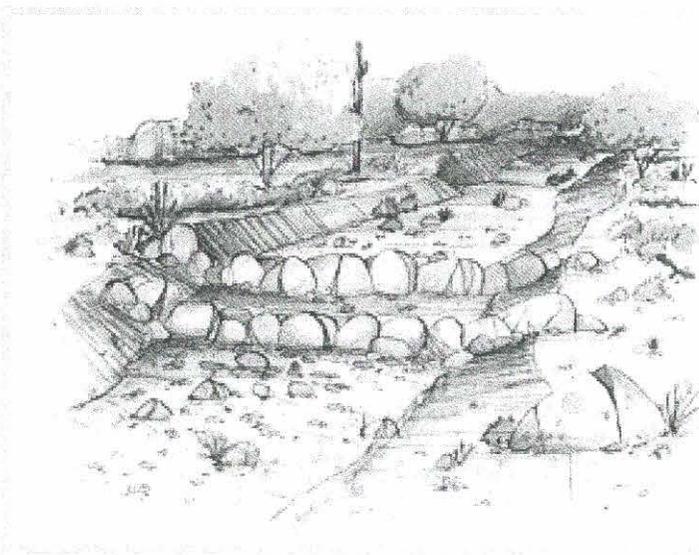


FIGURE 7. ARTISTIC RENDERING OF AN AESTHETICALLY DESIGNED GRADE CONTROL STRUCTURE

recommended burial depth for scour should be below the minimum channel invert for the entire crossing, including the erosion zone, unless it can be shown that no lateral erosion hazard exists. Support structures for overhead utilities should not be placed in the main channel, the floodplain, or erosion hazard zone. If the length of the span for support structures requires that they be located within the floodplain or erosion hazard zone, the structures should be designed using the 100-year general scour plus long-term scour burial depth.

3.4 Aesthetic Design Guidelines

The Town would like to incorporate aesthetic properties (Figure 7) into the design of drainage facilities and flood control alternatives. Aesthetic guidelines have been developed to aid planners and designers in design that incorporates and is consistent with the surrounding habitat and natural watercourse features. Following are some general guidelines.

3.4.1 Natural Channel Design

It is important that any required engineered channels conform to the shape and form of natural streams in the study area. Variable, sinuous alignments and side slopes, as well as varying angles of the channel slopes, create a more natural-looking channel. Natural materials, such as boulders and rocks, should be used at flow deflections in sinuous alignments.

3.4.2 Erosion Protection

Where nonstructural erosion hazard management is not feasible, erosion protection may be required to protect development. Rigid bank protection that includes concrete lining, soil cement (CSA), gunite bank lining, grouted riprap, and block walls is discouraged. The Town Engineer must approve installation of rigid bank protection. This type of bank protection



FIGURE 8. EXAMPLE OF FAILURE OF RIGID BANK PROTECTION

cannot be revegetated, nor can it be modified to account for aggradation or degradation, and it has a shorter design life than more flexible bank protection (Figure 8). If rigid bank protection is necessary, measures can be taken to aesthetically enhance it by adding color, texture, or form to blend it in with the natural surroundings or landscape theme.

Flexible bank protection includes riprap, articulated revetment, rock mattresses, geotextiles and, in some cases, gabion baskets. Flexible bank protection shall be designed per SS 7-98. This type of bank protection can be revegetated, has the ability to adjust to slight changes in bed or bank conditions without loss of function, and can be modified to account for aggradation or degradation in the channel. Also, flexible bank protection can be constructed or screened to blend with the natural character of the stream corridor.

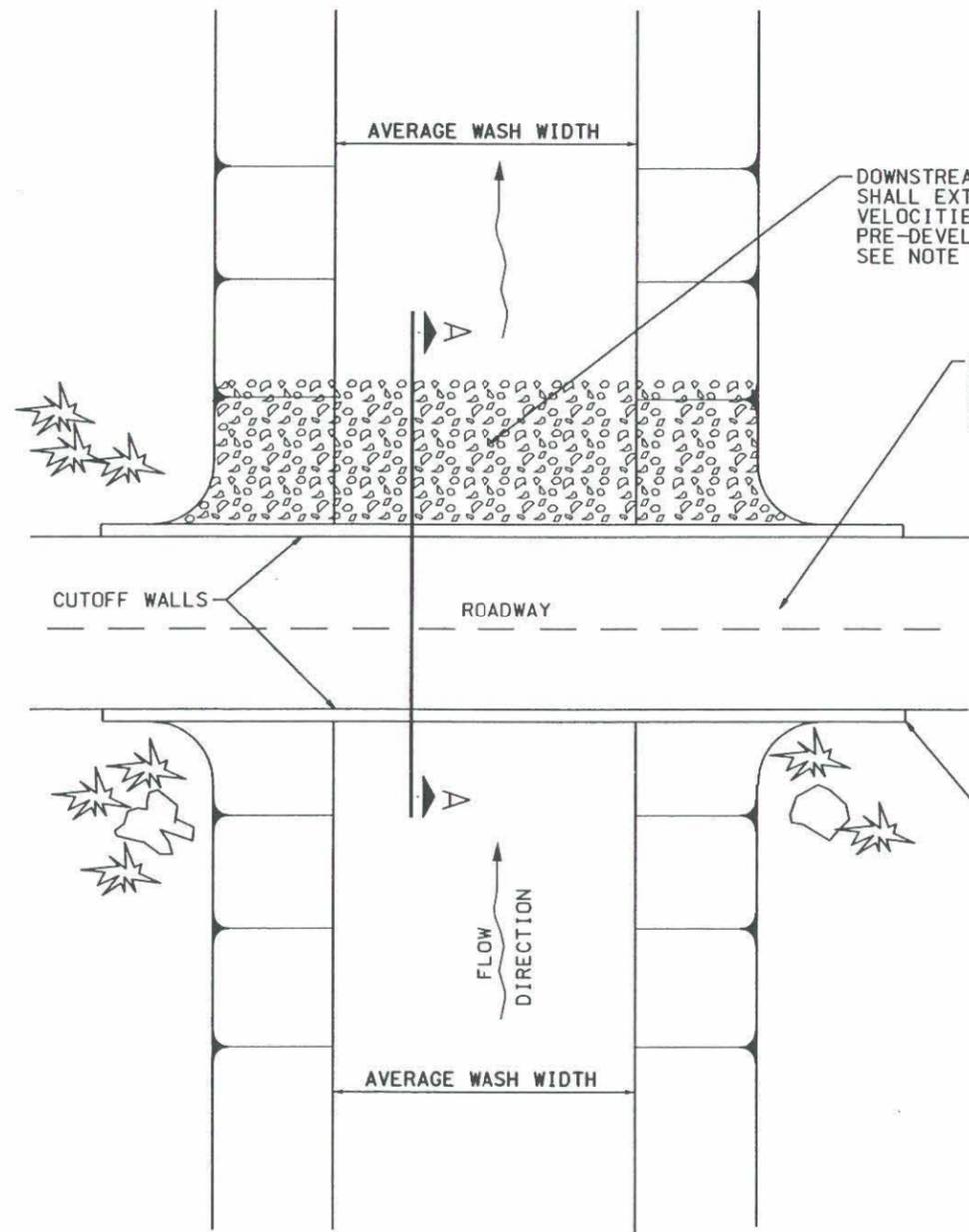
Bioengineered or nontraditional forms of bank protection are also possible solutions. However, natural bank vegetation is sparse in the study area, and it is subject to failure due to undercutting and long-term channel degradation. Bioengineering techniques require a reliable water supply and do not provide the same level of protection as traditional engineering bank protection measures. Bioengineering techniques are most applicable in areas where consequence of failure is low and regular inspection and maintenance are performed.

SECTION 4

References and Contacts

1. ADWR, State Standards for Floodplain Management in Arizona, available for download at <http://www.water.az.gov/publications>
2. Drainage Design Manual for Maricopa County, Arizona, Volume II-Hydraulics. Flood Control District of Maricopa County (FCDMC). Available at the FCDMC (602) 506-1501.
3. Drainage Design Manual for Maricopa County, Arizona, Volume I-Hydrology. FCDMC. Available at the FCDMC (602) 506-1501
4. Town of Carefree Subdivision Ordinance. Available at Carefree Town Hall (480) 488-3686
5. Town of Carefree Zoning Ordinance. Available at Carefree Town Hall (480) 488-3686
6. Carefree Drainage Master Plan. CH2M HILL. 2003. Available at the FCDMC (602) 506-1501
7. Data Collection Report, Carefree Drainage Master Plan. CH2M HILL. November 2002. Available at the FCDMC (602) 506-1501 and at Carefree Town Hall (480) 488-3686.
8. Maricopa Association of Governments (MAG), Uniform Standard Specifications for Public Works Construction. Available through MAG, 302 North First Avenue, Suite 300, Phoenix, Arizona 85003

Appendix
Generic Design Elements



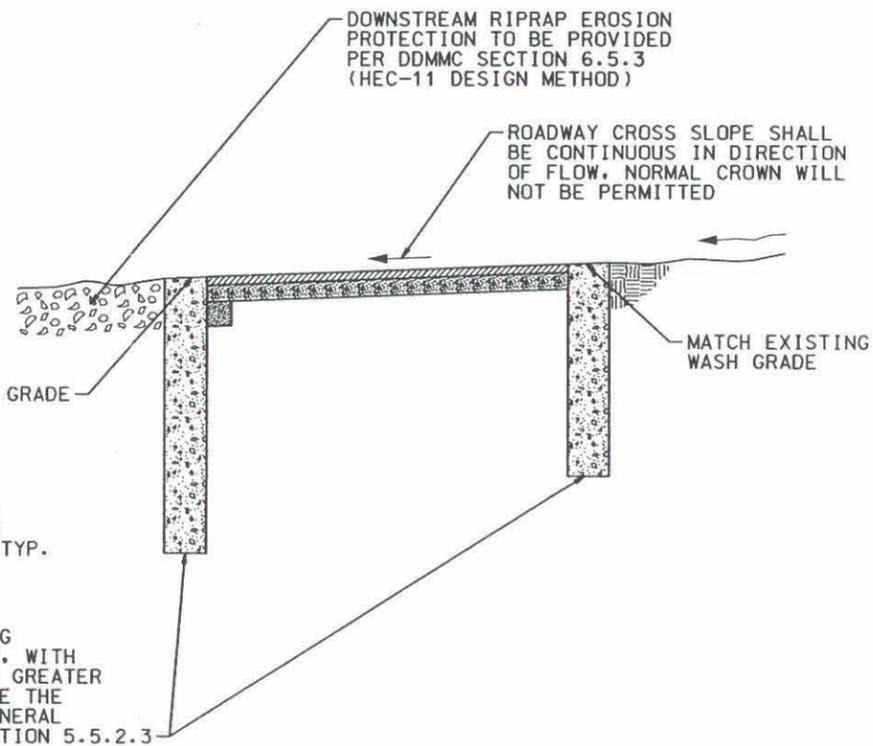
PLAN VIEW

DOWNSTREAM RIPRA PROTECTION SHALL EXTEND UNTIL WASH VELOCITIES RETURN TO PRE-DEVELOPMENT VELOCITIES, SEE NOTE 1

ROADWAY GEOMETRY AT DIP SECTION SHALL MATCH EXISTING WASH GEOMETRY, SEE NOTE 1

EXTENT OF CUTOFF WALLS, SHALL BE CONSTRUCTED TO 1 FT ABOVE 100-YR WSE, TYP.

CUTOFF WALLS PER MAG STANDARD DETAIL 552, WITH A DEPTH BELOW GRADE GREATER THAN OR EQUAL TO THE THE MAXIMUM DEPTH OF GENERAL SCOUR PER DDMMC SECTION 5.5.2.3



SECTION A-A

LEGEND

DDMMC: DRAINAGE DESIGN MANUAL OF MARICOPA COUNTY

MAG: MARICOPA ASSOCIATION OF GOVERNMENTS

NOTES

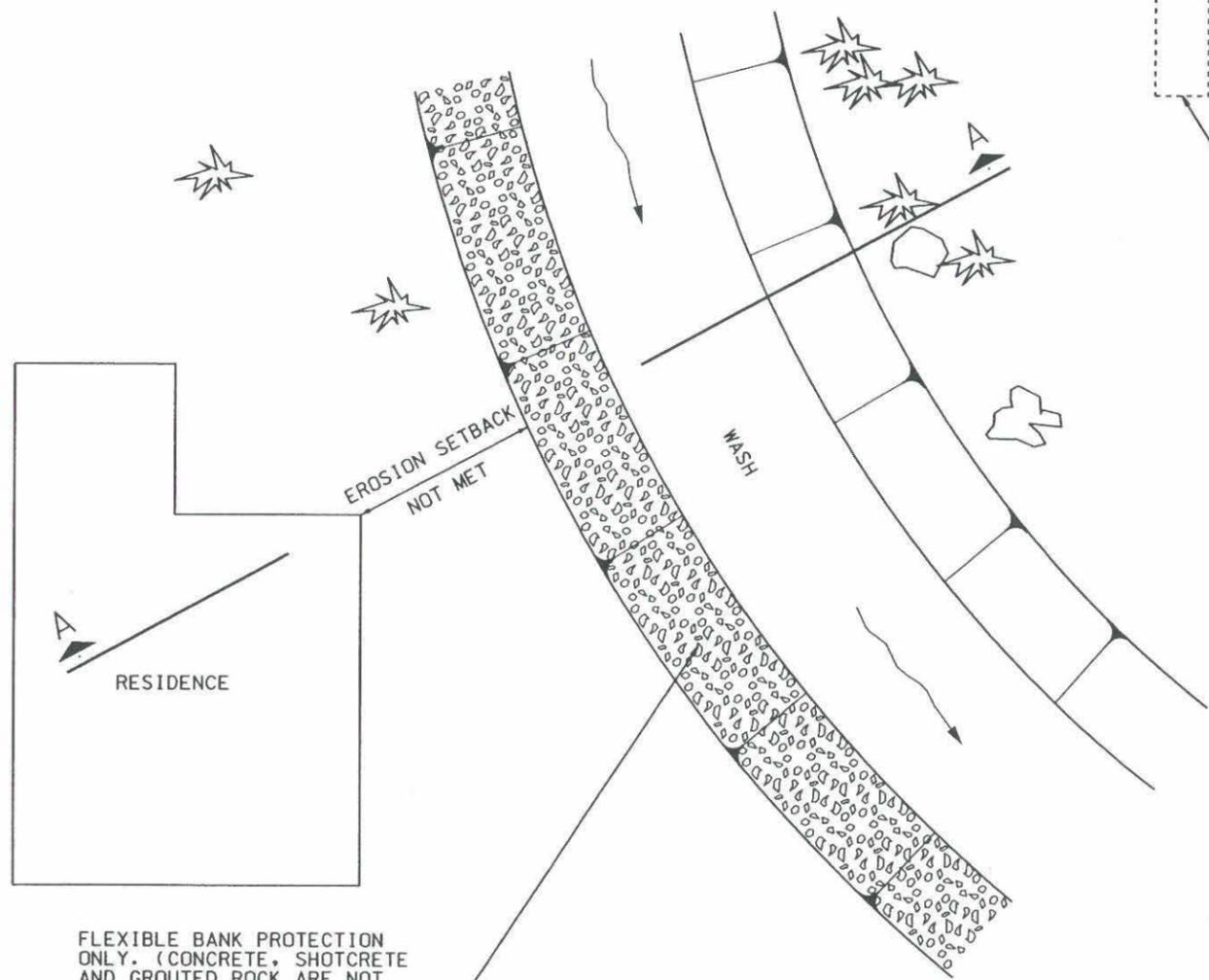
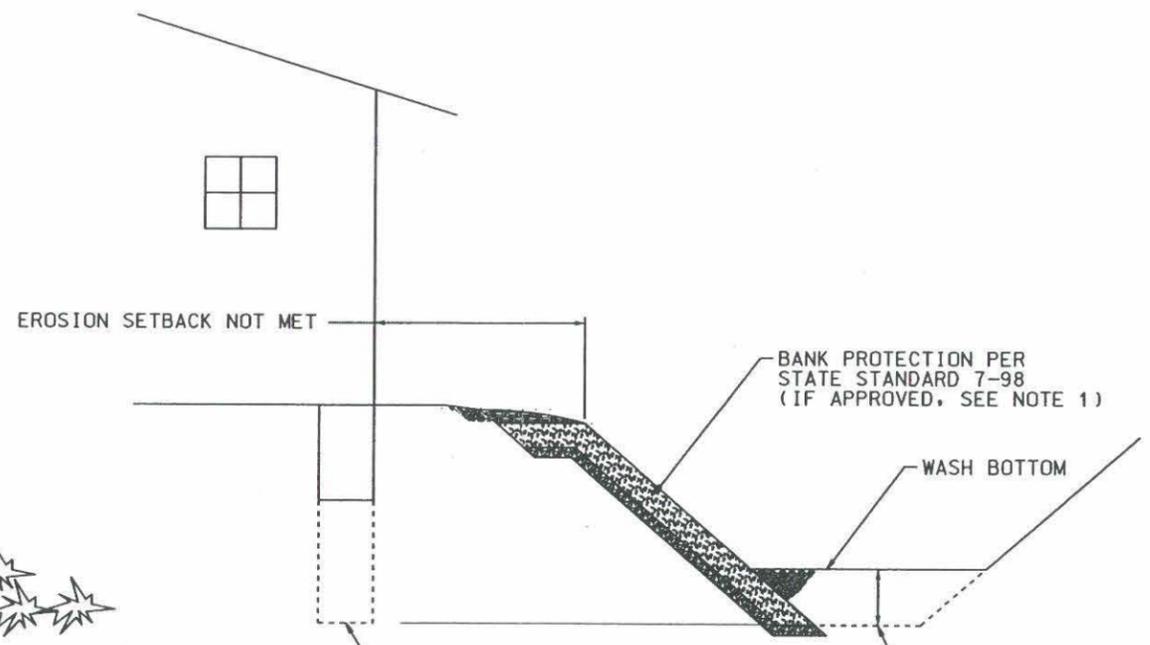
1. THE EXISTING WASH SHALL NOT BE CONSTRICTED AT THE ROADWAY CROSSING OR ELEVATED MORE THAN 0.5 FT UNLESS SEDIMENTATION HAS BEEN A HISTORIC PROBLEM BOTH UPSTREAM AND DOWNSTREAM OF THE ROAD CROSSING.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY



GENERIC DESIGN ELEMENT - DIP CROSSING

NOT TO SCALE



SECTION A-A

PLAN VIEW

FLEXIBLE BANK PROTECTION ONLY. (CONCRETE, SHOTCRETE AND GROUTED ROCK ARE NOT ACCEPTABLE MATERIALS UNLESS APPROVED BY THE TOWN ENGINEER, SEE NOTES 1 & 2.)

LEGEND

DDMMC: DRAINAGE DESIGN MANUAL OF MARICOPA COUNTY

SS: STATE STANDARDS FOR FLOODPLAIN MANAGEMENT

 BANK PROTECTION

NOTES

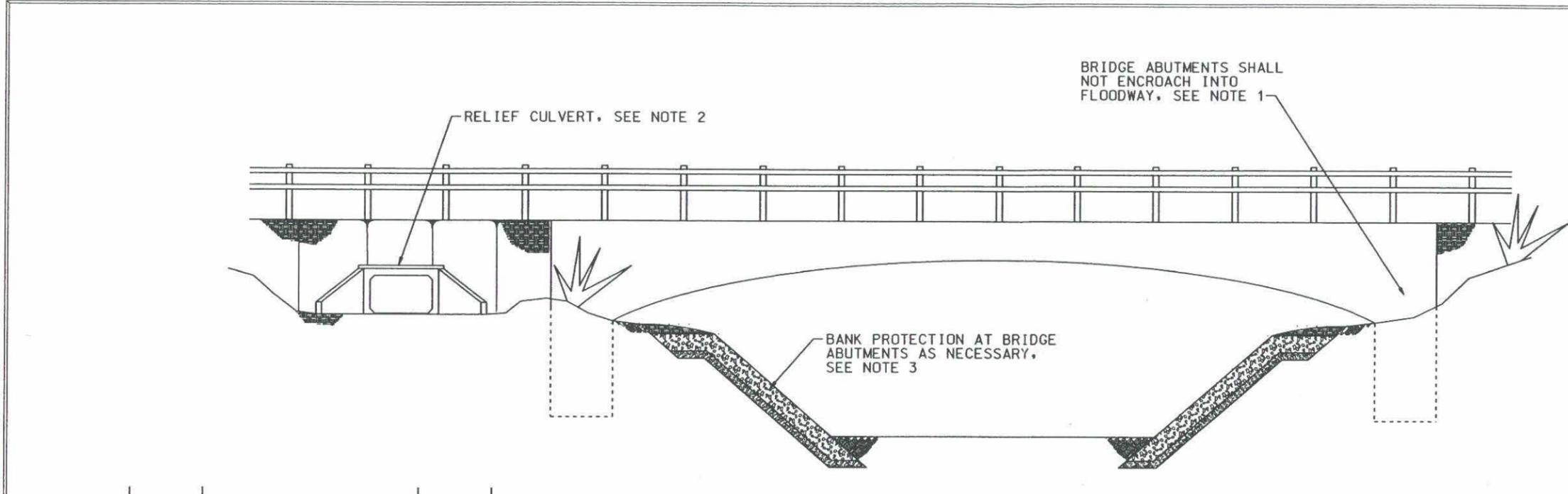
1. PROTECTION SHALL ONLY BE CONSTRUCTED TO MITIGATE EXISTING PROBLEMS UPON APPROVAL OF THE TOWN ENGINEER.
2. NEW DEVELOPMENT SHOULD NOT ENCROACH INTO EROSION SETBACK PER SS 5-96. IF STRUCTURES ENCROACH INTO SETBACK, FOUNDATIONS MUST EXTEND BELOW THE SCOUR DEPTH AS CALCULATED PER SS 5-96.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

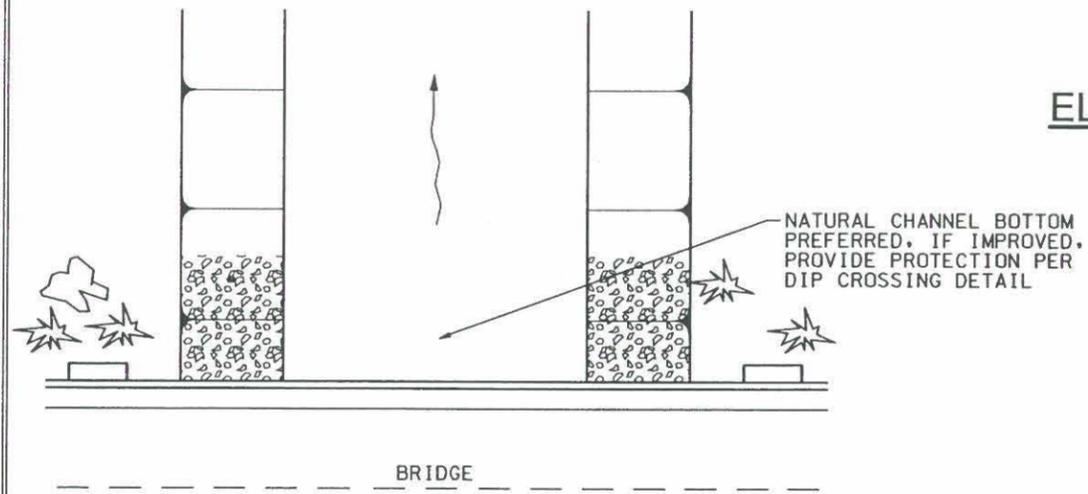


GENERIC DESIGN ELEMENT - BANK STABILIZATION

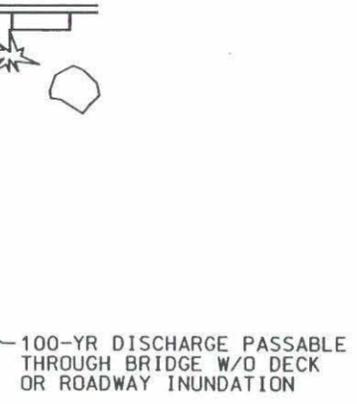
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ELEVATION VIEW



PLAN VIEW



BRIDGE ABUTMENTS SHALL NOT ENCR OACH INTO FLOODWAY, SEE NOTE 1

RELIEF CULVERT, SEE NOTE 2

BANK PROTECTION AT BRIDGE ABUTMENTS AS NECESSARY, SEE NOTE 3

NATURAL CHANNEL BOTTOM PREFERRED, IF IMPROVED, PROVIDE PROTECTION PER DIP CROSSING DETAIL

100-YR DISCHARGE PASSABLE THROUGH BRIDGE W/O DECK OR ROADWAY INUNDATION

LEGEND

WSEL: WATER SURFACE ELEVATION

NOTES

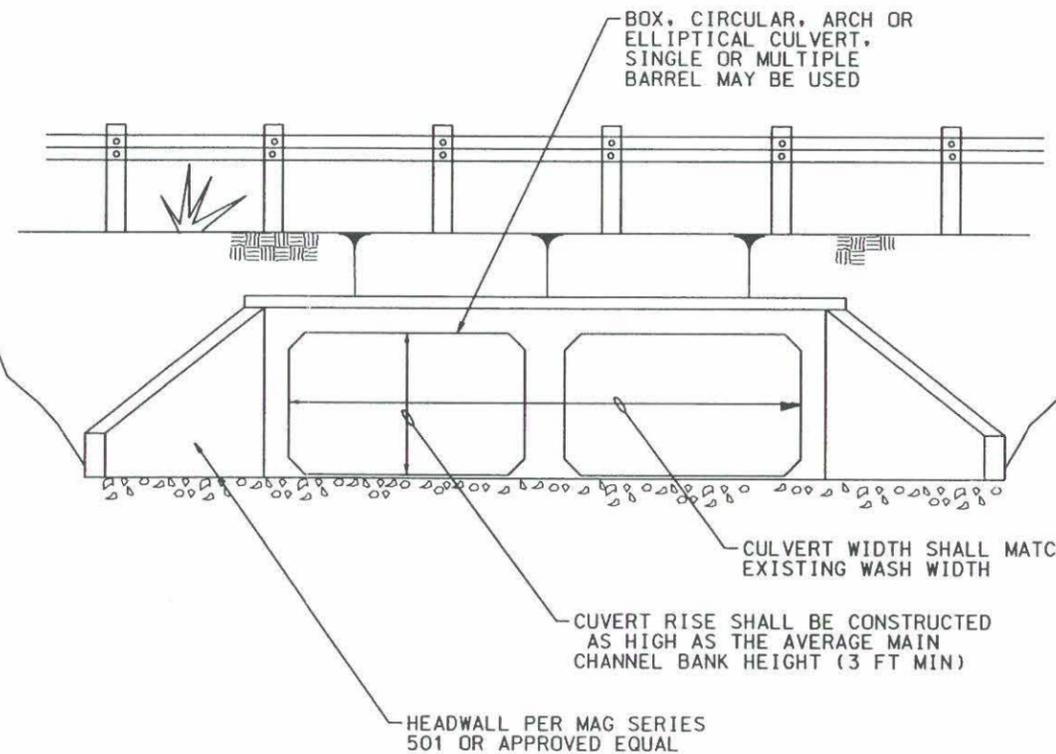
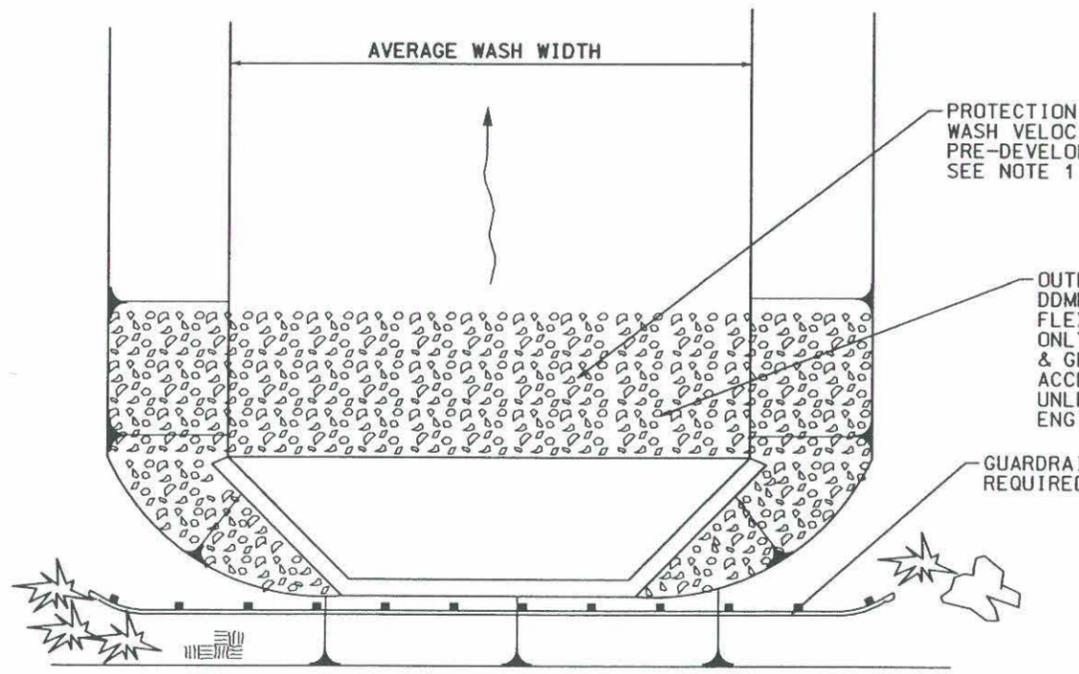
1. IT IS DESIRABLE THAT BRIDGE CROSSINGS SPAN THE ENTIRE FLOODPLAIN AND HAVE NO SIGNIFICANT IMPACT ON CHANNEL. BRIDGE CROSSINGS SHALL NOT RAISE UPSTREAM WSEL MORE THAN 1 FT ABOVE EXISTING LEVELS NOR CAUSE FLOODING UPSTREAM OR TO ADJACENT PROPERTIES.
2. BRAIDED STREAMS MAY REQUIRE THE USE OF RELIEF STRUCTURES TO MAINTAIN EXISTING FLOW PATHS & SEDIMENT BALANCE.
3. FLEXIBLE, NATURAL-LOOKING BANK PROTECTION PREFERRED. BANK PROTECTION MUST BE APPROVED BY TOWN ENGINEER.
4. BRIDGE DESIGN SHALL ACCOMMODATE EXISTING OR PLANNED TRAILS, PEDESTRIAN & EQUESTRIAN USAGES PER DIRECTION OF TOWN ENGINEER.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

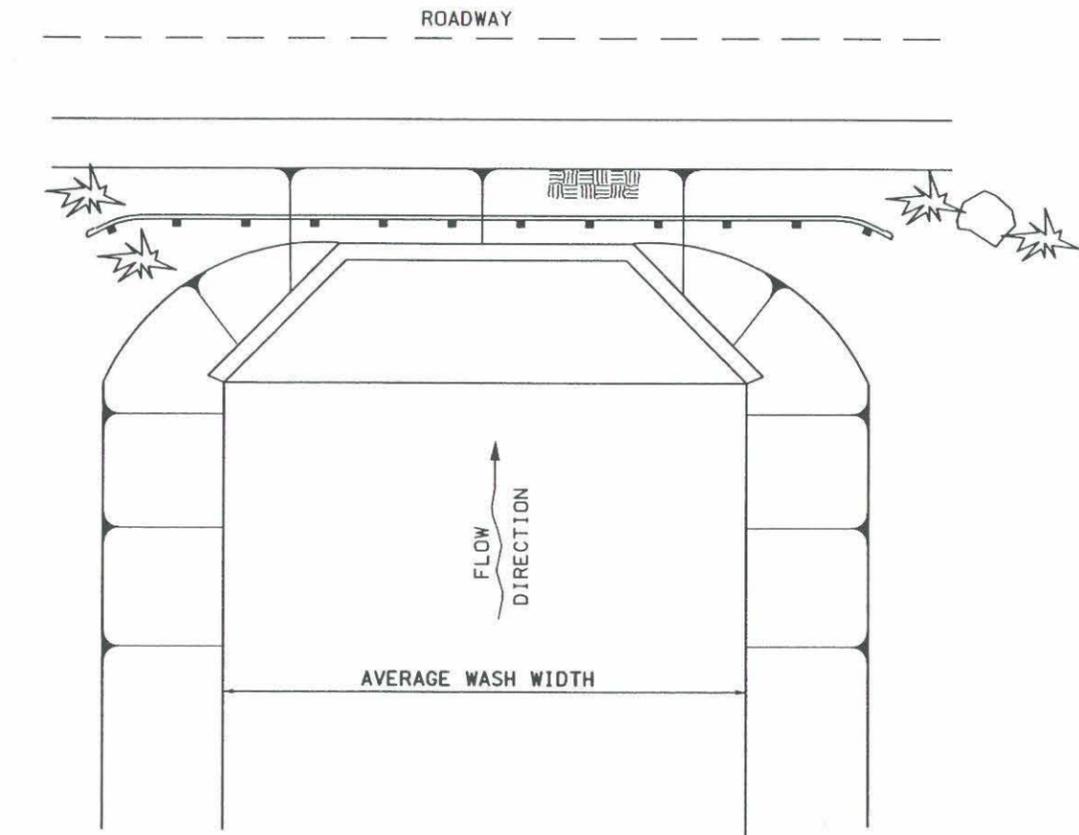


GENERIC DESIGN ELEMENT - BRIDGE CROSSING

NOT TO SCALE



ELEVATION VIEW



PLAN VIEW

LEGEND

DDMMC: DRAINAGE DESIGN MANUAL OF MARICOPA COUNTY

NOTES

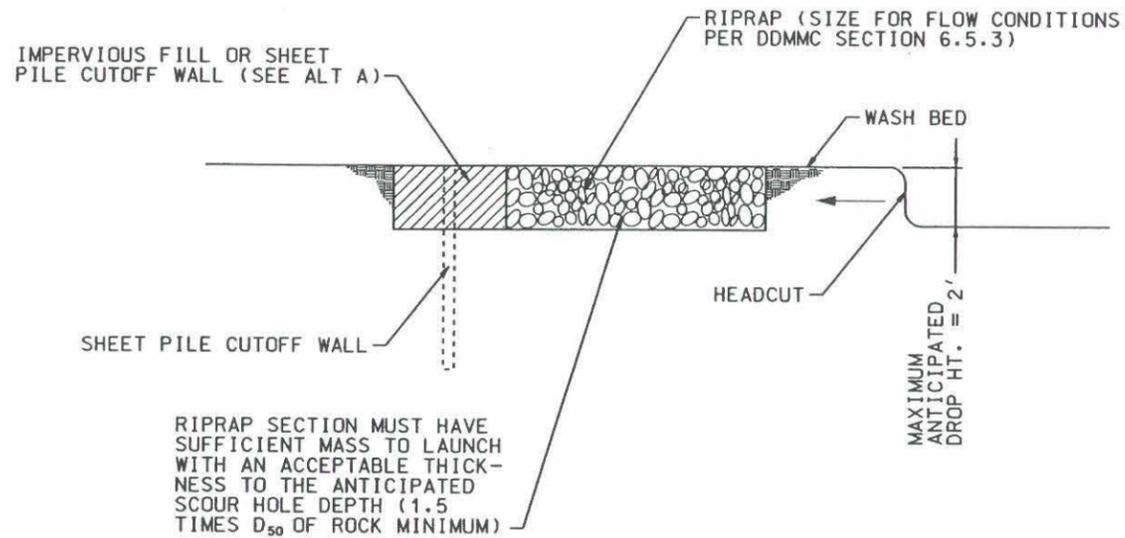
1. EXISTING TRAILS SHALL BE REPLACED IN KIND THROUGH RIP RAP PROTECTION, WHERE APPLICABLE
2. CULVERTS SHALL PASS 50-YR FLOW THROUGH CULVERT (100-YR W/ NO MORE THAN 0.5 FT OVER ROADWAY) PER DDMC 100-YR PASSABLE THROUGH CULVERT PREFERRED.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

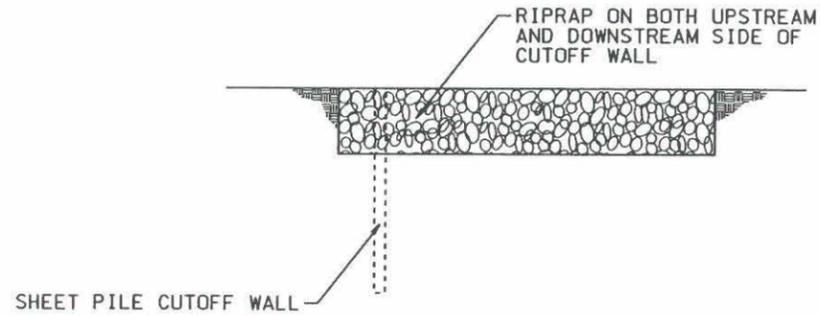


GENERIC DESIGN ELEMENT - CULVERTS & OUTLET PROTECTION

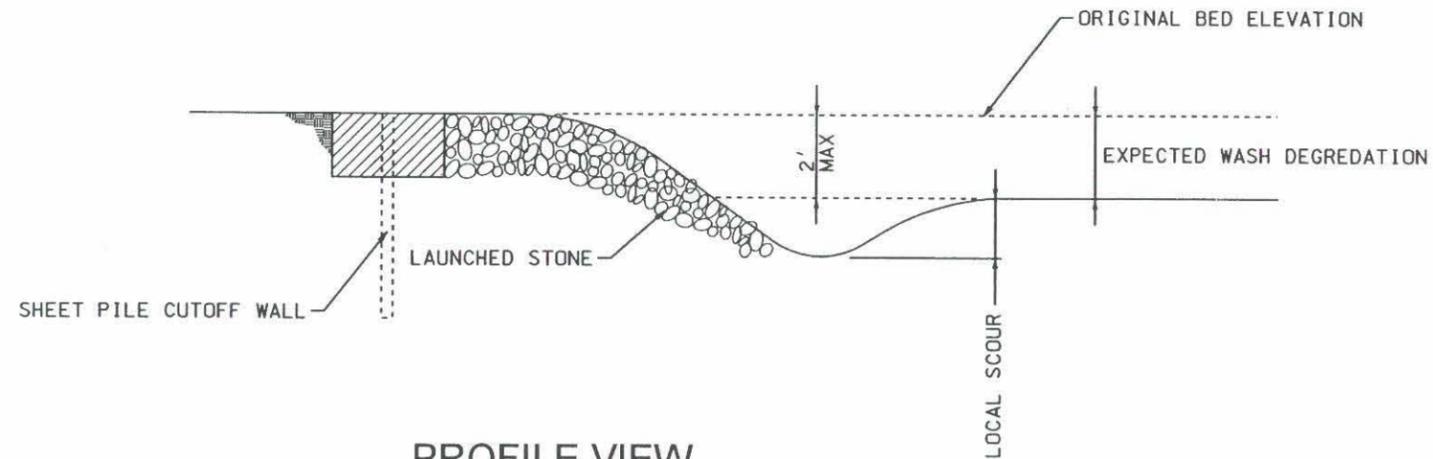
NOT TO SCALE



PROFILE VIEW
RIPRAP GRADE CONTROL STRUCTURE



ALTERNATIVE A
SHEET PILE CUTOFF WALL



PROFILE VIEW
RIPRAP GRADE CONTROL STRUCTURE
AFTER MIGRATION OF HEADCUT
TO STRUCTURE

LEGEND

DDMMC: DRAINAGE DESIGN
MANUAL OF MARICOPA
COUNTY

-  RIPRAP
-  IMPERVIOUS FILL

NOTES

1. GRADE CONTROL STRUCTURE SHALL ONLY BE CONSTRUCTED TO PREVENT DAMAGE TO STRUCTURES. EXTEND ANALYSIS OF WASH AND FLOODPLAIN ELEVATIONS AND SEDIMENT BALANCE REQUIRED.
2. LAUNCH SLOPE IS ASSUMED TO BE SLIGHTLY FLATTER THAN THE NATURAL ANGLE OF REPOSE OF THE RIPRAP.
3. RIPRAP GRADE CONTROL STRUCTURE MAY NOT BE SUITABLE FOR ALL APPLICATIONS. MAXIMUM DROP HEIGHT IS 2'. OTHER GRADE CONTROL STRUCTURES MAY BE ACCEPTABLE UPON APPROVAL OF TOWN ENGINEER:
 - STONE BED VERTICAL DROP STRUCTURE (WITH CAMOUFLAGED VERTICAL WALL)
 - SLOPING DROP GRADE CONTROL STRUCTURE: SLOPING SILLS SHALL BE COVERED WITH OR CONSTRUCTED OF NATURAL MATERIALS SUCH AS BOULDERS. LOOSE, GRADED RIPRAP IS NOT ALLOWED.
4. BAFFLE CHUTES ARE NOT ALLOWED.

**FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY**



GENERIC DESIGN ELEMENT -
GRADE CONTROL STRUCTURE

NOT TO SCALE

Appendix E
Inspection, Maintenance, & Monitoring Plan

DRAFT REPORT



INSPECTION, MAINTENANCE, & MONITORING PLAN

Carefree Drainage Master Plan

Prepared for



Prepared by



CH2MHILL

February 2003

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Appendices

- A Site Monitoring Sheets
- B Site Monitoring Figures
- C Photographs

Introduction

1.1 Background

The Flood Control District of Maricopa County (FCDMC) contracted with CH2M HILL in June 2001 to complete the Carefree Drainage Master Plan (DMP) study (FCD Contract No. 2000C037). The Carefree DMP study area encompasses the entire Town of Carefree (Town), which contains approximately 20 square miles. The purpose of the Carefree DMP was to identify and assess potential rainfall runoff hazards and to create a plan to reduce the potential damage to property or loss of life from flooding hazards. The DMP study included identifying existing and potential flooding problems evaluating erosion and performing sedimentation analyses. Information regarding flooding, sedimentation, and erosion issues was gathered and distributed to the Town, its residents and the FCDMC.

The Town consists primarily of low-density single-family residential development. Development has impacted the runoff and sedimentation patterns of the natural watercourses. Shifting at streambanks has occurred on major watercourses such as Galloway Wash, Galloway Wash North Branch, Rowe Wash, and Grapevine Wash. Disruption of the natural sediment balance in the area has led to aggradation and degradation, lateral migration, and avulsive channels. Higher runoff from developed areas and channelization of natural watercourses has led to higher peak flows and increased flooding occurrences.

The Town's drainage facilities consist of dip or at-grade wash crossings, pipe or box culverts, storm drains, and lined or unlined channels. During storm events, flows may cause deposition of sediments, erosion or structural damage at these crossings prohibiting emergency access and/or creating a potential public safety hazard.

1.2 Purpose

The purpose of this Inspection, Maintenance, and Monitoring Plan is to provide the Town tools for:

- Monitoring high-risk flood-prone areas
- Maintenance of drainage facilities after storm events
- Providing safe operation of these drainage facilities before, during, and after storm events

These guidelines were prepared for the Town of Carefree as a general framework for inspection, maintenance, and monitoring of drainage facilities. The Town has the authority to implement, modify, or make obsolete any portion of these guidelines.

Inspection and Monitoring Plan

2.1 When to Monitor

Regular maintenance and monitoring should be scheduled at minimum on an annual basis regardless of rainfall occurrences. Any storm event that produces visible runoff or sedimentation through, on, or over drainage facilities is an indication that monitoring should be performed. Typically, storm events that produce visible runoff in washes should trigger an inspection of the facilities. This level of monitoring should be continued for at least 3 years to establish a baseline condition for each conveyance feature. At that time, the level of monitoring may be modified based on evidence of accumulated data. To make the best use of the data, the rainfall precipitation should be recorded for each runoff event so that the long term relationships between rainfall, runoff, magnitude, frequency and maintenance can be established. The rainfall gauge data can be accessed by calling the Flood Control District of Maricopa County (FCDMC) office at (602) 506-1501.

2.2 Long-Term Monitoring

These guidelines include a list and description of several high-risk drainage facilities recommended for regular monitoring. This list may be modified by the Town as needed. Additional drainage facilities may need to be added to the list and some facilities may be removed if these facilities are repaired, replaced, modified, or made obsolete. Site monitoring sheets have been provided in Appendix A of this document that can be used to keep a log of long-term changes to each drainage facility. Wash aggradation (sedimentation) and degradation (erosion) can be measured and monitored over the course of several years. Lateral movement can be traced from measurements of top width and bottom width in relation to the drainage facility. Bank stability and damage to structures can be monitored over time and recommendations can be made for repair or replacement if necessary.

Long-term monitoring offers an opportunity to determine trends in the movement of sediments. This information can be useful for long-range planning and determining the nature and extent of repairs to existing facilities.

2.3 Monitoring Sites

Site Monitoring figure have been created for each of the recommended sites and are included in Appendix B of this document. These sites have had sedimentation or erosion and structural damage in past storm events and should be monitored on a regular basis. The monitoring sheets include a plan view showing the general location of the issue to monitor, in most cases a section or elevation view, and a picture of the site. For each site, a description of where and how to measure sedimentation or erosion is provided to facilitate the monitoring process. Also, a checklist is provided that can be photocopied and filled in

for each monitoring site. These checklists can be filed and saved to help identify long-term changes to the monitoring sites.

Most at-grade crossings require some maintenance after storm events due to buildup of sediment on pavement and downstream erosion and scour. Sediment is measured vertically in these locations at the upstream edges of the pavement and at the downstream end of the erosion protection or edge of pavement if erosion protection is not present.

Several locations along Galloway Wash should be monitored regularly, especially in areas where erosion setbacks for the wash have not been met and development has encroached the natural watercourse. In general, when a storm event occurs, washes should be monitored for erosion, sedimentation, lateral movement, and avulsion in readily accessible areas, recurring problem areas or in areas of new development.

Some specific areas of concern include culvert number 3 (See Monitoring Site No. 3, Appendix B of this document) on Cave Creek Road. Culvert number 3 is a monitoring site where sedimentation has occurred and virtually plugged the drainage structure. Aggradation has been a problem at the Dream Street Bridge and should be monitored and maintained. The culverts at Tree Lined Trail at Wildflower have severe sedimentation problems and need regular maintenance and monitoring to ensure proper function. The unprotected earthen berm on Galloway Wash between Scopa and Tranquil (see Site Monitoring Location Map, Appendix B) should be monitored and repaired for damage to eliminate potential failure during storm events. Damaged crossings at the eastern end of the Town should also be monitored and maintained for recurring sedimentation problems.

2.3.1 New Drainage Structures

In addition to the monitoring sites mentioned above, seven new sites will be added as a result of the Carefree DMP that was developed in February 2003. These sites consist mainly of drainage structures that were inadequate or not functioning properly. In the Carefree DMP, alternative solutions were evaluated to provide the best possible drainage structure at each of the seven sites. Once the construction of these drainage structures is complete, they will require frequent monitoring to ensure that they are constructed properly and maintain proper function. These sites include:

- Rising Sun Road at the Unnamed Tributary to Galloway Wash
- Pima Road at Galloway Wash
- Cave Creek Road at Unnamed Tributary to Cave Creek
- Tranquil Trail at Galloway Wash
- Sombrero Road at North Branch Galloway Wash
- Golden Spur Lane at Unnamed Tributary to Galloway Wash
- Cave Creek Road North of Carefree Highway

The new structures should be monitored at minimum on an annual basis. More detailed information about the existing culvert crossings can be found in the Memorandum for the Carefree DMP Sedimentation Alternative Analysis by JE Fuller, dated January 27, 2003.

2.3.2 Rising Sun Road at Galloway Wash

The existing Rising Sun Road crossing consists of a raised roadway section with a 60-inch-diameter by 36-inch-diameter corrugated metal pipe arch (CMPA) culvert and a 54-inch-diameter corrugated metal pipe (CMP) culvert. This drainage system is inadequate and continually gets clogged with sediment. During major storm events, sediment gets deposited on the upstream side of the culverts, flow overtops the roadway, and scour occurs on the downstream side of the culverts. This creates access problems during floods. The existing drainage system is proposed to be replaced with a five-barrel arch bridge (five 6-foot-diameter by 4.5-foot-diameter-pipe arches).

2.3.3 Pima Road at Galloway Wash

The existing drainage structure at Pima Road consists of an at-grade crossing (dip section). During major storm events, flow overtops the road, sediment is deposited on the road, and scour occurs downstream of the crossing. This also creates access problems and flooding of an existing property located in the historical floodplain. The existing at-grade crossing will be replaced with a proposed five-barrel arch bridge (five, 11-foot-diameter by 3.5-foot-diameter-pipe arches) and the wash will be regraded to prevent breakout flow from flooding the property.

2.3.4 Cave Creek Road at Unnamed Tributary to Cave Creek

The existing drainage structure at Cave Creek consists of three, 66-inch-diameter CMP culverts. The existing system is inadequate and sediment deposits at the culvert outlets. An additional two proposed 66-inch-diameter CMP culverts or two proposed 48-inch-diameter raised invert culverts will be added to the existing drainage facility.

2.3.5 Tranquil Trail at Galloway Wash

The existing drainage structure at Tranquil Trail consists of an at-grade (dip crossing) and two partially clogged culverts. The existing system is inadequate and results in clogged culverts. During major storm events, flow overtops the road, sediment is deposited on the road and inside the culverts, and scour occurs downstream of the crossing. This creates access problems during floods. The existing drainage structure will be replaced by a proposed six-barrel pipe-arch bridge (six, 20-foot-diameter by 4.5-foot-diameter-pipe arches).

2.3.6 Sombrero Road at North Branch Galloway Wash

The existing drainage structure at Sombrero Road consists of an at-grade (dip crossing). The existing system is inadequate and results in access problems. During major storm events, flow overtops the roadway, sediment deposits on the road, and scour occurs on the downstream lip of the pavement section of the crossing. The existing at-grade crossing will be replaced by a proposed four-barrel arch bridge (four 20-foot-diameter by 4.5-foot-diameter-pipe arches) and two proposed 54-inch-diameter relief culverts in the right braid of North Branch Galloway Wash.

2.3.7 Golden Spur Lane at Unnamed Tributary to Galloway Wash

The existing drainage structure at Golden Spur Lane consists of an at-grade crossing. The system is inadequate and results in access problems. During major storm events, flow overtops the roadway, sediment deposits on the road, and channel migration occurs. The existing drainage structure will be replaced with three proposed 10-foot by 4-foot reinforced-concrete box (RCB) culverts.

2.3.8 Cave Creek Road North of Carefree Highway

An existing double barrel 71- by 47-inch corrugated metal pipe arch exists under Cave Creek Road, north of Carefree Highway along with a smaller 49- by 39- inch arch culvert located nearby. All culverts' capacities are severely compromised by sediment. During major storm events, flow overtops the road, sediment is deposited on the road and inside the culverts, and scour occurs downstream of the crossing. The addition of three more 71- by 47-inch barrels is proposed at this location to increase the capacity so that the roadway remains passable during a 100-year runoff event.

Maintenance Plan

3.1 When to Maintain

Photographs of post-storm drainage facilities are included in Appendix C of this document to illustrate standard maintenance issues for the Carefree area. Individual maintenance criteria for drainage facilities includes:

- Channel grade aggradation (sedimentation) or degradation (erosion) of over 6 inches (see Figure 6, Appendix C)
- Bank locations eroded laterally over 5-feet, endangering existing structures
- Localized erosion has increased over 6 inches vertically, endangering existing structures or roadways
- Formation of avulsive channels
- Formation of scour holes
- Damage occurs or is eminent at a roadway, structure, residence, or building
- Hydraulic structure capacity (sediment has blocked drainage structure) has decreased over 15 percent, or a 15 percent reduction in overall inlet drainage area.
- A low-flow channel (thalweg) has occurred that was not previously in this location
- Cracks or separation of joints observed in channel linings and/or drainage structures
- Loss of supporting soils observed immediately behind engineered embankments (see Figure 5, Appendix C)
- Undermining (erosion of soil supporting) of drainage structure
- Sediment and debris buildup at at-grade crossings (see Figure 1, Appendix C)
- Pavement/roadway scour damage
- Evidence of upstream channel migration that would increase the skew of the approach channel to drainage structure inlets.
- Aggradation or erosion of flood control levees

3.2 Maintenance Activities

Table 1 identifies various maintenance criteria and the recommended maintenance activity to correct a given problem.

TABLE 1.
 Maintenance Criteria and Activities

Maintenance Criteria	Recommended Maintenance Activity*
Channel grade aggradation (sedimentation) or degradation (erosion) of over 6 inches	Remove sediment or debris or fill within right-of-way of eroded area.
Bank locations eroded laterally over 5 feet endangering existing structures	Construct bank protection.
Localized erosion has increased over 6 inches vertically endangering existing structures or roadways	Fill in eroded area. Replace support soil with compacted fill or replace subgrade and pavement.
Formation of scour holes	Fill in scour hole(s) with well graded, large diameter rock.
Formation of avulsive channels	Construct engineered levee to redirect water into main channel.**
Damage occurs or is eminent at a roadway, structure, residence, or building	Replace support soil with compacted fill, replace subgrade and pavement, extend foundation or construct cut-off walls.**
Hydraulic structure capacity has decreased over 15 percent due to sediment or debris buildup	Remove sediment or debris. Construct sediment trap or larger hydraulic structure if major problem or if recurring problem.** (See Figure 3, Appendix C.)
A low-flow channel (thalweg) has occurred that was not previously in this location	Compare channel capacity to previous inspection results. Construct sediment trap or grade-control structures if thalweg has increased or head-cut by more than 1-foot, respectively.**
Cracks or separation of joints observed in channel linings and/or drainage structures	Repair, close, and seal joints.
Undermining of drainage structure due to erosion	Fill in eroded areas, extend foundation or construct cut-off walls.**
Loss of supporting soils observed immediately behind engineered embankments	Remove bank protection. Replace embankment with compacted fill. Replace bank protection.**
Sediment and debris on at-grade crossing	Remove sediment and debris from road. Sediment and debris may be pushed into channel/wash on the downstream side of the crossing only. Do not create berm on upstream side with sediment and debris. (See Figures 1 and 7, Appendix C.)
Scour, pavement damage on at-grade crossing	Clear sediment and debris as stated above. Replace road subgrade and asphalt or other road surface material.
Evidence that upstream channel has migrated increasing skew of approach channel to drainage structure inlets.	Drainage structure may need to be modified, moved or skewed to accommodate new channel migration.**
Aggradation or erosion of flood control levees along channel banks.	Repair or replacement of levees with engineered fill. If levees are or will be FEMA approved levees more detailed analysis and repairs may be required.**

TABLE 1.
 Maintenance Criteria and Activities

Maintenance Criteria	Recommended Maintenance Activity*
----------------------	-----------------------------------

*Any addition or removal of fill material within a channel cross section will require a U.S. Army Corps of Engineers 404 permit. A maintenance 404 permit must be obtained by the Town prior to any ongoing maintenance procedures. Maintenance outside the public right-of-way may require easement acquisition.

**Detailed studies performed by a registered professional engineer may be required to confirm that these maintenance activities are appropriate, and to what extent they need to be performed. Permitting and/or easements may be required.

3.3 Regional Recommendations

Recurring problems, such as plugging of culverts due to sediment, debris, or severe erosion, that constantly undermine drainage facilities may be a sign of inadequacy of the current drainage facility system. Current culverts may be undersized and should be replaced with larger or different types of drainage facilities. Substandard storm drain grates should be replaced per current Maricopa Association of Governments (MAG) standards. Oversized and undersized culverts disrupt the natural sediment balance and flow patterns of the watercourses and should be replaced per design guidelines. Please refer to the Drainage Design Guidelines prepared for the Town as part of the Carefree DMP for a detailed discussion on the different types of drainage facilities and recommendations.

Appendix A. Site Monitoring Sheets

Site Monitoring Checklist

Site number: _____ Date: _____

Type of structure: _____

Location: _____

Flow Event: _____ Precipitation Amount: _____

Visible Flow? _____ Yes _____ No

Flow Still occurring? _____ Yes _____ No

Distance from measuring point down to channel bottom:

_____ Feet _____ Inches

Difference in distance from previous inspection:

_____ Feet _____ Inches Higher Lower (circle one)

Channel Dimensions Upstream of Drainage Facility:

Bottom Width: _____ Feet Top Width: _____ Feet

Left Bank Height: _____ Right Bank Height: _____

Distance from centerline of channel bottom to top of left bank:

_____ Feet _____ Inches

Distance from centerline of channel bottom to top of right bank:

_____ Feet _____ Inches

Thalweg (Low-Flow Channel): _____ Yes _____ No

Thalweg present at last Inspection? _____ Yes _____ No

Depth of thalweg from measuring point:

_____ Feet _____ Inches

Channel Dimensions Downstream of Drainage Facility:

Bottom Width: _____ Feet Top Width: _____ Feet

Left Bank Height: _____ Feet Right Bank Height: _____ Feet

Distance from centerline of channel bottom to top of left bank:

_____ Feet _____ Inches

Distance from centerline of channel bottom to top of right bank:

_____ Feet _____ Inches

Thalweg (Low-Flow Channel): _____ Yes _____ No

Thalweg present at last Inspection? _____ Yes _____ No

Distance (depth) of thalweg from measuring point:

_____ Feet _____ Inches

Erosion (Aggradation) of Flood Control Levees: _____ Yes _____ No

If yes at what
location?:

Describe:

Describe:

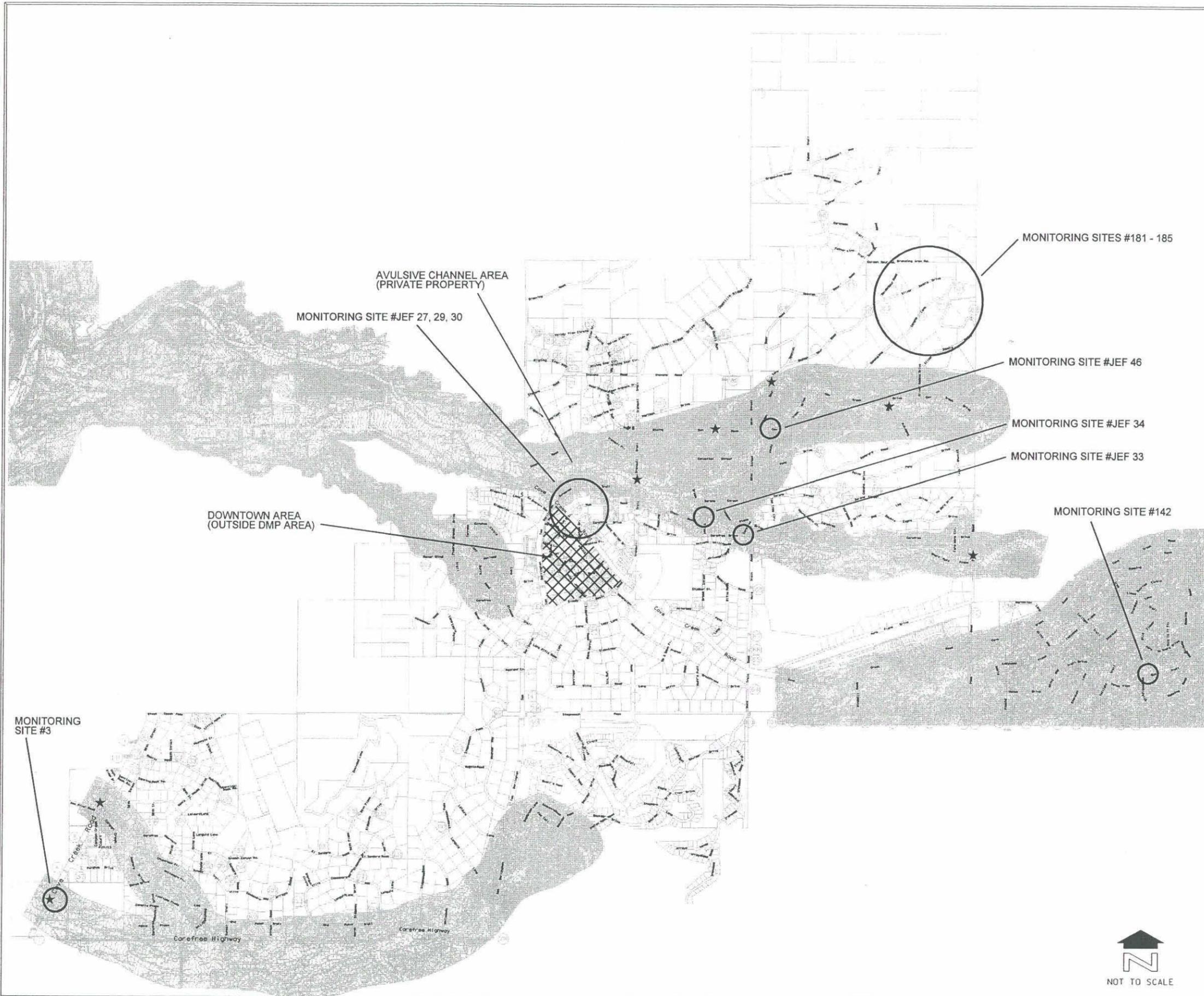
Observations:

OBSERVATION	YES	NO	DISTANCE / DEPTH	DESCRIPTION/LOCATION
Has any aggradation occurred since last inspection?				
Has any channel degradation occurred since last inspection?				
Have banks eroded laterally since last inspection?				
Are there any visible signs of localized erosion since last inspection ?				
Has avulsion occurred in the channel since last inspection?				
Is there visible runoff related damage to the roadway since the last inspection?				
Is there any visible runoff related damage at structure since the last inspection?				
If damage to structure is visible, describe. Include structure material and location of damage.				

OBSERVATION	YES	NO	DISTANCE / DEPTH	DESCRIPTION/LOCATION
<p>Is there any damage at a residence?</p> <p>Does damage occur at multiple residences? Add descriptions here.</p>				
<p>Is there any damage to commercial buildings?</p> <p>Does damage occur at multiple buildings? Add descriptions here.</p>				
<p>Has the hydraulic structure capacity (sediment has blocked drainage structure) of the drainage facility been reduced?</p>				
<p>Have cracks or separation of joints been observed in channel linings and/or drainage structures since the last inspection?</p>				
<p>Has loss of supporting soils been observed immediately behind engineered embankments since the last inspection?</p>				

OBSERVATION	YES	NO	DISTANCE / DEPTH	DESCRIPTION/LOCATION
Has undermining (erosion of soil supporting) been observed at the drainage structure since the last inspection?				
Has any degradation (erosion) occurred on any engineered or non-engineered levees on the channel banks since the last inspection?				

Appendix B. Site Monitoring Figures



LEGEND

- ★ ADVANCED STUDY SITES
- MONITORING SITE

NOTES

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

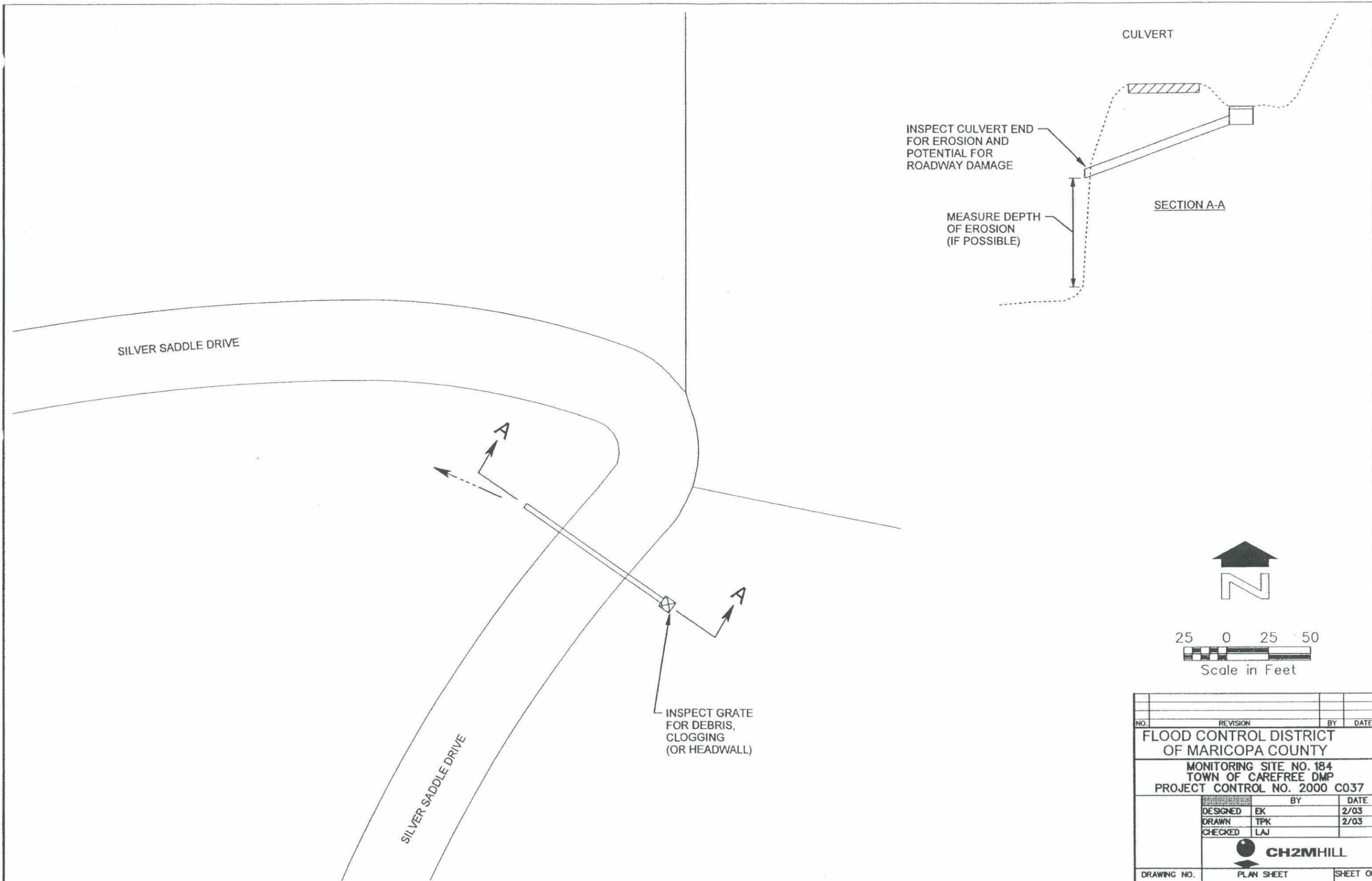


FIGURE 1
MONITORING SITES
INDEX SHEET

CAREFREE DRAINAGE MASTER PLAN



NOT TO SCALE



SILVER SADDLE DRIVE

SILVER SADDLE DRIVE

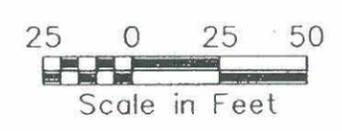
CULVERT

INSPECT CULVERT END FOR EROSION AND POTENTIAL FOR ROADWAY DAMAGE

MEASURE DEPTH OF EROSION (IF POSSIBLE)

SECTION A-A

INSPECT GRATE FOR DEBRIS, CLOGGING (OR HEADWALL)

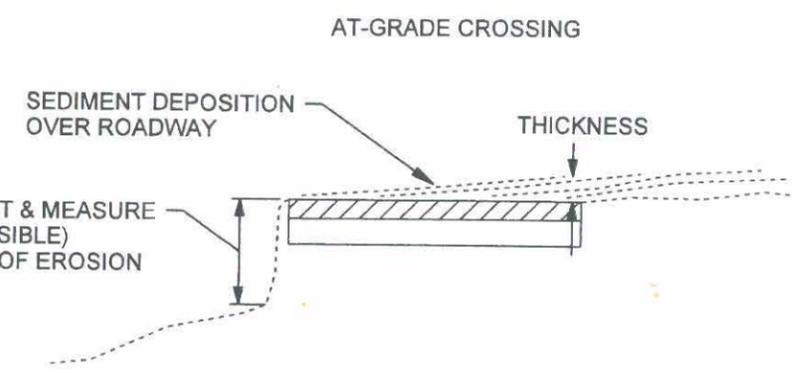


NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. 184 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
	DESIGNED	EK	2/03
	DRAWN	TPK	2/03
	CHECKED	LAJ	
		BY	DATE
DRAWING NO.	PLAN SHEET		SHEET OF

GOLDEN SPUR LANE

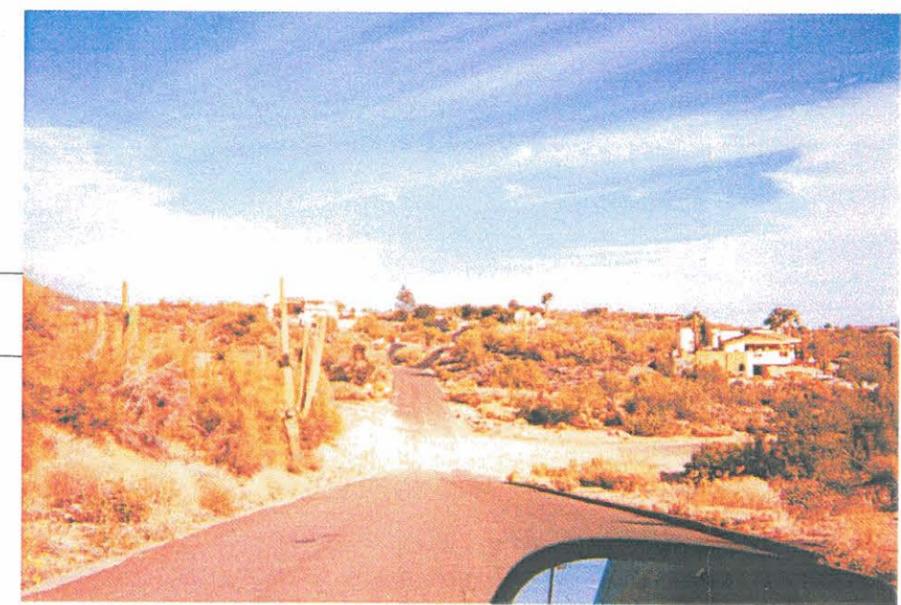


measure vertical distance



SECTION A-A

A
OBTAIN VERTICAL THICKNESS OF SEDIMENT ABOVE EOP GRADE

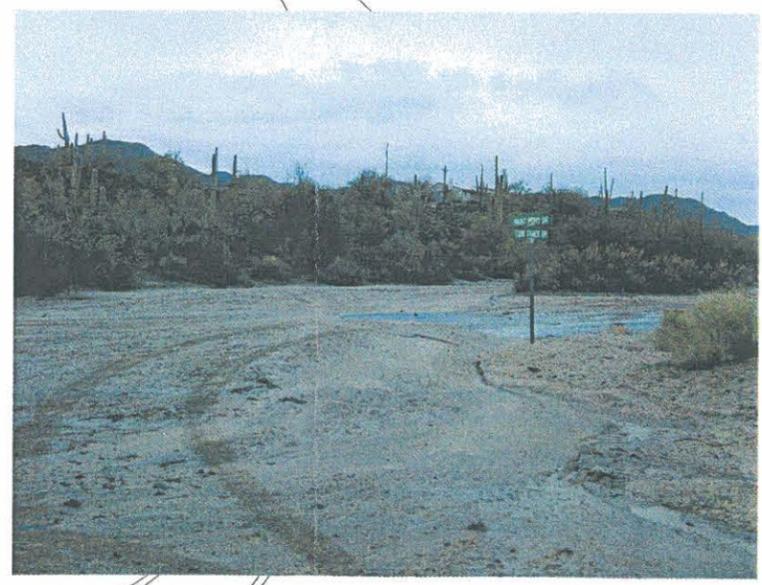


COW TRACK DRIVE

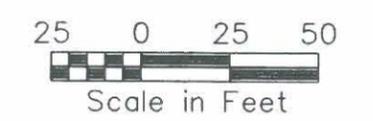
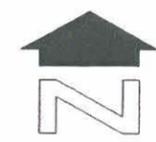
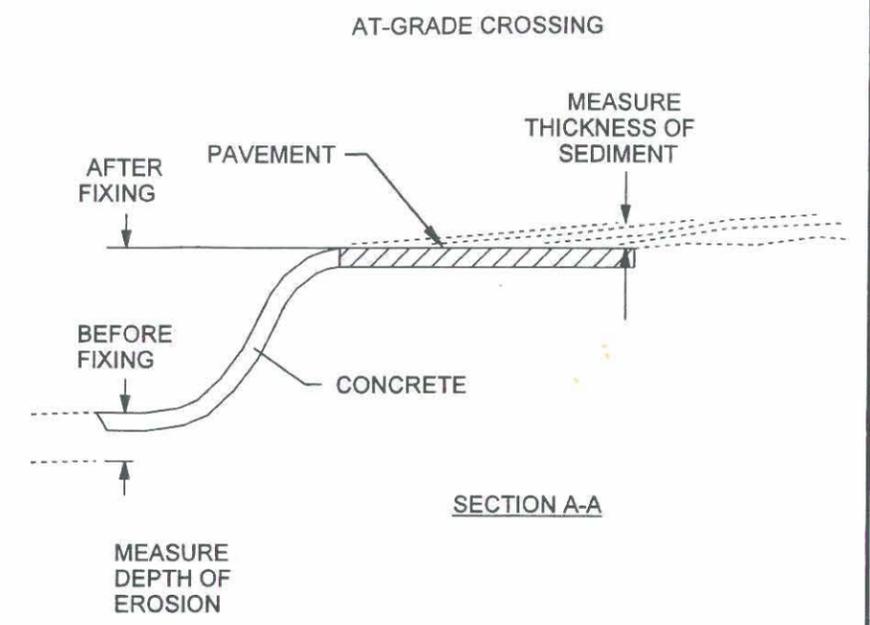
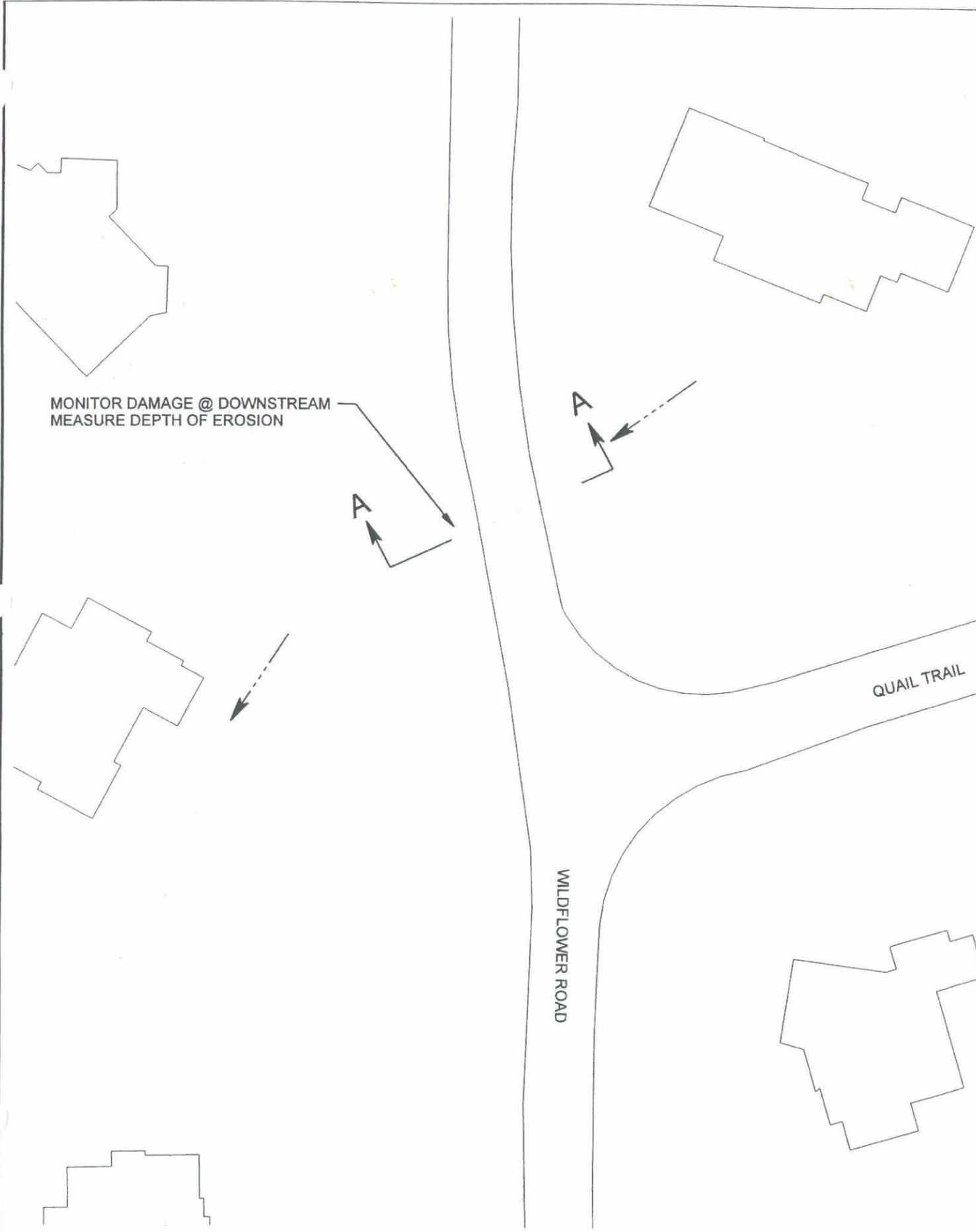
INSPECT PAVEMENT FOR EROSION DAMAGE, MEASURE VERTICAL DEPTH OF EROSION

PAINT PONY DRIVE

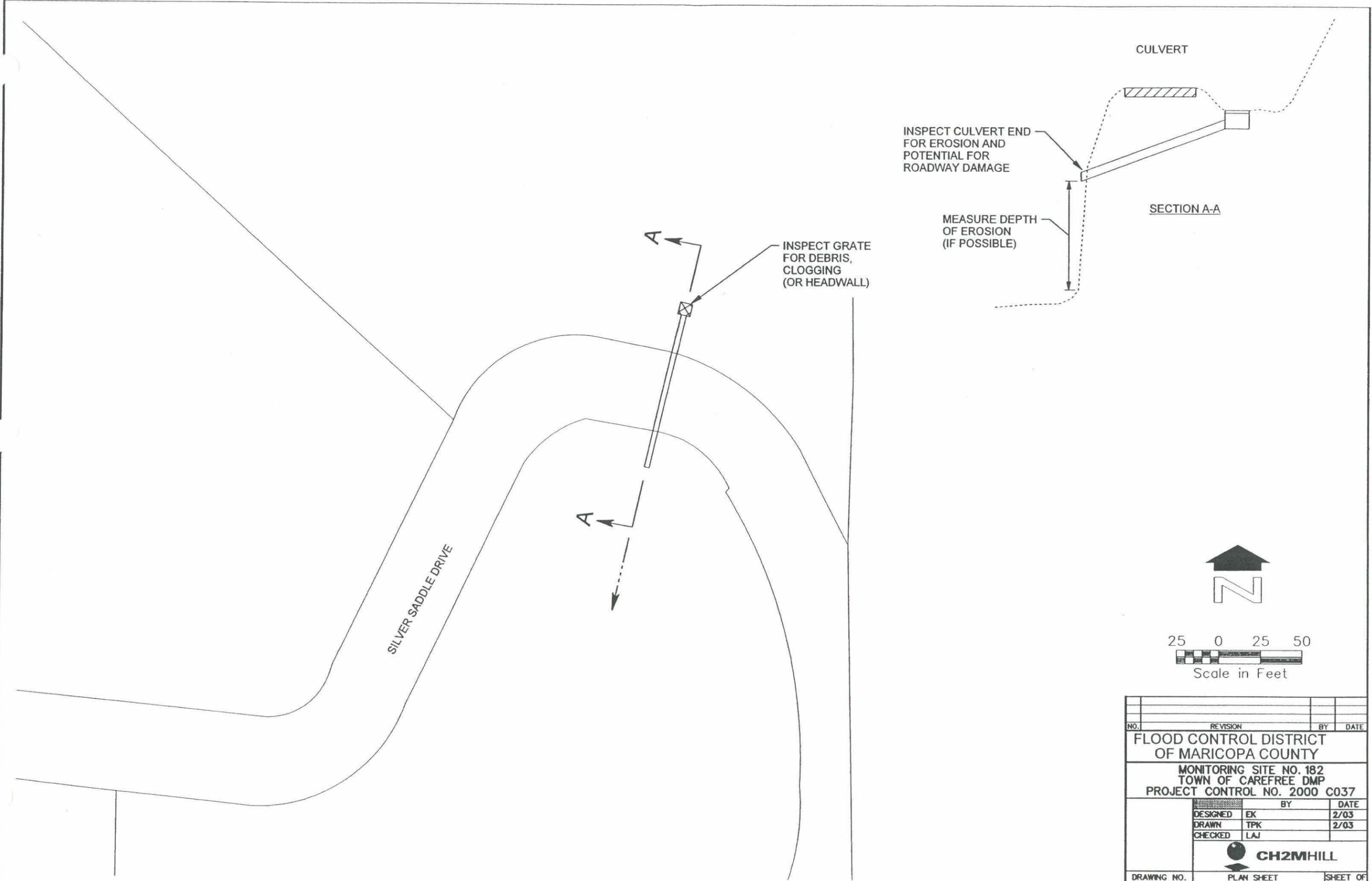
VISUALLY INSPECT INTEGRITY OF SLOPE - REPORT ANY POTENTIAL FAILURES OR IMPENDING DAMAGE TO PROPERTY OWNERS (PRIVATE PROPERTY)



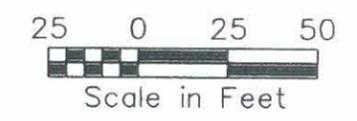
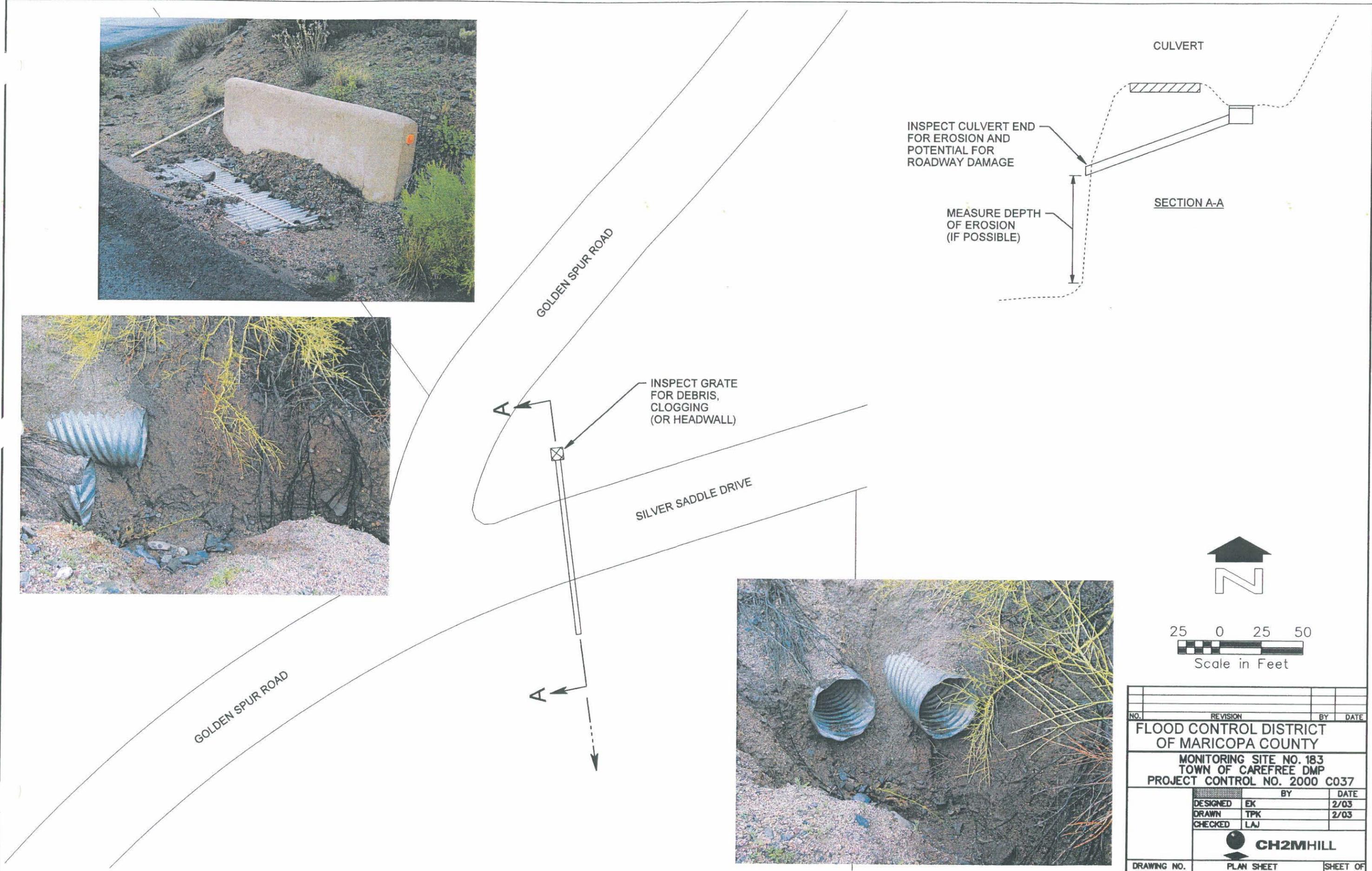
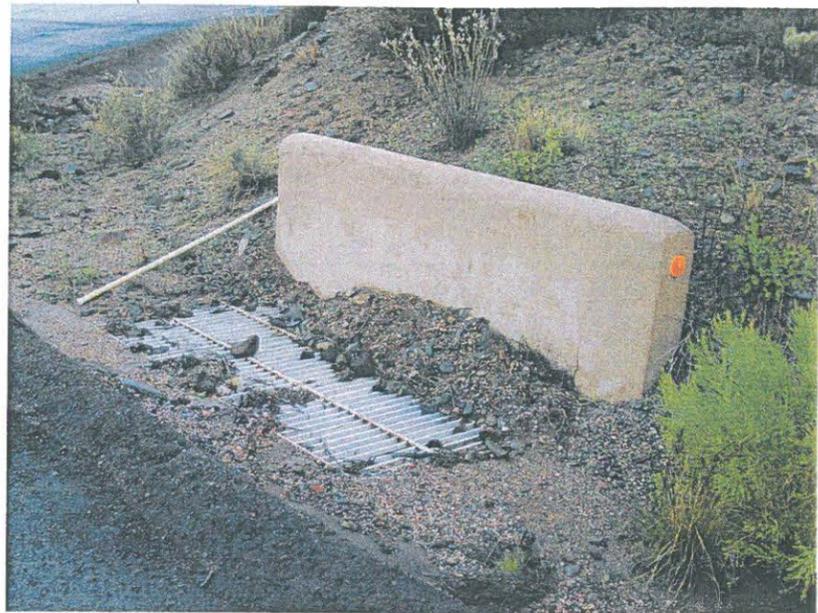
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY MONITORING SITE NO. JEF 46 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. 142 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
		BY	DATE
DESIGNED	EK		2/03
DRAWN	TPK		2/03
CHECKED	LAJ		
DRAWING NO.	PLAN SHEET	SHEET OF	



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. 182 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
		BY	DATE
	DESIGNED	EK	2/03
	DRAWN	TPK	2/03
	CHECKED	LAJ	
DRAWING NO.	PLAN SHEET		SHEET OF



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. 183 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		
DRAWING NO.	PLAN SHEET	SHEET OF	

GOLDEN SPUR ROAD

SILVER SADDLE DRIVE

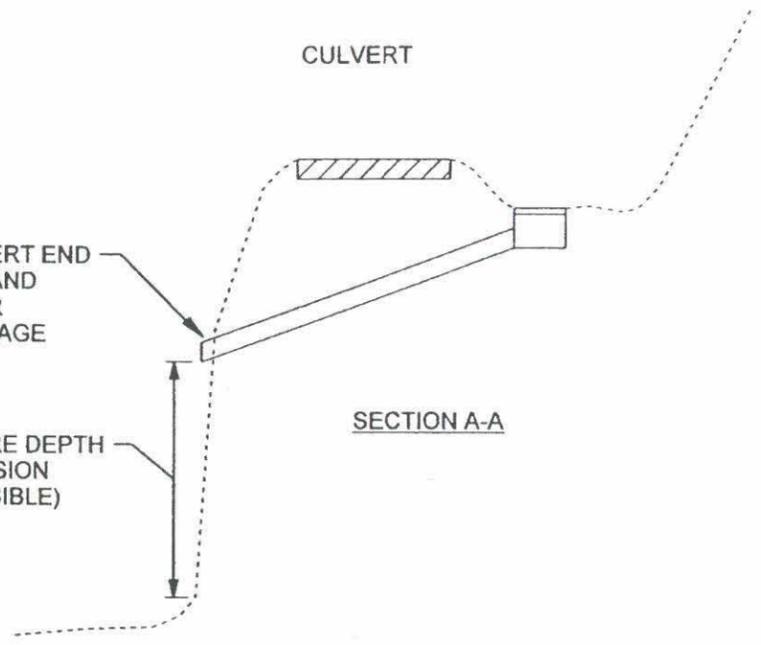
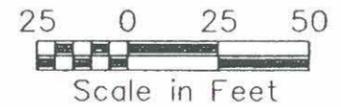
CULVERT

INSPECT CULVERT END FOR EROSION AND POTENTIAL FOR ROADWAY DAMAGE

MEASURE DEPTH OF EROSION (IF POSSIBLE)

SECTION A-A

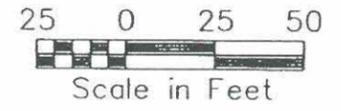
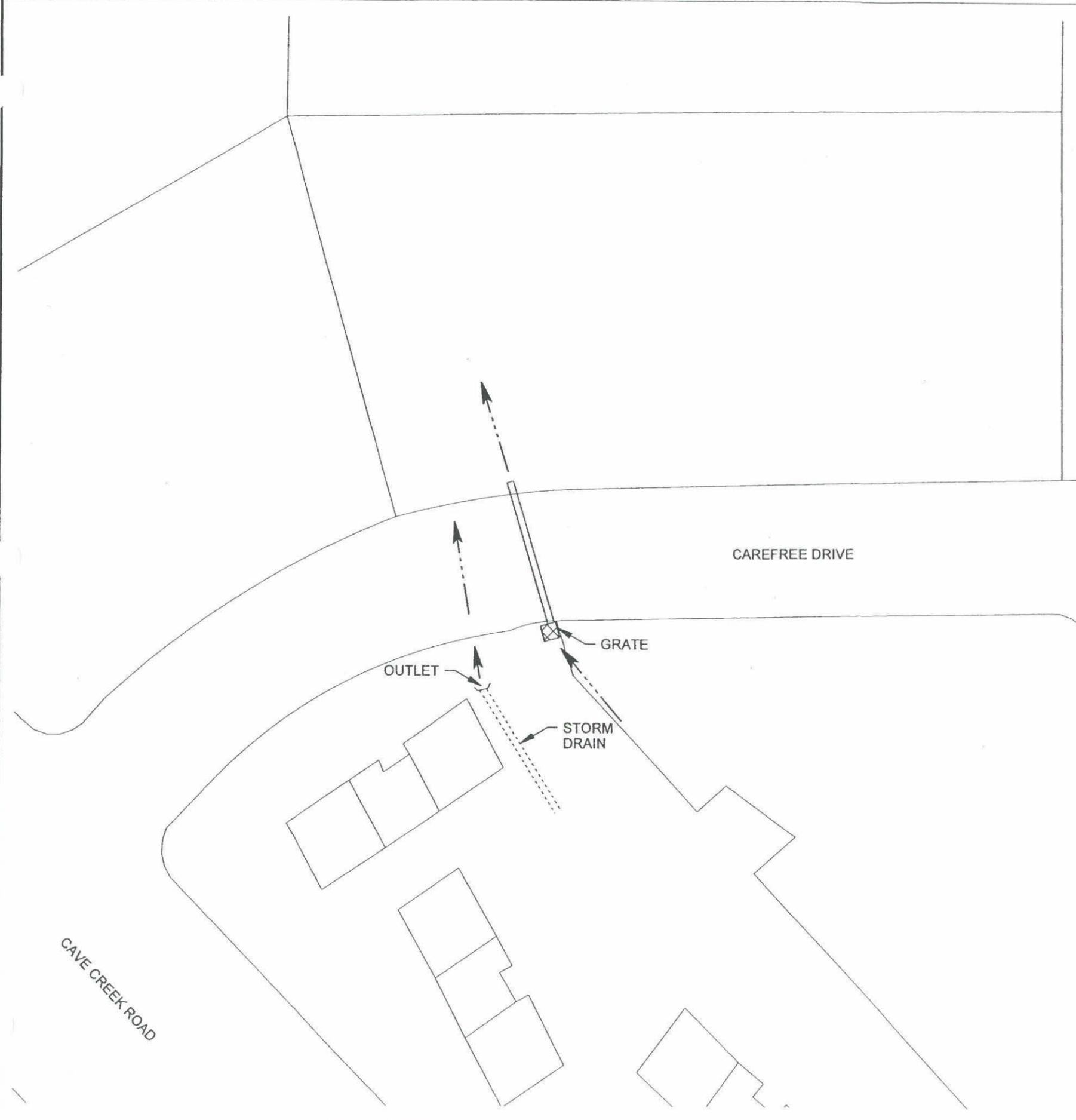
INSPECT GRATE FOR DEBRIS, CLOGGING (OR HEADWALL)



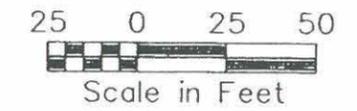
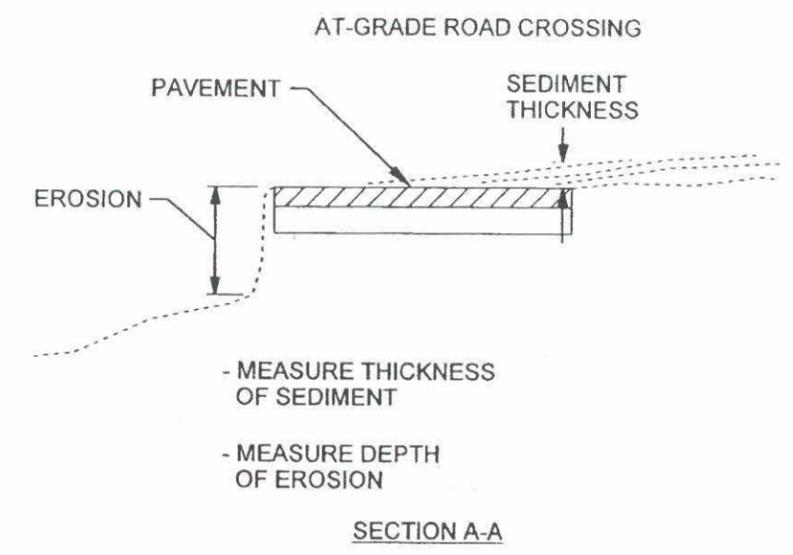
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. 185			
TOWN OF CAREFREE DMP			
PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	

CULVERT/GRATES/ROAD CROSSING

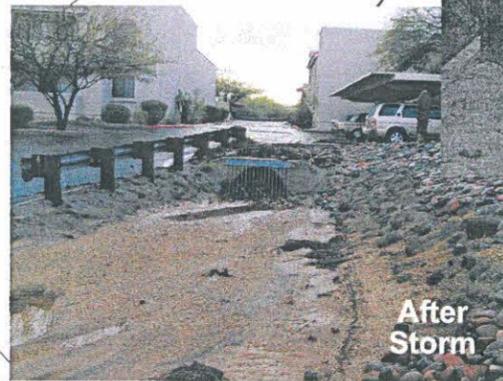
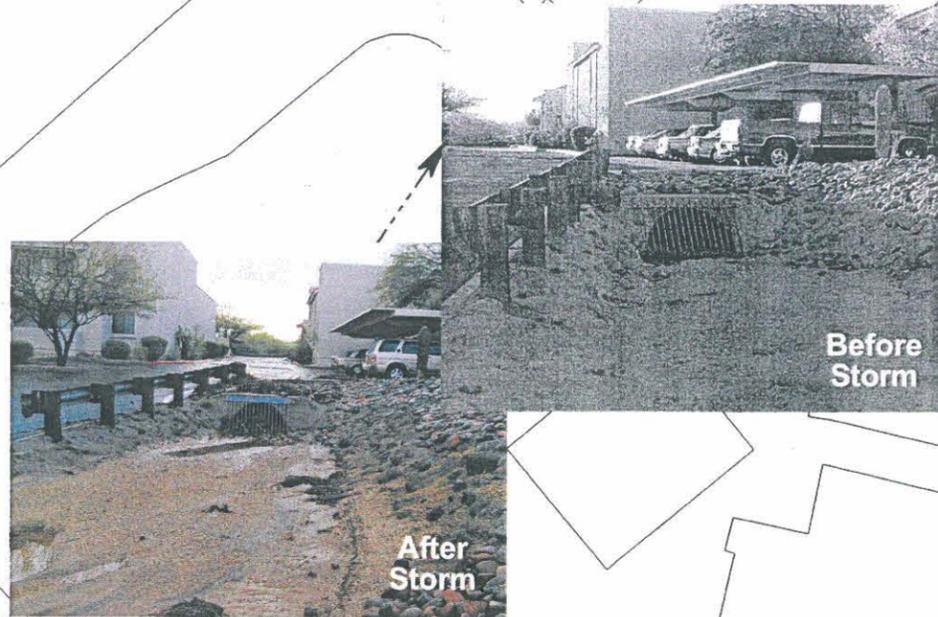
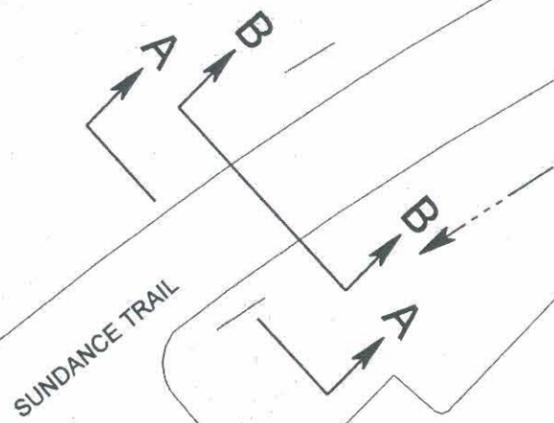
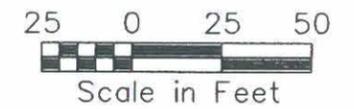
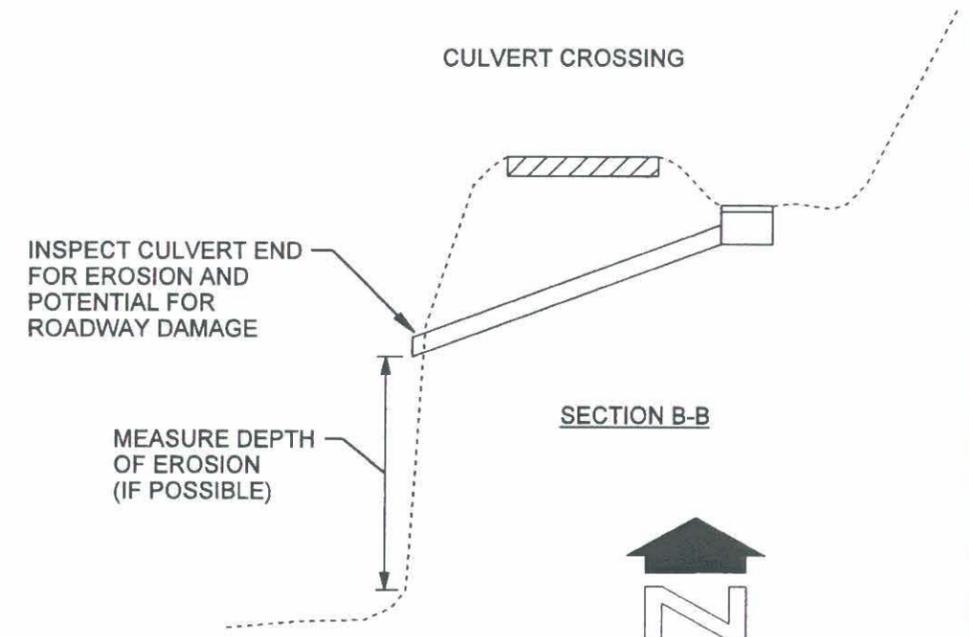
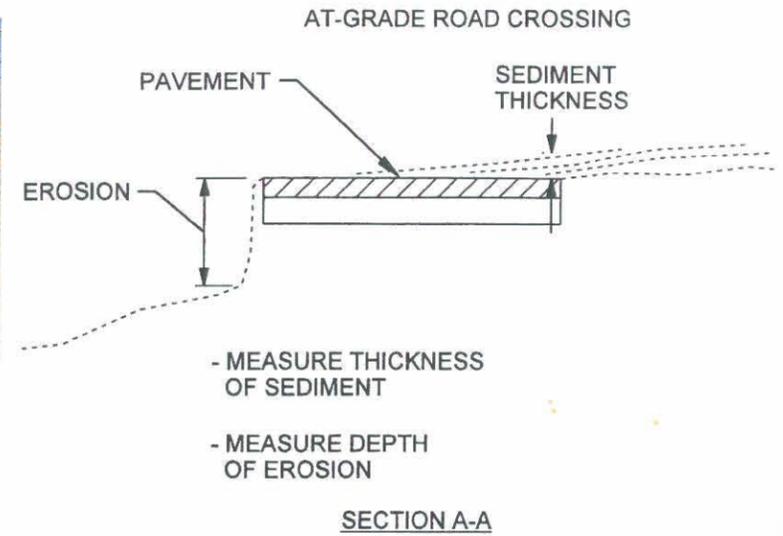
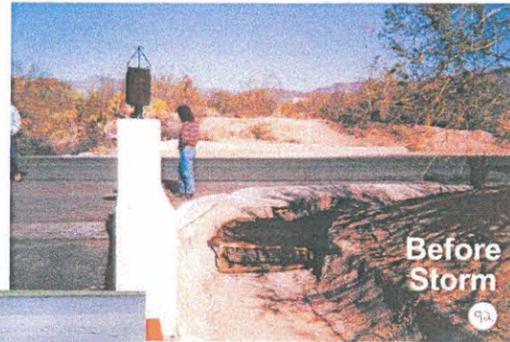
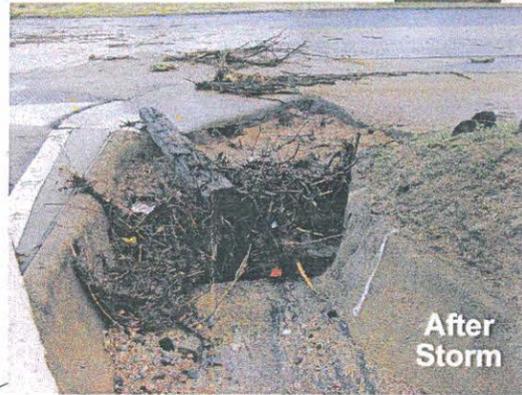
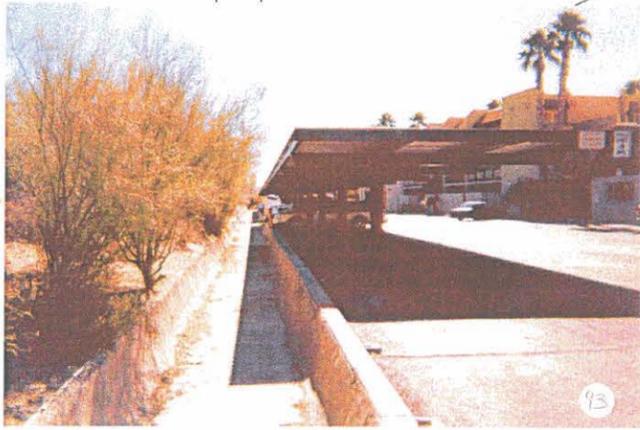
- CHECK GRATES AND DITCHES FOR DEBRIS
- CHECK STORM DRAIN SYSTEM INLETS



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. JEF 27 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
		BY	DATE
DESIGNED	EK		2/03
DRAWN	TPK		2/03
CHECKED	LAJ		
			
DRAWING NO.	PLAN SHEET	SHEET OF	



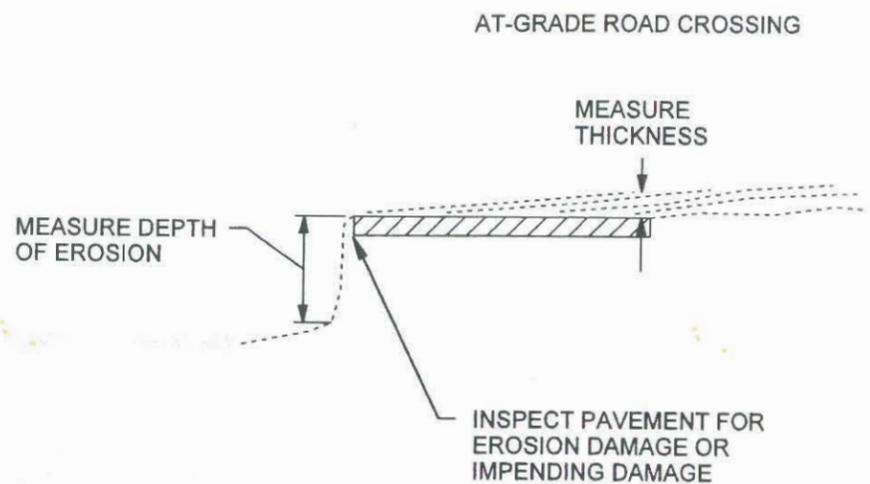
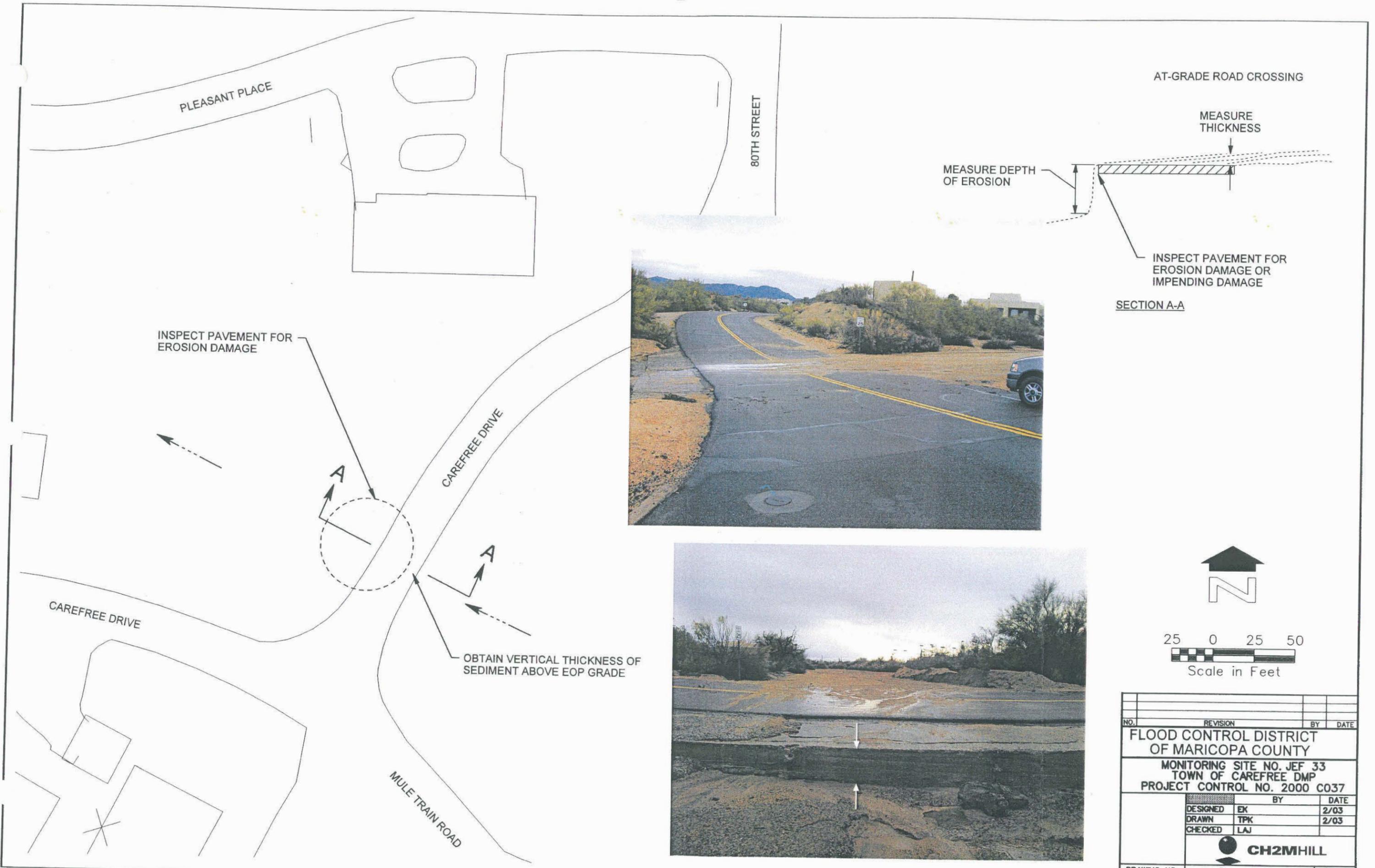
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. JEF 29 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
		BY	DATE
DESIGNED	EK		2/03
DRAWN	TPK		2/03
CHECKED	LAJ		
DRAWING NO.	PLAN SHEET	SHEET OF	



TOM DARLINGTON DRIVE

CAVE CREEK ROAD

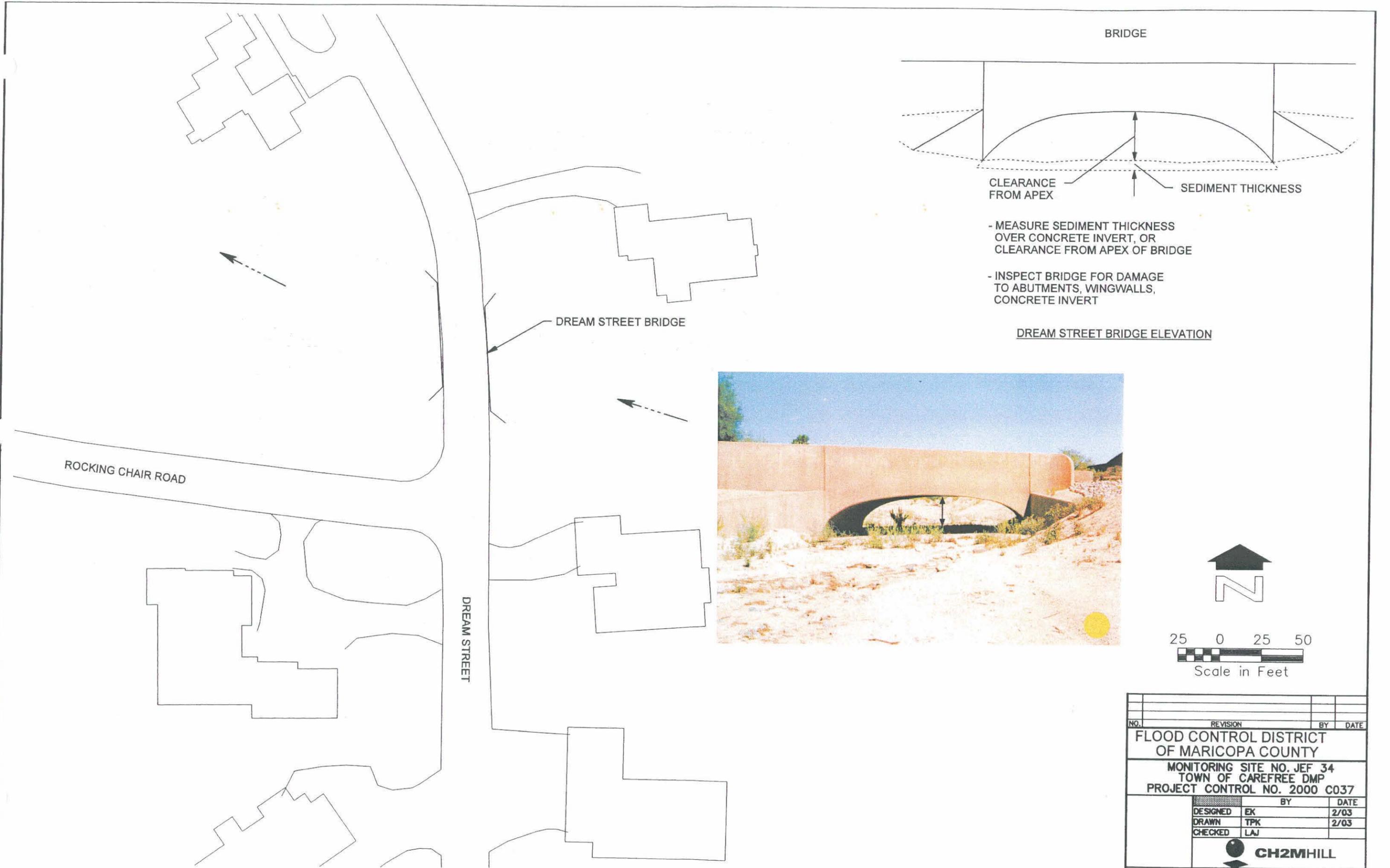
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY MONITORING SITE NO. JEF 30 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	



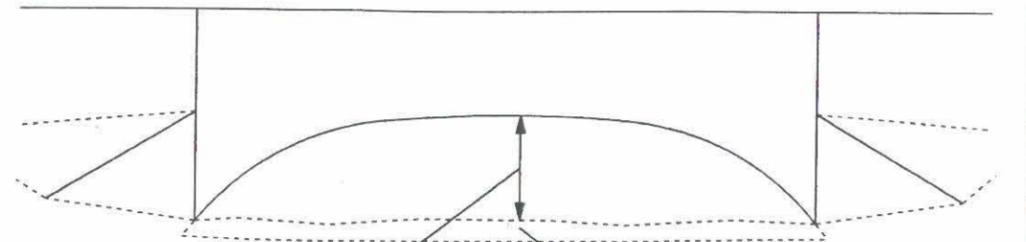
SECTION A-A



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. JEF 33 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	



BRIDGE



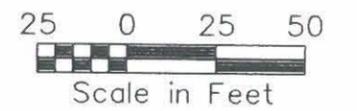
CLEARANCE FROM APEX

SEDIMENT THICKNESS

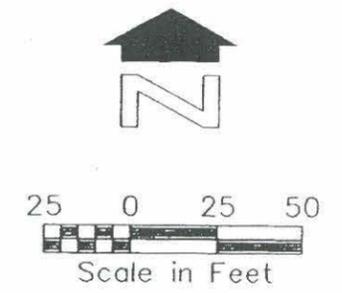
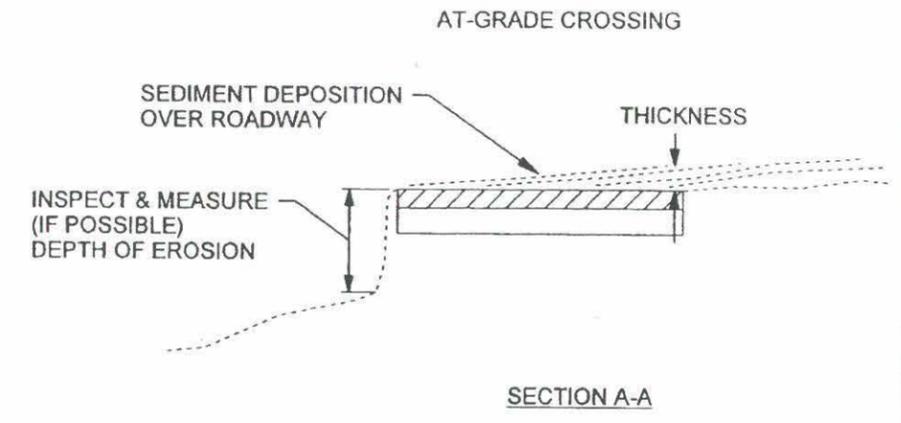
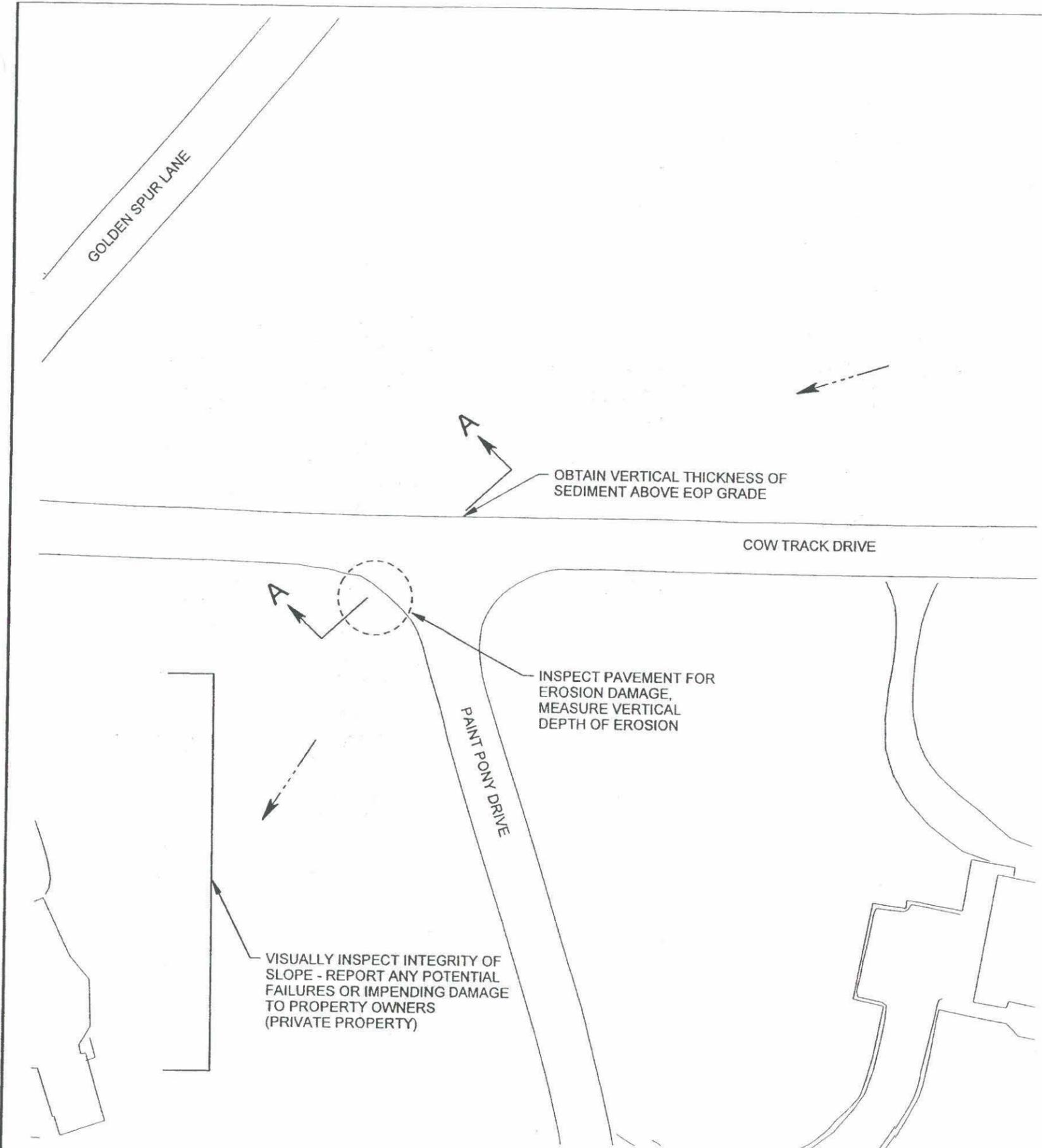
- MEASURE SEDIMENT THICKNESS OVER CONCRETE INVERT, OR CLEARANCE FROM APEX OF BRIDGE

- INSPECT BRIDGE FOR DAMAGE TO ABUTMENTS, WINGWALLS, CONCRETE INVERT

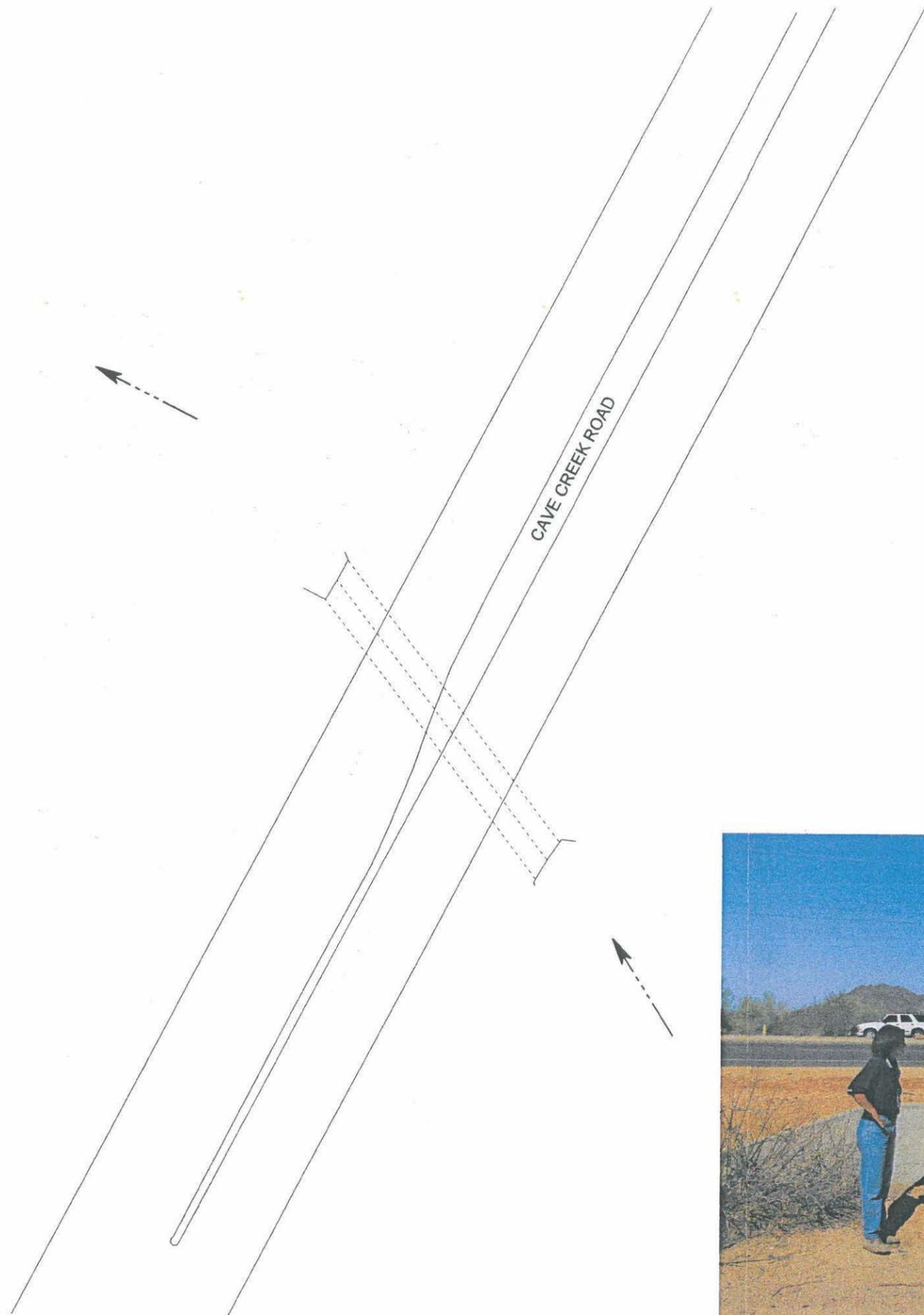
DREAM STREET BRIDGE ELEVATION



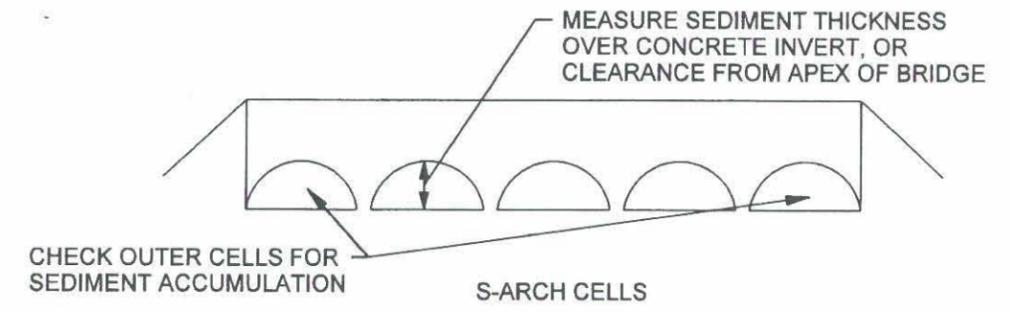
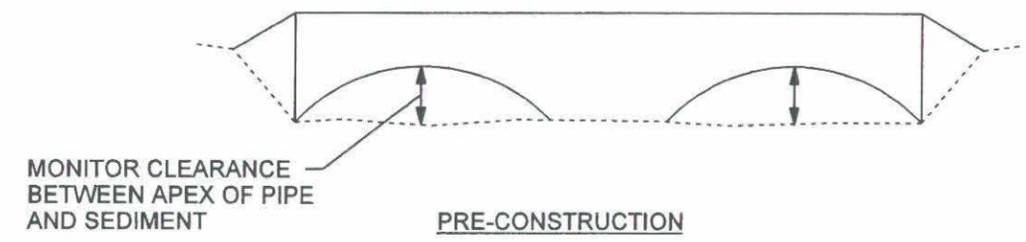
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY MONITORING SITE NO. JEF 34 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	



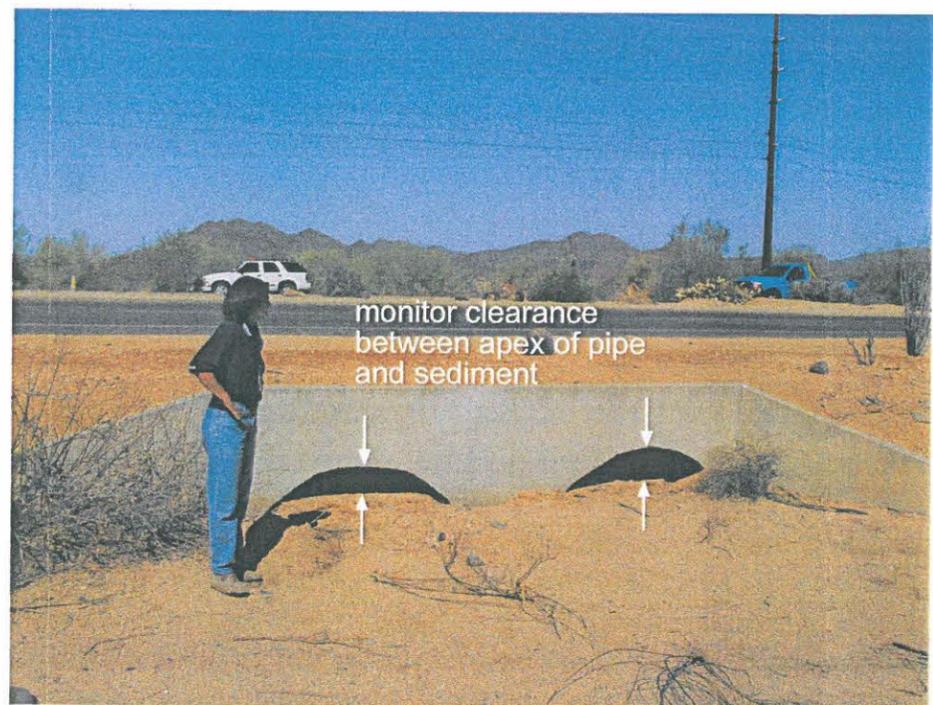
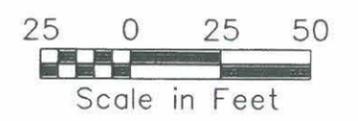
NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY			
MONITORING SITE NO. JEF 46 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
		BY	DATE
DESIGNED	EK		2/03
DRAWN	TPK		2/03
CHECKED	LAJ		
DRAWING NO.	PLAN SHEET	SHEET OF	



ARCH CULVERTS



POST CONSTRUCTION



NO.	REVISION	BY	DATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY MONITORING SITE NO. 3 TOWN OF CAREFREE DMP PROJECT CONTROL NO. 2000 C037			
DESIGNED	EK	BY	DATE
DRAWN	TPK		2/03
CHECKED	LAJ		2/03
DRAWING NO.	PLAN SHEET	SHEET OF	

Appendix C. Photographs



FIGURE 1. EXAMPLE OF MAINTENANCE CREW CLEARING SEDIMENT. NOTE HOW SEDIMENT PILE IS ON UPSTREAM SIDE (SHOULD BE DOWNSTREAM).



FIGURE 2. EXAMPLE OF HOW TO MEASURE SEDIMENT THICKNESS.



FIGURE 3. EXAMPLE OF DEBRIS AT GRATE.



FIGURE 4. EXAMPLE OF CULVERT END EROSION.



FIGURE 5. EXAMPLE OF FAILURE OF CUTOFF WALL.



FIGURE 6. EXAMPLE OF DOWNSTREAM EROSION.

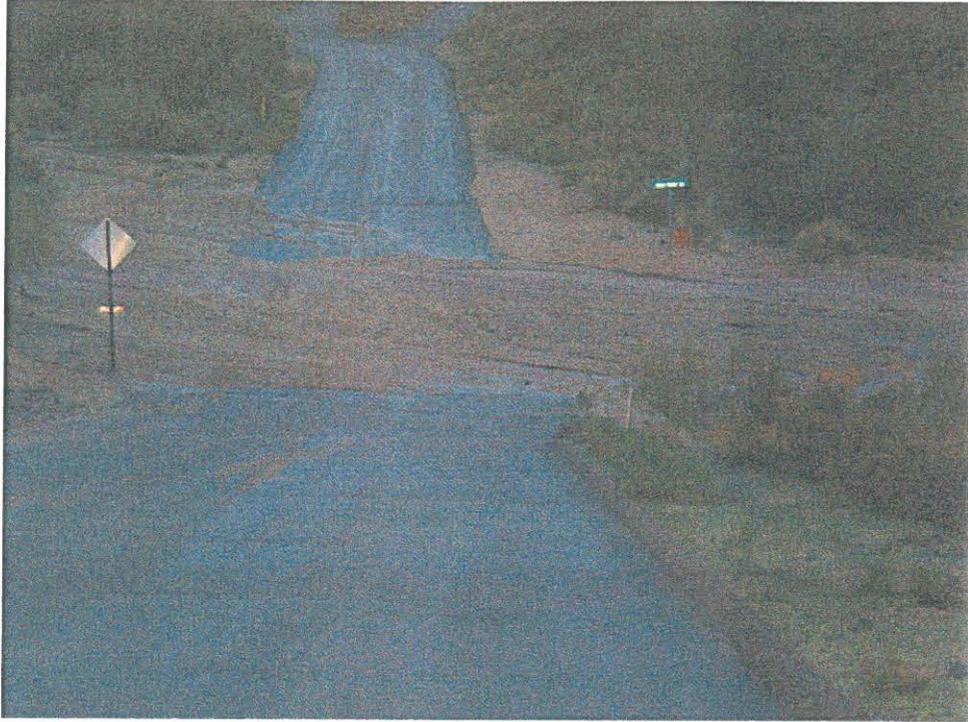


FIGURE 7. EXAMPLE OF SEDIMENT OVER ROADWAY.



FIGURE 8. EXAMPLE OF PROPERLY FUNCTIONING CUTOFF WALL.

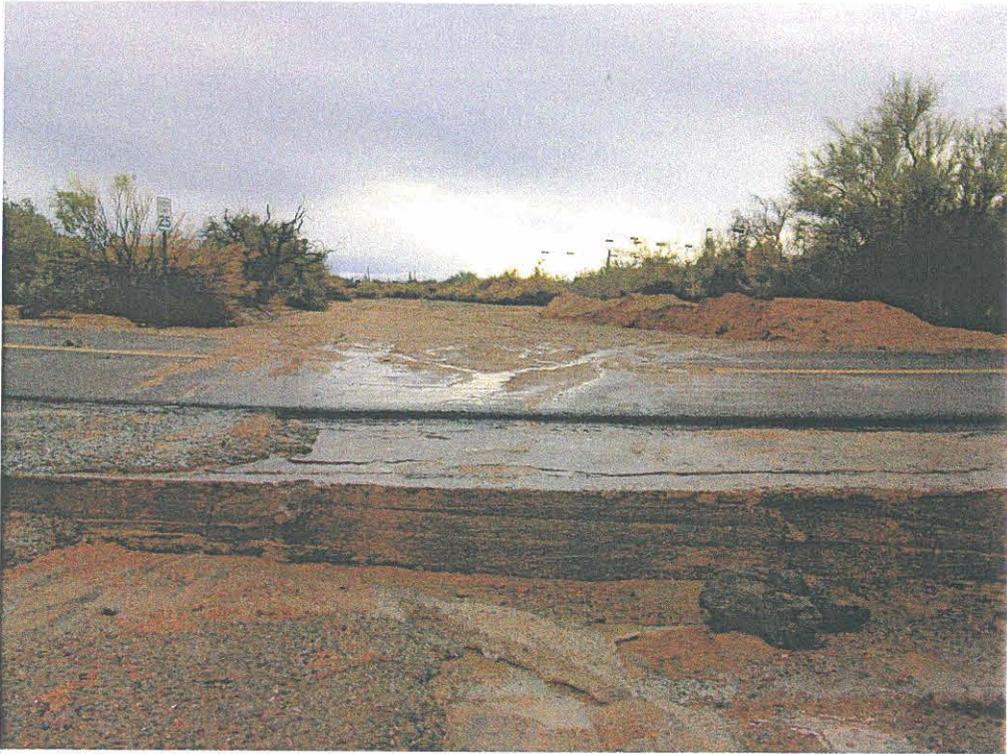


FIGURE 9. EXAMPLE OF PROPERLY FUNCTIONING CUTOFF WALL.

Appendix F
Implementation and Funding Plan

DRAFT REPORT



IMPLEMENTATION AND FUNDING PLAN

Carefree Drainage Master Plan

Prepared for



Prepared by



CH2MHILL

February 2003

Implementation and Funding Plan Carefree Drainage Master Plan

PREPARED FOR: Marilyn DeRosa, R.G./FCDMC
Doug Williams, A.I.C.P./FCDMC

PREPARED BY: Linda Johnson, P.E./CH2M HILL
Tony Bokich, P.E./CH2M HILL
Kent Ennis, C.F.A./CH2M HILL

DATE: February 6, 2003

The Flood Control District of Maricopa County (FCDMC) commissioned the Carefree Drainage Master Plan (DMP), encompassing the limits of the Town of Carefree (Town), to identify drainage problems and develop cost-effective solutions for stormwater management. This Implementation and Funding Plan was developed as part of the Carefree DMP as a tool to help the Town implement the results of the project.

Numerous recommendations for improvements were made in the DMP report, many of which require a financial investment from the Town to complete. The Funding Plan portion of this report identifies potential funding partners for these improvements.

Implementation of Drainage Master Plan Recommendations

For the Carefree DMP to be used as a guide for future development and analyses within the Town, it is recommended that the Town adopt this funding plan. This will ensure that future developments in the Town implement appropriate drainage planning and construction elements.

Existing Conditions

Improvements to existing features are recommended in the DMP report. Figure 1 presents a flow chart of the Implementation Plan.

Creation of a Capital Improvement Plan

After adoption of the DMP, creation of a Capital Improvements Projects (CIP) list ensures that the recommended projects receive consideration in Town planning activities. Additionally, many funding sources require projects to be on an adopted CIP to be eligible for funding assistance (see *Funding Plan* section, below).

The DMP report places potential projects in four general categories:

- Easily fixed: Can be accomplished with Town's engineering and maintenance staff
- Private Projects: Exist on private land or private roadways
- No feasible solutions: Within neighboring city jurisdictions, high cost/low benefit
- Fixable: Should be placed on Town's CIP

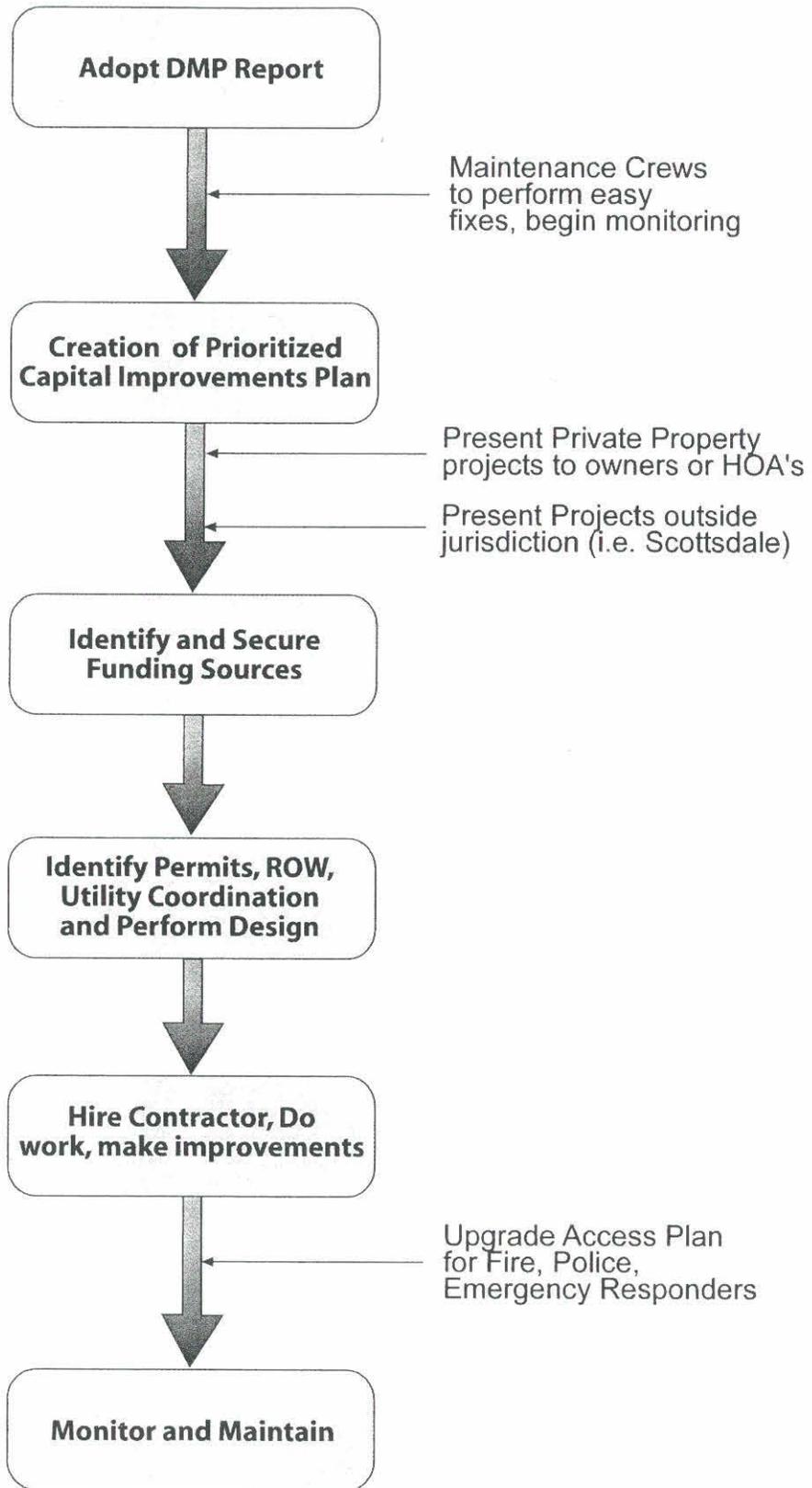


FIGURE 1
IMPLEMENTATION PLAN
 TOWN OF CAREFREE

The projects that fall into the “fixable” category are subject to placement on the Town’s CIP. The DMP report provides a discussion of each site, along with conceptual-level design at seven sites.

The Town’s needs and resources may change over time. Therefore, the DMP report identifies general criteria for prioritization but does not supply a prioritized list of projects to the Town. Instead, a matrix analysis procedure is supplied for the Town to use, if they desire, to create a prioritized CIP list.

Identify Funding Sources

The *Funding Plan* section of this report (below) discusses additional cost sharing opportunities for drainage improvement projects. Once the CIP list has been created, funding sources for the design and construction of the project can be secured.

Identify Permitting Requirements and Utility Conflicts

A *Permitting Summary*, located at the end of Appendix A of the DMP, was created for the DMP report. It identifies the federal, state, and local permits, approvals, reviews, and similar actions that may be required for construction of drainage improvements in the Town. This report gives an approximate agency processing timeframe. Depending on the necessary permits, significant lead times may be required. These requirements should be investigated before any outside design or construction firms are contracted. The Town does not hold drainage easements on many of the washes in the Town, and easements may be required for construction on private property.

Additionally, utility conflicts are likely at the potential project sites. The utilities that exist in Carefree include:

- Cox Communications (Cable)
- Black Mountain Gas
- Arizona Public Service
- Qwest (Telephone and Fiber Optics)
- Cave Creek Water Company
- Town of Carefree (Sewer, Storm Drain, Signals)
- Carefree Water Company

Some utility companies may require significant lead times to resolve potential utility conflicts. Therefore, utility companies should be contacted as soon as possible once a specific project has been initiated.

Accessibility, Monitor, and Maintain

The DMP report contains an *Inspection, Monitoring, and Maintenance Plan* for the Town, and a *Flood Accessibility Emergency Routes Evaluation*. Once a project is completed, recommended monitoring and maintenance should be implemented. Additionally, if the construction of improvements upgrades a roadway crossing from “impassable” to “passable” during a flood event, the Access Plan maps with the improvements should be distributed to emergency responders.

Future Development

A majority of the Town is already developed. Undeveloped parcels generally consist of residential lots within subdivisions. However, there are selected locations with the potential for future commercial developments and subdivisions.

Hydrology

The *Data Collection Report* for the Carefree DMP contains hydrology models for peak flow discharges for the 10-year and 100-year frequencies for the 6- and 24-hour durations for both existing and future condition land usages. This hydrology modeling provides an estimation of peak discharges at road crossing and culvert locations within the Town. This hydrology information should be used as the basis for all future drainage design.

Design Guidelines

Engineering Design Guidelines were created for the Carefree DMP. The purpose of these guidelines is to provide criteria and procedures for the evaluation, planning, and design of preferred stream corridor and stormwater management alternatives. This document can be used by developers, engineers, and homeowners when planning drainage improvements, and gives generic design elements for roadway dip crossings, bank stabilization, bridges, culverts, and grade-control structures.

Emergency Access

A *Flood Accessibility Emergency Routes Evaluation* was prepared for the Town as part of the DMP. This report details drainage crossings that will be considered impassable during runoff events, and recommends improvements that will enable access by residents. Several maps were created in this report that show parcels and drainage crossings that are inaccessible, and the changes to access as improvements are made. These maps should be distributed to emergency personnel and updated as improvements are made.

Funding Plan

The main sources of revenue for the Town are a share of the state sales tax (TPT), a 2 percent Town sales tax, permit fees, state urban revenue sharing (state income tax), gasoline and auto lieu taxes, annual franchise fees from Black Mountain Gas, cable TV license fees, and interest on investments. The Town does not levy a property tax.

Table 1 indicates the trend of collections of state-shared revenues and the Town's 2 percent TPT in recent years. Overall state shared revenues are likely to grow slowly for the remainder of fiscal year (FY) 2003 and FY 2004. Receipts from the state Urban Revenue Sharing (URS) program will decline in FY 2004. The URS program shares 15 percent of combined state personal and corporate state income taxes collected 2 years prior with all incorporated Arizona towns and cities based on their census population. URS distributions to all Arizona towns and cities will decline in FY 2004 because of the decline in statewide income tax revenues in FY 2002. This local revenue could also continue to decline in FY 2005 because of the strong possibility of another annual decrease in combined statewide income taxes in FY 2003.

TABLE 1
 Town of Carefree – Shared Revenues and Local TPT Collections

	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
TPT Revenue Sharing	\$ 200,798	\$ 211,108	\$ 225,556	Nav.	Nav.
Urban Revenue Sharing	253,327	265,876	305,290	311,573	264,000
State Shared Revenues	454,125	476,984	530,846	Nav.	Nav.
Town TPT Collections	1,905,320	1,955,284	1,833,020	Nav.	Nav.
Shared and Local Revenues	2,359,445	2,432,268	2,363,866	Nav.	Nav.
Annual Change		3.1%	-2.8%		
HURF Distributions	\$163,902	\$169,924	\$180,793	Nav.	Nav.
VLT Distributions	\$ 82,404	\$ 88,345	\$ 96,567	Nav.	Nav.

\Shared revenue and Town TPT data provided by Arizona Department of Revenue (DOR).

The FY 2004 Urban Revenue Sharing is a preliminary estimate from DOR.

Nav. = Not available

Existing Operating Fund Revenues

Most revenues not earmarked for specific uses are collected in the Town’s General Fund. This fund is used to support vital government operations such as Town and contractor-provided police and fire service, engineering and building inspection, finance and city administration. The recent decline in revenue growth suggests that it will be difficult for General Fund Operating Revenues to fund a significant portion of the Project Alternatives suggested in the Carefree DMP. Existing Town cash balances or approved tax increases could, at least in part, augment Operating Funds to finance a portion of these projects.

The following discussion presents funding options that may facilitate or contribute to financing portions of the DMP.

Cost Sharing with City of Scottsdale

Several of the project alternatives are on or align with the Scottsdale city limits. The Town should contact the appropriate persons in the Planning and Public Works Departments in Scottsdale to determine if a cost-sharing arrangement can be concluded. Mr. Bill Erickson is the Floodplain Administrator for the city of Scottsdale, and should be the first point of contact. He can be reached at 480-312-7652.

Federal Funding

The **Maricopa Association of Governments (MAG)** administers most of the transportation-related federal-aid funding programs in Maricopa County. The current federal Transportation Equity Act for the 21st Century (TEA-21) will expire at the end of September 2003, at which time it is expected to be renewed (TEA-3). To use federal funds, transportation-related projects must appear in an approved Transportation Improvement Program (TIP) and sponsors must show that it meets all applicable federal requirements. In

this case, these projects would probably include the bridges (metal arch pipe culvert systems) and culverts of the DMP. An “approved TIP” for MAG is a 5-year listing of projects that comply with all applicable air quality plans, public involvement, and federal programming requirements that have been adopted by the MAG Regional Council and approved by Arizona’s governor.

Pending reauthorization of the federal Transportation Equity Act, TEA-3, funding applications for the FY 2004 – FY 2008 period have not been prepared yet. However, Paul Ward, MAG’s Transportation Programming Manager, was relatively optimistic that the Town may be a good candidate for federal funding of a large portion, and perhaps all, of the bridge and culvert portions of the DMP projects. He emphasized that the absence of prior federal funding there would, in this instance, probably be an advantage to the Town. In addition, he believed that some rearrangement of project scheduling could be arranged to accelerate funding well before the FY 2008 end of the next funding cycle.

Because of the complexities of interpreting the language and eligibility requirements of the federal aid programs, it is recommended that a meeting with the Town, CH2M HILL, and Mr. Ward’s office should be arranged in the near future to facilitate the timely preparation of a funding application to MAG. Mr. Ward can be contacted at 602.254.6300 or pward@mag.maricopa.gov

A discussion of the planned FY 2004 – FY 2008 TIP Guidance Report is attached to this report as Appendix B.

State and Local Government Funding

The FCDMC has a policy of cost sharing up to 50 percent on prioritized and qualified flood control projects. The specific process needed for any project to be funded by the FCDMC is the CIP Prioritization Procedure, described below. Once a project has been prioritized and is part of the FCDMC’s CIP process, the FCDMC and the partnering agency must enter into an Intergovernmental Agreement (IGA).

The CIP Prioritization Procedure is an annual process conducted by the FCDMC. The contact is Richard Perreault (602.506.4774). A copy of the CIP Prioritization Procedure is include as Appendix C. The annual request process requires that requests be filed by July of each year.

The Town has already successfully worked with the FCDMC in a cost-sharing arrangement for the Town Center Drainage Project. The FCDMC was asked to cost share the construction of the system. The Town is the lead agency for the project and will operate and maintain the completed facilities. The FCDMC has reviewed the construction plans and is monitoring the construction.

Local Improvement Districts

Local improvement districts (LIDs) are legally designated geographic areas in the Town which, through the consent of the affected property owners, pay for public improvements through a supplemental property tax assessment. The Town would facilitate this process by coordinating the design and construction, as well as the sale of special assessment bonds to finance the improvements. When cost effective, the Town financially participates in a

district to oversize infrastructure to meet master plan standards, thus avoiding higher future costs.

In situations where bonds are issued to accelerate construction of a project, this financing approach ties the repayment of debt to those property owners who most directly benefit from the improvements financed. While LID bonds are not subject to specific debt limits, they do entail several practical constraints:

1. Affected property owners must agree to the creation of the district.
2. LID debt appears in the city's financial statements as an obligation of the city and can affect the city's bond ratings.
3. LIDS often include a "general" city contribution (for the share of improvements that benefit property owners outside the district) which must be financed with other sources.

In Arizona, all public debt more than 13 months in duration must be authorized by the affected constituents. All Arizona public jurisdictions, special improvement districts, and sanitary districts must obtain debt approval through the election or district-creation process. All new assessment and special districts can obtain debt approval through the petition process. In the petition process, 51 percent of the property owners in the district area will provide written consent to the assessment or district formation.

General Obligation and Revenue Bonds

General obligation (G.O.) bonds are a common method used to raise revenues for large-scale municipal projects. However, such bonds are usually backed by property tax collections. Beginning in 1980, Arizona state law mandated the separation of city property taxes into two components, the primary tax levy and the secondary levy. The primary levy may be imposed by the city for any governmental purpose, yet has strict limitations on how much can be levied. The secondary levy may only be used to retire the principal and interest on G.O. bonds issued by the city. As a result, it is the secondary levy that is usually used for G.O. bond financing of large capital projects in Arizona towns and cities. All projects funded with G.O. bonds must receive voter approval through a citywide bond referendum. According to Arizona law, any projects to be funded through either G.O. or revenue bonds must receive prior approval by the Town's citizens.

For the Town, a G.O. bond might be structured with the pledge of all unencumbered Town revenues. Advice of qualified bond counsel would be recommended to determine if this pledge of the Town's revenues would create a G.O. bond, or a revenue bond repayable (only) by the specifically identified Town revenues.

Development Fees

Development Fees are assessments on developers that allow for "pay-as-you-go" financing for capital projects. In this system, when a developer takes out a building permit, he is required to pay additional fees for fire, police, library, parks, water, sewer, transportation, and general government assessments.

Development fees are usually initiated following receipt of a formal rate structure study followed by governing body approval. Impact fees are common for public safety facilities, park and library improvements, water and wastewater capital needs, and transportation projects. Impact fees are also assessed to help offset the costs of future capital projects in such areas as community parks, rivers and trails, open space plans, and general government facilities. These impact, or expansion fees, are an important source of revenue for numerous municipalities in Arizona and they help to ensure that residential and commercial growth in the Town pays for itself. For example, the city of Phoenix charges fees for storm drainage facilities where that type of infrastructure is required and where the costs of necessary infrastructure have been identified.

Municipal Development Corporation Bonds

The Town could consider the establishment of a Municipal Development Corporation (MDC). An MDC is a nonprofit organization, over which the Town would exercise significant oversight authority, including the appointment of its governing board. The Town could enter into an agreement with an MDC under which the corporation sells bonds and pays for capital improvements. Over a period of years, the improvement will be purchased from the corporation by the Town. For the MDC to market its bonds, the Town would, typically, pledge its excise taxes (e.g., city sales tax, franchise fees, and certain state-shared taxes), and further pledge that, before entering into a purchase agreement with the MDC, actual annual excise tax collections will be at least some stipulated amount, sometimes up to three times the maximum annual debt service payment for all MDC bonds. A significant limitation of this financing mechanism is that payments to the MDC for bond debt service compete for resources with the Town's Operating Funds. While the Town may have some potential MDC bond capacity, selling MDC bonds could place a strain on the Town's operating budget.

References

CH2M HILL. *Carefree Drainage Master Plan*. 2003.

Flood Control District of Maricopa County. *CIP Prioritization Procedure*. Schedule FY '03/'04.

Maricopa Association of Governments. *FY 2004-2008 Transportation Improvement Program Guidance Report*. July 2002.

Appendix A



CIP Prioritization Procedure Schedule FY '03/'04

May 10, 2002	Agency Notices Mailed
June 21, 2002	Reminders Sent
July 19, 2002	Agency Proposals Submittal Deadline
August, 2002	Evaluation Committee Review and Evaluation
September 11, 2002	Evaluation Committee Recommendations to P&PM Division Manager
September 23, 2002	Staff Recommendations to Chief Engineer and General Manager
October 3, 2002 (Tentative)	FCAB Program Budget Committee Review
October 11, 2002	Staff Recommendations Forwarded to Agencies
October 23, 2002	Staff Recommendations Presented to the FCAB for Information
December 4, 2002	Final Staff Recommendations Presented to the FCAB for Action
January 10, 2003	Final Priority List Provided to Agencies
January 22, 2003	Proposed FY 02/03-06/07 CIP Presented to FCAB
February - June 2003	CIP Revisions Coordinated with OMB

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY CAPITAL IMPROVEMENT PROGRAM (CIP) PRIORITIZATION PROCEDURE

I. PURPOSE OF THE PROCEDURE:

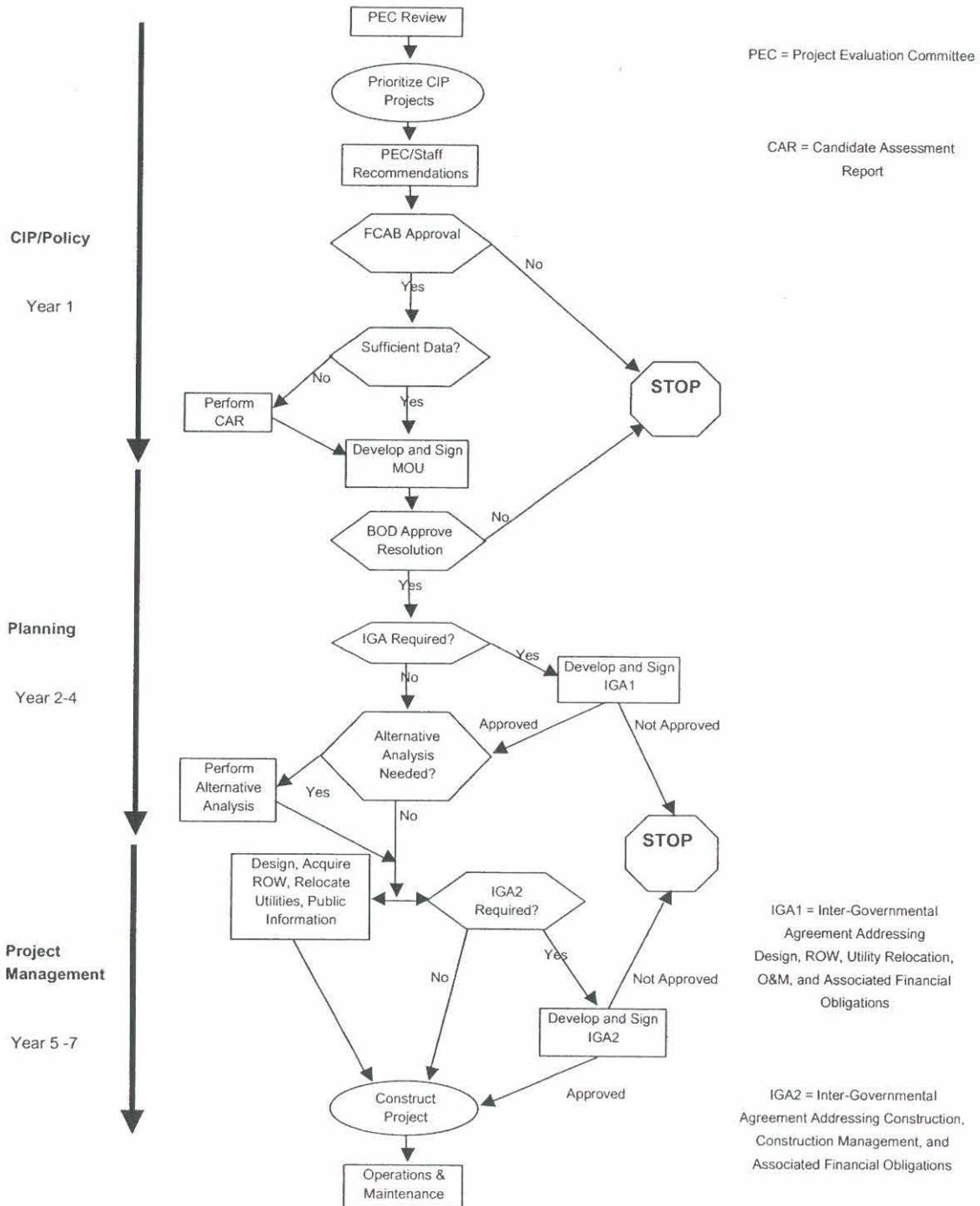
The Prioritization Procedure used by the Flood Control District is a multi-step decision process intended to implement previously approved fiscal policies from the District's Strategic Plan. Potential CIP projects are identified primarily through agency requests and/or the Area Drainage Master Studies/Area Drainage Master Plans/Watercourse Master Plans (ADMS/ADMP/WCMP), Floodplain Delineation or other District programs. The term "Agency" is defined as a municipality or other government agency, such as a department of the Federal or State government operating in Maricopa County.

In the first step, all projects or studies requested are evaluated by the Project Evaluation Committee (PEC) to determine whether the request should be recommended for inclusion in a District-funded planning or capital improvement program. Planning studies undertaken in the District's Planning Program are usually totally funded by the District. Projects recommended for the Capital Improvement Program (CIP) are usually cost shared between the District and the requesting agency(s).

If the PEC determines that a project request, which is recommended for inclusion in the CIP, needs additional information, they may recommend that a Candidate Assessment Report (CAR) be performed at District expense prior to having a project Memorandum of Understanding (MOU) and Resolution prepared. The purpose of a CAR is to develop more detailed information on potential CIP projects in the areas of design, rights of way, permitting, mitigation, construction, operations and maintenance requirements and costs. The information will be the basis for project cooperation MOUs and agreements and project scheduling (see FCD Project Flow Chart).

As ADMSs, ADMPs and WCMPs are completed and adopted, it is anticipated that a significant number of future CIP project requests will be generated through this program. Input received annually concerning project priorities coming from these, or other plans, as well as other potential projects, will continue to be sought and prioritized on a County-wide basis using this procedure. District staff will work with local municipalities to prepare the necessary documents and exhibits for the municipality to adopt the ADMS/ADMP/WCMP for land use and drainage infrastructure planning.

FCD Project Flow Chart



II. GOALS OF THE PROCEDURE:

1. To provide an objective method for prioritizing flood control and regional drainage projects generated through District programs or requested by other agencies.
2. To familiarize other agencies with the project evaluation criteria to be considered by the District when prioritizing potential projects for inclusion in the District's Five-Year CIP.
3. To optimize the timing of project requests with the District's annual budgeting cycle.
4. To reduce uncertainty in the project scoping and Intergovernmental Agreements (IGA) negotiation processes.
5. To identify projects on an annual basis that would be eligible for potential inclusion and prioritization in the District's Five-Year Capital Improvement Program (CIP).
6. To provide a mechanism for redistributing funds in the District's Five-Year CIP in response to unanticipated events which may impact the Five-Year CIP.

III. PROJECT REQUEST CALENDAR:

1. Each year by the second Friday in May, District staff will send notice to each appropriate agency requesting that the agencies prepare prioritized CIP project requests for the District's next fiscal year review cycle. The Letter of Intent (LOI) and seven (7) copies of each project proposal should be received by the District no later than the third Friday in July if an agency wishes to have projects considered by staff for the following fiscal year's Five-Year CIP. Project requests received after this date must be authorized for review by the Flood Control Advisory Board (FCAB) prior to staff prioritization. The notice will detail the criteria, listed in Section IV below, to be used by District staff when evaluating and prioritizing potential CIP projects.
2. By the third Friday in July, detailed information on District-proposed CIP projects will be submitted to the CIP/Policy Branch for processing.
3. CIP/Policy Branch staff will serve as point of contact, receive all CIP project proposals, and prepare project summaries for use by the Project Evaluation Committee. The Committee will be comprised of District staff and will include one or two members from the CIP/Policy Branch, the Manager of the Hydrology/Hydraulics Branch, the Manager of the Engineering Division, the Manager of the Operations and Maintenance Division, and the Manager of the Land Management Division.

4. During the month of August the PEC will review and prioritize all new project proposals for potential inclusion into the District's CIP. The priority for recommended projects that have not been initiated in the preceding fiscal year shall be based on the project proposal's total score, regardless of the year in which the proposal was submitted.
5. Projects that were previously requested that had CARs performed, and that are significantly different than the original request should be resubmitted and re-prioritized by the PEC.
6. By the second week of September, the PEC will provide its prioritized list of District-proposed and agency-requested planning studies and CIP projects to the Manager of the Planning and Project Management (PPM) Division.
7. By the first week of October, the Chief Engineer and General Manager, the Manager of the PPM Division, and the CIP/Policy Branch Manager will meet with the FCAB Program and Budget Committee to review staff recommendations. FCAB Program and Budget Committee guidance will then be incorporated into the staff recommendation. During the month of October, the staff recommendation will be presented to the FCAB for information and discussion, and will be provided to the agencies on the District's project prioritization mailing list.
8. By the first Wednesday in December, the staff recommendations, including any changes received since the October FCAB meeting will be presented to the FCAB for approval. Once approved, a final priority list will be provided to all agencies (by mid-January).
9. At the January FCAB meeting, the proposed Five-Year CIP will be presented to the FCAB.
10. At the discretion of the agency submitting a project proposal, those lower priority requests not approved by the FCAB can be reformatted and resubmitted after consultation with District staff.
11. The Planning Branch will be responsible for coordinating Memorandums of Understanding (MOU) and agreements with cooperating agencies, for completing the pre-design studies and for providing status reports on the projects.
12. Projects determined to be feasible through the CAR study step will be re-prioritized in accordance with #5 above. Projects which remain priorities and have signed IGAs, where applicable, will then be included in the District's Five-Year CIP.

IV. PRIORITIZATION CRITERIA:

The Prioritization Criteria has been developed as a means for staff to uniformly consider and evaluate District-generated or agency-requested Five-Year CIP projects. Agencies having jurisdiction over stormwater drainage in the project area must be able to demonstrate that their regulations conform with or exceed the provisions of the Uniform Drainage Policies and Standards (UDPS) for Maricopa County. To satisfy this requirement, copies of pertinent ordinances should be referenced and/or attached to the project request. In the event that concerns arise, a joint determination of conformance will be made by the requesting agency and the District.

Each request which meets this minimum standard will be evaluated by District staff and scored on the Project Evaluation Committee Project Priority Worksheet (copy attached). Through the eleven (11) weighted criteria listed below, a maximum total of 100 points per project is possible. If insufficient data is provided for a particular criterion, the minimum number of points will be awarded in that category. Projects will be ranked by staff according to the total points received.

A Letter of Intent (LOI) must accompany each project request and be signed by an agency staff manager responsible for submitting the request. The LOI is not a legally binding document. It will assist District staff in preparing future project MOUs and IGAs. When signed by the District's Deputy Chief Engineer, after a project is approved for inclusion into a future Five-Year CIP, it will become the basis for development and negotiation of project MOUs and IGAs.

PROJECT OVERVIEW & DETAILS

Project Description (0 points)

Provide a summary of the proposed project with a reproducible location map. Include information concerning project goals, problems to be addressed, anticipated project features, and relationships to any other planned, ongoing or completed infrastructure projects.

1. Agency Priority (5 points)

Multiple project proposals from a single agency should be ranked by the agency prior to submittal. Separate projects must not be grouped into generalized categories such as high, medium or low. However, a number of integrated projects required to improve a particular watershed may be classified as a single, phased project. As appropriate, the District will request an annual update of the agency's priority list.

2. Master Plan Element (8 points)

Provide information on the project's relationship to any existing or ongoing, flood control/stormwater management master plans or other types of plans. These plans could include, but are not limited to, Drainage, Land Use, Transportation, Recreation, Environmental, Economic Development or other agency-sponsored plans. For projects that are components of an agency-sponsored master plan, points will be awarded on the basis of the project's relative significance or priority within the overall plan. If the ADMS/ADMP/WCMP or other Master Plan has been adopted by the Agency, provide a copy of the adoption instrument (Resolution, Council Action, Board/Commission minutes, etc).

3. Hydrologic/Hydraulic Significance (10 points)

Describe existing watershed conditions. Where applicable, the description should assess both the contributing watershed and the availability and/or conveyance capacity of the receiving outfall system. The types of information to be considered include the following:

- a. Location in delineated floodway/floodway fringe area or non-delineated flood prone (minimum of two events in 10 years) area;
- b. Peak discharges and frequency of flooding events;
- c. Depth, velocity and duration of flow;
- d. Contributing watershed characteristics (size, slope, land use, etc.);
- e. Existing outfall characteristics (none, undersized, full capacity, etc.); and,
- f. Other.

4. Level of Protection (10 points)

Identify the flood return frequency (2-year to 100-year) to be addressed by the project. When applicable, information regarding both the anticipated design level of protection and the effective level of protection, such as that provided by storm drains combined with curb and gutter roadways, should be provided.

PROJECT BENEFITS

5. Area Protected (25 points)

Provide a summary of the benefits that would be provided by completion of the project. The various types of information to be considered includes the following:

- a. The number and estimated value of residential, commercial and industrial buildings to be protected that are located in delineated floodways or 100-year floodplains;
- b. The number and estimated value of residential, commercial and industrial buildings to be protected that are not located in delineated floodplains;
- c. Number of public buildings (schools, libraries, churches, etc.) to be protected;
- d. Amount of infrastructure (roads, drainage/flood control or wastewater facilities, etc.) to be protected or enhanced (e.g., storm drain capacity increase from 2-10 years.);
- e. Amount of cultivated acreage to be protected by the project;
- f. Acreage of developed, agricultural and undeveloped land to be removed from the 100-year floodplain;
- g. Percentage of agency's jurisdictional area (developed and undeveloped) to be protected;
- h. Identify the population directly and indirectly benefited by the project;
- i. Age of development and length of time that the flooding problem has existed;
- j. Year drainage regulations and/or floodplain delineation were adopted;
- k. Will completion of the project result in a reduction of the floodplain and/or an improvement in the community's floodplain rating? and,
- l. Other.

6. Environmental Quality (8 points)

Provide enough detail to permit an evaluation of how the project may immediately or potentially benefit existing conditions in the areas of:

- a. Water quality (e.g., will stormwater be managed through basins or wetlands prior to its discharge to the receiving waters?);

- b. Vegetation and wildlife habitat (e.g., will an existing wildlife corridor be maintained/enhanced, or will new habitat areas be created through the provision of dedicated drainage/open space areas?);
- c. Environmentally sensitive areas (designated wildlife areas, riparian corridors, etc.) to be protected;

7. Area-wide Benefits (10 points)

These immediate or potential benefits will be weighed in addition to the flood control requirements of the project:

- a. Multiple-use features, benefits and contributions such as ground water enhancement (either through groundwater percolation or direct recharge), support for alternative forms of transportation such as trails and bike paths, support for recreation opportunities, restoration of riparian and other habitat, and other open space uses and activities.
- b. Contributions to the visual quality of the environment through preservation or enhancement of the natural character of the landscapes of Maricopa County and/or enhancement of local community character.
- c. Contributions to the MAG Desert Spaces Open Space Management Plan, community transportation plans, park plans, open space plans and general plans.
- d. Improvement of quality of life indicators such as, but not limited to, preservation or enhancement of cultural and historic resources, and opportunities for conservation education within the community.
- e. Qualifies for grant funding such as transportation enhancement funds, water protection funding, wildlife habitat improvement funding, or other specific grant funding.

PROJECT FUNDING

8. Total Project Cost (6 points)

Estimate the total design, land acquisition, and construction costs, and provide a projection of the amount of time necessary to complete each phase. At a minimum, qualitative information on environmental permitting/mitigation and aesthetic/public acceptance costs should also be included.

9. Level of Partner(s) Participation (8 points)

Provide pertinent information on the availability of other agency resources to assist with project implementation. The types of information to be considered include the following:

- a. Direct agency matching dollars available;
- b. An agency's financial capabilities and ad-valorem tax contributions to the District;
- c. The availability of non-cash contributions (R/W donations, etc.);
- d. Previous agency flood control expenditures in the project area;
- e. The availability of funds from other sources, such as federal matching funds or private contributions; and.

10. Operation & Maintenance Costs (5 points)

At a minimum, the request should qualitatively address expected future public costs for the operations and maintenance of the project.

11. Operation & Maintenance Responsibility (5 points)

Describe in detail which agency will be responsible for the operation & maintenance of the completed project. The discussion should include whether the District, the requesting agency, or others will be expected to assume responsibility for operations, maintenance and replacement.

Note:

The information provided in #9-11 above will be used to evaluate and rank the requested projects. The information provided will be considered for negotiation of project partnering agreements. However, specific partner responsibilities and cost-sharing amounts will be determined in discussions with District staff on a project by project basis.

May 10, 2002

«Mrs» «First_Name» «Last_Name», «Designation»
«Title»
«Company»
«Address»
«City», AZ «Zip»

RE: Flood Control District CIP Prioritization Procedure For Fiscal Year 03-04

Dear «Mrs» «Last_Name»:

We are preparing to implement the FY 03/04 *Procedure for Identifying and Prioritizing Potential Five-year Capital Improvement Program (CIP) Projects*. Again, this year we are asking that you submit any requests for planning or floodplain studies that your municipality or agency would like us to consider for inclusion in a future Planning and Floodplain Delineation Program Budget. Any project your agency or municipality wishes to submit for consideration must be received by July 19, 2002. Please provide seven (7) copies of the submissions for each project or study that you are requesting. A copy of this year's CIP Prioritization Procedure Schedule is enclosed.

The results of the FY 02/03 Procedure and a complete discussion of the Prioritization Procedure can be reviewed on the District's web site <http://www.fcd.maricopa.gov/Neighborhood/CIP/Prioritization/>. Again, this year we are also requesting that the Letter of Intent (LOI) form be filled out and signed by the senior manager responsible for submitting the request. This will assist the District staff in preparing future project MOUs and IGAs and give us an idea when your project funding may be available. Please reproduce copies of the enclosed LOI form for each project that you submit.

The Prioritization Procedures reflect the District's commitment to a balanced approach to flood control, working with our municipal and agency partners, that includes a number of evaluation criteria:

- Submitting agency priority;
- Master plan element;
- Hydrologic/hydraulic significance;
- Level of protection;

- Area protected;
- Environmental quality;
- Area-wide benefits;
- Total project costs;
- Level of partner(s) participation;
- Operation and maintenance costs; and,
- Operation and maintenance responsibility.

Proposals for new projects should be formatted to address the eleven evaluation criteria described in the Procedure document. It is strongly suggested that proposals be submitted with a sufficient level of detail so that the Evaluation Committee can make informed decisions, particularly in cases where the proposals will involve significant District expenditures. Project proposals that explicitly address each of the evaluation criteria in a quantitative manner and that provide detailed project maps, diagrams and/or other visual plans will be more favorably reviewed. In the past, several potentially viable projects have been rejected on the basis that inadequate information was provided in the submission and the Evaluation Committee was unable to properly evaluate the benefits and costs associated with these projects. Please note that District staff are always happy to provide guidance on the preparation of proposals that meet the information requirements of the Evaluation Committee.

Project proposals not recommended for action in previous years may be resubmitted during this (FY 03/04) review period, but it is strongly suggested that agencies consult with District staff and make changes before resubmitting. Agencies or municipalities with project proposals that have previously been recommended for inclusion in the District's CIP should reconfirm their priority. Please contact Dick Perreault at rgp@mail.maricopa.gov or 506-4774, Ms. Kelly Presson at klp@mail.maricopa.gov or 506-4489, or me at 506-4703 with any questions concerning the Prioritization Procedure.

Sincerely,

Thomas D. Johnson, P.E., R.L.S.
Deputy Chief Engineer/PPM Division Manager

Enclosures:

FY 03/04 CIP Prioritization Procedure Schedule
FY 03/04 CIP Prioritization Procedure LOI

LOI (Letter of Intent)

FY 03/04 CIP Prioritization Procedure



/Agency Proposing Partnership: _____

1. Project Name _____

A. Project Description & Limits:

B. Estimated Project Cost:

2. Proposed Lead City/Agency For: (check appropriate column)

	FCD	City/Agency	Other:	N/A
A. Study	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Design	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. R/W Acquisition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Constr. Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Ops & Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Proposed Cost Share:

	FCD	City/Agency	Other:	Total:
A. Percentage - %				
B. Funding - \$				

4. Availability of City/Agency Funding (\$):

FY 03/04	FY 04/05	FY 05/06	FY 06/07	FY 07/08	Later FYs

5. City/Agency Adoption of ADMS/ADMP/WCMP: (Name: _____)

Yes
 Not yet, but willing to
 Not associated with Study or Plan

6. Signature: (City Engineer, Public Works Director, or Agency Manager)

Name: _____

Title: _____

Date

7. Remarks/Comments: (use additional sheet if necessary)

Signature: _____
 Thomas D. Johnson P.E., R.L.S.
 Deputy Chief Engineer
 Date _____
 Flood Control District of Maricopa County

Project Priority Worksheet

Project Name:

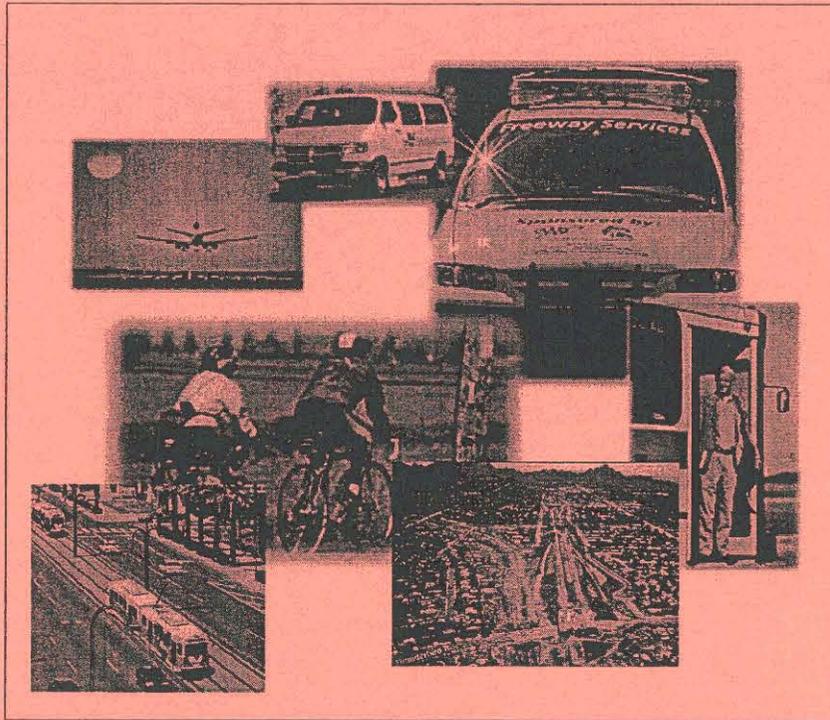
Requested By:

Date:

Factor	Range			PEC Points
Agency Priority	<u>Low</u> 0-1	<u>Med</u> 2-4	<u>High</u> 5	
Master Plan Element	<u>Low</u> 0-3	<u>Med</u> 4-6	<u>High</u> 7-8	
Hydrologic/Hydraulic Significance	<u>Low</u> 0-3	<u>Med</u> 4-7	<u>High</u> 8-10	
Level of Protection	<u>2-10 yr</u> 0-5	<u>11-50 yr</u> 6-8	<u>>50 yr</u> 9-10	
Area Protected	<u>Low</u> 0-9	<u>Med</u> 10-18	<u>High</u> 19-25	
Environmental Quality	<u>Low</u> 0-3	<u>Med</u> 4-6	<u>High</u> 7-8	
Area-wide Benefits	<u>Low</u> 0-3	<u>Med</u> 4-7	<u>High</u> 8-10	
Total Project Cost	<u>>\$10M</u> 0-3	<u>\$3-\$10M</u> 4-5	<u><\$3M</u> 6	
Level of Partner(s) Participation	<u>0-30%</u> 0-3	<u>31-60%</u> 4-7	<u>>60%</u> 8	
O&M Costs	<u>High</u> 0-2	<u>Med</u> 3-4	<u>Low</u> 5	
O&M Responsibility	<u>District</u> 0	<u>Others</u> 3	<u>Agency</u> 5	
			TOTAL	

Appendix B

FY 2004-2008 TRANSPORTATION IMPROVEMENT PROGRAM GUIDANCE REPORT



JULY 2002

 **MARICOPA
ASSOCIATION of
GOVERNMENTS**

Maricopa Association of Governments

302 North First Avenue, Suite 300

Phoenix, Arizona 85003

Phone: (602) 254-6300

FAX: (602) 254-6490

Contact: Paul D. Ward, Transportation Programming Manager

E-Mail: pward@mag.maricopa.gov

Website: www.mag.maricopa.gov

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LIST OF ABBREVIATIONS

ADOT	Arizona Department of Transportation
BMS	Bridge Management System
CMS	Congestion Management System
HOV	High Occupancy Vehicle
IMS	Intermodal Management System
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
L RTP	Long Range Transportation Plan
MAG	Maricopa Association of Governments
MPO	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
NHS	National Highway System
PMS	Pavement Management System
PTMS	Public Transportation Management System
RPTA	Regional Public Transportation Authority
SMS	Safety Management System
SOV	Single Occupancy Vehicle
STIP	State Transportation Improvement Program
TCM	Transportation Control Measure
TDM	Transportation (or Travel) Demand Management
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TSM	Transportation System Management
VHT	Vehicle Hours of Travel
VMT	Vehicle Miles of Travel

EXECUTIVE SUMMARY

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required, and the Transportation Equity Act for the 21st Century continued the requirement, that the Maricopa Association of Governments (MAG), in cooperation with the State and local agencies, systematically examine and review congestion, safety, air quality, socio-economic, system preservation and other factors in developing and implementing a regional Transportation Improvement Program (TIP) and a Long Range Transportation Plan (LRTP). To further this review and examination, the following six transportation management systems were identified:

- a Congestion Management System (CMS),
- an Intermodal Management System (IMS),
- a Pavement Management System (PMS),
- a Safety Management System (SMS),
- a Bridge Management System (BMS), and
- a Public Transportation Management System (PTMS)

This report briefly describes these systems and, where appropriate and possible, presents their most recent results. Additional information is also provided to ensure that Title VI, environmental justice and air quality issues are addressed in the programming process.

Currently, a group appointed by the MAG Management Committee has been tasked with reviewing the TIP programming process and is expected to make recommendations for improving the way in which projects are selected. This Process Improvement Committee (PIC) will especially focus on those projects to be funded with Congestion Mitigation and Air Quality (CMAQ) Improvement Program funds and the Surface Transportation Program funds sub-allocated to MAG (STP-MAG).

It is further expected that the re-authorization of TEA-21 will occur by the end of September, 2003. The funding projections that have been used to program fiscal years 2004 through 2007 in the Draft FY 2003-2007 MAG TIP are based on certain assumptions and projections from funding levels in TEA-21. The new legislation (which is being referred to as TEA-3) will contain more precise information regarding likely funding levels for the 2004-2009 period.

Primarily for the above two reasons, and with the likely exception of funding commitments to the Regional Freeway System and selected transportation control measures, it is anticipated that MAG will not program CMAQ or STP-MAG funds for the FY 2008 element of the FY 2004-2008 MAG Transportation Improvement Program. CMAQ and STP-MAG funds available prior to FY 2008 are, in most cases, already fully committed.

The deadline for submitting projects utilizing all other funding sources is **January 17, 2002**. These include all projects that use federal transportation funds other than CMAQ or STP-MAG (e.g. Interstate Maintenance (IM), National Highway System (NHS), 5309, 5311, etc),

and/or regionally, locally or privately funded projects that are classified as regionally significant.

Historical Overview

The passage of ISTEA in December 1991, represented a shift for transportation decision-making in metropolitan areas. The US Congress, through this legislation, vested significant decision-making authority with local elected officials acting through their Metropolitan Planning Organizations (MPOs), to guide the selection of state and local projects within their region. The purpose of the management systems is to provide information regarding the optimization of the transportation system that leads to project selection for federal, state, private and local funding.

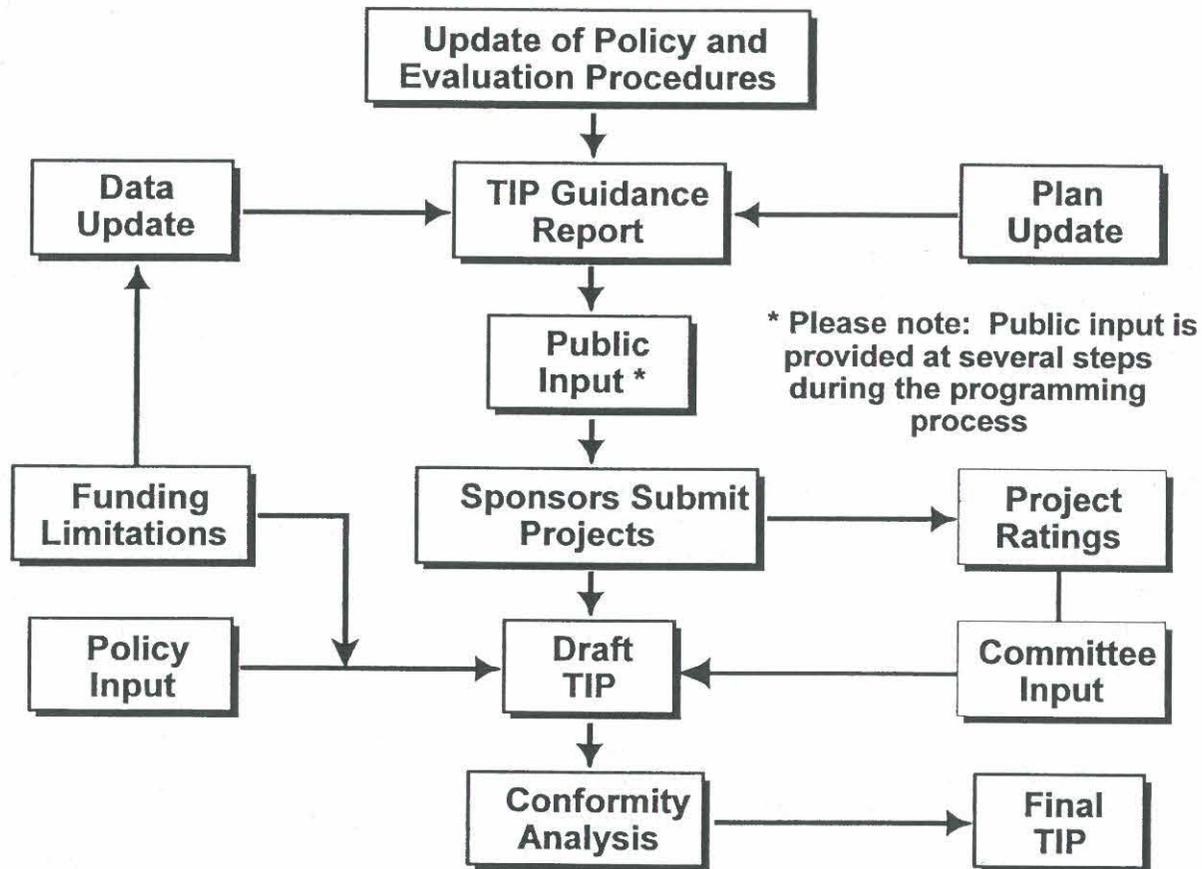
As a nonattainment area for carbon monoxide, ozone and particulate matter, MAG has additional requirements under the ISTEA legislation and these are reinforced by requirements under the Clean Air Act Amendments of 1990 (CAAA). MAG is also required to give first priority, during the selection of projects, to Transportation Control Measures (TCMs) that are included in the State Implementation Plan (SIP). The SIP is a State Plan that demonstrates how the Air Quality standards promulgated under the CAAA will be achieved, maintained, and enforced. The TCMs included in the SIP consist of programs such as the Regional Rideshare and Travel Reduction Programs. In addition, agencies are encouraged to pursue options other than Single Occupancy Vehicle (SOV) road capacity projects.

The National Highway System Designation Act of 1995 (NHS Act) directly addressed the “unfunded mandate” criticism that many States had regarding the management systems. This Act effectively removed the requirement for States to implement the management systems, with the exception of the Congestion Management System in non-attainment areas. As the management systems had been integrated with the TIP programming process, it was decided to continue with reporting of the management systems and to continue to utilize them as a basis for the submittal of projects for the forthcoming TIP. The integration of the MAG management systems and programming process is illustrated in Figure Exec-1 on the next page.

In June 1998, the Transportation Equity Act for the 21st Century (TEA-21) was essentially silent regarding management systems, thereby allowing the existing situation within States as described by ISTEA and the NHS Act to remain unchanged. The State has overall responsibility for ensuring the development of the management systems in cooperation with MPOs, where appropriate.

MAG has developed a CMS and an IMS for this region and the Regional Public Transportation Authority (RPTA) has developed a PTMS for the region, in conjunction with MAG and the Arizona Department of Transportation (ADOT). All of the management systems affecting this region have been developed and are in various stages of implementation and use.

**Figure Exec-1: Integration of the Management Systems
And the Programming Process**



TIP Development Process

Each year, the latest data, together with any updates to plans, policies, strategies and evaluation procedures, are integrated into this report. This report indicates needs and methods to evaluate proposed projects and includes underlying and recent policy guidelines and a description of the programming process. The report is provided as early in the process as possible to facilitate identification of projects and to allow agencies sufficient time to submit projects. The report will also include the respective forms for applying for whatever funds may be available, as appropriate.

Projects are submitted by sponsoring cities, towns and agencies to MAG to be rated, analyzed and considered for inclusion in the draft MAG Federally funded program. Then, following additional input from stakeholders, MAG staff and technical committees, ADOT and the RPTA, the Federally funded program is included in the draft TIP which is then, in turn, approved for the purposes of an air quality conformity analysis.

When public input, and the conformity analysis is complete, the TIP is forwarded to the

Regional Council for approval and finally to the Governor (or designee), for approval. The conformity analysis on the TIP and Long Range Plan is then reviewed and requires the approval of the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), working in conjunction with the Environmental Protection Agency (EPA). The first three years of the TIP are included in the Arizona State Transportation Improvement Program (STIP) and the STIP is then forwarded to Federal agencies for formal approval.

System Performance

Between 1990 and 2000, the MAG area increased by almost one million people and was the fastest growing among the 30 most populous metropolitan areas in the United States. This growth is projected to continue with population projected to increase over 50 percent and traffic projected to increase 76 percent between 2000 and 2022. This growth creates unique transportation demands.

Compared to other major metropolitan areas, the MAG region has a strong grid street system and the regional freeway system is nearing completion (the inner loop is fully completed). Projects currently underway include completion of SR-51 to the Pima freeway; construction HOV lanes (and some through lanes) on US-60 (Superstition freeway); construction of overpasses on US-60 (Grand Avenue); and widening of SR-85 to two lanes in each direction.

This region is currently a serious nonattainment area for carbon monoxide (CO), ozone (O₃) and particulate matter of less than 10 microns (PM-10). However, following four years of no violations for CO and O₃, MAG air quality staff are finalizing maintenance plans in preparation for upgrading the status of these pollutants. PM-10, however, remains a challenge.

Congestion Management System

The MAG Regional Council adopted a Congestion Management System (CMS) for the region in September 1994. Volume to capacity ratios on roads and transit passengers per mile are the principal indicators of congestion. This system includes an extensive rating process to evaluate projects which includes levels of congestion, cost effectiveness and gives bonus points for multimodal enhancements and supportive land use planning. Methods to address congestion include roadway, transit, bicycle, pedestrian and demand management projects. Table Exec-1 on the following page shows the performance indicators for PM peak hour speed under a variety of scenarios:

A map of arterial intersection and freeway link congestion during the p.m. peak hour is shown in Figure Exec-3. The data for this map is taken from the 1998 MAG Congestion study and is limited to the study boundaries. However, compared with the location of congested intersections from previous years' reports, the study boundaries are sufficiently wide enough to cover all of the likely intersections involved. Arterial intersection and

freeway link congestion is shown by the intersections and segments experiencing level of service (LOS) F.

Table Exec-1: System Performance Indicators¹

Year	Average PM Peak Hour Speed (mph) ²	Total PM Peak Hours of Delay (thousands)
2002	28.4	62.5
2006 TIP	27.7	78.7
2006 No Build	23.1	119.9
2022 Plan	23.5	172.4
2022 No Build	9.3	721.3

Arterial intersection congestion is generally distributed around the valley. Freeway congestion is focused along I-17 between Thomas Road and Thunderbird Road; on the Superstition Freeway from Mill Avenue to Lindsay Road; on I-10 from University Drive to Chandler Boulevard; on the Papago Freeway from 59th Avenue to the 16th Street; on the Red Mountain Freeway from 48th Street to the Price Freeway; on the Price Freeway from the Superstition Freeway to the Red Mountain Freeway; and on the Squaw Peak from I-10 to Shea Boulevard. In the future, there will be a need to provide adequate roadway capacity in areas of new development to prevent additional congestion.

Intermodal Management System

On April 26, 1995, the MAG Regional Council accepted the MAG Intermodal Management System (IMS) Report. The main focus of this report is on identifying and finding ways to improve connections to, and facilities at, intermodal terminals within the MAG region. The State IMS focuses on inter-urban corridor connections.

The MAG IMS has identified all major freight and passenger terminals in the region (Figure Exec-4). Based on a detailed questionnaire and field information, a list of potential IMS needs has been developed. Most of these needs relate to access to terminals because it is not feasible to directly apply public funds to private facilities. A rating system has been developed that ranks projects based on their ability to satisfy facility needs and performance measures.

¹Travel demand model forecasts used: 2001, 2006bld, 2006nb, 2021bld and 2021nb.

²Average modeled speeds on non-local streets and freeways during the PM Peak hour.

Pavement Management Systems

Most major jurisdictions in the MAG area currently have a quantitatively based Pavement Management System (PMS). ADOT has assumed a lead role in ensuring that all jurisdictions in Arizona implement a PMS and that some common indicators are used in each major system to facilitate comparability. Currently, information from PMSs in the MAG area is not comparable.

Safety Management System

A project to develop a regional safety management system has been programmed for FY 2005. ADOT has developed and maintains the Accident Location Information Surveillance System database. Information from this database was used to map the highest accident intersections in the MAG area (see Figure Exec-5).

Bridge Management System

ADOT currently maintains a Bridge Management System for all bridges throughout Arizona. Upgrades to this system are continuing, to fully address ISTEA requirements.

A map of bridge needs in the region is shown as Figure Exec-6. This is based on recently updated information and includes data on structural condition, traffic volumes and cost. Bridge needs are largely of two types: upgrades to support full loads and widenings to adequately address traffic volumes.

Public Transportation Management System

Public Transportation Management Systems (PTMS) are designed to facilitate the maintenance of existing transit capital investments. ADOT is responsible for developing a statewide management system for all transit vehicles and facilities purchased with federal funds. In the MAG area the RPTA has developed a PTMS for vehicles and facilities.

Title VI and Environmental Justice Considerations

Title VI of the Civil Rights Act of 1964 prohibits discrimination on the basis of race, color and national origin. Other federal laws and directives prohibit discrimination on the basis of age, disability and gender. These laws require recipients and sub-recipients of federal funds to give consideration to the impacts of plans and programs so as not to discriminate on the basis of the affected community and/or group.

Potential discrimination is to be addressed on a funding level basis, an environmental and health basis, as well as the exclusion or denial of benefits. As these laws apply to MAG and its member agencies, this section is providing information for consideration during the

process to update the MAG Long Range Transportation Plan and five year program. Section VII provides the detailed information for Title VI considerations for the Maricopa County region with distribution maps.

MAG currently conducts activities to encourage public participation in its decisions. These activities include open houses, community meetings, and presentations to local committees. This open process offers complete information on plans, timely public notice, public access to decisions, and opportunities for early and continuing involvement. In addition to general public involvement processes, the MAG Human Services Planning Program solicits input from local minority populations and people in under served communities. The processes and findings of the Human Services Planning Program are integrated into MAG's planning programs, and members of the MAG Human Services Planning Program staff are part of the MAG Title VI team.

Federal-Aid Programs

TEA-21 expires at the end of FY 2003 and it is anticipated that the Congress will reauthorize the Act maintaining at least the current funding levels and the same core funding programs. However, substantial changes could occur in these programs. MAG, also, is in the process reviewing its federal funding programming process and of updating its Long Range Transportation Plan and these two could affect both programming and policy objectives and the process by which projects are programmed. For these reasons, it is anticipated that exclusive of funding commitments to the Regional Freeway System and transportation control measures, MAG will not program Congestion Mitigation Air Quality (CMAQ) funds and MAG Surface Transportation Program (STP-MAG) funds for the FY 2008 element of the FY 2004-2008 MAG Transportation Improvement Program.

FYs 2003 through FY 2007 are close to fully programmed, except for those years where projects have already been accelerated during the fiscal year close out process during the past couple of years. Judging from the number and amount of projects being deferred from the current FY 2002 to FY 2003, and based on the likely reduced federal funding levels expected for next year is expected that FY 2003 may fall into a deficit situation. However, it is also likely that a similar proportion of FY 2003 projects will be requested to defer from FY 2003 to FY 2004 and this is likely to allow for a balance financial situation.

It is also anticipated that, during the programming process for the FY 2005-2009 TIP (next year), when further knowledge of the funds expected to be available to the region under TEA-3 is known, federally funded projects in ALL years of the TIP will be reviewed and adjusted. It is expected that this review and future adjustment will be one of the items discussed and one of the likely recommendations of the TIP Process Improvement Committee.

Member agencies seeking to use FTA Section 5310, FTA Section 5311 funds or local government set asides of ADOT STP for transit projects should coordinate all their applications with the RPTA and ADOT. For transportation enhancement funded projects MAG prioritizes all of the projects that fall within the region, but for bridge replacement, hazard elimination and safety funded projects, members should contact ADOT directly.

Members seeking to use FTA Section 5307 and FTA Section 5309 should contact the City of Phoenix and the RPTA.

Policy Considerations

The MAG TIP currently includes the ADOT Five Year Life Cycle Program, transportation projects included in the five year capital programs of member agencies, and regionally significant privately funded projects. Federal regulations require that all federally funded projects and all regional significant projects must be included in the TIP, and this TIP must be found to be in conformance with applicable air quality plans before the projects may proceed. Federal regulations also require that the TIP be fiscally constrained. Project sponsors need to supply information necessary to model and rate proposed projects. In particular, and in accord with Federal requirements, documentation is provided to demonstrate that options to SOV road capacity projects have been fully considered.

Regarding air quality, one aspect of the conformity analysis is that all TCMs included in air quality plans must also be included in the TIP. MAG has a rating system for evaluating air quality benefits of transportation projects and this information is considered in selecting projects.

The main result of TEA-21 was the large increase in the amount of federal funds to the nation in general and to Arizona and the MAG region in particular. The change in the mixture of the type of federal funds sub-allocated to the MAG region has necessitated changes to the existing policy that allocated up to 70 percent of MAG federal funds for regional freeway system. A new policy ensures that the regional freeway system will not receive any less than the funds originally programmed during the 1999-2003 TIP process. This ensures that a base amount of \$34.1 million will be targeted for freeways.

TEA-21 also strengthened the level of cooperation required between the states and MPOs. Previously, States were supposed to provide MPOs with estimates of the Federal and State funds that are available for programming purposes. TEA-21 requires that, for the purposes of developing the TIP, the MPO, public transit agency, and the State shall cooperatively develop estimates of funds that are reasonably expected to be available to support program implementation. Pursuant to this requirement, MAG, ADOT and RPTA annually agree upon a fair share funding estimate of Federal and State funding to be committed to complete projects in the MAG region over the next TIP period. A major benefit of the original agreement was that substantial accelerations of projects on the regional freeway system were made possible. Currently, the same agencies are discussing estimates for the FY 2004-2008 period.

As an outgrowth of this cooperation, MAG, ADOT and RPTA are working closely together to develop and implement a joint programming process. This process is generally described in Figure Exec-2. Public input is encouraged throughout the process and policy-based guidelines facilitate the identification and selection of projects.

The FY 2003-2007 MAG TIP totals about \$4.5 billion of which approximately \$1.36 billion is Federal funds (\$330 million in MAG Federal funds). All federally funded projects (those utilizing Title 23 transportation funds, with some minor exceptions) and all projects of regional significance must be included in the TIP which must meet air quality conformity requirements.

Figure Exec-2: Combined Regional Programming Process

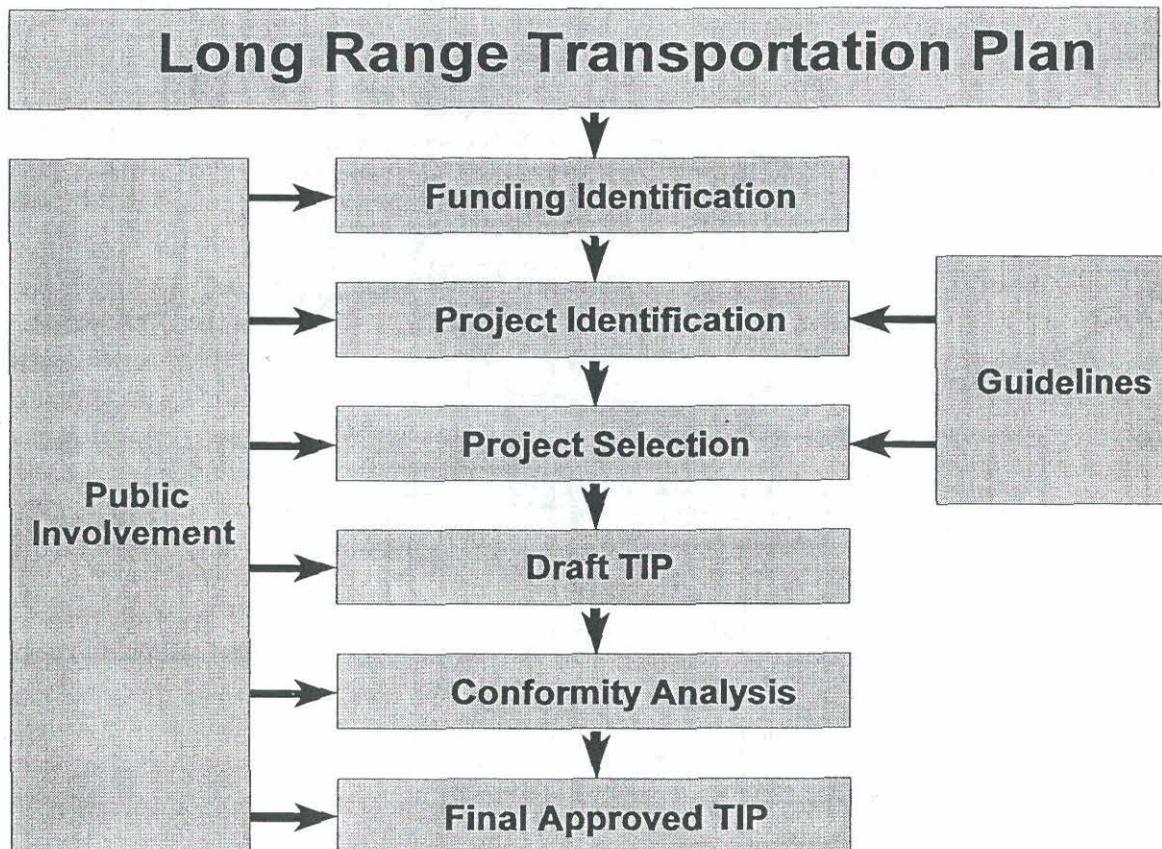


FIGURE EXEC-3: CURRENT CONGESTION

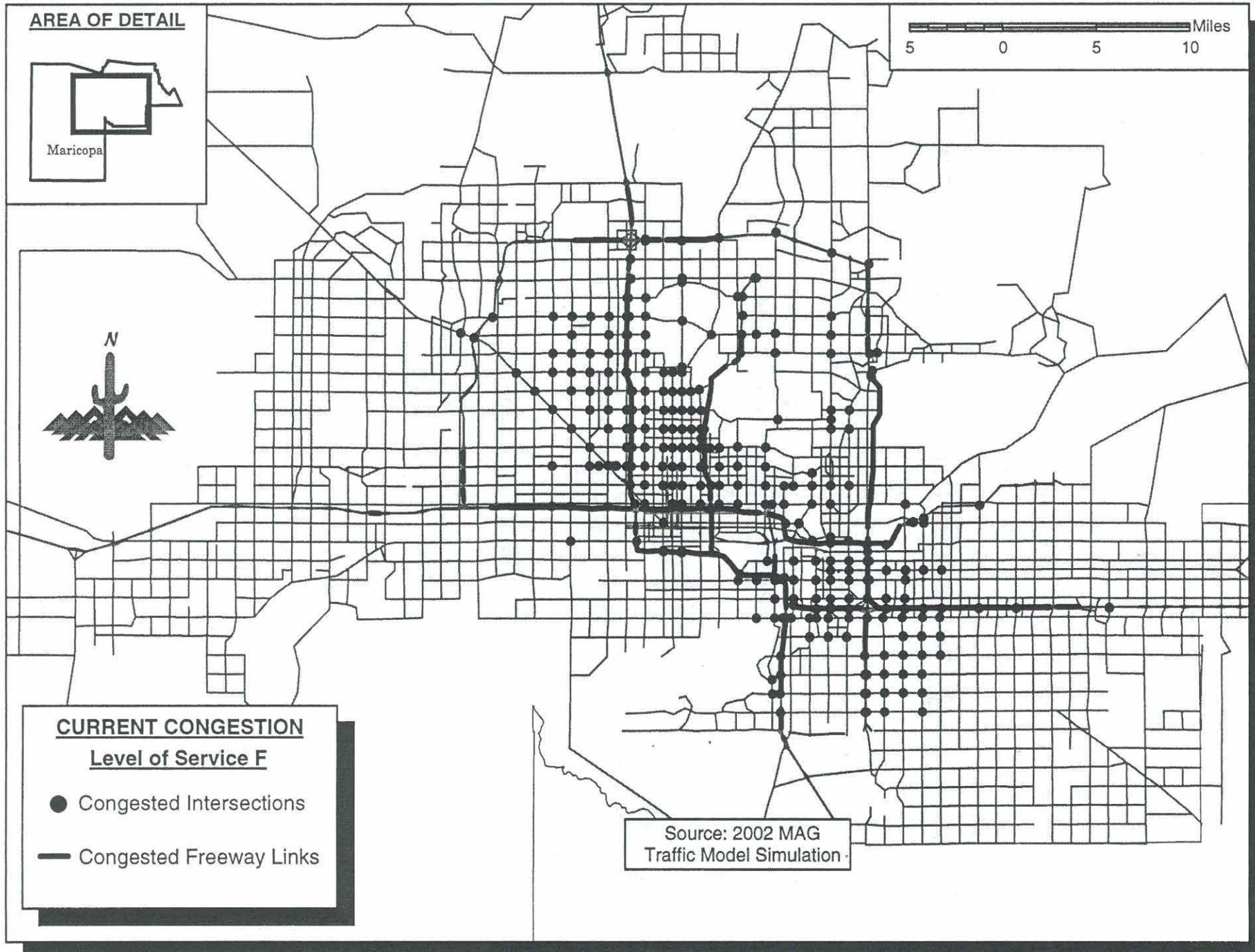


FIGURE EXEC-4: INTERMODAL TERMINALS

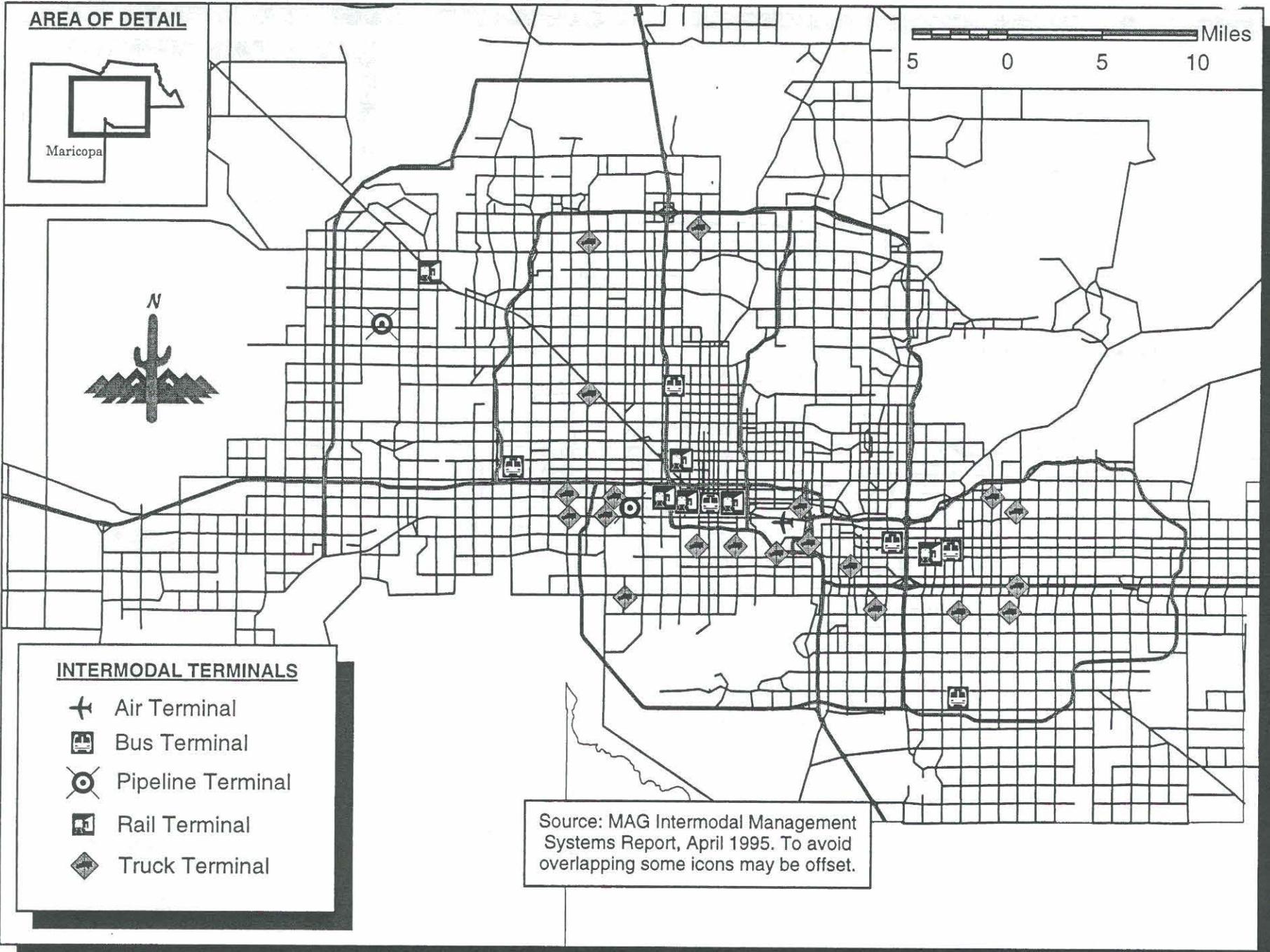


FIGURE EXEC-5: HIGH ACCIDENT LOCATIONS

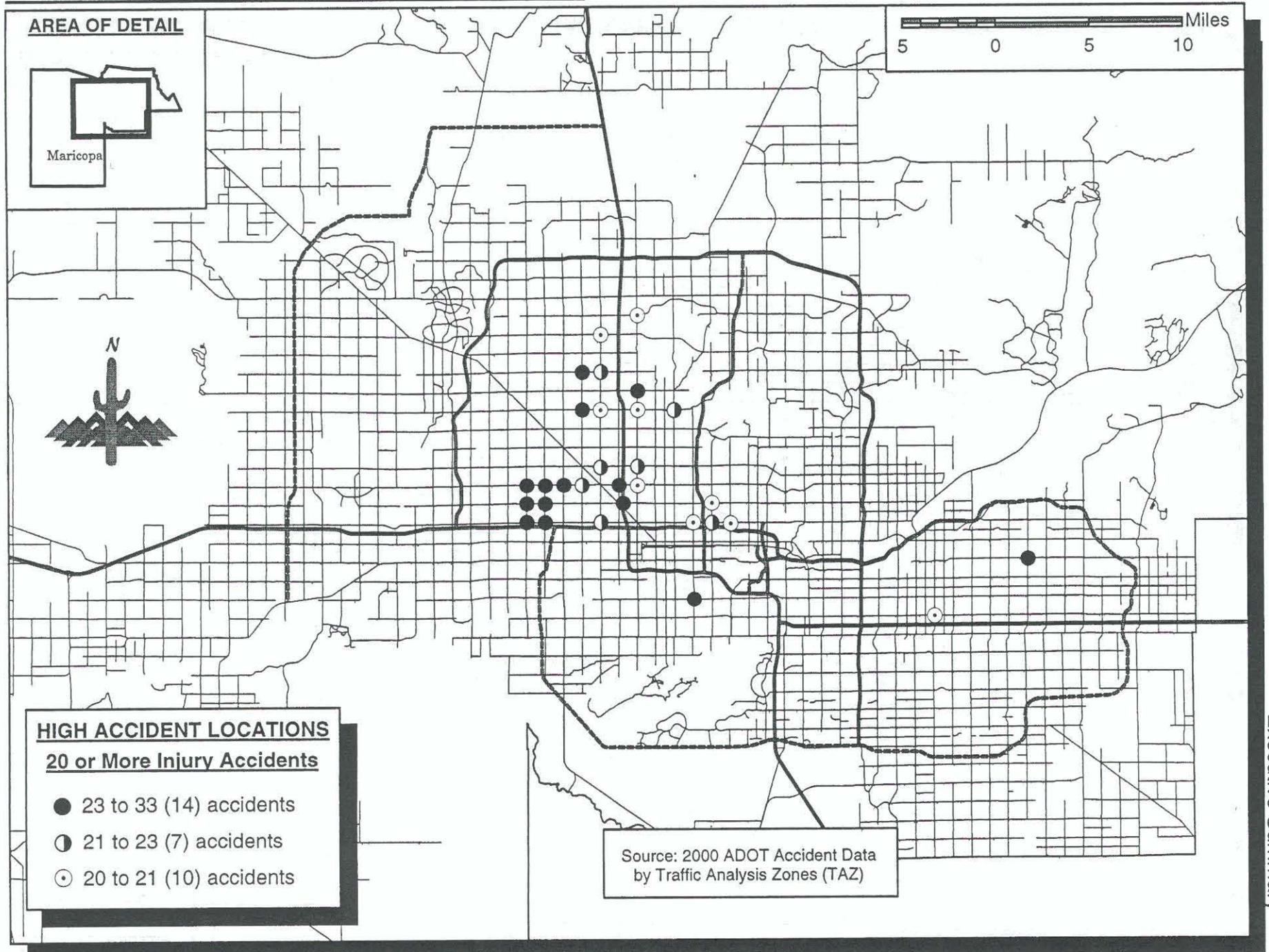
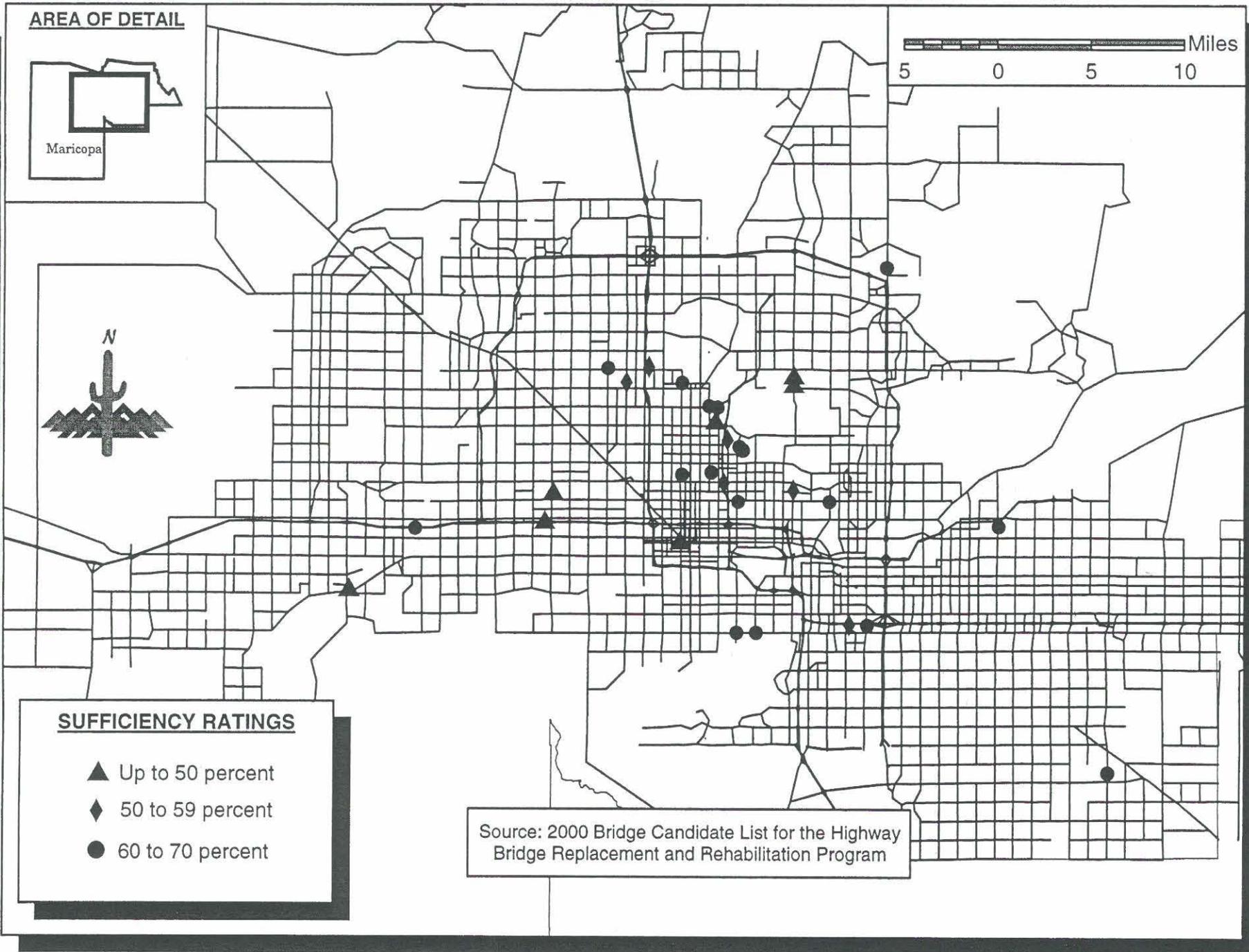


FIGURE EXEC-6: SUBSTANDARD BRIDGES



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SECTION I

INTRODUCTION

This report provides information necessary to program projects in the MAG Transportation Improvement Program (TIP) and continues the series of reports initiated by the FY 1995 MAG Transportation Management Systems Report. This first report was released in November 1994, and this was followed by annual updates released in November of the following years. As part of the FY 1997 update, the removal of the federal mandate for the development and implementation of these management systems was explained. The Congestion Management System, however, remains a requirement within the MAG region. The State has effectively continued with the development and implementation of the management systems and MAG urges its members to utilize the data provided by the management systems wherever appropriate.

The Management Systems are regarded as a useful tool to assist MAG agencies in their decision-making regarding transportation strategies and selection of individual projects. This report also provides the most recent guidelines approved by the MAG Regional Council for regional transportation priorities and explains the process for submitting projects for consideration for funding. This report continues to give additional socioeconomic guidance to MAG jurisdictions and agencies during the development of their transportation plans and programs for eventual incorporation into the MAG Transportation Improvement Program (TIP) and Long Range Transportation Plan (LRTP).

Background

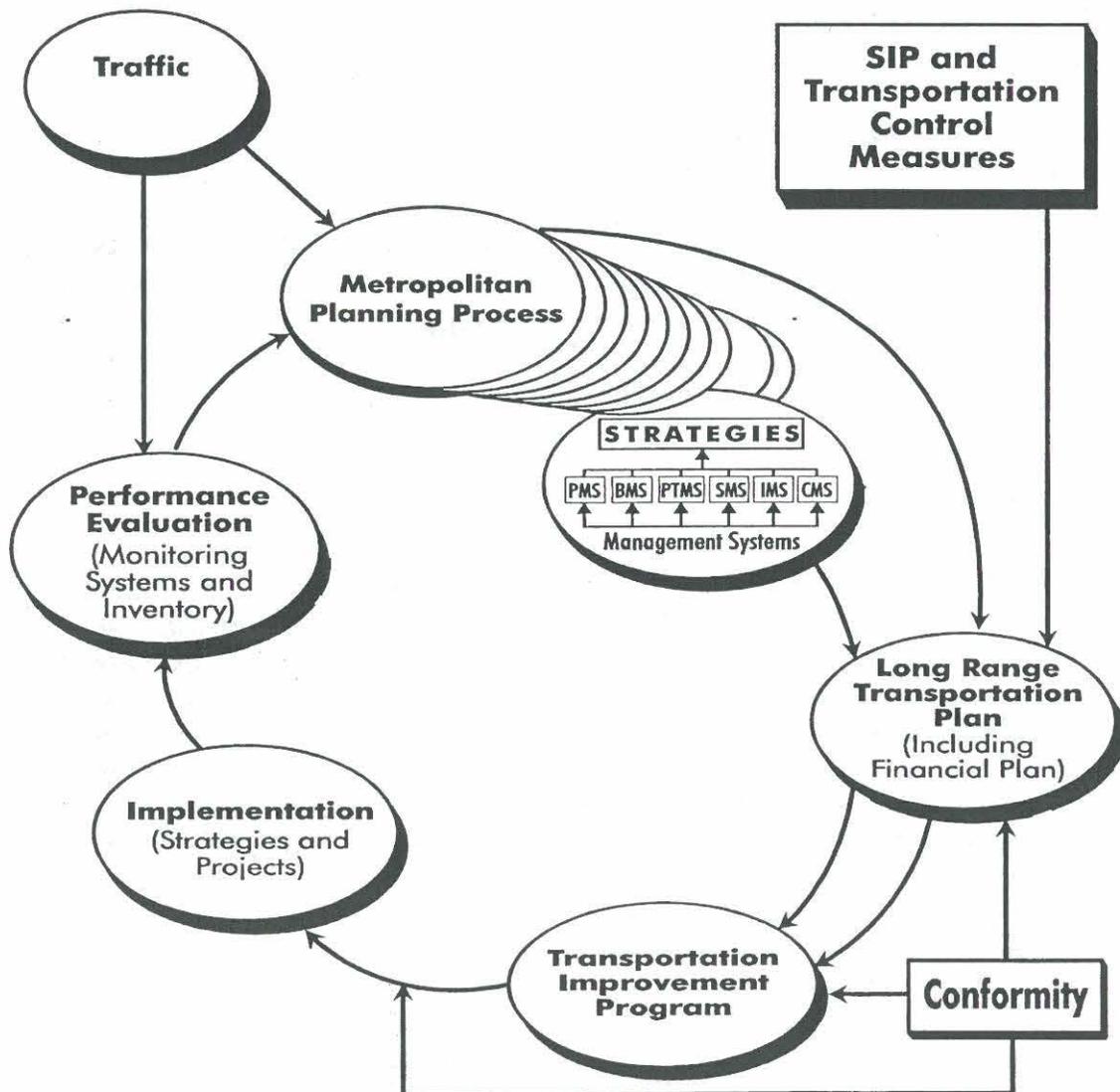
On December 18, 1991, President Bush (the elder) signed the Intermodal Surface Transportation Efficiency Act (ISTEA). This six year act replaced the 1987 Surface Transportation and Uniform Relocation Assistance Act, which expired on September 10, 1991. The overall objective of the new Act was to improve the performance of the statewide and metropolitan transportation systems through preservation, operations, and capacity enhancements. The Act was designed to accomplish these goals in part by requiring States and metropolitan planning agencies to work cooperatively to develop six coordinated transportation management systems to be used in the planning process (see Figure I-1, on the next page).

The management systems are intended to be used to identify problem areas in transportation systems, evaluate strategies and identify potential projects for solving these deficiencies. To make the application of these management systems easier, the ISTEA revised the previously established categorical funding programs into more flexible funding categories that allow the sharing of various categorical funds between differing modes of transportation.

Three of the management systems (congestion, intermodal and safety) focus on the performance aspects of the transportation system. The remaining three systems (bridge, pavement and public transportation) focus on the management of system assets. All six

management systems were intended to produce strategies for ensuring that the performance of the current and future systems is optimized. The success of these strategies are evaluated based on each separate transportation system as well as the entire transportation system as a whole. To evaluate these strategies, performance measures have been adopted for each of the six systems. These measures are used to provide a feedback mechanism to evaluate the effectiveness of the strategies, programs

FIGURE I-1
Transportation Planning Process



and projects that are implemented.

MAG Transportation Management System Process

The six management systems are designed to evaluate the performance of each transportation system, suggest strategies and recommend projects for improving them. These systems are also required to evaluate the effectiveness of the past implemented strategies and projects. The process by which the six management systems are used to evaluate and select projects is shown in Figure I-2.

Each year, the transportation system is evaluated based on adopted performance measures. This evaluation process is designed to identify how well each element of the system is performing. The evaluation is based on an analysis of the data from MAG transportation models, special studies, socioeconomic estimates and input from the public participation process.

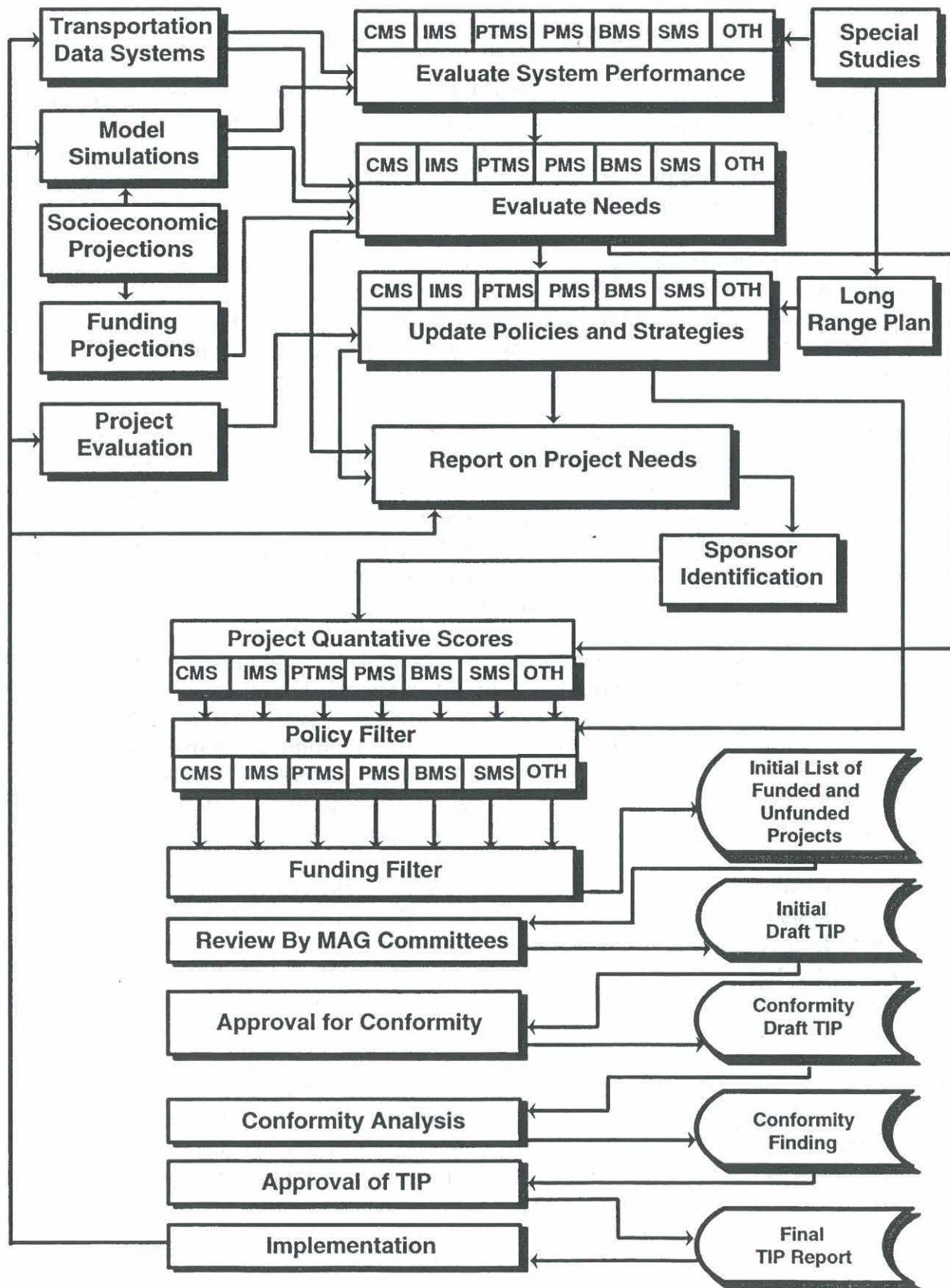
Using results of the system performance analysis, regional transportation needs are identified, analyzed and, where possible, mapped. Adopted transportation policies and strategies are then reviewed and amended as needed. The result of this process has been reported in past years in the MAG Transportation Management System Annual Update. The Annual Update was intended to be a guide for the MAG member agencies, ADOT, and Federal agencies in Maricopa County as they develop projects for inclusion in the MAG TIP and LRTP and this report fulfills a similar purpose.

To the extent possible, each project submitted to MAG will be evaluated based on rating systems set up for each of the six management systems. These rating systems are designed to provide a standardized score for each project regardless of mode or type of project. Currently, the CMS, the IMS and the Bridge Management System (BMS) are the only ones that have adopted rating systems. No rating systems for the Pavement Management System (PMS), Public Transportation Management System (PTMS) and Safety Management System (SMS) have been developed.

Based on the results of the project ranking system, each project will then be evaluated based on the basis of MAG adopted and mandated policies. An example of a mandated policy is the federal requirement to give projects listed in the State Implementation Plan for Air Quality (SIP) top priority for funding. An example of an adopted policy is the implementation of the priorities in the ADOT Life Cycle Program for the MAG Freeway/Expressway System.

After projects are evaluated, the availability of funding is considered and projects are selected for inclusion in the TIP. Where there are insufficient funds available to complete improvements identified through the management systems and planning process, the decision on which proposed improvement is of highest priority for inclusion in the TIP and LRTP is made through the MAG planning process.

FIGURE I-2: MANAGEMENT SYSTEM PROCESS



It should be emphasized that the management systems are principally tools to help decision makers. The decision making process includes input from MAG staff, MAG technical advisory committees, federal, state and local agencies, transportation providers and operators, as well as the public. Issues may also be considered by planners and decision makers that are not fully addressed in the management systems. These include regional mobility, economic development, and environmental considerations.

The final product of this whole process will be a recommended list of projects that addresses regional transportation system issues and needs. This list is to be financially balanced with respect to available federal, state and local revenues and be reasonably expected to be constructed within the programming period. When a final list of potential projects is drawn up and reviewed by the various MAG technical advisory committees as well as the public, it is sent, as part of the annual TIP, to the MAG Regional Council for approval.

Annual Report

The purpose of this report is to provide a mechanism to document the types and locations of transportation problems, suggest projects and indicate how proposed projects will be evaluated. This report is structured around the regional transportation planning process described above.

Included in the report are data, maps and an analysis of the existing and future conditions of the various modes of surface transportation as well as indications of future improvements. Each of the six management systems is described with respect to the federal regulations which control their development, the coordinated activities necessary to carry out the systems and the status of development for each. Other regulations that guide the development of transportation plans are included as an individual section. This report will be distributed to each of the MAG member jurisdictions. It is intended to be a tool for developing transportation improvement projects.

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SECTION II

SYSTEM PERFORMANCE

This section analyzes the performance of the transportation system from a regional perspective. This analysis provides an indication of the magnitude and type of investments that are needed throughout the system. Growth trends are reviewed and the impact of doing nothing is considered. The MAG regional transportation system is compared to other metropolitan areas to perform an assessment of relative need. Initial impacts of alternative investment strategies are also explored.

Current Conditions

An inventory of existing facilities, programs and services, travel demand and level of service is needed to conduct this analysis. This enables an assessment of the impact of projected socioeconomic growth, planned transportation improvements and forecasted changes in travel behavior. The inventory provides a baseline allowing relative comparison of existing and projected travel conditions.

Existing Facilities, Programs and Services

The MAG transportation modeling area is used for statistics in this section. This area is generally bounded by Apache Junction to the east, Buckeye to the west, Cave Creek to the north, and the Gila River Indian Community to the south. The 2002 network¹ used in the MAG travel demand models contains 12,577 lane miles of non-local streets. This includes 1,590 lane miles of freeways, 176 lane miles of freeway ramps, 9,378 lane miles of arterials, and 1,433 lane miles of collector roads. Currently, 13 percent of modeled lane miles are freeways and 75 percent are arterials. High Occupancy Vehicle (HOV) lanes account for 103 of the freeway lane miles and less than one percent of the total lane miles. The number of vehicle miles traveled (VMT) on an average 2002 weekday in the MAG transportation modeling area is estimated to be 76.3 million.

The regional transit system includes 66 local and 21 express bus routes for a total of 18 million annual bus miles of service (revenue miles). The regional transit fleet consists of 596 wheelchair-accessible buses, 289 dial-a-ride vehicles and 169 vanpool vehicles. The bus service area covers nearly 600 square miles containing six transit centers, seven regular park and ride lots and 44 joint use lots. The transit system has 6,451 bus stops, 2,698 of which have shelters or benches. The annual number of passenger boardings on buses is 37,496,804 with an additional 968,120 on the dial-a-ride service. The percentage of total daily person trips using public transit on an average weekday is approximately one percent.

A variety of Transportation (or Travel) Demand Management (TDM) Programs and

¹ This data is derived from the 2002 MAG travel demand model assignment, prepared in May 2002.

Transportation System Management (TSM) programs are underway in the MAG region. TDM programs encourage reductions in travel demand, while TSM programs better manage existing traffic flows within the transportation system. These programs also promote alternative modes of travel including carpooling, vanpooling, transit usage, walking and bicycles, and alternative work schedules, including telecommuting and compressed work schedules.

In order to provide for better traffic flow in the system there is a need for better coordination of traffic signals. There are significant opportunities in real time signal operations. That is, individual traffic signals would be adjusted by minute to minute information on traffic conditions. In 1992, MAG allocated funds to Maricopa County to study traffic signal coordination in the Valley and the most recent Draft FY 2003-2007 MAG TIP contains about \$64 million for freeway management systems and intelligent transportation system projects, a large part of which is funded with MAG federal funds.

The MAG Rideshare Program supports efforts to share an automobile ride and to use alternative modes of transportation throughout the MAG area. The regional carpool/vanpool matching program, sponsored by MAG, was initiated for the purpose of reducing energy consumption. Since 1986, the regional rideshare program has been administered by the Regional Public Transportation Authority (RPTA). The state rideshare program (Capitol Rideshare) offers carpool matching and other rideshare services to all state employees. RPTA has provided a third party vanpool service to interested commuters since 1987.

The Maricopa County Trip Reduction Program, established with the primary goal of air quality improvement, targets employers with 50 or more employees. Participating employers are required to prepare a travel reduction plan to reduce the number of commuter trips or vehicle miles traveled by single occupant motor vehicles.

The Clean Air Campaign, a public/private partnership including Chamber of Commerce participation, has urged motorists to carpool, take the bus, or otherwise avoid solo commuting one day each week as a voluntary "no drive day" campaign. A relatively new approach to travel demand management is the formation of Transportation Management Associations (TMAs) and employer transportation networking groups. Through these formal and informal associations, employers share resources to promote alternative mode use, improve mobility, or implement trip reduction programs in their local areas.

The MAG Regional Bicycle Plan includes a total of 662 miles of on-road bicycle facilities. Currently, 152 miles have a bicycle lane or an edge stripe. Many jurisdictions in the MAG region are actively implementing bicycle facilities.

A growing number of employers are allowing their employees to work in a location other than the central office. With telecommuting, employees can be linked to the central office by a personal computer or fax machine. To promote telecommuting, in 1995 the RPTA started a program to match public service workers with available government office space near their homes.

Existing Travel Demand and Level of Service

Characteristics of existing travel demand for the MAG transportation modeling area are summarized in Table II-1. Data for 2002 represents average weekday conditions.

**Table II-1: 2002 Characteristics of Travel Demand
For the MAG Region ²**

Characteristic of Travel Demand	Total	Per Capita ³
Total Daily Vehicle Trips	10.6 million	3.25
Total Daily Vehicle Miles of Travel (VMT) ⁴	76.3 million	23.5
Total PM Peak Hours of Delay	62,485	69 seconds

The 1998 weekday travel statistics in Table II-2 provide an indication of current congestion levels. Congestion on freeways is defined as severe stop-and-go traffic or LOS F, as calculated in the 1994 Highway Capacity Manual. The travel time delays at LOS F are generally unacceptable to most drivers in an urban area. In general, congestion occurs when the traffic volume exceeds the capacity of a roadway or intersection. A recent MAG Congestion Study indicates that 17 percent of the freeway miles and 20 percent of the intersections for which field data were collected experienced congestion on an average weekday in 1998, as shown below. For intersections, congestion is defined as LOS F for 15 minutes or longer and, for freeways, LOS F for 30 minutes or longer.

Table II-2: 1998 Congestion Indicators for MAG Region ⁵

Congestion Indicator	Totals	Total Congested	% Congested
Freeway Mileage	231	38	16.5
Intersections	647	128	19.8

² This data is derived from the 2002 MAG travel demand model assignment, prepared in May 2002.

³ Population includes resident and non-resident (transient and seasonal) persons.

⁴ VMT for the modeling area after reconciliation with the Highway Performance Monitoring System (HPMS).

⁵ Congestion indicators are based on PM peak data collected during the 1998 MAG Regional Congestion Study, September 2000.

Another indication of how well the transportation system is performing is the average speed that exists on roads of different types. Average daily speeds by facility type (freeway and arterial) are identified in Table II-3. Freeways are facilities that provide uninterrupted traffic flow with access limited to ramp locations. In the MAG area, arterial streets are primarily mile streets serving through traffic and also providing access to adjacent properties.

Table II-3: 2002 PM Peak Hour Speeds (MPH) ⁶

Facility Type	Speed (mph)
Freeways ⁷	36.4
Arterials ⁸	25.2
Average ⁹	28.4

Comparison with Other Urban Areas

To provide another measure of existing conditions, travel characteristics for the Phoenix urbanized area have been compared to figures from other urbanized areas with populations of 1 million or more. An urbanized area is a census defined unit with a minimum average population density of 1,000 people per square mile that includes a large population center and its adjacent communities. Together these have a high degree of economic and social interaction. Table II-4 presents a summary of findings. In 1985, the Phoenix area lagged far behind other metropolitan areas in miles of freeway per capita, but modest gains have been made in recent years. In 2000, the Phoenix urbanized area had 5.78 miles of freeway per 100,000 population, still one of the lowest freeway miles per capita of any of the 39 urbanized areas with a population of 1 million or more.

According to the U. S. Department of Transportation, the Phoenix area transit systems had 32 million annual passenger boardings in 1990 ¹⁰. This averages approximately 16 annual boardings per capita based on the 1990 Census Urbanized Area population.

⁶ Derived from the 2002 MAG travel demand model assignment, prepared in May 2002.

⁷ Including HOV lanes, but excluding ramps.

⁸ Including expressways and Grand Avenue.

⁹ Includes freeways, expressways, Grand Avenue, and major arterials.

¹⁰ This data is derived from the USDOT Urban Mass Transit report entitled Transit Profiles: Agencies in Urbanized Areas exceeding 200,000 Population for the 1990 Section 15 Report Year. Urban area data is consolidated to the respective MSA for comparison.

TABLE II-4: Selected 2000 Statistics for Urbanized Areas with Populations Greater Than or Equal to 1 Million

Urbanized Area	Est. Pop (1000)	Net Land Area (Sq. Mi.)	1000 Pop. Per Sq. Mi.	Daily Vehicle Miles of Travel			Centerline Miles of Roadway			Fwy Miles per 1000 Persons	Daily VMT Per Capita
				Total (1000)	Freeway (1000)	% That Are Freeway	Total	Freeway	% Freeway		
New York - NE NJ, NY	17,089	3,962	4.31	263,905	101,299	38.4%	37,623	1,130	3.0%	0.0661	15.40
Los Angeles, CA	12,384	2,231	5.55	280,793	126,498	45.1%	26,949	652	2.4%	0.0526	22.70
Chicago-Northwestern IN, IL	7,702	2,730	2.82	158,240	48,276	30.5%	23,764	477	2.0%	0.0619	20.50
Philadelphia, PA	4,068	1,347	3.02	77,005	24,483	31.8%	13,417	347	2.6%	0.0853	18.90
San Francisco-Oakland, CA	4,022	1,203	3.34	90,277	47,982	53.1%	9,316	330	3.5%	0.0820	22.40
Detroit, MI	3,836	1,304	2.94	92,359	31,125	33.7%	13,808	283	2.0%	0.0738	24.10
Dallas-Fort Worth, TX	3,746	1,712	2.19	116,548	49,197	42.2%	17,830	594	3.3%	0.1586	31.10
Washington, DC	3,617	999	3.62	82,959	34,533	41.6%	10,329	306	3.0%	0.0846	22.90
Atlanta, GA	2,977	1,757	1.69	100,693	42,488	42.2%	13,145	306	2.3%	0.1028	33.80
Boston, MA	2,917	1,138	2.56	59,361	22,890	38.6%	10,148	211	2.1%	0.0723	20.30
San Diego, CA	2,653	733	3.62	62,809	33,745	53.7%	5,965	246	4.1%	0.0927	23.70
Houston, TX	2,487	1,537	1.62	91,883	39,195	42.7%	15,251	368	2.4%	0.1480	36.90
Minneapolis-St. Paul, MN	2,475	1,192	2.08	60,720	27,094	44.6%	10,919	316	2.9%	0.1277	24.50
Miami-Hialeah, FL	2,270	353	6.43	43,577	13,584	31.2%	5,607	120	2.1%	0.0529	19.20
Phoenix, AZ*	2,820	1,054	2.68	58,405	19,424	33.3%	10,232	163	1.6%	0.0578	20.71
Baltimore, MD	2,107	712	2.96	45,021	22,659	50.3%	6,608	278	4.2%	0.1319	21.40
St. Louis, MO	2,044	1,124	1.82	58,761	25,739	43.8%	8,064	320	4.0%	0.1566	28.70
Seattle, WA	1,994	844	2.36	51,430	24,008	46.7%	7,101	241	3.4%	0.1209	25.80
Denver, CO	1,993	720	2.77	43,997	16,904	38.4%	7,007	209	3.0%	0.1049	22.10
Tampa-St Pete-Clearwater, FL	1,953	650	3.01	44,473	8,356	18.8%	7,539	124	1.6%	0.0635	22.80
Cleveland, OH	1,783	838	2.13	37,800	17,284	45.7%	5,530	227	4.1%	0.1273	21.20
San Jose, CA	1,626	365	4.46	38,343	16,529	43.1%	4,111	126	3.1%	0.0775	23.60
Fort Lauderdale-Hollywood, FL	1,601	327	4.90	37,335	12,832	34.4%	4,207	109	2.6%	0.0681	23.30
Pittsburgh, PA	1,569	1,086	1.45	35,632	11,128	31.2%	8,441	283	3.4%	0.1804	22.70
Milwaukee, WI	1,532	518	2.96	31,888	9,701	30.4%	5,095	111	2.2%	0.0725	20.80
Norfolk Bch - Newport News, VA	1,507	952	1.58	34,588	11,269	32.6%	5,512	173	3.1%	0.1148	23.00
Kansas City, MO	1,422	1,036	1.37	41,187	19,307	46.9%	7,545	374	5.0%	0.2630	29.00
Sacramento, CA	1,394	383	3.64	29,724	12,769	43.0%	4,569	105	2.3%	0.0753	21.30
Riverside-San Bernardino CA	1,340	514	2.61	32,876	16,601	50.5%	4,735	139	2.9%	0.1037	24.50
Portland-Vancouver, OR	1,338	469	2.85	31,517	12,595	40.0%	5,615	137	2.4%	0.1024	23.60
San Juan, PR	1,303	274	4.76	17,415	6,187	35.5%	2,811	66	2.3%	0.0507	13.40
Las Vegas, NV	1,256	270	4.65	24,128	6,848	28.4%	2,963	77	2.6%	0.0613	19.20
Cincinnati, OH	1,176	630	1.87	32,605	15,744	48.3%	4,887	176	3.6%	0.1497	27.70
Orlando, FL	1,160	395	2.94	32,288	9,532	29.5%	3,610	156	4.3%	0.1345	27.80
San Antonio, TX	1,143	485	2.36	33,445	15,775	47.2%	5,002	211	4.2%	0.1846	29.30
Buffalo-Niagara Falls, NY	1,112	564	1.97	21,448	6,365	29.7%	3,985	139	3.5%	0.1250	19.30
Oklahoma City, OK	1,083	647	1.67	25,980	8,932	34.4%	4,714	150	3.2%	0.1385	24.00
New Orleans, LA	1,065	270	3.94	15,414	5,613	36.4%	3,290	75	2.3%	0.0704	14.50
West Palm Beach, FL	1,041	307	3.39	25,277	8,368	33.1%	2,591	87	3.4%	0.0836	24.30
Ave for Urbanized Areas > 1 M	2,819	965	2.92	63,131	25,201	39.9%	8,970	255	2.8%	0.0904	22.40

* Population based statistics for the Phoenix Urbanized Area are based on population data submitted to FHWA as part of the ADOT HPMS submittal as the population total reported by 2000 Highway Statistics - 2.1 million - conflicts with both available Census data for 2000 and with previous issues of Highway Statistics. Source: Based on 2000 Highway Statistics (United State Department of Transportation, Federal Highway Administration).

According to the Census Bureau, an urbanized area contains a central city with a population of at least 50,000 plus the closely surrounding settled incorporated area. For annual boardings, the Phoenix urbanized area ranked 34 out of the 39 million-plus areas. The highest rate for other metropolitan areas was in New York City with 167 boardings per capita, the lowest rate was Orlando, with 9.09.

Projections

The MAG travel demand models estimate the VMT in the MAG modeling area. These estimates are based on projections of population and employment by traffic analysis zone (TAZ). The TAZ population and employment projections for 2000-2020 were adopted by the MAG Regional Council in June 1997.

Population and employment in the region have increased substantially over the past 40 years. Between 1960 and 1970 the County grew by approximately 300,000 people, an increase of 3.3 percent per year. Over the period 1970 through 1995 the population increased by 1.6 million, an average annual increase of 4.4 percent. Between 1995 and 2000 County population grew from 2.5 million to 3.1 million, representing an average annual growth rate of 4.1 percent. The resident population in Maricopa County is projected to reach 4.5 million by 2020.

County population grew by 105 percent during the twenty year period from 1960 to 1980. VMT grew 170 percent during this same period. Factors contributing to the disproportionate increase in VMT included smaller household sizes, higher work force participation rates, and an increased number of vehicles per household.

Trends in population and VMT growth in the modeling area are illustrated in Figure II-1. VMT is projected to grow by nearly two-thirds between 2000 and 2020, while population is expected to increase by more than fifty percent.

Long Range Plan Performance

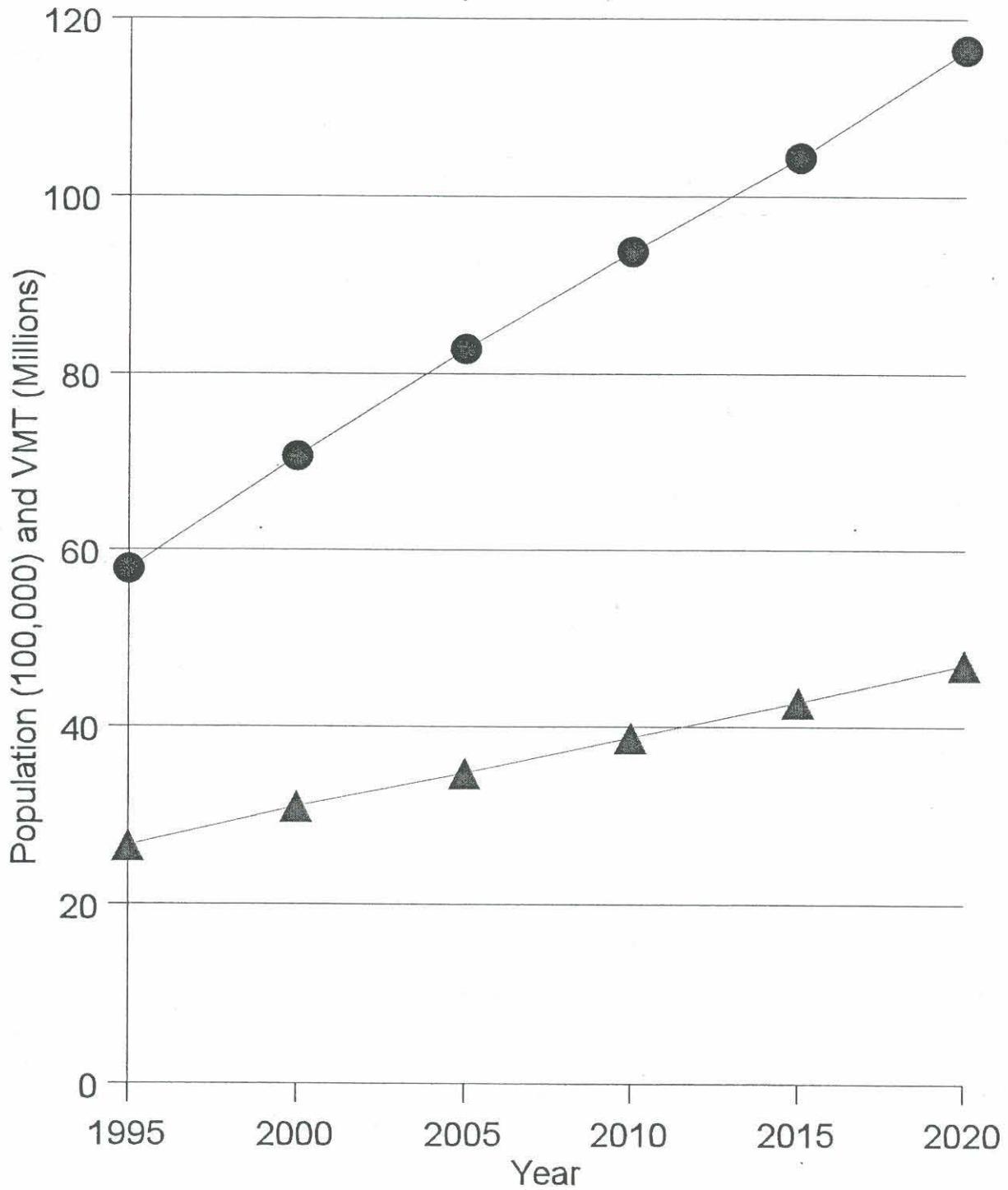
The MAG Long Range Transportation Plan (LRTP) provides multimodal policy direction for all modes of transportation through the year 2022. The Plan includes the traditional elements of freeways, streets, transit and airports. In 1992, a bicycle plan was completed and the pedestrian element was updated in 1995. An update to the off road system is currently underway. Demand Management is also an element of the MAG Transportation Planning Process.

The MAG travel demand models were applied to assess performance of the LRTP in 2022 for a variety of system indicators. Results of the assessment were then compared to the results from the no-build scenario.¹¹

¹¹ The 2022bld travel demand model assignment was used for the plan scenario and the 2022nb assignment, for the no-build scenario. These assignments were prepared in May, 2002 for the 2002 Conformity Analysis.

FIGURE II-1

Trends in Population and VMT



- ▲ Population in Modeling Area
- Vehicle Miles Traveled (VMT)

The 2022 Plan scenario represents completion of the LRTP. It includes completion of the freeway system, a 40 percent increase in arterial lane miles, a tripling of local bus service, a tripling of van pools, a quadrupling of express bus service and construction of a 39 mile light rail system. The no-build scenario consists of the transportation system as it exists in 2002, combined with the amount of travel demand that is projected for 2022. This comparison serves to highlight the effect that the completion of the planned improvements will have on the performance of the system.

Table II-5 presents the performance statistics that result from this comparison. Daily VMT is four percent higher for the Plan scenario. The amount of travel on the freeways is 17% higher due to the construction of 652 more freeway lane miles in the Plan. With the transportation improvements contained in the Plan, PM peak hours of delay decrease by more than three-quarters and the average PM peak hour speed is two and one-half times the no-build speed.

**Table II-5: Performance of the 2022 Plan Compared
With the 2022 No-Build Scenario**

Characteristics of Travel Demand	2022 No-Build	2022 Plan	% Diff
Total Daily VMT (millions)	116.8	121.4	4.0%
Daily VMT on Freeways (millions)	36.7	43.1	17.4%
PM Peak Hours of Delay (thousands)	721.3	172.4	-76.1%
PM Peak Hour Speed (mph)	9.3	23.5	152.7%

TIP Performance

The FY 2003-2007 MAG Transportation Improvement Program (TIP) serves as a five-year regional guide for the preservation, management and expansion of public transportation services based on committed funding. Projects include highway, street, transit, demand management and alternative mode improvements. The TIP comprises approximately 948 highway projects and 316 transit projects totaling \$4.5 billion in programmed obligations for the five year period. To determine the impact programmed improvements have on the overall performance of the transportation network, the TIP was compared with a no-build scenario. The no-build scenario is the amount of travel anticipated for 2006 assigned to the year 2002 transportation system.

Table II-6 presents the performance statistics that result from a comparison of completion of the projects in the TIP through 2006 with a 2006 no-build scenario. Daily VMT is about one percent higher with the TIP improvements and travel on freeways increases by nearly eight percent. With the improvements in the TIP, PM peak hour delay decreases by one-

third and PM peak hour speeds are twenty percent higher than the no-build scenario.

Table II-6: Performance of the 2006 TIP Compared with the 2006 No-Build Scenario ¹²

Characteristics of Travel Demand	2006 No-Build	2006 TIP	% Change
Total Daily VMT (millions)	84.7	85.4	0.9%
Daily VMT on Freeways (millions)	29.2	31.4	7.6%
PM Peak Hours of Delay (thousands)	119.9	78.7	-34.3%
PM Peak Hour Speed (mph)	23.1	27.7	19.9%

Congestion Management System (CMS) Performance Measures

Roadways

Current freeway congestion is mapped in Figure II-2¹³, shown on the following page. The congested freeway lane miles for 2002 and the 2022 no-build scenario are compared in Table II-7. If nothing is done to build new roads, widen existing roads, and improve transit service, the congested freeway lane miles will almost triple over the next twenty years. In addition, more than 60% of the freeway lane miles will become congested.

Table II-7: Lane Miles of Congested Freeway - 2002 Compared with 2022 No-Build Scenario

Congestion Level (V/C Ratios)	Lane Miles of Freeway		
	2002 Conditions ¹⁴	2022 No Build ¹⁵	Difference
Not Congested	810	422	-48%
Near Congested	570	231	-59%
Congested	386	1,113	188%
Total	1,766	1,766	0%

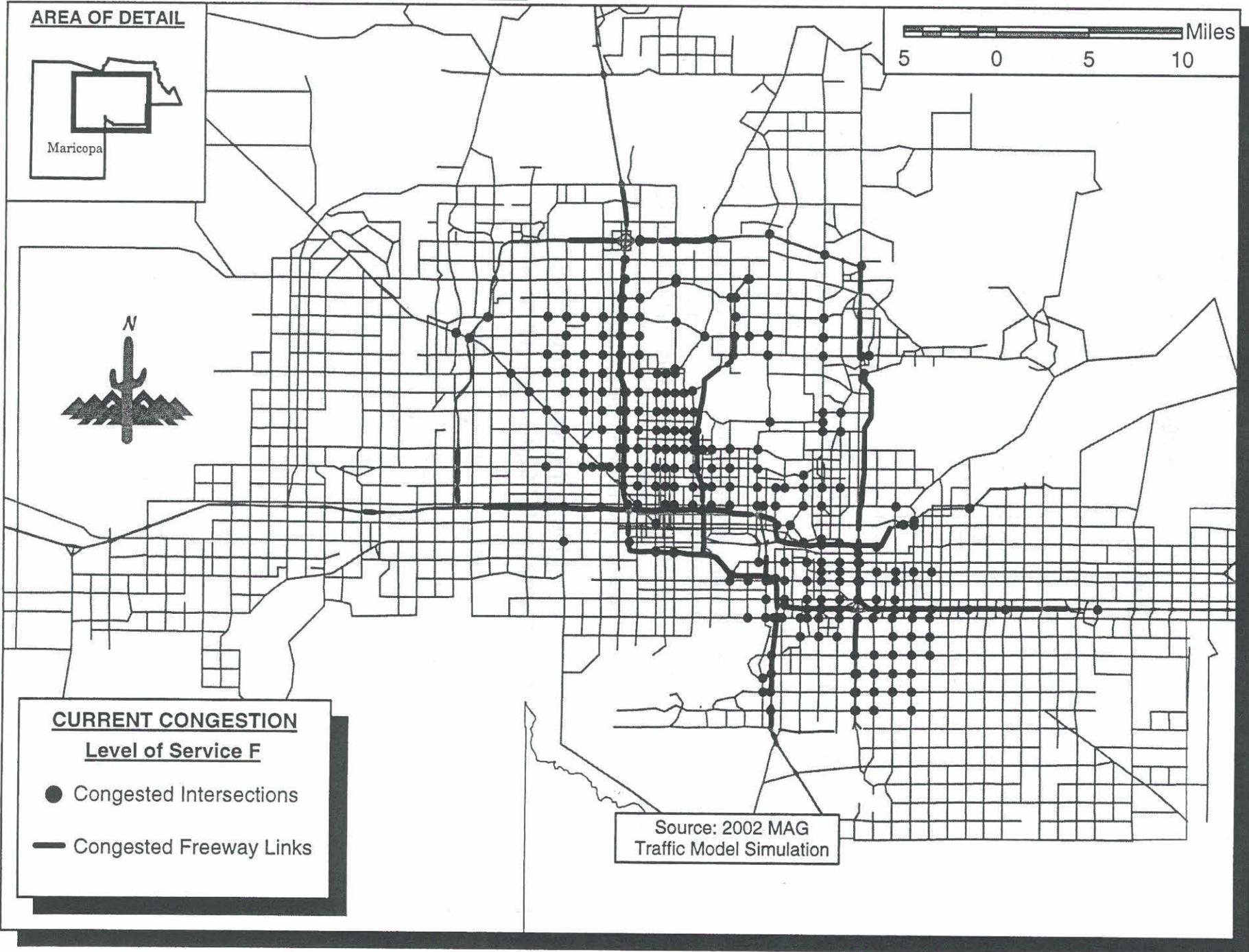
¹² The 2006bld travel demand model assignment was used for the TIP scenario and the 2006nld assignment, for the no-build scenario. These assignments were prepared in May, 2002 for the 2002 Conformity Analysis.

¹³ 2002 MAG travel demand model assignment, prepared in May 2002.

¹⁴ 2001 MAG travel demand model assignment.

¹⁵ 2021NB MAG travel demand model assignment

FIGURE II-2: CURRENT CONGESTION



Transit

Several possible measures of transit performance were initially evaluated as candidates for the Congestion Management System. Load factor (actual ridership as a percent of vehicle capacity) is the most direct measure of transit capacity. However, it is only collected for the express routes in the MAG region. The Regional Public Transit Authority (RPTA) also collects information on passengers per day and passengers per mile. After careful consideration, passengers per mile, as measured by boardings per mile of bus travel was selected as the proposed performance criteria. Current performance rating criteria are shown in Table II-8 below.

Table II-8: Transit Performance Criteria

Serious	>3	passengers per mile (ppm), current line
High	2-3	ppm, current line
Medium	1-2	ppm, current line
Low	<1	ppm, current line

Current transit boardings per mile for each bus on regular routes in FY 2001 are displayed in Table II-9A. Based upon ridership statistics provided by RPTA, 15 percent of all RPTA routes have daily ridership exceeding three ppm. Seventeen percent of all RPTA routes have daily ridership between two and three ppm, 29 percent have daily ridership ranging between one and two ppm, and 39 percent of the routes have daily ridership below one ppm.

Bicycles

Bicycle routes are defined by the MAG Bicycle Plan, which is updated periodically by the MAG Bicycle Task Force. To date, approximately 124 of the 662 planned miles of the bicycle system have been constructed. Obviously, there are many gaps in the system. These gaps affect both the choice of routes and the decision to use the bicycle mode in the first place. Therefore, the primary measure of bicycle performance is the availability of bike lanes, and whether they are full 4-foot wide striped lanes or merely wide outside lanes marked by bike route signs.

Bicycle performance also exhibits relative levels of severity. Depending on the peak hour volumes of traffic in a given corridor, the general performance of the bicycle system may depend more on the levels of arterial congestion along or near its routes than it does on the quality of the bicycle route itself. Therefore, for the purposes of the CMS, bicycle performance is to be considered relative to the performance of the arterial on which the bike facility is located.

**Table II-9A: FY 2001 Boardings per Mile on
Regular Routes on a Typical Weekday***

Route #	Boardings Per Mile						
Blue	2.1	28	1.8	67	2.0	112	0.3
Green	4.0	30	0.8	68	0.5	120	0.7
Red	3.3	35	2.8	70	0.4	122	0.6
Yellow	1.0	40	0.9	72	1.3	124	0.2
0	3.7	41	3.2	76	0.3	131	0.3
3	3.4	43	2.2	77	1.2	136	0.4
7	2.8	44	1.3	80	2.0	138	0.9
8	2.8	45	1.6	81	0.7	146	0.1
10	4.1	50	3.2	84	0.2	156	0.7
12	2.4	52	1.6	90	1.8	170	1.3
13	1.3	56	1.0	92	0.9	184	0.1
15	2.9	59	1.4	96	1.1	186	0.5
16	3.7	60	2.1	104	1.2		
17	3.7	61	1.7	106	1.4	DASH	2.4
19	3.7	62	0.8	108	0.4	FLASH	0.8
24	3.0	65	0.8	109	0.3	GUS	0.6
27	2.6	66	0.8	112	1.7		

* Based on data in the Annual Short Range Transit Report, Fiscal Year 2002-2006 (RPTA)

Current transit boardings per mile (BPM) for each bus on express routes in FY 2001 are displayed in Table II-9B below:

**Table II-9B: FY 2001 Boardings per Mile (BPM) on
Express Routes on a Typical Weekday ***

Route #	BPM						
500	0.7	521	0.9	560	1.4	590	0.9
501	0.8	531	0.9	561	0.8	591	1.3
502	0.5	532	1.0	570	0.8	592	0.8
510	0.7	533	1.1	580	1.0		
512	0.7	540	1.1	581	1.3		
520	0.6	541	1.1	582	0.7		

* Based on data in the Annual Short Range Transit Report, Fiscal Year 2002-2006 (RPTA)

SECTION III

CONGESTION MANAGEMENT SYSTEM

The MAG Congestion Management System (CMS) is designed to address congestion problems in the region. It includes all surface transportation modes and provides decision makers with a systematic basis for analyzing and evaluating the congestion impacts of transportation projects. A report entitled Congestion Management System (MAG, 1994) contains a detailed description of the MAG CMS. System level outputs from the MAG CMS are discussed in Section II of this report.

Regulations

The CMS was developed by MAG according to the ISTEA Interim Final Rules for the metropolitan planning area, which includes all of Maricopa County and the Town of Apache Junction. MAG, as the designated MPO, has the responsibility for developing and implementing a CMS process that includes the following elements:

- Performance Measures
- Data Collection and System Monitoring
- Identification and Evaluation of Proposed Strategies
- Implementation of Strategies
- Evaluation of Effectiveness of Strategies.

ISTEA states that "the anticipated performance and expected benefits of traditional and nontraditional strategies that will contribute to the more efficient use of existing and future transportation systems shall be identified and evaluated based on the established performance measures."

The following eleven factors should first be considered before the decision is made to add general purpose lanes to existing roadways (factor 12):

- | | |
|---|---|
| 1. Transportation demand management measures. | 7. Congestion pricing strategies. |
| 2. Traffic operational improvements. | 8. Growth management and activity center strategies. |
| 3. HOV usage. | 9. Access management techniques. |
| 4. Public transit capital improvements. | 10. Incident management techniques on freeways. |
| 5. Public transit operational improvements. | 11. Intelligent Vehicle Highway System strategies. |
| 6. Non-traditional mode usage. | 12. The addition of general purpose lanes to existing roadways. |

CMS Documentation

Congestion Management System (MAG, 1994) describes in detail the MAG Congestion Management System and supercedes all previous CMS documents and systems developed by MAG. It was approved by the MAG Regional Council in September 1994.

Changes since the approval of the report include:

1. Replacement of project volume-to-capacity ranges with project volume-to-capacity ratios. In the CMS report, projects were assigned membership in one of four volume-to-capacity ranges to assess congestion impacts. To improve the sensitivity of the CMS to project differences, the CMS was modified to use individual project volume-to-capacity ratios directly.
2. Removal of project measures of future congestion in the CMS rating system. The CMS rating system included a volume-to-capacity ratio that was based on using projected traffic volume against current roadway capacity. This measure has been removed from the CMS rating system. The impacts of projects on future congestion is assessed at a system level in the performance chapter of this report.

Project Ranking System

Each project submitted to MAG that would potentially increase the capacity of a roadway must go through the CMS system in order for it to be included in the TIP. In order to do this, each project sponsor needs to provide certain basic data on these projects. From this information, projects can be rated and compared to each other. The rating system evaluates projects based on volume-to-capacity ratios (V/C), performance (cost) effectiveness factors, mobility zone and land use planning strategies and modal enhancements.

The CMS Rating System evaluates freeway, arterial, transit, bicycle, demand management and other related projects only against similar projects and develops modal performance statistics. Based on these, the rating system develops a ranked list of projects by mode so that the best of each mode can be compared to the best of every other mode. Once this is accomplished a system of normalized scores is developed so that each project can be equally evaluated against other projects regardless of mode or the cost of a project.

CMS projects are submitted to MAG each year for consideration for inclusion in the MAG TIP. Each submitted CMS project includes, among other items, standard background information concerning location, project description, costs, length, and fiscal year of development. In addition, CMS projects sponsors provide additional information such as present volumes (based on the recently approved regional networks such as the 1998 MAG Congestion Study), mobility zones and land use planning information, and modal enhancement features. From this information each project is included in the rating process.

Project categories such as Transportation Demand Management (TDM) and Transportation System Management (TSM) projects are also rated, but instead of a fixed point system they are evaluated using the MAG committee process to rank projects in their expert area, using among other information, the goals, policies and procedures identified in the CMS.

An integral part of the CMS rating system is the MAG Life Cycle Program which evaluates and prioritizes all freeway projects located on the MAG Freeway/Expressway System. Arizona Revised Statute 28-1597.02(B) required MAG to adopt criteria for setting priorities for freeway construction. Current freeway rating criteria as used in the MAG LRTP include:

- Congestion Relief
 - Travel Demand
 - Accident Reductions
 - Cost Effectiveness
 - Social and Community Improvements
 - Air Quality Improvements
 - System Continuity and Mobility
 - Joint Funding
-
- Establishment of a complete freeways system as rapidly as possible.
 - Construction of segments to serve regional needs.
 - Construction of segments that provide connectivity with other elements of the freeway system.

System Alternatives

The MAG Congestion Management Systems Alternatives Report states that ISTEA prohibits programming highway or capacity projects that provide a significant increase in single occupant vehicles (SOV) in transportation management areas unless the project results from an approved CMS. An analysis of reasonable travel demand reduction and operational strategies must be performed. Where the analysis demonstrates that the additional SOV capacity in a corridor is warranted, appropriate strategies for managing the proposed SOV facility or other travel demand reduction and operational strategies appropriate for the corridor must be identified.

The alternatives analysis report addressed these requirements by investigating and analyzing a wide range of techniques for mitigating traffic congestion, including travel demand management (TDM) programs, land use controls, market incentives, road improvement, transit improvements, and other modal options. Potential programs and strategies for each of these alternatives are discussed in the following paragraphs.

Employer Based TDM Programs

MAG is currently funding, with ISTEA funds, the Regional Rideshare Program, the Capitol Rideshare Program, and the County Travel Reduction Program. The alternatives report recommends other programs that can be funded either publicly or privately including:

- Programs to encourage vanpooling
- Preferential parking for carpools and vanpools
- Parking subsidies for carpools or surcharges for single occupant vehicles
- Transit subsidies
- Programs to encourage bicycle or pedestrian use
- Time shifting strategies such as staggered work hours and four day weeks
- Telecommuting

Public Sector TDM Programs

Public sector programs are typically directed toward reducing vehicular travel of all kinds or increasing capacity of existing facilities. Since the passage of ISTEA, MAG has funded or is actively promoting a number of programs aimed at reducing vehicular demand including:

- Improving the public transit system
- Improving bicycle facilities
- Improving regional traffic signal coordination
- Constructing High Occupant Vehicle facilities on freeways

Land Use Controls

Land use controls implemented by local governments can dramatically alter the demand for travel. However, these types of controls are typically difficult to implement and are geared for long term results rather than immediate congestion relief. The MAG CMS rating system for individual projects gives considerable weight to those jurisdictions that have actively pursued land use controls that reduce travel demand. Typical land use controls that help reduce travel demand include:

- Increasing the density of development in activity centers. This decreases average trip length and shifts some trips from vehicle driving to walking, bicycling or transit. However, care should be given to this strategy due to the sometimes undesirable effects this type of development may have on localized air quality and congestion levels.
- Careful site planning for transit oriented development and other mixed use developments in order to encourage walking and transit use, and reduce the length of some vehicle trips.
- Promoting mixed use developments. Combining several destinations at one location can reduce overall travel demand.
- Encouraging policies and plans which balance regional jobs and housing in order to minimize work trip lengths.

Market Incentives

The Systems Alternatives Report analyzed the effects of market incentives with respect to how effective they were in influencing travel demand. Nationally, experience suggests that shifting of travelers from SOV's to alternative modes on a congested peak period travel network is cost effective to society, employers and individual travelers. The cost to persuade someone to change their mode from a SOV appears to be less than the benefit received by society from the switch. Market incentives that should be considered include:

- Parking charges
- Preferential parking
- Transportation allowances
- Employer/government based studies
- In-kind services
- Congestion pricing
- Taxes and fees

Transit Improvements

Transit service options in Maricopa County and other areas of the country that have proven to be effective in reducing SOV travel demand include:

- Fixed route bus service
- Express bus service
- Intercity connections
- Dial-a-Ride services
- Subscription bus service
- Busway HOV facilities
- Queue bypasses for buses
- Park-and-ride lots
- Transit centers
- Freeway bus transit stations

Road Improvements

Road improvements that increase SOV capacity can be considered only after all other reasonable travel demand reduction and operational strategies have been performed. If it is determined that road improvements are warranted the following alternatives should be considered:

- Improvements to the MAG freeway system
- New roadway capacity (e.g., freeways, Roads of Regional Significance and arterials)
- Intersection improvements
- HOV facilities
- Intelligent Transportation Systems (ITS) such as freeway management systems, computerized traffic signal systems, ramp metering and motorist information systems
- Access control management
- Reversible lanes and one-way streets

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SECTION IV

SAFETY ISSUES

The following section concerns safety issues and data that should be taken into account in the programming and planning of transportation projects in the MAG area. This section includes specific sections on information sources, safety trends and high accident locations.

Safety Management System (SMS)

The development of a regional SMS is programmed in the FY 2003-2007 MAG Transportation Improvement Program for fiscal year 2005. It is anticipated that this effort will be conducted by ADOT, working in cooperation with MAG and the RPTA/Valley Metro.

Information Sources

MAG member agencies monitor safety conditions on facilities they own and operate. To obtain this information, please contact MAG member agencies directly.

A common reporting mechanism for collecting information on motor vehicle crashes has been implemented statewide. This data is compiled by the ADOT Traffic Records Section and is housed in a statewide database called the Accident Location Identification Surveillance System (ALISS). Summary information from this database is reported annually by ADOT. For more information on this database and ADOT safety reports, please contact the ADOT Traffic Records Section at (602) 712-7437 or visit the ADOT website <http://www.dot.state.az.us>.

The National Highway Traffic Safety Administration (NHTSA) has also developed a fatal accident database known as the Fatality Analysis Reporting System (FARS). FARS data may be obtained by visiting the NHTSA website at <http://www.nhtsa.dot.gov>. The NHTSA also provides reports on national and state safety issues.

Safety Statistics and Trends ¹

Accident data from 1990 through 2000 are listed in Table IV-1. This data is based on ADOT and NHTSA information. Rates for crashes, injuries and fatalities are expressed as accidents per 100,000 people. All dollar amounts listed in Table IV-1 were converted to constant 2002 dollars using the consumer price index.

¹ All data in this section is based on information contained in Arizona Motor Vehicle Crash Facts or on the ADOT website.

Total economic loss in Maricopa County over the 1990-2000 period is estimated at approximately \$14.7 billion. This amounts to approximately \$523 per year, per person over the period. Since 1996, economic loss per capita has declined from \$520 per person to \$519 per person – virtually no change. In 2000, total economic loss in Maricopa County is estimated at over \$1.6 billion.

In 2000, 86,688 crashes were reported in Maricopa County and there were over 754,000 reported crashes over the 1990-2000 period. Since 1993, the number of reported crashes in Maricopa County per 100,000 people has been consistently above that of the nation, and while the County crash rate has been relatively stable, the national rate has declined.

From 1990 through 2000, the number of injuries reported per 100,000 people has declined in Maricopa County, but has consistently been above the national rate. In 2000, the number of injuries per 100,000 people in Maricopa County was 1,643, while for the nation it was 1,159. There were 50,883 reported injuries in 2000 and 484,793 injuries reported over the 1990-2000 period.

In 2000, there were 433 reported traffic fatalities, and over the 1990-2000 period, 4,183 fatalities were reported. Except for 1995, reported fatalities per 100,000 people in Maricopa was less than that of nation. In Maricopa County from 1990 to 2000, fatalities per 100,000 people declined by approximately 14 percent. For the nation, fatalities per 100,000 people declined 15 percent over the 1990-2000 period.

Intersection Safety Data

Crash data used in Table IV-2 and Figures IV-1, IV-2 and IV-3 are based on ALISS data for 2001 and include only intersection related fatal and injury crashes. Traffic data used to calculate crash rates are primarily based on data collected for the 1998 MAG Congestion Study and the 1998 MAG Weekday Average Traffic map.

Table IV-2 lists intersection data that is mapped in Figures IV-1, IV-2 and IV-3. Accident rates were calculated by dividing total accidents by annualized approach volumes² and multiplying by 1 million. The overall rank was developed by calculating z-scores for values in the accident and accident rate columns. Z-scores for each intersection were then added together and used to sort the data so that rankings could be assigned.

² The approach volumes were annualized by multiplying them by 0.91 and then multiplying by 365.

Table IV-1: Safety Trends in Maricopa County - 1990 through 2000

Year	Pop ³ (000)	Economic Loss (2002 Dollars) ⁴		Crashes			Injuries			Fatalities		
		Total Loss (Millions)	Total Loss per Capita ⁵	Maricopa County		U.S.	Maricopa County		U.S.	Maricopa County		U.S.
				Total	Rate ⁶	Rate	Total	Rate ⁷	Rate	Total	Rate ⁸	Rate
1990	2,130	\$675	\$317	56,079	2,633	2,594	39,307	1,845	1,295	348	16.3	17.9
1991	2,181	\$836	\$383	51,401	2,357	2,426	35,265	1,617	1,228	296	13.6	16.5
1992	2,241	\$1,174	\$524	53,485	2,387	2,353	37,411	1,669	1,204	311	13.9	15.4
1993	2,319	\$1,445	\$623	59,873	2,582	2,369	41,435	1,787	1,222	322	13.9	15.6
1994	2,416	\$1,509	\$625	66,773	2,764	2,495	45,511	1,884	1,225	377	15.6	15.6
1995	2,529	\$1,861	\$736	72,358	2,861	2,549	47,630	1,883	1,319	452	17.9	15.9
1996	2,634	\$1,370	\$520	72,976	2,771	2,553	47,587	1,807	1,313	397	15.1	15.9
1997	2,741	\$1,400	\$511	73,616	2,686	2,474	44,801	1,634	1,250	400	14.6	15.7
1998	2,845	\$1,385	\$487	78,395	2,756	2,344	46,528	1,635	1,181	412	14.5	15.4
1999	2,968	\$1,425	\$480	83,070	2,799	2,303	48,435	1,632	1,187	435	14.7	15.3
2000	3097	\$1,609	\$519	86,688	2,799	2,323,780	50,883	1,643	1,159	433	14.0	15.20
Total	-----	\$14,688	-----	754,714	-----	-----	484,793	-----	-----	4,183	-----	-----

3 Draft Revised Population - Maricopa County - 1990 to 2000 (Maricopa Association of Governments, December 2001);

4 The consumer price index was used to convert dollars amounts listed in ADOT sources to 2002 constant dollars. Also, reporting or estimating procedures seem to have changed in 1996, resulting in a sharp drop in estimated economic loss in that year despite increases in the number of crashes, injuries and fatalities;

5 The data in this column was calculated using the following formula: Total Economic Loss Col * 1,000,000 / (Population Col * 1,000);

6 Total crashes per 100,000 people. Calculated using the following formula: Total Crashes Col * 100,000 / (Population Col * 1,000);

7 Total injuries per 100,000 people. Calculated using the following formula: Total Injuries Col * 100,000 / (Population Col * 1,000);

8 Total fatalities per 100,000 people. Calculated using the following formula Total Fatalities Col * 100,000 / (Population Col * 1,000).

Figure IV-2: 2001 Intersection Crash Data

Intersection	Daily Approach Volume ^a	Number of Fatal and Injury Crashes ^b				Fatal and Injury Crashes per Million Entering Vehicles ^c		Overall Rank
		Injury	Fatal	Total	Rank	Crash Rate	Rank	
43rd Ave at Peoria Ave	73,500	32	1	33	1.0	1.35	9.0	1.0
67th Ave at Indian School Rd	67,500	31	0	31	2.0	1.38	6.0	2.0
59th Ave at Indian School Rd	68,000	30	1	31	2.0	1.37	7.0	3.0
16th St at Broadway Rd	39,000	22	2	24	10.0	1.85	2.0	4.0
59th Ave at Thomas Rd	61,500	27	1	28	5.0	1.37	8.0	5.0
Central Ave at Southern Ave	26,000	18	0	18	37.0	2.08	1.0	6.0
Bell Rd at Cave Creek Rd	81,000	28	1	29	4.0	1.08	20.0	7.0
67th Ave at McDowell Rd	58,500	23	2	25	8.0	1.29	11.0	8.0
43rd Ave at McDowell Rd	61,000	25	0	25	8.0	1.23	13.0	9.0
59th Ave at McDowell Rd	52,500	22	1	23	12.0	1.32	10.0	10.0
19th Ave at Dunlap Ave	82,000	27	0	27	6.0	0.99	27.0	11.0
51st Ave at Indian School Rd	75,000	25	1	26	7.0	1.04	22.0	12.0
67th Ave at Thomas Rd	62,500	24	0	24	10.0	1.16	16.0	13.0
40th St at Southern Ave	25,500	15	0	15	68.0	1.77	3.0	14.0
Broadway Rd at Central Ave	36,500	17	1	18	37.0	1.48	4.0	15.0
24th St at Roosevelt St	36,000	17	0	17	45.0	1.42	5.0	16.0
24th St at McDowell Rd	57,500	20	1	21	17.0	1.10	19.0	17.0
19th Ave at Camelback Rd	66,000	22	0	22	15.0	1	26.0	18.0
75th Ave at Indian School Rd	52,500	20	0	20	22.0	1.15	17.0	19.0
35th Ave at Camelback Rd	59,500	21	0	21	17.0	1.06	21.0	20.0
43rd Ave at Glendale Ave	67,000	22	0	22	15.0	0.99	28.0	21.0
27th Ave at Indian School Rd	78,500	23	0	23	12.0	0.88	40.0	22.0
83rd Ave at Indian School Rd	45,500	18	0	18	37.0	1.19	15.0	23.0
Cave Creek Rd at Greenway Pkwy	89,500	23	0	23	12.0	0.77	53.0	24.0
35th Ave at McDowell Rd	69,500	20	1	21	17.0	0.91	35.0	25.0
16th St at McDowell Rd	64,500	20	0	20	22.0	0.93	33.0	26.0
35th Ave at Thomas Rd	59,000	17	2	19	32.0	0.97	29.0	27.0

Figure IV-2: 2001 Intersection Crash Data

Intersection	Daily Approach Volume ^a	Number of Fatal and Injury Crashes ^b				Fatal and Injury Crashes per Million Entering Vehicles ^c		Overall Rank
		Injury	Fatal	Total	Rank	Crash Rate	Rank	
Val Vista Dr at US 60 ^f	36,000	15	0	15	68.0	1.25	12.0	28.0
32nd St at McDowell Rd	68,000	20	0	20	22.0	0.89	39.0	29.0
24th St at Thomas Rd	68,500	20	0	20	22.0	0.88	41.0	30.0
7th St at Southern Ave	37,000	15	0	15	68.0	1.22	14.0	31.0
19th Ave at Greenway Rd	72,000	20	0	20	22.0	0.84	43.0	32.0
27th Ave at Bethany Home Rd	63,000	19	0	19	32.0	0.91	36.0	33.0
35th Ave at Peoria Ave	83,000	21	0	21	17.0	0.76	55.0	34.0
Mesa Dr at Southern Ave	72,350 ^f	20	0	20	22.0	0.83	44.0	35.0
7th St at Northern Ave	83,500	21	0	21	17.0	0.76	57.0	36.0
35th Ave at Bethany Home Rd	63,500	19	0	19	32.0	0.9	37.0	37.0
19th Ave at Northern Ave	73,500	19	1	20	22.0	0.82	45.0	38.0
75th Ave at Thomas Rd	50,000	17	0	17	45.0	1.02	24.0	39.0
Broadway Rd at Stapley Dr	58,150 ^f	18	0	18	37.0	0.93	34.0	40.0
35th Ave at Northern Ave	77,500	19	1	20	22.0	0.78	52.0	41.0
I-17 at Greenway Rd	40,000	15	0	15	68.0	1.13	18.0	42.0
35th Ave at Thunderbird Rd	79,500	20	0	20	22.0	0.76	56.0	43.0
Arizona Ave at Warner Rd	60,500 ^e	18	0	18	37.0	0.9	38.0	44.0
19th Ave at Peoria Ave	71,000	19	0	19	32.0	0.81	49.0	45.0
19th Ave at Indian School Rd	83,000	20	0	20	22.0	0.73	61.0	46.0
16th St at Camelback Rd	72,500	19	0	19	32.0	0.79	51.0	47.0
35th Ave at Van Buren St	63,000	18	0	18	37.0	0.86	42.0	48.0
32nd St at Broadway Rd	43,500	15	0	15	68.0	1.04	23.0	49.0
Brown Rd at Mesa Dr	51,250 ^f	16	0	16	58.0	0.94	32.0	50.0
7th St at Buckeye Rd	45,000	15	0	15	68.0	1	25.0	51.0
67th Ave at Camelback Rd	62,500	16	1	17	45.0	0.82	46.0	52.0
Broadway Rd at Higley Rd	47,500 ^f	15	0	15	68.0	0.95	30.0	53.0
7th Ave at Camelback Rd	74,000	18	0	18	37.0	0.73	60.0	54.0

Figure IV-2: 2001 Intersection Crash Data

Intersection	Daily Approach Volume ^a	Number of Fatal and Injury Crashes ^b				Fatal and Injury Crashes per Million Entering Vehicles ^c		Overall Rank
		Injury	Fatal	Total	Rank	Crash Rate	Rank	
Gilbert Rd at University Dr	63,900 ^f	17	0	17	45.0	0.8	50.0	55.0
Cooper Rd at Guadalupe Rd	48,000	15	0	15	68.0	0.94	31.0	56.0
Southern Ave at Stapley Dr	66,250 ^f	16	1	17	45.0	0.77	54.0	57.0
19th Ave at Union Hills Dr	69,000	17	0	17	45.0	0.74	58.0	58.0
43rd Ave at Thomas Rd	73,500	17	0	17	45.0	0.7	66.0	59.0
32nd St at Bell Rd	87,000	18	0	18	37.0	0.62	81.0	60.0
16th St at Thomas Rd	74,500	17	0	17	45.0	0.69	70.0	61.0
Arizona Ave at Ray Rd	75,100 ^e	17	0	17	45.0	0.68	72.0	62.0
64th St at McDowell Rd	55,500	15	0	15	68.0	0.81	47.0	63.0
16th St at Van Buren St	55,500	15	0	15	68.0	0.81	47.0	63.0
7th St at Bell Rd	79,500	17	0	17	45.0	0.64	77.0	65.0
Tatum Blvd at Thunderbird Rd	67,500	16	0	16	58.0	0.71	63.0	66.0
16th St at Indian School Rd	80,000	17	0	17	45.0	0.64	78.0	67.0
92nd St at Shea Blvd	80,687 ^g	17	0	17	45.0	0.63	79.0	68.0
51st Ave at Thunderbird Rd	69,500	16	0	16	58.0	0.69	68.0	69.0
7th St at Camelback Rd	82,500	17	0	17	45.0	0.62	82.0	70.0
43rd Ave at Northern Ave	70,000	16	0	16	58.0	0.69	69.0	71.0
40th St at Bell Rd	71,500	16	0	16	58.0	0.67	73.0	72.0
Broadway Rd at Mesa Dr	60,950 ^f	15	0	15	68.0	0.74	59.0	73.0
51st Ave at McDowell Rd	63,000	15	0	15	68.0	0.72	62.0	74.0
Frank Lloyd Wright Blvd at Scottsdale Rd	64,500	15	0	15	68.0	0.7	64.0	75.0
Baseline Rd at Val Vista Dr	64,800 ^f	15	0	15	68.0	0.7	65.0	76.0
27th Ave at Camelback Rd	65,000	14	1	15	68.0	0.69	67.0	77.0
19th Ave at Bethany Home Rd	66,000	15	0	15	68.0	0.68	71.0	78.0
44th St at McDowell Rd	79,500	15	1	16	58.0	0.61	84.0	79.0
Center St at McKellips Rd	67,300 ^f	15	0	15	68.0	0.67	74.0	80.0

Figure IV-2: 2001 Intersection Crash Data

Intersection	Daily Approach Volume ^a	Number of Fatal and Injury Crashes ^b				Fatal and Injury Crashes per Million Entering Vehicles ^c		Overall Rank
		Injury	Fatal	Total	Rank	Crash Rate	Rank	
43rd Ave at Indian School Rd	81,500	16	0	16	58.0	0.59	86.0	81.0
7th St at McDowell Rd	82,000	16	0	16	58.0	0.59	87.0	82.0
19th Ave at Thunderbird Rd	83,000	16	0	16	58.0	0.58	88.0	83.0
51st Ave at Thomas Rd	69,500	14	1	15	68.0	0.65	75.0	84.0
19th Ave at Bell Rd	83,500	16	0	16	58.0	0.58	89.0	85.0
32nd St at Thomas Rd	70,000	15	0	15	68.0	0.65	76.0	86.0
Country Club Dr at University Dr	71,750 ^f	14	1	15	68.0	0.63	80.0	87.0
43rd Ave at Dunlap Ave	73,000	15	0	15	68.0	0.62	83.0	88.0
35th Ave at Dunlap Ave	75,500	15	0	15	68.0	0.6	85.0	89.0
32nd St at Camelback Rd	78,500	15	0	15	68.0	0.58	90.0	90.0
7th St at Indian School Rd	88,500	15	0	15	68.0	0.51	91.0	91.0

- a. Unless specifically noted, the traffic volume used is based on 1998 Average Weekday Traffic (Maricopa Association of Governments, September 1999).
- b. Based on data in the Accident Location Information and Surveillance System (ADOT Traffic Records Section) as of May 15, 2002. Crashes included in these columns are those indicated in the ALISS database as being intersection related and involving either a reported fatality or injury that occurred over the 1/1/2001 - 12/30/2001 period.
- c. This column was calculated using the following formula: "Fatal and Injury Crashes" column value / ((("Approach Volume" column value) x 0.91) x 365 Days) / 1,000,000)
- d. The overall rank was calculated using a composite index that is an equally weighted normalized score of the total crashes column and the crash rate column. The overall rank was calculated as follows:
 (1) A z-score was calculate for values in total crash column.
 (2) A z-score was calculated for values in the crash rate column
 (3) The z-scores for each intersection were added together and then sorted and replaced with rankings.
- e. Based on 2001 City of Chandler Intersection Traffic Volumes (City of Chandler).
- f. Based on 2001 Traffic Volume Map (City of Mesa).
- g. Based on City of Scottsdale traffic count for 1/11/2000. Note: traffic volumes for this intersection have declined since the opening of the Pima Freeway.

FIGURE IV-1: HIGH ACCIDENT LOCATIONS

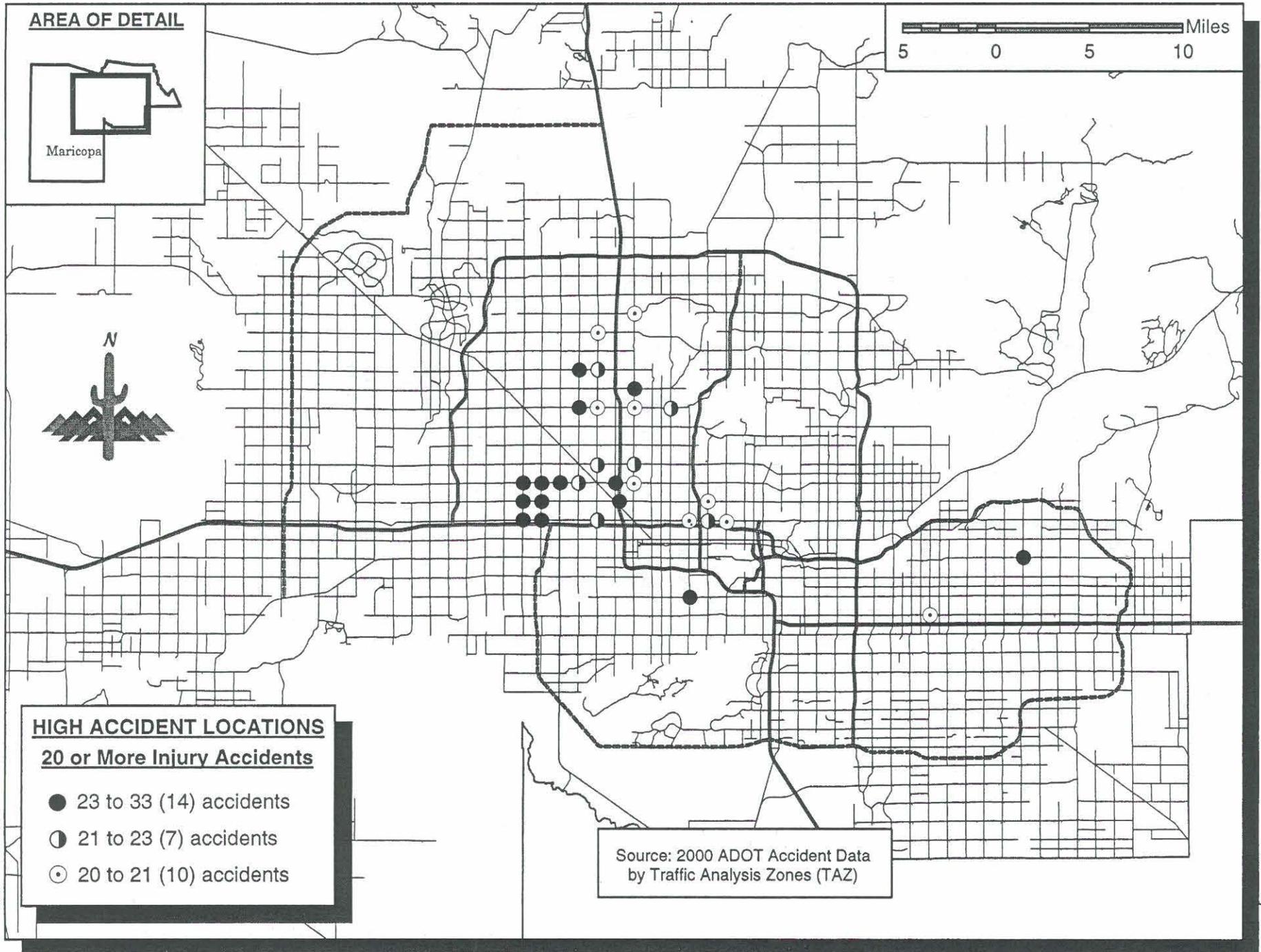


FIGURE IV-2: HIGH ACCIDENT RATE LOCATIONS

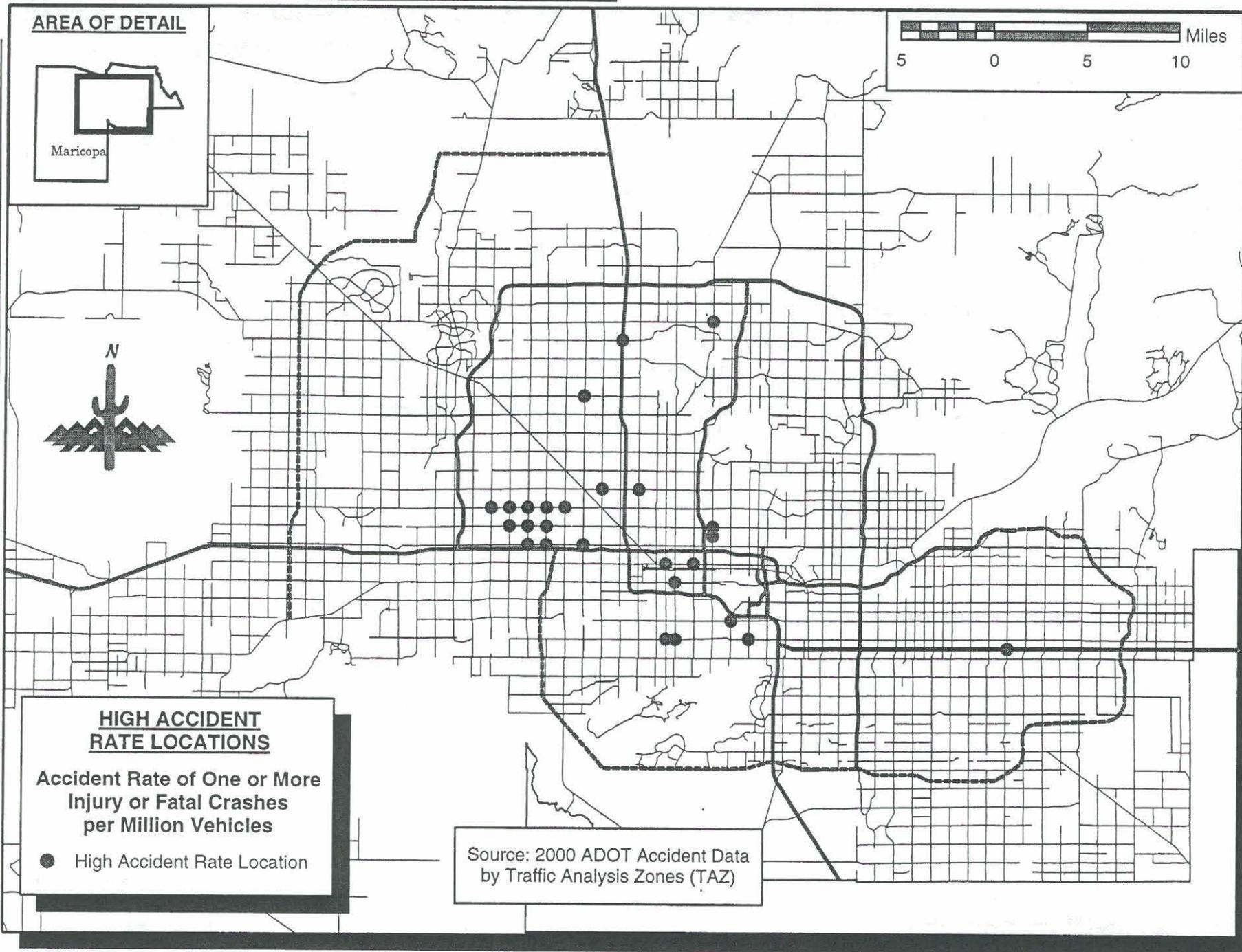
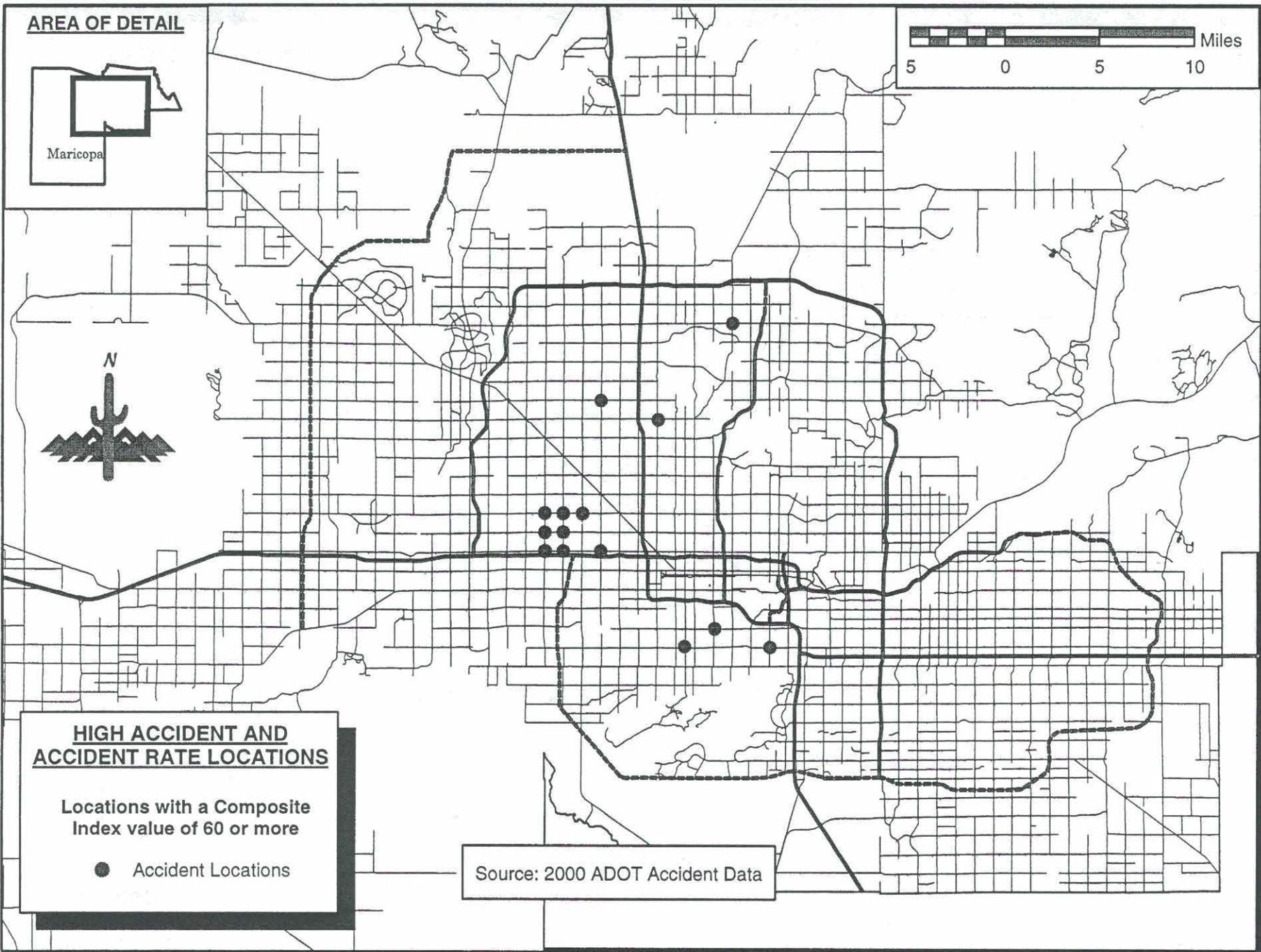


FIGURE IV-3: HIGH ACCIDENT AND ACCIDENT RATE LOCATIONS



SECTION V

SYSTEM PRESERVATION

This section contains regional information from the Intermodal Management System, the Pavement Management System and the Bridge Management System. These management systems are identified in the Transportation Equity Act for the 21st Century and are designed “... to provide a framework for cost-effective decision making to enhance transportation service at reduced public and private life cycle cost ...” and focus on preserving and addressing infrastructure needs.

Pavement Management System

Federal regulations define a Pavement Management System (PMS) as a systematic process that provides information for use in implementing cost-effective pavement reconstruction, rehabilitation, and preventative maintenance programs and that results in pavements designed to accommodate current and forecasted traffic in a safe, durable, and cost-effective manner. The American Association of State Highway and Transportation Officials (AASHTO) has developed a report – AASHTO Guidelines for Pavement Management Systems (AASHTO, July 1990) – to aid state and local agencies in the development of a PMS.

ADOT has developed and implemented a PMS for the State Highway System. Other MAG member agencies have developed PMSs for roads within their jurisdiction. Table V-1 in the back lists key characteristics of existing PMSs. These systems do not yield comparable estimates as they rely on different measurement systems.

Bridge Management System

ADOT is the lead agency for the development and implementation of a Bridge Management System (BMS). The BMS that has been developed includes a computer database of bridge information, a software system for providing the analytical capabilities suggested by federal regulations and an on-going process for inspecting and collecting information on bridges throughout Arizona. In the MAG area, the City of Phoenix and Maricopa County and other MAG member agencies are involved in the inspection of bridges and the collection of bridge data.

Based on the information in the BMS, bridges are assigned a sufficiency rating. This rating takes into account: structural adequacy and safety, serviceability and functional obsolescence, and importance for public use. Bridges with a sufficiency rating of 100 are deemed fully sufficient and not in need of repair or reconstruction. Bridges with sufficiency ratings below 70 are deemed in need of repair and are given priority in the allocation of

federal funding for bridges. This federal funding is available to all MAG member agencies and is administered by ADOT.

Table V-2 in the back lists projects with sufficiency ratings below 70. Figure V-1 in the back lists bridges with sufficiency ratings of 75 or below. Bridges that are listed on Table V-2 or whose location is shown on Figure V-1 are eligible for federal bridge funds (See Section IX on how to apply for federal bridge funds). For more information on the BMS and bridge sufficiency ratings please contact the ADOT Bridge Management Section at (602) 712-8616.

Intermodal Management System

Federal regulations indicate that an effective Intermodal Management System (IMS) for intermodal facilities and systems is one that “... *provides efficient, safe, and convenient movement of people and goods through integration of transportation facilities and systems and improvement in the coordination in planning, and implementation of air, water, and the various land-based transportation facilities and systems ...*” [23 CFR §500.111].

At a minimum, an IMS is to include the following:

- (a) The establishment of performance measures;
- (b) The identification of key linkages between one or more modes of transportation, where the performance or use of one mode will affect another;
- (c) The definition of strategies for improving the effectiveness of these modal interactions; and
- (d) The evaluation and implementation of these strategies to enhance the overall performance of the transportation system.

In close coordination with ADOT, the private sector and MAG member agencies, MAG established an IMS in accord with federal requirements. This system includes a survey of intermodal needs and facilities that was conducted in 1995. Figure V-2 shows the location of key intermodal facilities and Table V-3 lists projects needs as identified in the 1995 survey.

MAG has also established an Intermodal Working Group and conducts periodic forums with representatives from the freight community and MAG member agencies to identify and evaluate intermodal projects and to develop strategies for addressing intermodal needs.

Management System Data and Maps

The follow section contains maps and tables of information that should be considered in the development of projects for the MAG Transportation Improvement Program. Table V-1 lists PMS information. BMS information is included in Table V-2 and Figure V-1. IMS information is included in Figure V-2 and Table V-3.

TABLE V-1: EXISTING PAVEMENT MANAGEMENT SYSTEMS

Jurisdiction	PMS Software	Pavement Data	Frequency	Comments
ADOT	NOS	Full Range	Annually	Network Optimization Software designed by consultant. Inertial Profilometers used.
Apache Junction	CarteGraph	Full Range	3 Years	Visual inspection and evaluation as needed.
Chandler	Stantec PMA	Full Range	3 Years	Visual inspection and evaluation as needed.
El Mirage	None	Good Range	Annually	Visual inspection and evaluation as needed.
Fountain Hills	None	Good Range	5 Years	Visual inspections and Inventory stored on Q&A database.
Gilbert	Chec PMS	Good Range	Annually	Visual inspection and manual system. Implementing a software based system.
Glendale	Mixed system	Full Range	3 Years	Inventory collected visually.
Goodyear	Carte-Graph System	Full Range	Annually	Visual inspection.
Litchfield Park	None	Good Range	Annually	Visual inspection. Manual inventory system.
Maricopa County	In house program	Full Range	3 Years	Laser roughness measuring device in use. Section line roads inspected
Mesa	In house program	Full Range	Annually	Uses GIS database software.
Peoria	In house program	Full Range	2 Years	Uses GIS database software.
Phoenix	Super PMS	Full Range	2 Years	PURD equipment.
Scottsdale	Intergraph/ITX	Good Range	Annually	System being developed. Current manual system.
Surprise	None	Good Range	Annually	Visual inspection. Manual system.
Tempe	Stanley ITX	Full Range	5 Years	Uses a software based system.
Tolleson	None	Good Range	Annually	Visual inspection. Manual system.
Wickenburg	None	Good Range	Annually	Visual inspection. Manual system.
Youngtown	None	Good Range	Annually	Visual inspection. Manual system.

TABLE V-2: LISTING OF BRIDGES ELIGIBLE FOR FUNDING IN THE BRIDGE REPLACEMENT AND REHABILITATION PROGRAM

Suff. Rating	Agency	Feature Intersected	Roadway Carried	Location
33.9	Goodyear	Wash	Riggs Road	1.2 miles east of Rainbow Rd
35.0	Phoenix	Sky Harbor Blvd	Southwest OP	Sky Harbor Airport Term 3
36.3	Scottsdale	Drain Channel	64th St Driveway	0.05 miles south of Shea Blvd
36.3	Scottsdale	Drain Channel	64th St Driveway	0.15 mile south of Shea Blvd
39.0	Phoenix	Grand Canal	59th Avenue	59th Ave s of Indian School Rd
39.0	ADOT	Alchesay Canyon	SR-88	45.4 miles of Jct US-60
40.6	Maricopa Co	Avondale Wash	MC-85; FAS 371	0.5 miles west of Bullard Ave
41.0	ADOT	I-10	63rd Avenue	5 miles west of Jct I-17
41.0	ADOT	Papago Drain Channel	63rd Avenue	0.1 miles north of Jct I-10
46.0	Phoenix	Arizona Canal	12th Street	0.5 miles north of Glendale Ave
47.0	Phoenix	SPRR Madison	7th Ave	7th Ave S of Jefferson St
49.4	Maricopa Co	Gila River	Old US-80 Hwy	South of Gillespie Dam
50.0	Phoenix	Sky Harbor Blvd E	Northwest OP	Sky Harbor Airport Term 3
53.0	Phoenix	Sky Harbor Blvd E	Parking Ins & Exits	Sky Harbor Airport Term 3
53.0	Phoenix	Sky Harbor Blvd E	North Center OP	Sky Harbor Airport Term 3
54.0	Phoenix	Arizona Canal	35th Avenue	35th Avenue north of Dunlap Ave
55.0	Phoenix	Sky Harbor Blvd W	Parking Ins & Exits	Sky Harbor Airport Term 3
55.0	Phoenix	Sky Harbor Blvd E&W	Center Flyover	1.5 miles east of 24th Street
55.0	ADOT	Gillespie IRR Canal	SR 88	0.05 miles west of Jct SR-85
56.0	ADOT	US-60	Rural Road	2.42 miles east of Jct I-10
56.0	Phoenix	Cave Creek Wash	Peoria Ave	Peoria Ave east of I-17
58.0	Phoenix	Grand Canal	15th Street	0.5 miles n. of Indian School Rd
59.0	Phoenix	Arizona Canal	Maryland Ave	0.5 miles north of 16th Street
59.0	Phoenix	Arizona Canal	48th Street	0.2 miles n. of Indian School Rd
60.0	Phoenix	Grand Canal	7th Ave	7th Ave south of Campbell Ave
60.0	ADOT	First Wash Creek	SR 88; FAS 214	13.8 miles east of Jct US-60
60.0	Phoenix	Arizona Canal	43rd Avenue	43rd Ave & Peoria Ave

TABLE V-2: LISTING OF BRIDGES ELIGIBLE FOR FUNDING IN THE BRIDGE REPLACEMENT AND REHABILITATION PROGRAM

Suff. Rating	Agency	Feature Intersected	Roadway Carried	Location
61.0	ADOT	Boulder Creek	SR 88; FAS 214	15.2 miles east of Jct US-60
61.0	Phoenix	Arizona Canal	Northern Avenue	Northern Ave east of 7th St
61.0	Phoenix	Western Canal	24th Street	24th Street north of Baseline Rd
62.0	Phoenix	Arizona Canal	Dunlap Avenue	Dunlap Ave east of 7th Ave
62.0	ADOT	Hassayampa River	US-60; WB	0.2 miles east of Jct US-93
62.1	Maricopa Co	Queen Creek	Power Road	0.2 miles s. of Queen Creek Rd
63.0	Phoenix	Western Canal Bridge	32nd St	32nd Street north of Baseline Rd
64.0	Phoenix	Grand Canal	24th Street	24th Street south of Thomas Rd
64.0	Phoenix	Sky Harbor Blvd W	Sky Harbor Blvd E	0.5 miles east of 24th St
64.0	Phoenix	Dry Wash	12th Street	100 feet north of Northern Ave
64.0	Mesa	Consolidated Canal	Main St - Old 60	0.3 miles east of Jct Gilbert Rd
65.0	ADOT	Lewis Pranty Creek	SR 88	28.9 miles east of Jct US-60
65.0	ADOT	Sand Tank Wash	SR 88; FAP 023	0.5 miles west of Jct SR-85
67.0	Phoenix	Arizona Canal	29th Street	0.1 miles north of Dunlap Rd
67.0	Phoenix	Arizona Canal	25th Street	0.4 miles north of Dunlap Rd
68.0	ADOT	Agua Fria River	I-10; EB	19.2 miles west of Jct I-17
68.0	ADOT	Agua Fria River	I-10; WB	19.2 miles west of Jct I-17
68.3	Mesa	Consolidated Canal	IRR Gilbert Road	0.2 miles south of McDowell
69.0	Phoenix	Grand Canal	12th Street	0.4 miles n of Indian School Rd
70.0	Scottsdale	Drain Channel	Downing-Olson Dr	At Jct north of 90th St
70.0	ADOT	US-60	McClintock Rd	3.42 miles east of Jct I-10
70.3	Scottsdale	Crosscut Canal	Thomas Rd	At intersection with 64th St
70.9	Scottsdale	Arizona Canal	IRR/Pima Rd	Pima Road at Lincoln Drive
71.0	ADOT	US-60	Washington St	0.09 miles west of Jct US-93
71.0	ADOT	Loop 101	Apache Blvd	At Jct US-60
71.0	ADOT	Fish Creek	SR 88	27.7 miles east of Jct US-60
73.0	ADOT	I-17	Thomas Rd	0.4 miles north of Jct I-10

TABLE V-2: LISTING OF BRIDGES ELIGIBLE FOR FUNDING IN THE BRIDGE REPLACEMENT AND REHABILITATION PROGRAM

Suff. Rating	Agency	Feature Intersected	Roadway Carried	Location
73.0	ADOT	West Sycamore Ck	FS 25A	TS 07N; R 08E; SEC 13
73.0	ADOT	Dry Wash	SR 88	29.9 miles east of Jct US-60
73.1	Scottsdale	Indian Bend Wash	Indian School Rd	Indian School Rd at Hayden
74.0	ADOT	US-60	Frontier St	0.1 miles west of Jct US-93
76.0	ADOT	I-10	IRR/Riggs Rd	12.6 miles south of Jct US-60
76.0	Phoenix	ACDC	29th Avenue	South of Metrocenter
76.3	Maricopa Co	Tempe canal	Broadway Rd	0.2 miles east of Price Fwy
76.4	Scottsdale	Drainage waterway	Pima Rd Driveway	0.35 miles north of Shea Blvd
76.6	Scottsdale	Crosscut Canal	Goldwater Blvd	0.25 miles n of Indian School Rd
77.0	ADOT	I-17; NB-SB	SR-74; Carefree Hwy	At Jct SR-74
77.0	ADOT	Wash	Apache Trail-Old 60	4 miles west of Jct SR-88
77.0	ADOT	I-17	Happy Valley Rd	6 miles south of Jct SR-74
78.0	Scottsdale	Drainage waterway	Via De Ventura	0.55 miles east of Scottsdale Rd
78.0	Phoenix	Dry Wash	47th Place	North of Horseshoe Road
78.0	ADOT	Wash	I-8	5.3 miles west of Jct SR-85
78.0	ADOT	SB17 - WB10 Ramp	SB I-17 Frontage Rd	0.3 miles north of I-10
78.8	Maricopa Co	Agua Fria River	Indian School Rd	0.5 mile east of El Mirage
79.0	ADOT	SR-85	SB 88; WB	At Jct SR-85
80.0	Phoenix	ACDC	25th Ave	0.3 miles north of Dunlap Ave

FIGURE V-1: SUBSTANDARD BRIDGES

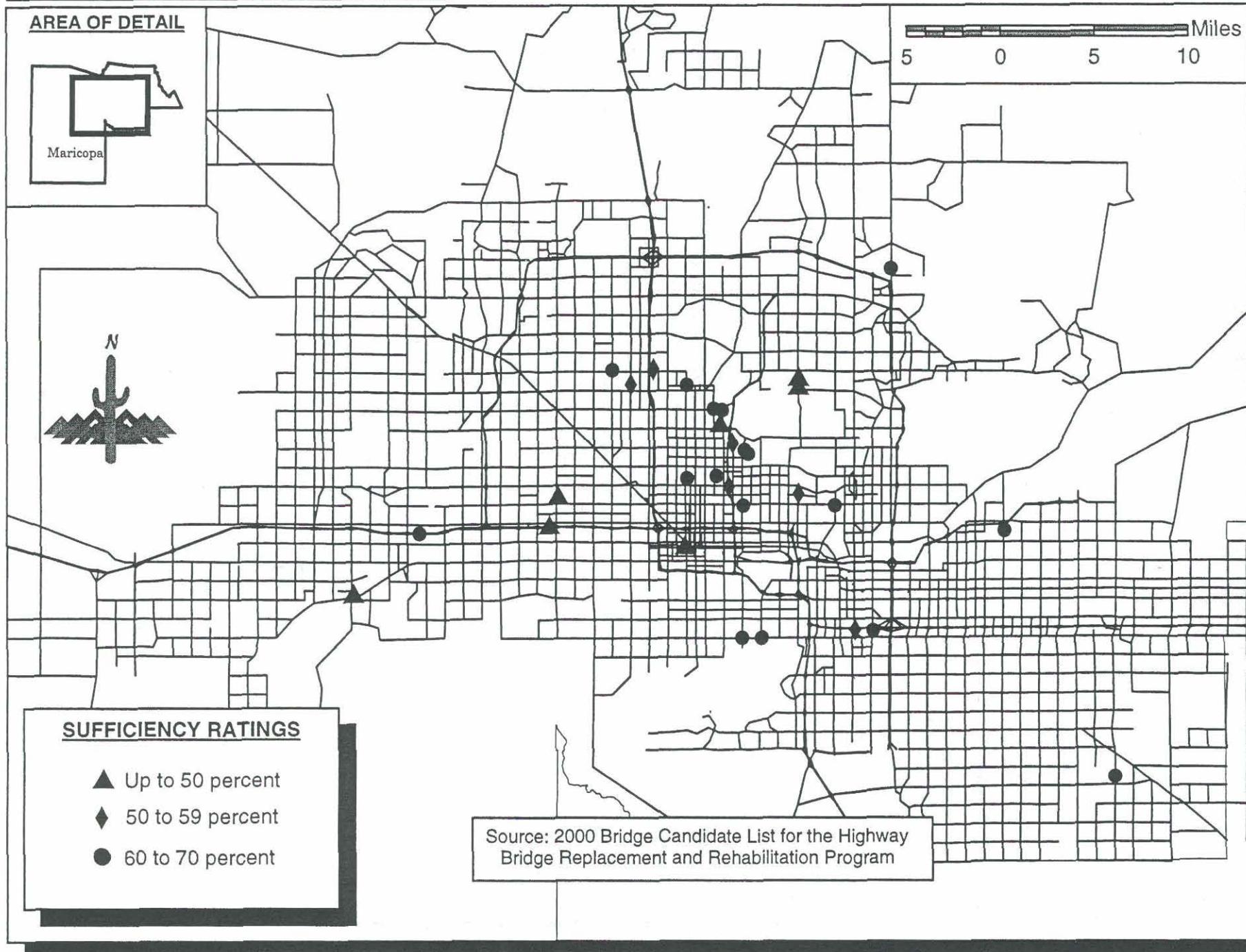


TABLE V-3: CONCERNS IN IMS SURVEY OF FREIGHT INTERESTS

LOCATIONS OF TRAFFIC CONGESTION	
Hohokam Freeway & University	Buckeye, 35th to 43rd
I-10 at Superstition Freeway	Buckeye at 43rd Avenue
I-10 at I-17	24th Street at University
I-10 at Broadway	I-10, Warner to Broadway
I-10 at Chandler	Superstition Freeway, Mesa to I-10
Thomas at 65th Street	I-10, 35th Avenue to 7th Street
I-17, Dunlap to Bell	51st Street at Railroad Crossing
Buckeye at 24th Street	Superstition Freeway, Mesa to Country Club
Buckeye at 27th Street	52nd, Broadway to University
43rd Avenue at I-10	Thomas at 61st Street
43rd Avenue at Railroad Crossing	Superstition Freeway, at US-60
I-10, 32nd Street to 48th Street	54th Avenue, Van Buren to Buckeye
Grand at Myrtle	Mesa Drive at Baseline
Grand at Railroad Crossing	19th Avenue at Buckeye
Broadway at 34th Street	I-10, 40th Street to Superstition Freeway
Southern at 48th Street	I-10 at Grand Ave
I-17, I-10 to Cactus	I-17 at 19th Avenue
I-10 at 48th Street	Broadway Rd, 48th Street and Southern
I-17, Thomas Rd to McDowell Rd	I-10 at 7th Street
51st Ave, Grand to Bethany Home Rd	I-17, Bell Rd to McDowell Rd
35th Ave at Railroad Crossing	I-17, Indian School to Cactus
24th St, University to Camelback	
LOCATIONS WITH INADEQUATE PAVEMENT	
2nd Street from Pima to Mohave	59th Avenue from Bethany Home to Bell
3rd Avenue from Railroad to Jackson St	3402 South Central (Parking Lot)

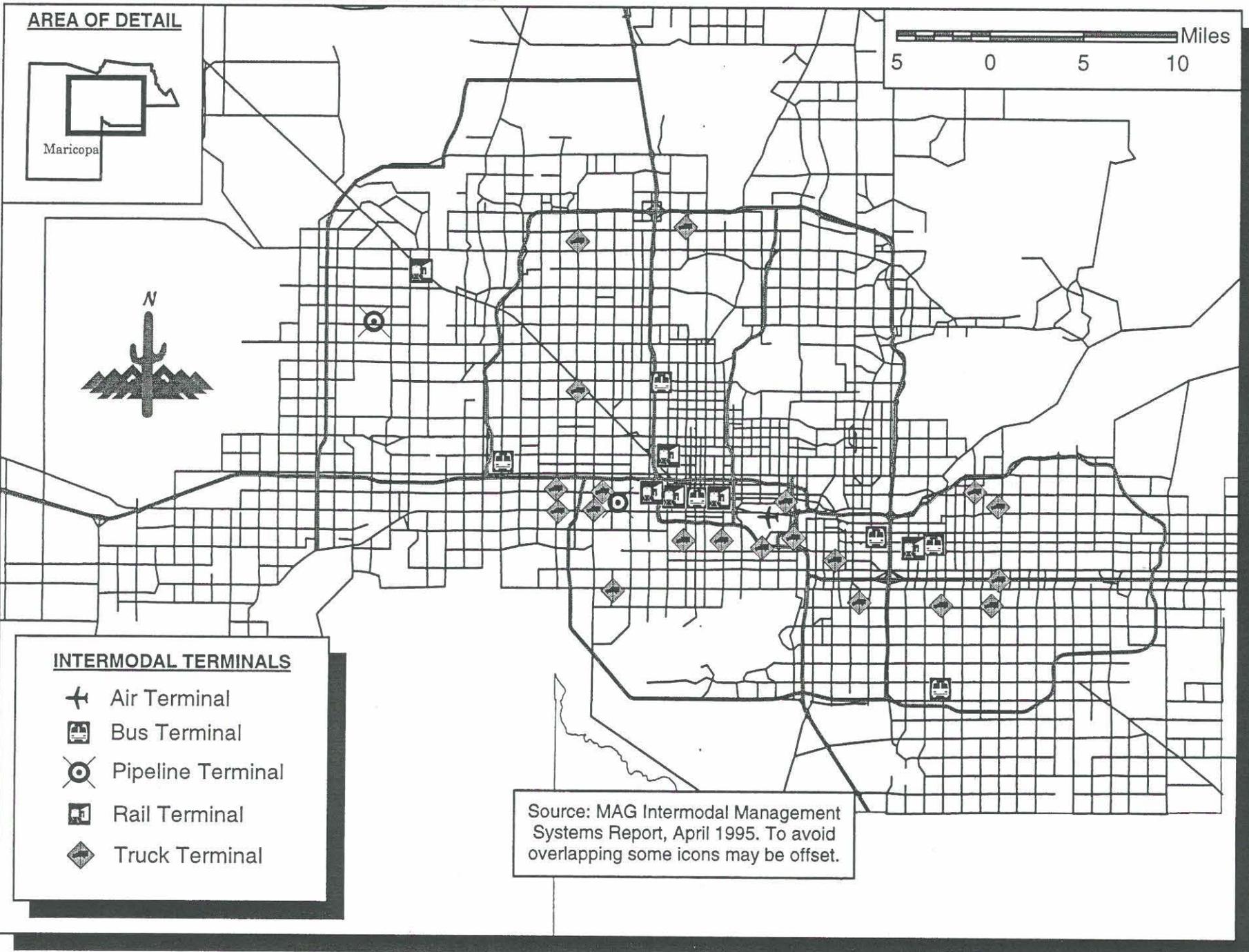
TABLE V-3: CONCERNS IN IMS SURVEY OF FREIGHT INTERESTS

LOCATIONS OF TRAFFIC CONGESTION	
3rd Avenue from Lincoln to Van Buren	Baseline from Horne to Center Streets
4th Avenue from 300 S to Jackson	Broadway from 40th to 48th Street
22nd Avenue and Indian School Road	Grand Avenue from 27th Avenue West
24th Street and University Drive	Jackson from 3rd to 4th Avenues
24th Street and Buckeye	Lewis from Baseline to Javelina
47th Avenue and Jefferson	Magnolia Street from 40th to 42nd Street
49th Avenue and Jefferson	Mesa Drive, US 60 to Baseline
51st Avenue and Grand (Railroad)	RR crossing on Watkins E of 7th Street
51st Avenue, Broadway to I-10	Superstition and I-10 Exchange
52nd St, Thomas Rd to McDowell Rd	Valley Rd, 51040 to Eagle Eye Road
LOCATIONS WITH INADEQUATE ROAD SIGNING	
Tom Murry Avenue - 5105 North	37th Avenue and Cambridge
I-17 at I-10	I-17 and Jefferson
43rd and Lower Buckeye	
LOCATIONS WHERE MANEUVERING IS DIFFICULT	
24th Street and University	920 W Grand Avenue
21st Avenue and Desert Cove	3401 Harbor Drive
25th and Buckeye	3402 E Central
39th Ave: Cactus to Sweetwater	4500 N 43rd Avenue
42nd Street and University	6210 Myrtle (warehouse)
111 S 34th Street	Price Road and Chandler Boulevard
University and Hohokam Freeway	
LOCATIONS WITH INADEQUATE CLEARANCE	
RR Underpass, 17th Ave S. of Van Buren	I-17 and Buckeye Road
I-10 and 19th Avenue overpass	

TABLE V-3: CONCERNS IN IMS SURVEY OF FREIGHT INTERESTS

LOCATIONS OF TRAFFIC CONGESTION	
LOCATIONS WHERE TRAFFIC SIGNALS ARE NEEDED	
Coulter and Tim Murry	Smith and University
Buckeye and 27th Street	McDowell and 35th
43rd Avenue and Fillmore	1306 27th Avenue
45th Avenue and Van Buren	Hidalgo and Central 47th Avenue and Van
Hohokam Freeway and University	I-17 and Jefferson
Thomas Road and 37th Avenue	35th Avenue and Van Buren
2021 51st Street	Litchfield and McDowell
LOCATIONS WHERE MERGING LANES ARE NEEDED	
I-10 south of Superstition Freeway	Smith at University and 7th St at Maricopa
75th Avenue around Camelback	43rd Ave from Buckeye to Lower Buckeye
US-60 at 202 interchange	US 60 and Eagle Eye Road
I-10 at Baseline and I-17 at Jefferson	35th Ave and Lower Buckeye

FIGURE V-2: INTERMODAL TERMINALS



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SECTION VI

PUBLIC TRANSPORTATION

The Public Transportation Management System (PTMS) is an inventory of public transportation facilities and equipment in the region. It includes the age, condition, remaining useful life, and replacement costs for all transit assets. This information will provide decision makers with a basis for determining a schedule for fleet replacement in order to maintain present levels of service.

Description of the PTMS

A PTMS is a systematic process that continually collects and analyzes information on the condition and replacement or rehabilitation cost of transit assets. This information is incorporated into the planning of the regional public transportation system, and it enables decision makers to select cost-effective strategies for providing and maintaining transit assets in a serviceable condition. For the purposes of the PTMS, transit assets are defined as public transportation facilities (e.g., maintenance facilities, stations, terminals, transit related structures, equipment and rolling stock).

The Regional Public Transportation Authority (RPTA) is responsible for monitoring and maintaining the PTMS for the Phoenix Urban area. This PTMS:

- covers urban and rural area public transportation systems receiving funding under the Federal Transit Act in the MAG region;
- maintains transit assets to accommodate current and predicted use of ridership in a safe and cost-effective manner;
- is coordinated with the implementation of the CMS and the IMS; and
- incorporates standards to evaluate the condition of each transit asset.

Analysis

Fixed route and paratransit service is provided in twelve communities in the MAG Regional Planning Area covering approximately 585 square miles. Fixed route service is comprised of 64 local routes, 21 express routes, and four circulators. Weekday and Saturday operations occur on most routes from 4 a.m. to 10 p.m., with some service in Tempe until 1:00 a.m. Service on Sunday is primarily concentrated in Tempe and Phoenix with limited service penetrating the communities of Mesa and Scottsdale. Paratransit services operate both within the fixed route bus service area and in outlying areas of the region. The current transit assets are shown in Table VI-1. These assets are owned by the various agencies and contractors who provide transit service.

Table VI-1: Transit Assets as of June 30, 2001

	Number of vehicles	Average age
Bus	610	6 years
Paratransit	321	3 years
Vanpool	201	0.8 years
Other major facilities include: 6 Transit Centers, 3 regional park-and-rides and 9 maintenance facilities **		

* Includes Maricopa County, Red Cross, and Human Services Vehicles.

** Includes 6 contractor owned/leased maintenance/operations facilities that mainly service transit fleets; and one city-owned facility that services all city-owned vehicles.

Potential Projects

Projects recommended to maintain the existing service levels include replacement of fleet (fixed route buses, paratransit fleet, and vanpool vans) and upgrading of passenger and maintenance facilities. These projects will be funded through a variety of sources including Federal, State and local funds.

Fleet

All vehicles purchased for regional transit will be meet ADA requirements and will use low emission engines or alternative fuels.

In order to maintain service, vehicles that have reached the end of their useful life need to be replaced. The FTA provides guidelines for minimum useful life for transit vehicles as listed in Table VI-2.

Table VI-2: FTA Guidelines for Min. Useful Life of Transit Vehicles

Vehicle Type	Useful Life
Large heavy-duty buses (approx 35'-40', articulated)	12 years/500,000 miles
Medium, heavy-duty buses (approx 30')	10 years/350,000 miles
Medium, medium-duty buses (approx 30')	7 years/200,000 miles
Medium, light-duty buses (approx 25'-30')	5 years/150,000 miles
Other light-duty vehicles (small buses & specialized vans)	4 years/100,000 miles

Tentative replacement schedules for fixed route, vanpool and paratransit vehicles are listed in Table VI-3 and Table VI-4. These schedules indicate that at a minimum, 23 fixed route buses are recommended for addition to the TIP for 2008. Light-duty, paratransit and vanpool vans programmed for purchase in 2004 and medium size, light-duty vehicles programmed for purchase in 2003 may need to be programmed for replacement in 2008 based on years of standard useful life.

**Table VI-3: Regional Fixed Route Bus Fleet Inventory
As of 6/30/2001**

Agency	Year	Manufacturer	Qty	Projected Useful Life (Years)	Year Eligible to Retire*	Tip Status
Phoenix	1999	No. Am. Bus Ind. (NABI)	35	12	2011	Future TIP
	1998	No. Am. Bus Ind. (NABI)	150	12	2010	Future TIP
	1996	New Flyer	29	12	2008	Programmed
	1994	New Flyer	50	12	2006	Programmed
	1994	Specialty Vehicles	1	10	2004	Programmed
	1992	BIA (Orion II)	2	10	2002	Programmed
	1990	BIA (Orion II)	6	10	2000	Programmed
	1990	Gillig	7	12	2002	Programmed
	1990	TMC	36	12	2002	Programmed
	1989	TMC	15	12	2001	Programmed
	1988	TMC	20	12	2000	Programmed
	1987	BIA (Orion I) non-FTA	4	10	1997	Programmed
	1985	MAN	21	12	1997	Programmed
	1982	GMC (Rehab 1994)	13	Rehab yr+5	1999	Programmed
	1981	GMC (Rehab 1994)	14	Rehab yr+5	1999	Programmed
	1979	GMC (Rehab 1994)	6	Rehab yr+5	1999	Programmed
			Subtotal	409		
RPTA	1999	No. Am. Bus Ind. (NABI)	9	12	2011	Future TIP
	1999	No. Am. Bus Ind. (NABI)	1	12	2011	Future TIP
	1999	No. Am. Bus Ind. (NABI)	6	12	2011	Future TIP

Agency	Year	Manufacturer	Qty	Projected Useful Life (Years)	Year Eligible to Retire*	Tip Status
RPTA (continued)	1999	El Dorado/National	9	10	2009	Future TIP
	1998	No. Am. Bus Ind. (NABI)	6	12	2010	Future TIP
	1998	No. Am. Bus Ind. (NABI)	7	12	2010	Future TIP
	1998	No. Am. Bus Ind. (NABI)	4	12	2010	Future TIP
	1995	El Dorado/National	6	10	2005	Programmed
	1994	New Flyer	21	12	2006	Programmed
	1993	Neoplan	1	12	2005	Programmed
	1990	Gillig	1	12	Contractor	Not Programmed
	1979	GMC	1	12	Contractor	Not Programmed
			Subtotal	72		
Mesa	2000	El Dorado/National MST	6	10	2010	Not Programmed
	1994	El Dorado/National	23	10	2004	Programmed
			Subtotal	29		
Scottsdale	2001	El Dorado/National	9	10	2011	Future TIP
	2000	El Dorado/National	9	10	2010	Future TIP
			Subtotal	18		
Tempe	1999	No. Am. Bus Ind. (NABI)	15	12	2011	Future TIP
	1999	El Dorado/National	16	10	2009	Future TIP
	1998	No. Am. Bus Ind. (NABI)	13	12	2010	Future TIP
	1998	No. Am. Bus Ind. (NABI)	15	12	2010	Future TIP
	1998	Advanced Veh. Systems	3	10	2008	Recommended for 2008
	1998	El Dorado/National	20	10	2008	Recommended for 2008
			Subtotal	82		
TOTAL			610			

* Projected Useful Life and Year Eligible to Retire are estimates provided as a guide for programming purposes only. Useful life is based on years and/or mileage and FTA minimums. Local funds are required from the requesting agency for purchase the vehicle

and agencies may choose to keep the vehicle longer than the FTA minimum and/or projected useful life as long as the vehicle is maintained in good repair and in good condition. Actual retirement dates may be shorter or longer than the years identified above depending on mileage and condition of the vehicle and the owning agency's desire to keep the vehicle in service.

NOTE: Average cost for a new bus is \$330,000 in year 2002 \$. Buses normally take 12-24 months from the time of order to delivery.

**Table VI-4: Regional Paratransit and Vanpool Fleet Inventory
as of 6/30/2001**

Operating Agency	Year	Manufacturer/ Modifier	Qty	Projected Useful Life (In Years)*	Year Eligible to Retire*	Tip Status
Glendale	2000	Supreme/AZ Bus	5	6	2006	Programmed
	1998	El Dorado/AZ Bus	3	6	2004	Programmed
	1996	El Dorado/AZ Bus	3	6	2002	Programmed
	1995	El Dorado/AZ Bus	5	6	2001	Programmed
		Subtotal	16			
Guadalupe	1994	Wide One	1	6	2000	Programmed
	1994	GM	1	6	2000	Eligible
		Subtotal	2			
Maricopa County	2000	Braun	20	7	2007	Programmed
	1997	Wide One	14	7	2004	Programmed
	1996	Wide One	7	7	2003	Programmed
	1993	Ford	14	7	2000	Programmed
	1992	GM	11	7	1999	Programmed
	1992	Chrysler	4	7	1999	Programmed
	Subtotal	70				
Peoria	1999	El Dorado/AZ Bus	3	6	2005	Programmed
	1998	El Dorado/AZ Bus	2	6	2004	Programmed
	1996	Wide One	4	6	2002	Programmed
		Subtotal	9			

Operating Agency	Year	Manufacturer/ Modifier	Qty	Projected Useful Life (In Years)*	Year Eligible to Retire*	Tip Status
Phoenix	2001	Braun	40	4	2005	Programmed
	2000	Braun	15	4	2004	Programmed
	1998	Braun	26	4	2002	Programmed
	1998	Northbridge	5	4	2002	Programmed
	1997	Northbridge	24	4	2001	Programmed
Phoenix (HSD)	2001	Supreme/AZ	7	6	2007	Programmed
	2000	El Dorado/AZ Bus	7	6	2006	Programmed
	1997	El Dorado/AZ Bus	11	6	2003	Programmed
	1996	El Dorado/AZ Bus	11	6	2002	Programmed
		Subtotal	146			
RPTA East Valley Dial-a-Ride (Various agencies)	2001	Supreme/AZ Bus	6	6	2007	Programmed
	2000	Braun	35	4	2004	Programmed
	1998	Star Custom	8	6	2004	Programmed
	1997	Star Custom	14	6	2003	Programmed
		Subtotal	63			
SCAT	2000	Supreme/AZ Bus	3	6	2006	Programmed
	1998	Northbridge	6	4	2002	Programmed
	1996	Wide One	3	4	2000	Programmed
		Subtotal	12			
Surprise	1994	Wide One	2	6	2000	Programmed
	1989	Wide One	1	6	1995	Programmed
		Subtotal	3			
PARATRANSIT TOTAL			321			
RPTA (VANPOOL)	2001	Dodge	163	4	2005	Programmed
	1999	Dodge	36	4	2003	Programmed
	1997	Dodge	1	4	1999	Programmed
	1993	Dodge	1	4	1997	Programmed
VANPOOL TOTAL			201			

* Projected Useful Life and Year Eligible to Retire are estimates provided as a guide for programming purposes only. Useful life is based on years and/or mileage and FTA minimums. Local funds are required from the requesting agency of 20% of the cost of the vehicle and agencies may choose to keep the vehicle longer than the FTA minimum and/or projected useful life as long as the vehicle is maintained in good repair and in good condition. Actual retirement dates may be shorter or longer than the years identified above depending on mileage and condition of the vehicle and the owning agency's desire to keep the vehicle in service.

NOTE: This list does not include expansion vehicles that are to be acquired through existing grants or are programmed in the 2002-2006 TIP. Expansion vehicles to be purchased in 2002-2004 and not shown on this list may need replacements programmed in the current TIP cycle, depending on the acquisition date and the expected life of the expansion vehicles. Also not included are vehicles that may need to be programmed to "replace" the "replacement vehicles" identified as "Programmed" that are expected to be purchased in 2001-2003. These future replacement vehicles may also need to be programmed in the current TIP cycle, depending on the acquisition date and the expected life of the replacement vehicle. Average cost for a paratransit vehicle ranges from \$45,000 for a light-duty, standard size van to \$53,000 (gasoline) -65,000 (CNG) for a light-duty, medium size cut-away in FY2002 \$. Paratransit vehicles normally take 6-8 months from the time of order to delivery.

Facilities

It is recommended that passenger and maintenance facilities be upgraded approximately every 8-10 years. Structural, mechanical, and aesthetic upgrades are needed to keep the facility safe and in good repair, to improve/maximize the efficiency of the operations, and preserve the visual condition of the facility. As a guideline, upgrades should be programmed at 10-20% of the original construction cost depending on the size, complexity, and usage of the facility. Facilities in the system should be examined and agencies should assess the need for upgrades at facilities in their jurisdictions.

Each year, cities and agencies in the region submit both federally and locally funded new transit project requests for inclusion in the TIP. Projects requested are for federal funds available in the new fifth year of the program and for any other year in which funds are or have become available.

Requests received by MAG for transit projects are forwarded to the RPTA for review and projects are assigned a priority ranking using the prioritization process established in 1993 by the RPTA and transit agencies in the region. RPTA staff then prepares a list of the submitted projects in priority order, compares the requests for federal funds to the level of federal urban formula funds (5307 funds) expected in each year of the TIP, evaluates the proposed TIP program as a whole for financial constraint and provides funding recommendations for all transit projects submitted. The proposed transit program, listing the projects with rankings and funding recommendations, is reviewed by MAG staff, the

RPTA, the City of Phoenix and transit agencies in the region for inclusion in a draft TIP. The City of Phoenix, as designated recipient of Federal Transportation Administration (FTA) funds, reviews the program to ensure included projects are (1) eligible to receive federal funding and (2) project requirements and environmental regulations have been met or will be completed prior to advancing federal funds to the project. Additionally, the City of Phoenix must confirm that any agency requesting federal funds is in compliance with FTA rules and regulations and has submitted required reporting documents to be eligible to receive federal assistance.

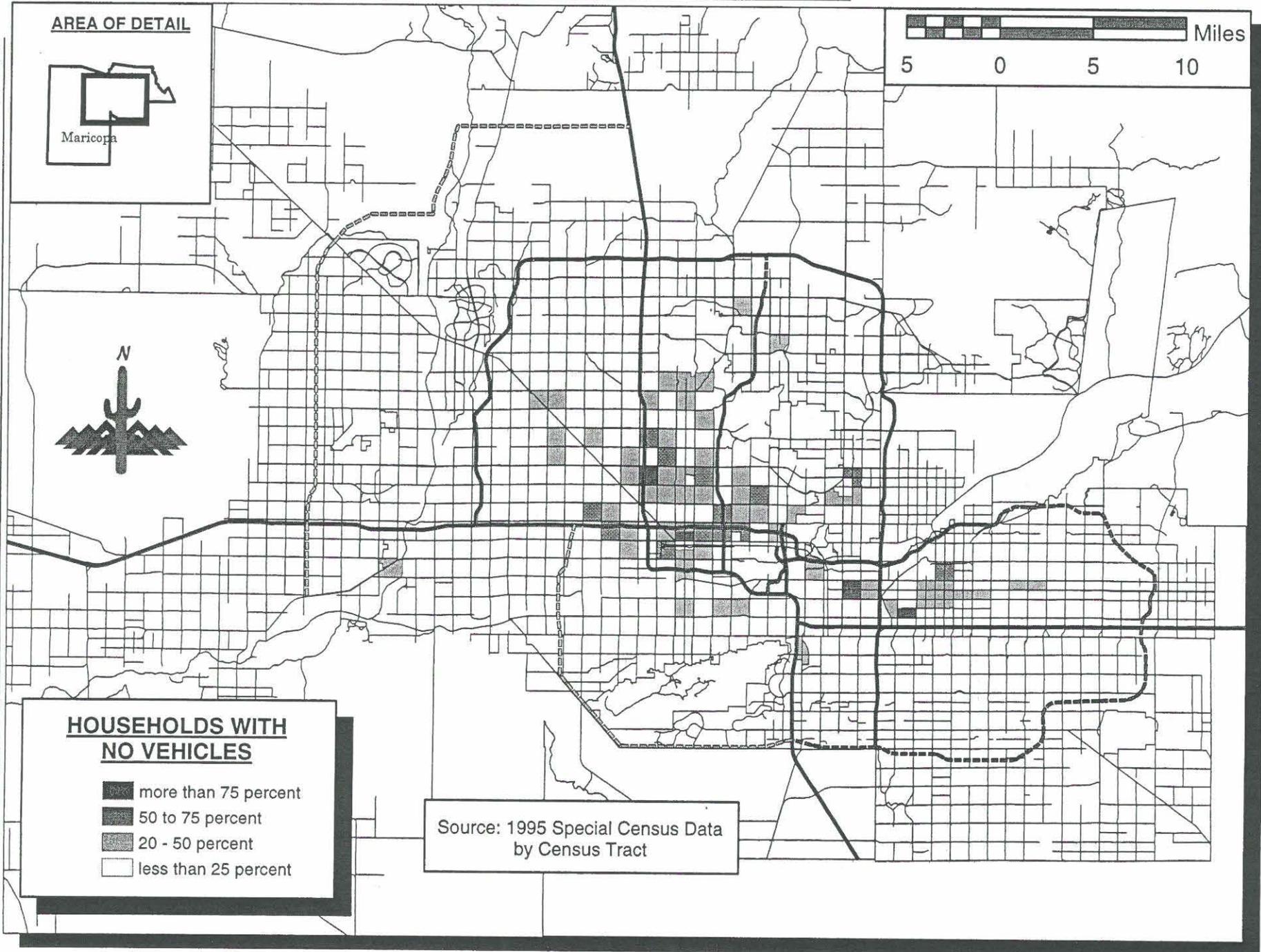
Light Rail Transit

Efforts are underway in the region to develop and implement a Light Rail Transit (LRT) system. This effort is described in the MAG Long Range Transportation Plan as a 39 mile system. The LRTP also describes a the segment in the vicinity of Interstate 10 and Central Avenue through downtown Tempe to the vicinity of McClintock Drive in Mesa as the initial operating segment of the system. The Central Phoenix/East Valley Light Rail Transit Project, currently in the preliminary engineering phase, has identified a 20.3 mile preferred Minimum Operating System (MOS). This MOS begins in the vicinity of Christown Mall, from Camelback Road and Central Avenue south to Washington Street, east through downtown Tempe to Longmore Road and Main Street in Mesa. The LRTP will be updated with revised MOS, following approval by the FTA.

Households with No Vehicles

For consideration of Public Transportation needs and services. Figure VI-1 is provided illustrating households with no vehicles. This map provides preliminary indication that households with no vehicles are found more frequently in the central metropolitan area. The information for this map was obtained from the Census Transportation Planning Package (CTPP). The CTPP was based on a series of questions regarding transportation in the 1990 Census. It is expected that FY 2000 data will be available in time for next year's report.

FIGURE VI-1: DISTRIBUTION OF HOUSEHOLDS WITH NO VEHICLES



Source: 1995 Special Census Data by Census Tract

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SECTION VII

TITLE VI AND ENVIRONMENTAL JUSTICE CONSIDERATIONS

The U.S. Government requires nondiscrimination in federally assisted programs of the Department of Transportation (49 CFR 21). The Federal Highway Administration requires that state highway agencies meet minimum requirements for assurances, civil rights, and Title VI coordination (23 CFR 200). The USDOT Order to Address Environmental Justice in Minority Populations and Low-Income Populations is part of the DOT Environmental Justice Strategy (60 FR 33896). This order creates a process to integrate concerns of environmental justice as outlined in Executive Order 12898. The Arizona Department of Transportation (ADOT) is the transportation agency for Arizona.

MAG is responsible for incorporating Title VI requirements and environmental justice concerns in its planning and programming processes, and the enforcement of statewide compliance, including the MAG region, is the responsibility of ADOT. MAG's policy is to assist ADOT in its compliance efforts.

Title VI of the Civil Rights Act of 1964 prohibits discrimination on the basis of race, color and national origin by recipients and sub-recipients of federal funds and prohibits exclusion from participation in, denial of benefits, or being subjected to discrimination under any program or activity receiving federal financial assistance. Additional federal and state laws and directives prohibit discrimination on the basis of age, gender, handicap or disability. The Executive Order on Environmental Justice encourages consideration of environmental justice concerns, especially the impact of programs and activities on low-income and minority populations.

Potential discrimination is to be addressed on a funding level basis, an environmental and health basis, as well as the exclusion or denial of benefits. As these laws apply to MAG and its member agencies, this section is providing information for consideration during the process to update the MAG Long Range Transportation Plan and five year program.

Maricopa County Demographics

As part of its role as the regional planning entity, MAG gathers, maps and analyzes demographic data disseminated by the U.S. Bureau of the Census and other sources. This demographic data may be useful to better planning that could help ensure that traditionally unserved and underserved populations are not excluded, denied benefits, nor subjected to discriminatory effects -- whether intended or unintended. The information below and the data for the maps that follow were gathered from the 1990, 1995 and 2000 census statistics, where appropriate.

Representation by Race

White persons make up the majority population in Maricopa County comprising 85% of Maricopa County's residents (1,801,570 persons) in 1990. Hispanic persons comprised

16% (341,158), Blacks 3.5% (74,309), Native American, American Indian, Eskimo or Aleut 2% (44,241), and Asian/Pacific Islanders also 2% (35,216). Note that a Hispanic can be considered a member of any race, thus numbers of other ethnic groups may include those who also are Hispanic. Hispanics make up the largest share of the minority population and distribution patterns of all minorities. Figure VII-1 illustrates where people of minority race live and Figure VII-2 illustrates where people of Hispanic origin live.

Representation by Age Group

The U.S. Bureau of the Census also gathers information about residents' age. The seventy-six million Baby Boomers, now ages thirty-one through fifty (31-50) years, are skewing the proportion of adults in the general population. Beginning the year 2006, they will skew the proportion of elderly persons in the general population.

Elderly persons reside throughout Maricopa County with some clusters appearing in areas that were planned for or cater to them as a target market. Figure VII-3 illustrates that elderly people generally are well-distributed among the general population. They tend to settle less in the western county areas and cluster more in the northwestern developments of Sun City and Sun City West, the Sun Lakes Development southeast of Chandler and in the eastern regions of Mesa and Maricopa County toward Apache Junction.

Representation by Income

Federal poverty guidelines have been changing annually. In 1989, poverty for a family of four was defined as annual income of \$12,674 or less. In 1994, poverty for a family of four was defined as annual income of \$14,800 or less; in 1998 it was \$16,450 or less; and in 2000 it was \$17,050 or less. The federal poverty guideline for 2002 is shown in Table VII-1.

TABLE VII-1: 2002 POVERTY INCOME GUIDELINES EFFECTIVE July 1, 2002

SIZE OF FAMILY UNIT	POVERTY GUIDELINE	SIZE OF FAMILY UNIT	POVERTY GUIDELINE
1	\$8,856	6	\$24,264
2	\$11,940	7	\$27,336
3	\$15,024	8	\$30,240
4	\$18,096	9	\$33,504
5	\$21,180	10	\$36,588
More than 10	Increase by \$257 for each additional person in the family unit		

In 1989, the average poverty rate for Arizona's urban counties (Maricopa and Pima Counties) was 13.5 percent, and for its thirteen rural counties was 23.1 percent. In Maricopa County, lowest income households are found more frequently on Indian reservations, in south-central Phoenix, north-central Tempe, Guadalupe, Avondale, Buckeye, Gila Bend, Tolleson, Surprise and El Mirage. Figures VII-4A and VII-4B illustrate the distribution of low-income households and low-income workers by place of work in the region by density.

Representation by Gender

In Maricopa County, females that are heads of household account for approximately 13 percent of all households in the region. As illustrated by Figure VII-5, the concentrations of female head of household are more well-distributed in the region than elderly population, however, the clusters that do exist are similar to those in the elderly category.

Representation by Disability

For the first time, the U.S. Bureau of the Census asked a question on mobility limitation in the 1990 census. Persons were identified as having a mobility limitation if they had a health condition that had lasted for six or more months and which made it difficult to go outside the home alone. Examples of outside activities on the questionnaire included shopping and making doctor office visits. In Maricopa County, there are approximately 31,600 persons within this category which account for 1.5 percent of the population. Figure VII-6 provides a geographic distribution of this population.

Environmental Justice and Public Involvement

MAG currently conducts activities to encourage public participation in its decisions. These activities include open houses, community meetings, and presentations to local committees. This open process offers complete information on plans, timely public notice, public access to decisions, and opportunities for early and continuing involvement. In addition to general public involvement processes, the MAG Human Services Planning Program solicits input from local minority populations and people in underserved communities. The processes and findings of the Human Services Planning Program are integrated into MAG's planning programs, and members of the MAG Human Services Planning Program staff are part of the MAG Title VI and Environmental Justice team.

MAG employs a strategy of expanded information dissemination and public access to plans and decisions. Copies of studies and reports are placed in public libraries in the region as standard procedure.

MAG committee meetings are conducted in accordance with the Open Meeting Law, and thus provide citizens public opportunities to comment before meetings of MAG technical and policy committees. Alternative formats, accessible meeting locations and accessible

meeting times are encouraged for MAG meeting planning.

MAG houses numerous records of data, statistics and information. Data collection, analysis and portrayal methods and products are evaluated periodically. MAG's data sources, including data on low income and minority populations, are updated annually.

MAG partners with the Arizona Department of Transportation (ADOT), the Regional Public Transit Authority (RPTA), and MAG member agencies on public involvement efforts. These partnerships will continue in the form of periodic meetings and communications with ADOT, RPTA, and the member agencies. MAG maintains an open dialogue with the ADOT Office of Civil Rights.

MAG has partnered with the Arizona Department of Economic Security for human services planning since 1976. The MAG human services planning process enhances the organization's consideration and participation of minority, poor and other population groups in developing regional plans and projects.

MAG maintains a home page on the Internet (www.mag.maricopa.gov) which provides the public with access to information on the role and history of the agency and its programs, as well as the agendas and minutes of Committee meetings. The web page serves as an excellent portal for disseminating information about MAG events, programs and plans.

MAG has also retained the services of two specialists to enhance the agency's outreach to four Title VI groups. The two include an outreach associate to the Hispanic, African American and the Native American communities, as well as one associate to the community with disabilities.

FIGURE VII-1: DISTRIBUTION OF POPULATION OF RACIAL MINORITY STATUS

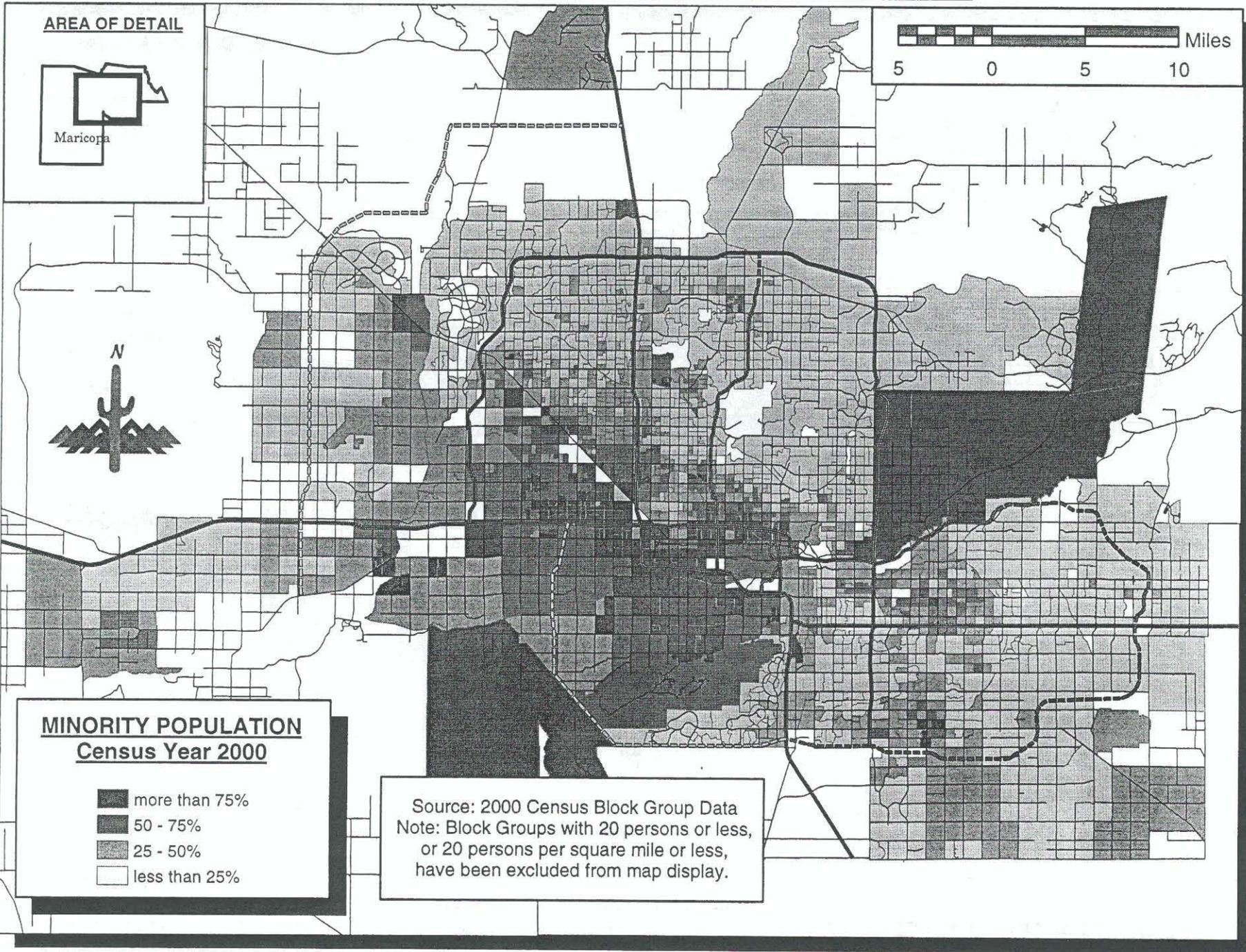


FIGURE VII-2: DISTRIBUTION OF POPULATION OF HISPANIC DESCENT

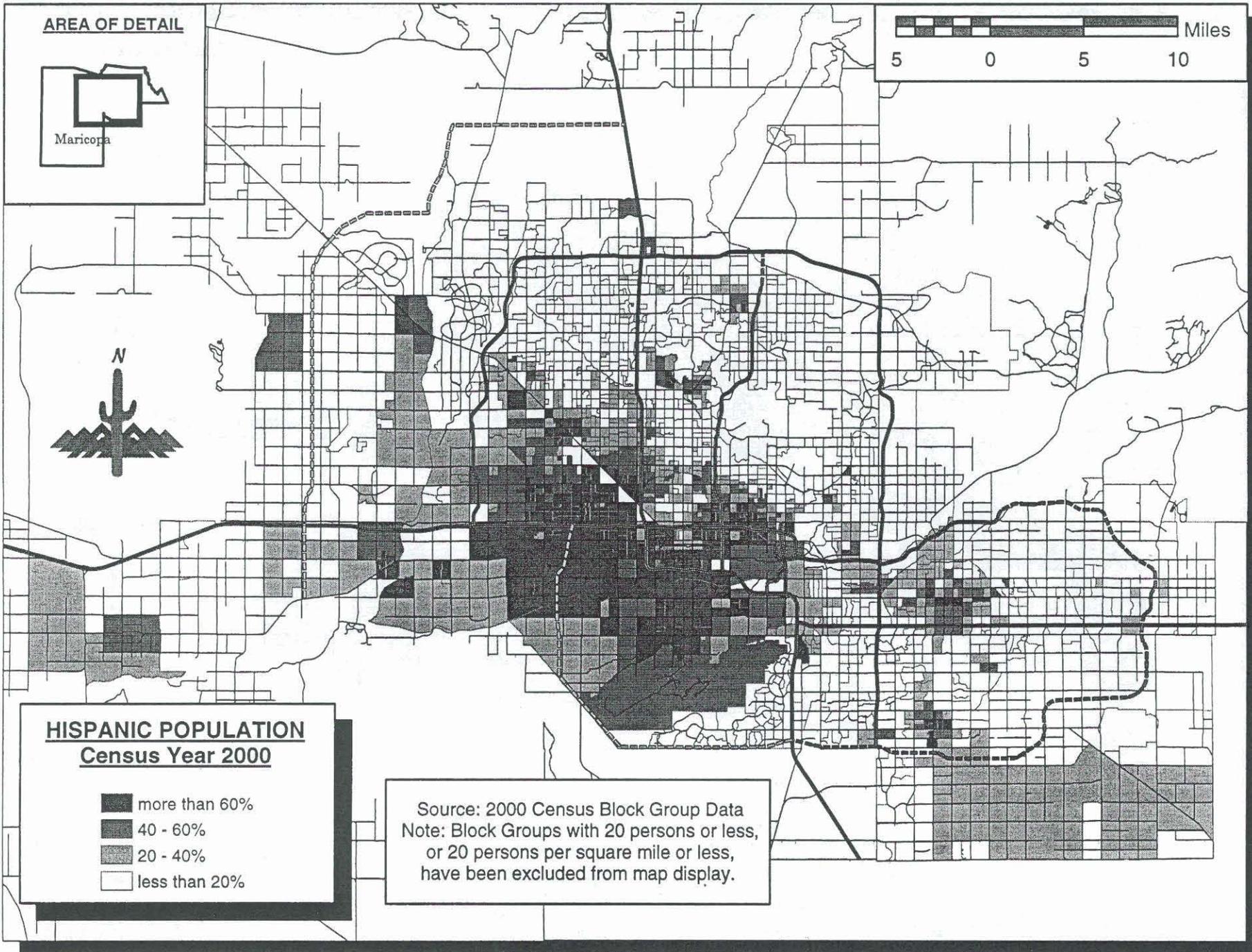


FIGURE VII-3: DISTRIBUTION OF POPULATION AGE 60 YEARS OR OLDER

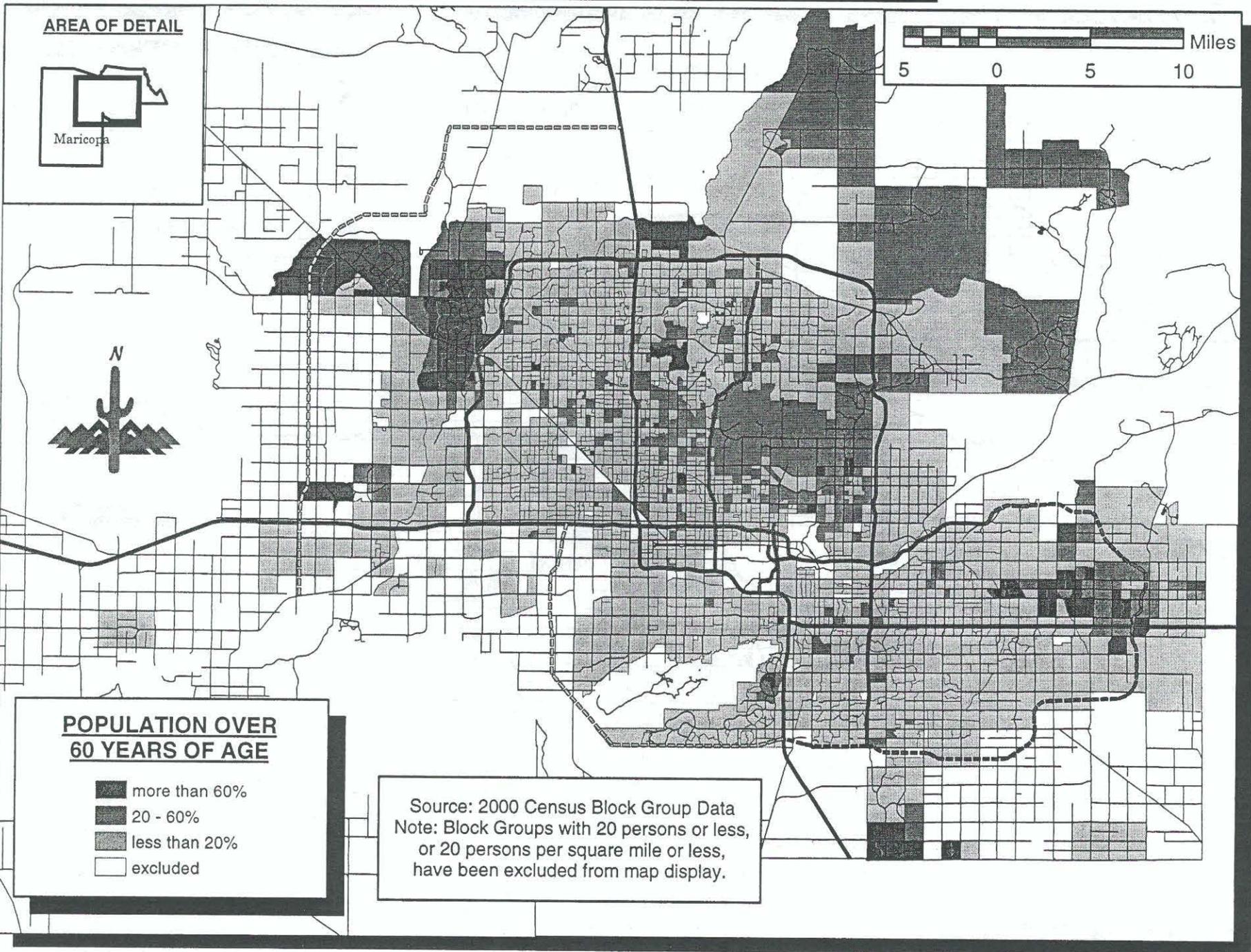


FIGURE VII-4A: DISTRIBUTION OF LOW INCOME HOUSEHOLDS

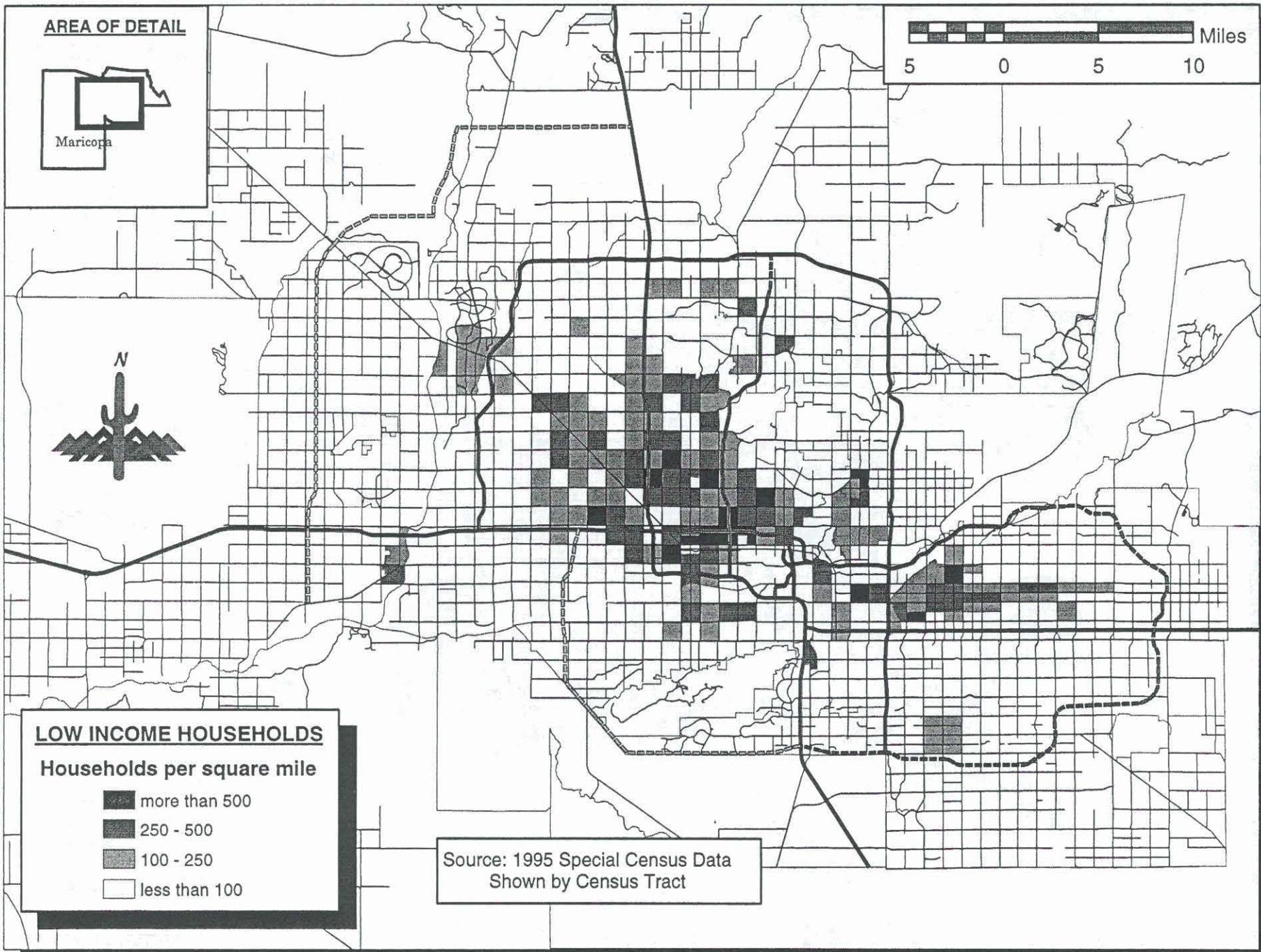


FIGURE 11-4B: LOW INCOME WORKERS BY PLACE OF WORK

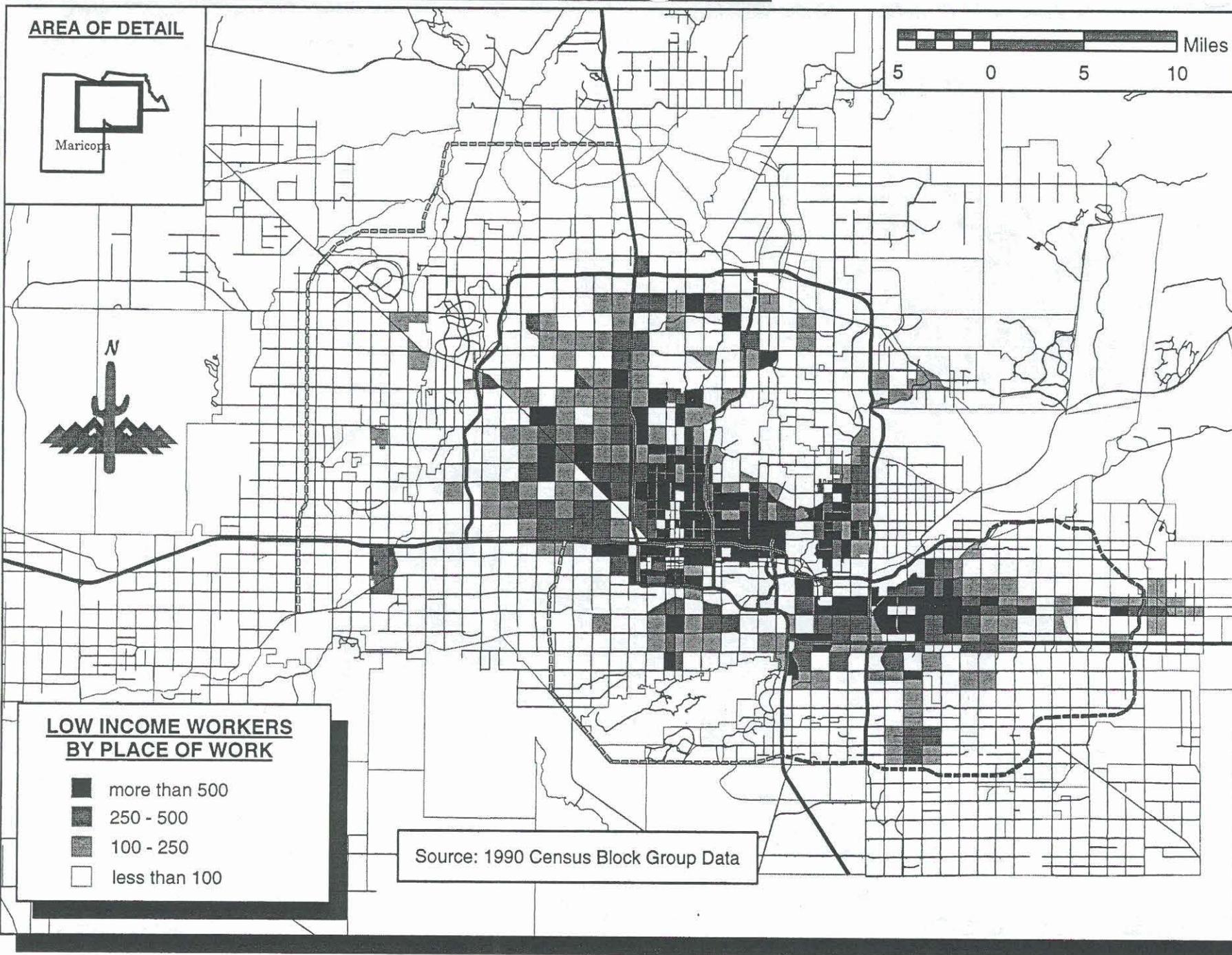


FIGURE VII-5: DISTRIBUTION OF FEMALE POPULATION

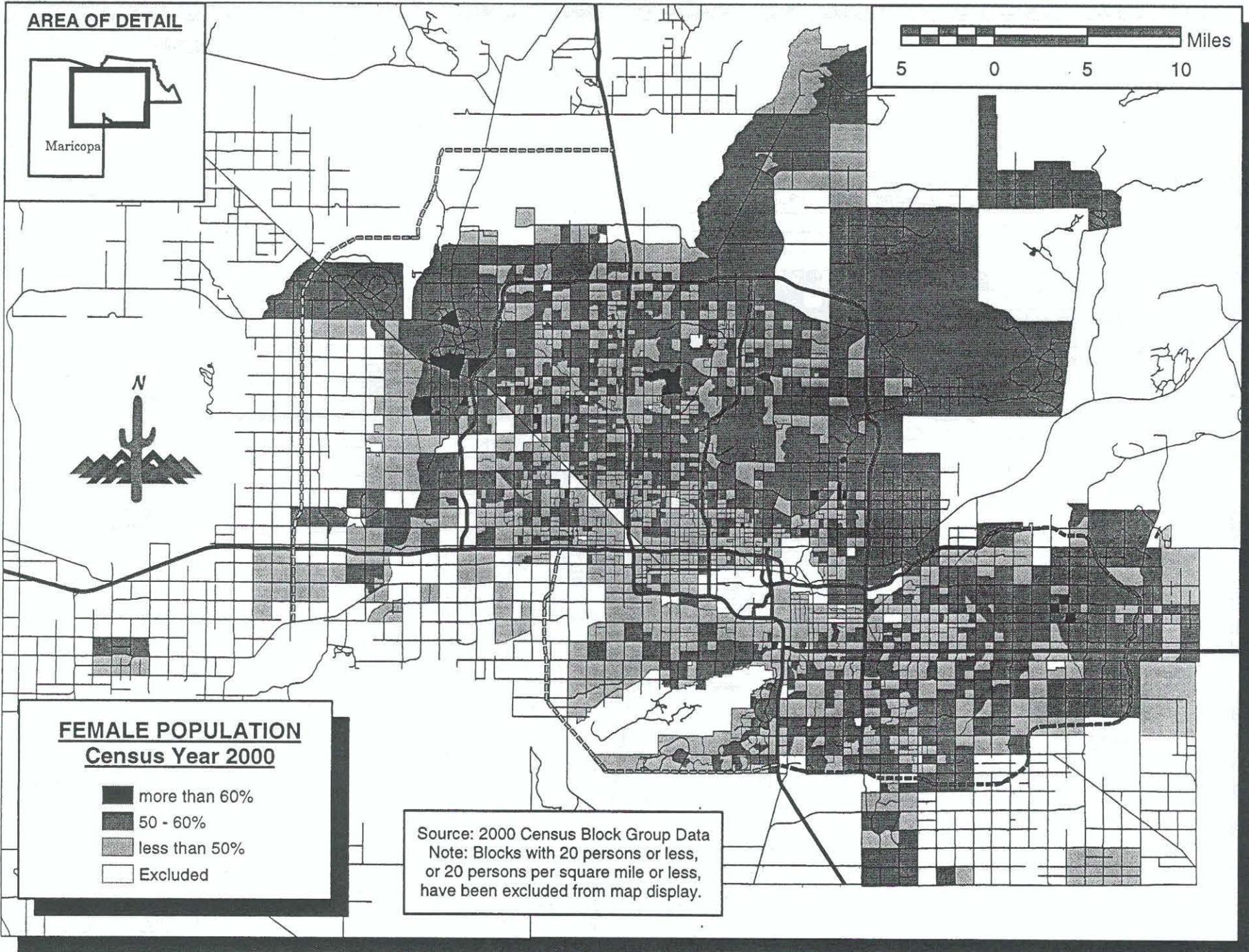
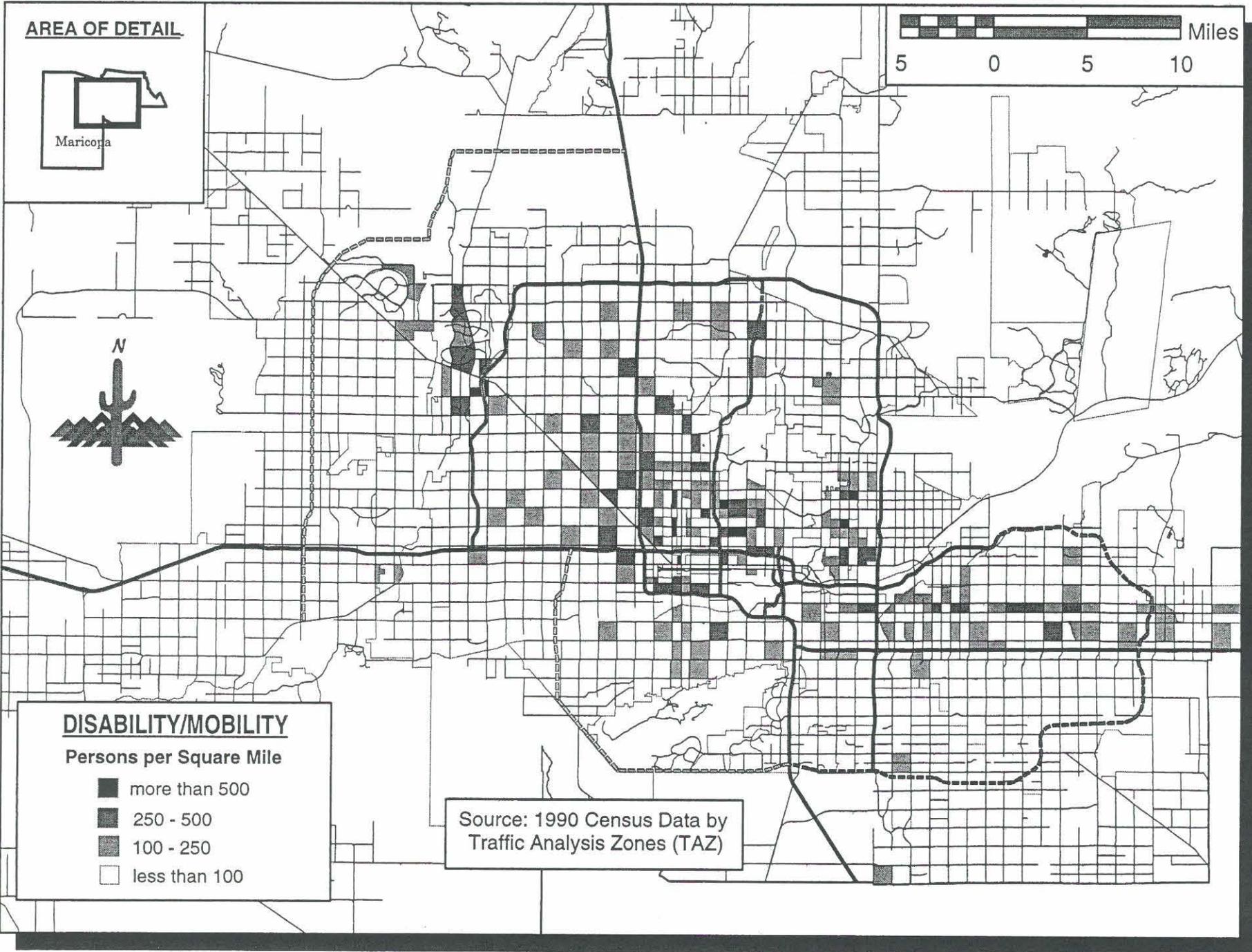


FIGURE VI-6: DISTRIBUTION OF POPULATION WITH DISABILITY OR MOBILITY LIMITATIONS



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SECTION VIII

AIR QUALITY CONSIDERATIONS

Air quality is a significant factor in the planning and programming of transportation projects in the region. Federal laws and regulations, as well as local and state actions, closely link air quality with the development of the transportation system. This section addresses the Congestion Mitigation and Air Quality (CMAQ) emission reduction criteria used to evaluate projects, the inclusion of transportation control measures (TCMs) in the transportation improvement program, and conformity of transportation plans, programs, and projects with applicable air quality implementation plans.

Air Quality Issues

Currently, portions of Maricopa County are designated as nonattainment areas with respect to the National Ambient Air Quality Standards for three criteria pollutants, carbon monoxide, ozone, and particulate matter under ten microns in diameter (PM-10). As a nonattainment area, the region is subject to the transportation "conformity" requirements of the federal Clean Air Act. The rule applies nationwide to "all nonattainment and maintenance areas for transportation-related criteria pollutants for which the area is designated nonattainment or has a maintenance plan" (40 CFR 93.102). A description of the carbon monoxide and PM-10 nonattainment areas is provided below.

The Maricopa County carbon monoxide nonattainment area is located within the Salt River Valley in the central portion of Arizona. The northern boundary of the area is located approximately six miles north of the Carefree Highway and southern boundary is located generally along Hunt Highway. On the east, the area is bounded approximately by the Pinal County Line and the Tonto National Forest; and on the west by Jackrabbit Trail and Beardsley Canal. The same boundary applies to the 1-hour ozone standard.

The Maricopa County PM-10 nonattainment area was defined in terms of township and range in the October 1990 Federal Register as "The rectangle determined by, and including, T6N, R3W; T6N, R7E; T2S, R3W; T2S, R7E; T1N, R8E." The nonattainment area is generally encompassed by 259th Avenue on the west, Hunt Highway on the south, Meridian Road on the east, and a boundary approximately six miles north of Carefree Highway on the north. Included in the nonattainment area is T1N, R8E, an area that includes a part of the City of Apache Junction in Pinal County.

MAG has addressed the relationship between the TIP and air quality implementation plans on an ongoing basis since the enactment of the 1977 amendments to the Clean Air Act. However, with the enactment of the Clean Air Act Amendments of 1990 and subsequent conformity regulations, meeting transportation conformity requirements has become

significantly more challenging.

One of the major federal requirements is that the TIP and LRTP cannot be approved by the MAG Regional Council unless it is found to be in conformance with all applicable air quality implementation plans. Prior to obligating federal funds for transportation projects in the region, the U.S. Department of Transportation, after U.S. Environmental Protection Agency (EPA) review, must determine that the MAG TIP and LRTP are in conformance with applicable air quality plans.

CMAQ Emission Reductions

Final federal guidance for the CMAQ Improvement Program effective April 28, 1999, indicates that Metropolitan Planning Organizations (MPOs) need to develop procedures for assessing emission reduction benefits for proposed CMAQ projects. The guidance encourages States, MPOs, and transit agencies, in consultation with air quality agencies, to cooperatively develop evaluation criteria. In accordance with this guidance, the Maricopa Association of Governments first distributed Draft Methodology for Evaluating Congestion Mitigation and Air Quality Improvement Projects for review and comment in June 2000. Enhancements to the CMAQ Methodology, that included MAG modal and technical committee review, were completed in July, 2001. MAG contracted with Sierra Research in 2002 to evaluate the CMAQ methodologies. A workshop was conducted on April 29, 2002. Recommendations made by Sierra Research, as well as comments received at the MAG workshop, will be considered in updating the CMAQ methodologies during the Summer of 2002. A revised methodology will be available in August 2002. The CMAQ Methodology includes a procedure to assess the emission reduction benefit for several types of projects including, but not limited to: Bus Projects, Bicycle and Pedestrian Facilities, Paving Projects, PM-10 Certified Street Sweepers, Traffic Flow Improvements, Intersection Improvements, Vanpool Vehicles, and Transportation Demand Management projects (e.g. Trip Reduction, Rideshare Programs).

The purpose of the CMAQ program is to provide funding for projects and programs designed to assist nonattainment and maintenance areas in complying with the NAAQS. The MAG region is the only area in Arizona classified as a Serious nonattainment area for carbon monoxide, ozone, and particulate matter less than ten microns in diameter (PM-10). Eligible projects and programs to reduce particulate matter in PM-10 nonattainment areas include the paving of dirt roads, shoulders, and access points, diesel bus replacements, and the purchase of PM-10 efficient street sweepers. Approximately \$30 million in CMAQ funding is suballocated annually to MAG. These projects also include eligible transportation control measures such as: programs for improved public transit, bicycle and pedestrian facilities and programs, travel demand management, and traffic flow improvements.

Each year, MAG programs available federal funds. Jurisdictions are requested, through the MAG Management Committee, Transportation Review Committee, and modal committees, to submit requests for federally funded projects. It is important to note that the CMAQ

assessment is not intended for minor project revisions and fiscal year closeouts made to the TIP.

In addition, the guidance calls for the States to prepare an CMAQ Annual Report each February on CMAQ expenditures and air quality benefits. MAG reports to the Arizona Department of Transportation how these funds have been spent and the expected air quality benefits through the CMAQ Annual Report. As part of the annual reporting, the estimated air quality benefits from obligated projects is anticipated to be based on the CMAQ Methodology.

In general, the methodologies for quantifying the emission reduction benefit and cost-effectiveness of typical CMAQ-funded projects involve the estimation of daily emission reductions, expressed as the sum of carbon monoxide, total organic gases, and particulate matter less than ten microns in diameter, expressed in kilograms per day, and the cost-effectiveness of each project, measured in CMAQ and total dollars per metric ton of total emissions reduced. Total organic gases are gaseous emissions that lead to the formation of ozone.

The cost-effectiveness of a project will be calculated by dividing the annualized project cost, in terms of CMAQ dollars requested and total dollar cost, by the annual total emission reduction benefit in metric tons. The project cost will be annualized by amortizing the CMAQ funds requested and total cost for the project over the expected effectiveness period (project life) using a five percent discount rate. A five percent discount rate represents the opportunity cost of using public dollars to fund a project, versus investing the same public funds in a certificate of deposit earning five percent per year over the life of the project.

Transportation Control Measures

A transportation control measure as defined in the transportation conformity rule is “any measure that is specifically identified and committed to in the applicable implementation plan that is either one of the types listed in Section 108 of the Clean Air Act, or any other measure for the purpose of reducing emissions or concentrations of air pollutants from transportation sources by reducing vehicle use or changing traffic flow or congestion conditions.” The transportation control measures from Section 108(f)(1)(A) and also found at 42 U.S.C. Section 7408(f)(1) are:

- (i) programs for improved public transit;
- (ii) restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high occupancy vehicles;
- (iii) employer-based transportation management plans, including incentives;
- (iv) trip-reduction ordinances;
- (v) traffic flow improvement programs that achieve emission reductions;
- (vi) fringe and transportation corridor parking facilities serving multiple occupancy

- vehicle programs or transit service;
- (vii) programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use;
- (viii) programs for the provision of all forms of high-occupancy, shared-ride services;
- (ix) programs to limit portions of road surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place;
- (x) programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and private areas;
- (xi) programs to control extended idling of vehicles;
- (xii) programs to reduce motor vehicle emissions, consistent with title II, which are caused by extreme cold start conditions;
- (xiii) employer-sponsored programs to permit flexible work schedules;
- (xiv) programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity;
- (xv) programs for new construction and major reconstructions of paths, tracks or areas solely for the use by pedestrian or other non-motorized means of transportation when economically feasible and in the public interest. For purposes of this clause, the Administrator shall also consult with the Secretary of the Interior; and
- (xvi) program to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks.

Federal conformity regulations require that TCMs established in applicable air quality implementation plans be implemented in a timely manner. Similarly, in 40 CFR 93.113(c), EPA specifies three rules to be considered for programming and implementing TCMs in the transportation improvement program:

- (1) States and local agencies assure eligible TCMs under federal transportation laws are on or ahead of the schedule established in the applicable air quality implementation plan and that there is a priority to approve or fund TCMs over other projects within their control, including projects in locations outside the nonattainment or maintenance area;
- (2) The TIP cannot be found to conform if TCMs in the applicable air quality implementation plan which have been programmed in the TIP are behind schedule because of funding reallocation to projects other than TCMs in the TIP, or if the funds are reallocated to projects other than eligible air quality improvement projects, (e.g., CMAQ); and,
- (3) Nothing in the TIP may interfere with the implementation of any TCM in the applicable implementation plan.

In summary, the TCMs included in applicable air quality implementation plans are required to be a priority for funding in the MAG Transportation Improvement Program. Examples of TCMs which may be programmed in the MAG TIP include:

- Maricopa County Travel Reduction Program
- Regional Rideshare Program
- Bicycle facility projects (often as part of certain road improvements)
- Public transit improvements
- Pedestrian facility projects (often as part of certain road improvements)
- High Occupancy Vehicle lanes on freeways
- Freeway Management System projects

Conformity

The federal transportation conformity final rule (40 CFR Parts 51 and 93) specifies criteria or requirements for conformity determinations for transportation plans, programs, and projects and their respective amendments. The federal conformity rule was first promulgated in 1993 by the EPA, following the passage of amendments to the federal Clean Air Act in 1990.

The rule applies nationwide to “all nonattainment and maintenance areas for transportation-related criteria pollutants for which the area is designated nonattainment or has a maintenance plan” (40 CFR 93.102). Currently, portions of Maricopa County are designated as nonattainment areas for three criteria pollutants: carbon monoxide, ozone, and PM-10. Therefore, transportation plans and programs for the Maricopa County nonattainment area must satisfy the requirements of the federal transportation conformity rule.

Under the federal conformity rule, the principal criteria for a determination of conformity for transportation plans and programs are:

- (1) the TIP and LRTP must pass an emission budget test with a budget that has been found to be adequate by EPA for transportation conformity purposes, or emission reduction test(s);
- (2) the latest planning assumptions and emission models specified for use in air quality implementation plans must be employed;
- (3) the TIP and LRTP must provide for the timely implementation of TCMs specified in the applicable air quality implementation plans;
- (4) consultation.

The conformity process usually follows MAG Regional Council recommendation to authorize a conformity analysis of the draft TIP and LRTP. Should this analysis find that either the draft TIP or LRTP is not in conformance, revisions would be necessary and additional modeling could be required. Revisions could include the elimination of some projects and the provision of strengthened or additional TCMs. The final determination of conformity for the TIP and LRTP is the responsibility of the Federal Highway Administration and the Federal Transit Administration.

Regionally Significant Projects

The federal transportation conformity rule defines a regionally significant project as “a transportation project (other than an exempt project) that is on a facility which serves regional transportation needs (such as access to and from the area outside of the region, major activity centers in the region, major planned developments such as new retail malls, sports complexes, etc., or transportation terminals as well as most terminals themselves) and would normally be included in the modeling of a metropolitan area’s transportation network, including at a minimum all principal arterial highways and all fixed guideway transit facilities that offer an alternative to regional highway travel.”

According to Title 23 Section 450.324(f)(3-5), all regionally significant transportation projects proposed to be funded with Federal funds and all regionally significant transportation projects proposed to be funded with non-Federal funds shall be included in the TIP. In accordance with the transportation conformity rule specifying consultation procedures (40 CFR 93.105(c)(ii)), MAG developed consultation procedures for determining when a project is regionally significant. These procedures, summarized below, are contained in the *MAG Transportation Conformity Guidance and Procedures* adopted on September 27, 1995 and revised on March 27, 1996 by the MAG Regional Council.

The MAG procedures indicate that a proposed modification to a roadway facility will be considered regionally significant if it satisfies all three of the following criteria:

- it is on a road which serves regional transportation needs (i.e., urban freeways, other urban or rural principal arterials; and the one-mile grid street network and extensions thereof), and
- it is greater than one-half mile in length, or is on a freeway, freeway ramp, or roadway which carries traffic over or under a freeway at an interchange, and
- it would alter the number of striped through-lanes available for motor vehicle use, and thus would normally be reflected in the roadway network used by MAG for regional transportation modeling purposes.

In addition, fixed guideway transit facilities (e.g. trackage for light rail service, or dedicated busways) that serve regional transportation needs also meet the definition of a regionally significant project.

The determination of whether or not a transportation project is regionally significant is the responsibility of the government agency (e.g. city, town, county) with jurisdiction for approving the project. Arizona conformity rules effective since June 15, 1995 have prohibited a recipient of federal highway or transit funds from adopting or approving “a transportation project, regardless of funding source, without first determining whether the transportation project is regionally significant” [R18-2-1429(B)]. If due to the particular type of project its regional significance cannot readily be determined by the agency, a determination from MAG may be requested.

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SECTION IX

FEDERAL-AID PROGRAMS

The following section provides general background on programming federal projects in the TIP and on specific Federal-Aid funding programs available to MAG member agencies for programming. All of these programs are reimbursement programs. There are five “core” programs, Interstate Maintenance, National Highway System, Surface Transportation Program, Congestion Mitigation and Air Quality, and Bridge Replacement and Rehabilitation.

Definitions and Concepts

The current Federal authorizing legislation, TEA-21, includes two broad types of federal-aid programs. The first type, contract authority programs, constitute the majority of transportation federal-aid programs. These programs are based on a six year (October 1, 1998 to October 2003) funding stream that is guaranteed to the States for reimbursement of transportation expenditures. Congress annually appropriates funds from this stream to cover prior commitments that are expected to come due during the year and passes legislation to allow new commitments from the funding stream for the coming years.

The major contract authority programs include: Surface Transportation Program (STP), Congestion Mitigation and Air Quality (CMAQ), National Highway System (NHS) and Interstate Maintenance (IM). These programs make up the majority of transportation federal-aid programs and are described in more detail later in this section.

The second category is appropriated budgetary programs. In these programs, there is no guarantee of future funding of the program beyond the current fiscal year.

To use federal funds one must have Obligation Authority (OA). OA is the power to commit the federal government to reimburse parties for work performed on its behalf. To “obligate” a project is thus to obtain a promise from the federal government to reimburse the sponsors of a project for work performed. Any work performed prior to the obligation is not reimbursable unless it is first cleared by the agency that administers the funding for the federal government – ADOT for FHWA funded projects and the City of Phoenix Public Transit Department for FTA funded projects.

Each year Congress sets an OA level which is an amount of available funding that may be obligated in a year. This level is usually expressed as a percent share of the funds available for commitment and expires at the end of each federal fiscal year, September 30. Because of this, OA must be used by the end of the federal fiscal year or be lost. Apportionments may also be lost if not utilized, although they usually carry a four year time limit. However, this varies amongst the funding categories.

TIP Listing Requirements

To use Federal funds, a project must appear in an approved TIP and its sponsors must show that the project meets all applicable federal requirements. In the MAG area, an “approved TIP” is a five-year listing of projects that complies with all applicable air quality plans, public involvement and federal programming requirements and has been adopted by the Regional Council and approved by the Governor. The new TIP is adopted each year and supercedes the preceding TIP. All Title 23 federally funded surface transportation projects must be listed in the TIP. At a minimum, a project listing must include the project limits, a description of the work to be performed, the year it is to be obligated and the type and amount of funds to be used.

The project work description should be limited to features that are eligible for the federal funds requested as the listing of ineligible features may call into question the eligibility of the project. If the project contains incidental features that are not eligible for federal funds, federal reimbursement for these features will not be permitted. However, funds listed as the agency’s contribution to the project in excess of those needed to match federal funds for eligible features of the project may be used to fund the ineligible features.

A “federal match” is the share of the project’s total cost that the federal government will reimburse the project sponsor. For projects funded with the MAG share of STP or with CMAQ funds, the “federal match” is the dollar amount listed in the TIP. For most other types of federal funds, the federal match is the share of the project’s ultimate cost that will be reimbursed by the federal government. For example, if after obligation a project increases its cost by \$100,000 above that listed in the TIP and the federal match is 94.3 percent, the federal contribution will increase by \$94,300 provided that the project is funded from sources other than STP-MAG or CMAQ. If the example project was a CMAQ or a STP-MAG funded project, the federal contribution would not increase.

Project Development Requirements

Within the MAG region, ADOT and the City of Phoenix are the parties responsible for administering the process to develop federally funded projects for the FHWA and FTA, respectively. In performing this role, they act as agents for the federal government and are governed by federal regulations which limit their discretion. Projects may only be obligated after they have been approved by the administering agencies of having met all federal requirements.

The development process for highway construction projects generally requires up to 18 months lead time. It includes approval by ADOT of environmental, right-of-way and utility clearances and the development of plans and specifications to federal standards that are capable of being bid by ADOT. As obtaining the necessary clearances my requires the review of a number of ADOT sections, and may require third-party actions, such as those of utility companies or other MAG member agencies, it is generally not feasible to accelerate the ADOT approval process.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The Congestion Mitigation and Air Quality (CMAQ) federal-aid program is a contract authority program that is apportioned to a State based on population located in ozone and carbon monoxide nonattainment areas and, except in some exceptional circumstances, the funds may only be spent in these nonattainment areas. Under TEA-21, the apportionment of CMAQ funds to Arizona is based solely on the population of the MAG area and no substantial populations reside in other Arizona nonattainment areas. For this reason, CMAQ is effectively limited to the MAG area.

The applicable nonattainment area in the MAG area that CMAQ funds may be spent on is the PM-10 nonattainment area. This area includes all of Township 1 North Range 8 East (e.g. part of Apache Junction) plus the rectangle generally bounded on the west by the border between Range 4 West and Range 3 West (e.g. 259th Avenue), on the north by the border between Township 7 North and Township 6 North (e.g. 7 miles north of the Carefree Highway), on the east by the border between Range 7 East and Range 8 East (Meridian Road) and on the south by the border between Township 2 South and Township 3 South (the Hunt Highway).

CMAQ funding is limited to projects that provide air quality improvements. The following activities are generally eligible for CMAQ:

- transportation activities in an approved State Implementation Plan;
- transportation control measures to assist areas designated as nonattainment under the Clean Air Act Amendments of 1990;
- pedestrian/bicycle off-road or on-road facilities;
- traffic management/monitoring/congestion relief strategies;
- transit projects, including the purchase of transit vehicles;
- alternative fuel projects;
- intermodal freight;
- alternative fuel projects (including vehicle refueling infrastructure);
- alternative fuels (including clean fuel fleet programs and conversions);
- telecommunications;
- travel demand management;
- rideshare programs;
- inspection and maintenance programs, with some notable restrictions;
- public education and outreach activities;
- project development activities for new services and programs with air quality benefits;
- establishing/contracting with transportation management associations;
- fare/fee subsidy programs;
- experimental pilot projects/innovative financing; and
- other transportation projects with air quality benefits.

Example projects that are eligible for CMAQ funding include: HOV lane construction, the purchase of PM-10 street sweepers, left and right turn lane construction, dirt road paving and bicycle, pedestrian and transit projects.

Transportation projects that add through lane capacity are not eligible for CMAQ funding. Also, drainage improvements, traffic calming, ADA improvements and operations and maintenance activities (except as part of a limited year pilot program) are not eligible for CMAQ funding.

The federal match for CMAQ in Arizona is 94.3 percent. On average there was approximately 31.5 million per year in CMAQ allocated to projects in the FY 2002-2006 MAG TIP. The following table lists the amount of CMAQ allocated by year and modal category in the FY 2003-2007 MAG TIP.

**Table IX-1: FY 2003-2007 MAG TIP CMAQ Allocations
(Millions of Dollars)**

Modal Category	2003	2004	2005	2006	2007	Total	Average
Air Quality/TDM	\$ 3.2	\$ 3.2	\$ 3.6	\$ 2.7	\$ 3.9	\$ 16.6	\$ 3.3
Bicycle	5.1	8.5	3	5.4	6.7	28.7	5.7
Freeway	3.1	1.3	4.7	0	0	9.1	1.8
ITS	2.5	3.7	2.2	6.8	3.7	18.9	3.8
Pedestrian	0.4	1.2	0.6	0.9	2.5	5.6	1.1
Street	11.6	9.5	5.1	3.8	11.2	41.2	8.2
Telecommunication	1.4	0.8	0.5	1.9	0	4.6	0.9
Transit	5.2	5.1	7.9	6.5	7.5	32.2	6.4
Total	\$ 32.5	\$ 33.3	\$ 27.6	\$ 28.0	\$ 35.5	\$156.9	\$ 31.4

MAG Surface Transportation Program (STP-MAG)

A share of the Surface Transportation Program funding apportioned to Arizona is sub-allocated for urbanized areas with populations exceeding 200,000 (currently only this region and that of the Pima Association of Governments, in Tucson qualifies). These funds are directly programmed by the respective MPO for the urbanized area and there are few limitations on this funding. However, the funding must be utilized on federal-aid eligible routes and is primarily targeted at regional projects.

Through FY 2014, MAG has committed \$34.1 million per year in MAG federal funds for completion of regional freeway system and the retirement of federal grant anticipation notes associated with this system. This commitment is to be met by first using STP-MAG funding and then by using CMAQ funding if there is not enough STP-MAG available. In addition, MAG has committed \$1.5 million per year for regional transportation planning and

air quality studies and contingencies.

This leaves little STP-MAG available for MAG member agency use. In the FY 2003-2007 MAG TIP, less than \$10 million in STP-MAG funds were available for non regional freeway or non regional study use.

State Allocated Federal-Aid Programs

The State is directly responsible for allocating the majority of federal funding within the State, including some funding types targeted for local government use. Requests for this funding should be directed to the relevant section within ADOT. The following programs are directly administered by ADOT:

1. Transportation Enhancements (STP-TEA). This funding source comes from a ten percent set-aside of the STP funds apportioned to each State. Transportation enhancements are transportation-related activities that are designed to strengthen the cultural, aesthetic, and environmental aspects of the Nation's intermodal transportation system. Eligible activities for this funding type include:
 - provision of facilities for pedestrians and bicycles (off-road or on-road facilities, including modification of existing public sidewalks to comply with the requirements of the Americans with Disabilities Act);
 - provision of safety and educational activities for pedestrian and bicyclists;
 - acquisition of scenic easements and scenic or historical sites (including the provision of tourist and welcome center facilities);
 - landscaping and other scenic beautification;
 - historic preservation;
 - rehabilitation and operation of historic transportation buildings, structures, or facilities (including historic railroad facilities and canals);
 - preservation of abandoned railroad corridors (including the conversion and use of pedestrian or bicycle trails);
 - control and removal of outdoor advertising;
 - archaeological planning and research;
 - environmental mitigation to address water pollution due to highway runoff or reduce vehicle-caused wildlife mortality while maintaining habitat connectivity, and
 - establishment of transportation museums.

Approximately half of the available funds are used statewide for projects on the state highway system and the remaining funds are made available for eligible projects submitted by local governments. The federal match is approximately 94.3 percent of the total cost of the project. In-kind contributions are allowed as part of the local contribution.

For enhancement projects on the state highway system, MAG agencies should contact the ADOT Phoenix Construction District Engineer. For local agency sponsored projects off the state highway system, MAG coordinates and ranks

submitted projects and submits a prioritized list to the ADOT Transportation Enhancement Review Committee (TERC). The ADOT TERC reviews projects submitted from the State and recommends a list to the State Transportation Board for scoping and programming, as appropriate.

2. Bridge Funding (BR). The Highway Bridge Replacement and Rehabilitation Program provides funds to assist the States in their programs to replace or rehabilitate deficient highway bridges and to seismic retrofit bridges located on any public road. Eligible activities for this funding include:

- the total replacement of a structurally deficient or functionally obsolete highway bridge on any public road with a new facility in the same general traffic corridor;
- the rehabilitation that is required to restore the structural integrity of a bridge on any public road, as well as the rehabilitation work necessary to correct major safety (functional) defects; and
- bridge painting, seismic retrofitting, calcium magnesium acetate applications, sodium acetate/formate, or other environmentally acceptable, minimally corrosive anti-icing and de-icing compositions or installing scour countermeasures.

To be eligible for this funding a bridge must be over a waterway, other topographical barriers, other highways or railroads, and the bridge must be significantly important and unsafe because of structural deficiencies, physical deterioration or functional obsolescence.

The federal match for this program is 94.3% and the ADOT bridge program averages around \$4 million per year statewide. The funds are available on a first-come, first-served basis. To apply for this funding, MAG member agencies should contact the ADOT Bridge Management Section at (602) 712-8616. In general, bridges in the MAG region are in excellent shape compared with other regions and, especially compared to other States.

3. Hazard Elimination and Safety (STP-HES). A ten percent share of State STP is set aside for safety projects that provide for spot safety improvements. To use this funding, an applicant must show that a safety problem exists, that it has taken corrective measures available to it and that these measures have failed to correct the problem. The federal match is generally 94.3 percent, but can be as much as 100 percent in certain circumstances. Similar to BR funds, these funds are available on a first-come, first-served basis. To apply for these funds, MAG member agencies should contact the ADOT Local Government Section at (602) 712-7545.

4. Railroad Crossing (STP-RR). A share of STP is also set aside for address railroad crossing safety problems. The federal match is usually 94.3 percent. To apply for these funds, please contact the ADOT Utility and Railroad Engineering Section at (602) 712-7541.

ADOT Federal-Aid Programs

ADOT is the direct recipient of a number of federal-aid programs that are used to build and maintain state highways. These federal-aid programs and the amounts programmed for them in the MAG area are listed in the following table.

**Table IX-2: ADOT Federal-Aid Programs in the
FY 2003-2007 MAG TIP – Thousands of Dollars**

Year	IM	NHS	STP (ADOT)	Total
2003	\$ 14,357	\$ 0	\$ 80,420	\$ 96,780
2004	0	0	60,095	60,095
2005	30,365	2,829	9,968	43,162
2006	32,062	106,618	2,876	141,556
2007	0	0	0	0
Total	76,784	109,447	153,359	339,590
Average	\$ 15,357	\$ 21,889	\$ 30,672	\$ 67,918

Federal Transit Administration Funding Programs

A variety of funding programs have been developed for transit. The Regional Public Transportation Authority (RPTA) coordinates the programming of these funds on behalf of MAG. These programs include:

- Section 5307. Section 5307 were formerly know as Section 9 funds. Section 5307 is a formula program used for capital expenditures and preventative maintenance. At least 1 percent of the funding apportioned to each area must be used for transit enhancement activities such as historic preservation, landscaping, public art, pedestrian access, and enhanced access for persons with disabilities. The federal match is 80 percent.
- Section 5309. Section 5309 was formerly known as Section 3. It is discretionary program that provides transit capital assistance for new fixed guideway systems (New Starts) and bus and bus related projects. The federal match is 80 percent.
- Section 5310. Section 5310 was formerly know as Section 16. It is a formula program that provides capital assistance through the State to organizations that provide specialized transportation services to elderly persons and persons with

disabilities. The federal match is 80 percent. To obtain more detailed information on this funding source please contact the Transit Programs Group of the ADOT Transportation Planning Division at (602) 712-7465

- Section 5311. Section 5311 was formerly known as Section 18. It is a formula program that provides funds for capital and operating expenses in non-urbanized areas (rural areas). To obtain more detailed information on this funding source please contact the Transit Programs Group of the ADOT Transportation Planning Division at (602) 712-7465.

SECTION X

POLICY GUIDELINES AND PROCESS

The results of the management systems as reviewed in this report will be used in developing the FY 2004-2008 MAG Transportation Improvement Program (TIP). This section outlines some of the overriding factors in the programming process including guidelines, scheduling and policies.

Schedule

It is anticipated that other than for regional freeway projects and for transportation control measures, projects will not will not be programmed with MAG Surface Transportation Program and Congestion Mitigation Air Quality funding for fiscal year 2008 as MAG is currently reviewing and revising the programming process for MAG federal funds and it is expected that this work will not be completed in time to allow for the programming of these funds. Also, MAG is in the middle of a major update to the long transportation plan which is expected to yield new projects and policy objectives that will be incorporated into the MAG programming process and the pending expiration and re-authorization of TEA-21 clouds funding projects for FY 2008.

Listed below is a tentative schedule for adopting the TIP and LRTP. This schedule is designed to allow continuous and early public input into the planning and programming process. It is also intended to insure adequate time to conduct rigorous analyses of the air quality, financial, congestion and other considerations.

Table X-1: Tentative Schedule to Update the TIP

Date	Function
2002	
July	FY 04-08 MAG TIP Guidance Report
August	Joint Policy Meeting (MAG/ADOT/RPTA)
July - October	Stakeholders meetings held concurrent with the TAC and TRC meetings
2003	
January 17	Member agencies submit privately and locally funded projects for inclusion in TIP for an Air Quality Conformity Analysis (AQCA)
Mid February	FY 04-08 Draft MAG TIP (listing of projects) produced
February	Joint Open House and Hearing for MAG, ADOT, RPTA and CTOC
February	Regional Transportation Stakeholders Meeting (tentative)
February	Transportation Fair at Central Transit Station

Date	Function
February	TACs review FY 04-07 Draft MAG TIP
End Feb	Draft TIP recommended by TRC for an AQCA
March	Draft TIP recommended by MC and RC for an AQCA
June	MAG final public hearing on the TIP, LRTP and Conformity Analysis
July	TIP, LRTP and Conformity Analysis targeted to be submitted to the Management Committee for review
July	TIP, LRTP and Conformity Analysis targeted to be submitted to the Regional Council for final approval
August	The approved TIP, LRTP, and Conformity Analysis targeted to be submitted (as appropriate) to Federal Agencies and Governor's designee

Existing Policies

Policies will guide the development of the TIP. These guidelines are based on Regional Council actions, federal regulations, committee recommendations, and planning judgements. A listing of these guidelines is provided below and later in this section:

General Policy Guidelines:

- LRTP -- Major projects proposed for addition to the TIP should flow from the LRTP. Major needs rated highly by the Management Systems that are not in the current TIP or LRTP should be considered for addition to these documents.
- Program Process -- Results from the Management Systems will be used to facilitate development of the TIP. However, these management systems are but one set of tools used in the planning and programming process. Other issues include mobility, accessibility, the environment, economic development, financial constraints and public involvement. The final decision rests with the MAG Regional Council.
- Data Requirements -- All projects included in the TIP will need to include adequate information to apply the MAG project rating system. This information needs to be supplied by the project sponsor when the project is submitted to MAG. Additional information is being requested this year for potentially Federally funded projects.
- Committee Review -- Lists of rated projects will be provided to MAG transportation technical committees for review. MAG transportation technical committees include street, bicycle, pedestrian, intermodal, the Air Quality Technical Advisory Committee and the Transportation Review Committee. The RPTA will assess transit projects.
- Funding Levels -- The TIP requires a funding plan based on committed funding. In a change from previous procedures, the MAG Federal funds are limited to 90 percent obligation authority (OA) for the whole TIP cycle from 2004 to 2008 instead of the 95 percent utilized under previous legislation. This reflects the actual receipt

of federal OA and staff predictions. TEA-21 "firewall" amounts may be exceeded, but the actual OA rate is not expected to match the appropriated levels. Also, the funding amounts will be expressed in constant 2000 dollars. Local and ADOT programs, as well as privately funded projects, also need to be limited to committed funding.

Freeway System Guidelines

Existing policies for funding and priorities for regional freeway projects are currently under review Regional Council Transportation Subcommittee.

- Freeway Funding -- In 1995, as part of the changes to the regional freeway plan resulting from the failure of Proposition 400, the Regional Council increased the share of MAG federal funding being programmed for the Proposition 300 Freeway/ Expressway System from 50 percent to up to 70 percent and adopted freeway priorities accordingly. The increase in CMAQ funds to the MAG region under TEA-21 compared with the relative lack of increase in STP funds required a re-evaluation of this policy. In 1998, the Regional Council set a base for the use of MAG Federal funds on the Regional Freeway System of \$34.1 million. This amount requires the programming of CMAQ funds on non-RARF funded freeway projects within the region and consequent exchange of non-CMAQ funds for Regional Freeway System projects.
- Freeway Priorities -- The Regional Council has adopted criteria to prioritize freeway projects. Freeway priorities have been developed and adopted to be used in developing the MAG TIP.
- HOV -- The Regional Council adopted a High Occupancy Vehicle (HOV) Plan for the MAG freeway system. Any new freeway project in a planned HOV corridor should include HOV facilities. MAG has set priorities for the development and implementation of HOV facilities within the MAG region. The highest priorities are: I-17, from Thomas Road to Dunlap Avenue (project is nearing completion); US-60 (Superstition Freeway) from I-10 to Power Road (currently programmed from I-10 to Val Vista Drive as design-build project starting in 2001); and SR-51 (Squaw Peak Parkway) from I-10 to Shea Boulevard (already programmed for HOV lanes from McDowell Road to Glendale Road in 2003 and HOV ramps connecting I-10 to Squaw Peak in 2004).

Federal Fiscal Year Close Out Guidelines

In May 1995, the Regional Council approved the recommendations of the Subcommittee to Examine the Reallocation of MAG Federal Funds. These recommendations have been subsequently amended and include eight actions as follows:

1. Approval -- Regional Council approval of all MAG federal funding changes;
2. Cost Increases -- The amount of MAG federal funding available for a project is the programmed amount listed in the current TIP. The sponsoring agent is responsible

for any cost increases;

3. Project Carry Forward -- For a project in the first year of the adopted program, the sponsoring agent will notify MAG staff by March 1 if a project is to be withdrawn or requested to be carried forward. Projects will be carried forward only one time and will need to be obligated by September 30 in the following year;
4. Close Out Priorities -- The first priority for uncommitted and redistributed obligation authority occurring in the first year of the program will be to advance current federally funded programmed projects that are ready to be obligated. The second priority is to increase the federal share of projects being obligated in the first year of the program. The process of selecting these projects will consider committee input and results of the management systems;
5. Project Readiness -- Member agencies will be encouraged to have programmed federally funded projects ready to be obligated as soon as possible. Projects ready to go will have a high priority to be advanced to the current fiscal year to ensure that committed obligation authority is fully used, and to increase prospects of receiving a share of Arizona redistributed obligation authority;
6. Commitment to Programmed Projects -- In updating the five year program, projects will not be deleted except as requested by member agencies, or as required by lack of project progress or conformity requirements. Therefore, the focus of updating the five year program should be on adding projects in the fifth year of the program and not on changing projects in the first four years;
7. CMAQ -- A commitment will be made to using Congestion Mitigation and Air Quality (CMAQ) funds. Surface Transportation Program (STP) funds will not be obligated at a higher rate than CMAQ funds; and
8. Procedural Changes -- Any future change in adopted procedures for the allocation of MAG federal funds, will require review by the MAG Transportation Review Committee and other committees as appropriate. Final action will be by the Management Committee and Regional Council.

Other guidelines for Street projects are:

- Federal System -- MAG Federal funds need to be applied to projects on roadways rated higher than rural minor collector on the Federal Functional Classification System.
- SOV -- ISTEA requirements for a CMS requires that the following options to Single Occupancy Vehicle (SOV) capacity projects need to be considered:
 1. Demand management programs
 2. Traffic operational improvements
 3. HOV facilities
 4. Public transit capital improvements
 5. Public transit operational improvements
 6. Measures to encourage nontraditional modes

7. Congestion pricing
8. Growth management
9. Access management
10. Incident management, and
11. An Intelligent Vehicle Highway System.

As part of the TIP submittal process, all jurisdictions are requested to supply documentation that all specified ISTEA options have been considered (regardless of funding source) prior to using the SOV option.

Air Quality Guidelines

- CMAQ Emissions Reduction -- A more stringent requirement under TEA-21 guidelines for the CMAQ program was to complete an estimate of the emissions reduction for air quality pollutants, prior to the programming CMAQ funds for eligible projects. In the MAG region, the pollutants include carbon monoxide, ozone and particulate matter of less than ten microns (PM-10). This CMAQ rating system was initially developed in 1999 and is currently being improved.

Not all eligible projects are quantifiable through the rating system, but the federal guidelines allow qualitative analysis where quantitative analysis is not possible. Results of the CMAQ rating system are used by MAG committees, together with other inputs such as CMS scores and some individual modal rating system scores during the selection of projects through the programming process.

- TCMs -- All transportation control measures (TCMs) included in the State Implementation Plan for air quality are to be funded before other federally funded transportation projects.

Alternative Modes Guidelines

- Transit -- MAG Federal funds may not be used for transit operations, but may be used for capital purchases of transit vehicles.
- Bicycle -- In the past, \$450,000 per year has been reserved for bicycle projects. This funding was reserved in the TIP as a lump sum. Under current procedures there are no modal allocations. Therefore, to be eligible for MAG Federal funds, specific bicycle projects need to be identified and they will be evaluated against other potential transportation projects. The TIP includes several bicycle projects and resulted in an average of over \$3 million in federally funded bicycle projects being selected each year.

MAG Federal Funding

The ISTEA legislation sharply increased the amount of federal funding sub-allocated to the MAG Region each fiscal year. For the period of ISTEA, MAG received an apportionment of approximately \$40 million in federal funds including STP, CMAQ and planning funds. However, this amount was reduced due to annual Obligation Authority (OA) limitations imposed on the expenditure of these funds. OA is the authority to spend the annual federal

cash apportionment MAG receives each year. For example, in FY 1999, the apportionment of funds was substantially higher than expected, due to the newly signed TEA-21, but the OA allowed was set at 85 percent, which nevertheless resulted in a large increase in the amount of usable federal funds expected. Using historical trends, the average OA received for the life of ISTEA was approximately 95 percent. However, OA rates are averaging less than 88 percent for TEA-21 to date.

The TEA-21 legislation has again substantially increased federal funding to Arizona and to the MAG region. This Act has increased the appropriations targeted for Arizona by an average of over 57 percent over its six year life. However, the increase of federally mandated sub-allocated funds to the MAG region was expected to be in the region of only 35 percent. This would have increased the amount of federal funds to the MAG region by an average of approximately \$15 million to an annual average total of \$55 million, compared to an annual \$40 million under ISTEA (excluding planning funds).

More recently, general growth in the economy has triggered some of the growth provisions within TEA-21, especially Revenue Aligned Budget Authority (RABA). The main result of these provisions is the larger than expected increase in the amount of federal funds being available. Comparing the amounts of sub-allocated STP and CMAQ funds available to MAG under ISTEA and TEA-21, STP funds have increased from an average of \$28 million per year to \$32 million and CMAQ funds have increased substantially from \$12 million to an average of \$30 million.

Expectations for the forthcoming TIP cycle are that the two prime funding sources for MAG will continue, and will likely increase. STP sub-allocations are estimated at an average of \$35.5 million, CMAQ also at \$36.5 million, and OA is estimated at 88 percent. Even though the final three years of the forthcoming TIP cycle fall outside of the current TEA-21 legislation, funding increases during previous re-authorizations have been in the realm of 20 to 50 percent, so the current assumptions are on the conservative side and can be adjusted according to future changes.

During the first few years of TEA-21, a change occurred in the method used to determine how State and Federal funds are allocated to the metropolitan regions within Arizona. Under ISTEA, the State was supposed to provide MPOs with estimates of available State and Federal funds which the MPOs could utilize in developing the metropolitan TIPs. In 1998, a finding by the Federal Highway Administration during the triennial certification review of the State/MPO Planning Process within the MAG region found that the State had not been correctly complying with this requirement.

TEA-21 provides an important change to this requirement. The new Act requires that *"For the purpose of developing the TIP, the MPO, public transit agency, and State shall cooperatively develop estimates of funds that are reasonably expected to be available to support program implementation."* The process used by ADOT to allocate funds to various programs was predominantly a project specific needs-based system.

Detailed discussions between ADOT, the MPOs, COGs and the Public Transit Agencies to achieve consensus on programming guidelines for Arizona resulted in a set of agreements known as the Casa Grande Resolves. One of the agreements engendered the

formation of a Regional Allocation Advisory Committee (RAAC). The primary goal of the RAAC is to find an equitable method for allocating transportation funding resources within the State.

Concurrent with the above discussions, MAG underwent a review of existing policies regarding transportation programming priorities within the region. This review occurred at the highest level within MAG and was conducted by a Transportation Subcommittee of the Regional Council, chaired by Mayor Wayne Brown of Mesa. The Subcommittee's efforts culminated in the approval by the full Regional Council of a set of Policy Guidelines for programming regional transportation funds. These guidelines are described as follows:

Policy Guidelines

In July 1998, the MAG Regional Council took action to direct that guidelines be developed for selecting projects for inclusion in the FY 2000-2004 MAG TIP. They also recommended an expanded public outreach process. Focus groups have been held and stakeholders have been consulted. It is proposed that these guidelines be used in programming uncommitted regional transportation funds including ADOT discretionary funds, regional sales tax funds, federal transit funds and MAG federal funds.

This paper presents six programming parameters in the areas of Regionalism, Multimodalism, Air Quality, Congestion, Human Services, and Funding. Specific program objectives are listed for each parameter.

Regionalism (Focus regional funds on meeting regional needs):

Regional needs and projects serve regional travel needs. Also, MAG is held accountable by stakeholders and the public to address regional issues. MAG regional commitments include the following:

- *The existing dollar amount of funding committed for the completion of the regional freeway system within the identified time frame needs to be maintained.* Completion of new freeways was a high priority for stakeholders and focus groups. Maintaining a 70 percent commitment to freeways became, effectively, impossible as TEA-21 substantially increased the share of MAG funds in the CMAQ category; CMAQ funds can not be used for new freeway construction unless it includes qualified uses, such as the construction of an HOV lane.
- *Provide capital support to improve the regional transit system.* Improved transit was the highest funding priority for stakeholders and focus groups. In the stakeholder process improved transit service was the highest priority to meet air quality and welfare to work needs.
- *Expedite completion of the regional freeway system.* These are freeways presented to the voters in 1985 including the Grand Avenue Expressway and right-of-way protection and interim construction of the Estrella Freeway. The Paradise Parkway remains deleted from the MAG Freeway Plan. After transit, completing freeways was

the highest modal priority for both the stakeholders and focus groups.

- *Complete a regional System of High Occupancy Vehicle (HOV) facilities including HOV lanes, park and ride lots and HOV ramps in accord with adopted priorities.* For stakeholders, freeway HOV lanes were the second highest freeway priority.
- *Weight proposed street projects on the adopted Roads of Regional Significance more strongly than other street projects.* In the stakeholders process the highest priority street issue was to establish regional routes for increased travel. Participants in focus groups also expressed a need for more regional routes.
- *Recognize the importance of the state highway system within the region as it relates to improving air quality and reducing congestion.* The state highway system within the region is an important part of the regional transportation system. Less congestion and improved air quality as it relates to the regional system as a whole will benefit the economy and public health of the region and the State.
- *Provide support for regional integration of Dial-a-Ride services.* The need to improve Dial-a-Ride services has been strongly expressed in regional meetings conducted by MAG in July and September.
- *Support regional programs to reduce travel demands.* System efficiency measures were rated highly in the stakeholder's process. Highly rated projects included vanpool, carpool and telecommuting programs.
- *Support a regionally integrated Intelligent Transportation System to improve system performance.* Signal coordination was rated highly by stakeholders and focus groups. This measure is also related to improving air quality.
- *Support projects that effectively contribute to meeting regional air quality standards.* The need for investments to improve air quality was highly rated by stakeholders and clearly is a regional issue.
- *Support projects that integrate land use and transportation planning to provide a transportation system which interfaces with land use needs and provides appropriate accessibility by the various transportation modes.* Stakeholders and focus groups identified the importance of integrating land use and transportation planning. The existing Congestion Management System incorporates land use and the Valley Vision 2025 process may further identify land use and transportation integration issues.

Multimodalism (Support a multimodal transportation system):

All modes need to be supported with regional funds and multimodal projects need to be highly considered in selecting projects for funding. A multimodal perspective was clearly supported by stakeholders and focus groups. Multimodal approaches include the following:

- *Continue capital commitments to transit and Dial-a-Ride services.* As previously noted at MAG meetings there has been significant support to improve the transit system and

Dial-a-Ride services.

- *Support bicycle and pedestrian projects.* Significant support was registered in the stakeholders process for bicycle and pedestrian facilities.
- *Encourage carpooling by supporting demand management programs, HOV lanes, and park-and-ride facilities.* Stakeholders noted significant support for demand management programs and HOV lanes.
- *Support regionally significant telecommuting, teleconferencing, and teleworking projects.* In the stakeholder process, significant support was provided for these types of projects.
- *Projects that support more than one mode of transportation need to be highly considered in the project selection process.*
- *Projects that enhance intermodal connections need to be highly considered in the project selection process.*
- *Encourage non-automobile travel by supporting community design which facilitates bicycle, pedestrian and other non-automotive travel.*

Air Quality (Support effective projects to meet air quality standards):

Improving air quality is a public health and quality of life issue. Failure to meet air quality requirements could also halt transportation projects. Air quality was the second highest priority for funding in the stakeholder process. Significant areas of funding needed to improve air quality include the following:

- *Support programs which reduce pollution caused by vehicular travel.* Reducing vehicle emissions was strongly supported by stakeholders and focus groups.
- *Develop and implement programs to retire old diesel vehicles.* Accelerating retirement of pre-1988 diesel vehicles before January 2004 could significantly improve air quality.
- *Reduce re-entrainment of dust from paved roads.* This could include funding for vacuum street sweepers. This funding commitment would be subject to the availability of vacuum street sweepers that meet national standards.
- *Reduce dust from unpaved roads and shoulders.* This could include paving dirt roads and unpaved shoulders with significance traffic volumes.
- *Develop a demonstration program to reduce PM-10 concentrations in the areas of highest concentration.* Particulate concentrations are localized and a demonstration program could have major impacts. Alternative approaches would need to be studied as part of this effort but could include street sweeping, street paving and stabilization of dirt lots.

- *Selection of projects for turning lanes should be weighted by adjacent carbon monoxide levels.*
- *Continue a set-aside of MAG Surface Transportation Program (STP) funds to meet air quality and transportation special study needs. Air quality studies and plans are critical to cleaning up the air and meeting federal requirements.*

Congestion (Focus funds to reduce congestion):

The public process demonstrated that congestion is an overarching transportation concern. Congestion was directly mentioned as the principal concern at the MAG freight forum, and at focus groups it was an underlying concern for a high level of frustration with travel in the region. The MAG Congestion Management System is used in selecting projects for funding.

- *The MAG Congestion Management System (CMS) should continue to be used to rate projects. This system rates projects in terms of their ability to address congestion, and these scores are a major factor in selecting projects for funding.*
- *Consider MAG CMS policies in selecting projects including full consideration of non-single occupancy vehicle options. This is a federal requirement.*

Human Service Needs (Support transportation projects that address the needs of underserved populations):

The disabled need basic transportation services and welfare recipients need access to jobs. The need for improvements to Dial-a-Ride services and welfare to work programs were strongly supported in the MAG public outreach process.

- *Support electronic equipment and services needed to regionally integrate local Dial-a-Ride services. The need for improved Dial-a-Ride service (especially between jurisdictions) has been strongly supported at MAG public meetings.*
- *Support programs that ensure access to jobs, especially for welfare recipients. The Stakeholder outreach process confirmed that transportation is a major problem for welfare recipients.*
- *Support an improved regional bus system. In the stakeholder process, bus improvements were the highest priority to meet welfare to work needs.*
- *Develop a strategic plan to address aggressive driving behavior. Road rage was expressed as a major concern in focus groups.*

Application Forms

The application forms for applying for MAG Federal funds are usually provided as part of Appendix A to this report. However, as MAG Federal funds for FFY 2008 will not be programmed during the forthcoming TIP development cycle, the forms have been omitted. Electronic copies of the forms are usually made available on the MAG website for download and copying, and attempts continue on finding a way to submit the request electronically directly via the MAG website.

MAG staff are working on an overhaul of the computerized TIP data entry system and a beta version will be available and distributed to members of MAG technical advisory committees for review in the forthcoming months, in time for updating projects already shown in the TIP and for entering locally and privately funded projects for FFY 2008.

Further information will be provided on the TIP data entry system in due course, but if there are any questions regarding these items, please contact Paul Ward or Stephen Tate at (602) 254-6300.

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Appendix G
Improvement Cost Information

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

TOWN OF CAREFREE

PROJECT CONTROL NO. 2000 CO37

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$
1.	General Requirements, Mobilization, Bonds and Insurance	1	LS	\$ 275,000	\$ 275,000
2.	Preconstruction Surveys	1	LS	\$ 10,000	\$ 10,000
3.	Cave Creek Road - 6	1	LS	\$ 711,000	\$ 711,000
4.	Tranquil Trail	1	LS	\$ 592,000	\$ 592,000
5.	Rising Sun Road	1	LS	\$ 119,000	\$ 119,000
6.	Golden Spur Lane	1	LS	\$ 312,000	\$ 312,000
7.	Sombrero Road	1	LS	\$ 440,000	\$ 440,000
8.	Pima Road	1	LS	\$ 204,000	\$ 204,000
9.	Cave Creek Road - 3	1	LS	\$ 278,000	\$ 278,000
SUBTOTAL OF EXTENDED AMOUNTS FOR WORK LISTED ABOVE					\$ 2,941,000
BID ADJUSTMENTS					
	Contractor overhead	10%			294,100
	Contractor Profit	5%			147,050
	Contingency	30%			882,300
TOTAL PRICE (The sum of the computed totals)					\$ 4,264,000

Cave Creek Road - 6					
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$
DEMO/REMOVE EXISTING STRUCTURES					
	Demo/Remove Existing Road Surface				
	a Demo Existing Pavement 3" thick	1,120	SY	\$ 3.85	\$ 4,312
	b Disposal of Debris	1	LS	\$ 2,500.00	\$ 2,500
CONSTRUCT NEW FEATURES					
	Cut and Fill Common Earth				
	a Excavation	3,360	CY	\$ 2.10	\$ 7,056
	b 50' haul	3,360	CY	\$ 0.82	\$ 2,755
	c Water wagon	6,720	CY	\$ 0.43	\$ 2,890
	d Backfill Material	1,279	CY	\$ 11.25	\$ 14,389
	e Backfill 50' haul	1,279	CY	\$ 0.82	\$ 1,049
	f Compaction	1,279	CY	\$ 2.79	\$ 3,568
	g Grading	1,200	SY	\$ 1.13	\$ 1,356
	Construct New Road Surface				
	a 12" Gravel Base	1,120	SY	\$ 14.75	\$ 16,520
	b Prepare Base	1,120	SY	\$ 0.82	\$ 918
	c 2" Binding Course	1,120	SY	\$ 3.57	\$ 3,998
	d 1" Wearing Course	1,120	SY	\$ 2.17	\$ 2,430
	Outlet Protection (Rip Rap)	417	CY	\$ 39.00	\$ 16,263
	Embankment Fill Protection	40	MSF	\$ 47.50	\$ 1,900
	Wash crossing 20'-4" x 4'-6" CMPA	378	LF	\$ 1,270.00	\$ 480,060
	a Headwall	450	SF	\$ 161.75	\$ 72,788
	b Concrete	284	CY	\$ 266.00	\$ 75,544
					\$ 711,000

02220-875-1710

12.1-214
Allowance

Historical

02310-440-3300

02720-200-0300

02720-215-0100

02740-300-0120

02740-300-0300

02370-300-0100

02920-510-4600

Contech Construction Products

02830-100-2200

Allowance also page 441

Tranquil Trail					
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$
DEMO/REMOVE EXISTING STRUCTURES					
	Demo/Remove Existing Road Surface				
a	Demo Existing Pavement 3" thick	1,778	SY	\$ 3.85	\$ 6,845
b	Disposal of Debris	1	LS	\$ -	\$ -
c	Remove existing culverts	1	LS	\$ 2,500.00	\$ 2,500
CONSTRUCT NEW FEATURES					
Earthwork					
a	Excavation	500	CY	\$ 2.10	\$ 1,050
b	50' haul	500	CY	\$ 0.82	\$ 410
c	Water wagon	1,000	CY	\$ 0.43	\$ 430
d	Backfill Material	640	CY	\$ 11.25	\$ 7,200
e	Backfill 50' haul	640	CY	\$ 0.82	\$ 525
d	Compaction	640	CY	\$ 2.79	\$ 1,786
g	Grading	320	SY	\$ 1.13	\$ 362
Construct New Road Surface					
a	12" Gravel Base	1,778	SY	\$ 14.75	\$ 26,226
b	Prepare Base	1,778	SY	\$ 0.82	\$ 1,458
c	2" Binding Course	1,778	SY	\$ 3.57	\$ 6,347
d	1" Wearing Course	1,778	SY	\$ 2.17	\$ 3,858
	3' Currugated Steel Guardrail Post @ 6' 3" O.C.	580	LF	\$ 13.25	\$ 7,685
	Outlet Protection (Rip Rap)	291	CY	\$ 39.00	\$ 11,349
	Embankment Fill Protection	58	MSF	\$ 47.50	\$ 2,755
	Wash Crossing 20'-4" x 4'-6"	242	LF	\$ 1,270.00	\$ 307,340
a	Headwall	910	SF	\$ 161.75	\$ 147,193
b	Concrete	210	CY	\$ 266.00	\$ 55,860
					\$ 592,000

02220-875-1710
Assume no cost
Allowance

12.1-214
Allowance

Historical

02310-440-3300

02720-200-0300
02720-215-0100
02740-300-0120
02740-300-0300
R02700-130
02370-300-0100
02920-510-4600

Contech Construction products
02830-100-2200
Allowance also page 441

Golden Spur Lane					
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$
DEMO/REMOVE EXISTING STRUCTURES					
	Demo/Remove Existing Road Surface				
a	Demo Existing Pavement 3" thick	1,411	SY	\$ 3.85	\$ 5,432
b	Disposal of Debris	1	LS	\$ -	\$ -
c	Remove existing culverts	1	LS	\$ 5,000.00	\$ 5,000
CONSTRUCT NEW FEATURES					
Earthwork					
a	Excavation	500	CY	\$ 2.10	\$ 1,050
b	50' haul	500	CY	\$ 0.82	\$ 410
c	Water wagon	3,700	CY	\$ 0.43	\$ 1,591
d	Backfill Material	3,200	CY	\$ 11.25	\$ 36,000
e	Backfill 50' haul	3,200	CY	\$ 0.82	\$ 2,624
f	Compaction	3,200	CY	\$ 2.79	\$ 8,928
g	Grading	1,600	SY	\$ 1.13	\$ 1,808
Construct New Road Surface					
a	12" Gravel Base	1,411	SY	\$ 14.75	\$ 20,812
b	Prepare Base	1,411	SY	\$ 0.82	\$ 1,157
c	2" Binding Course	1,411	SY	\$ 3.57	\$ 5,037
d	1" Wearing Course	1,411	SY	\$ 2.17	\$ 3,062
	Outlet Protection (Rip Rap)	46	CY	\$ 39.00	\$ 1,806
	Embankment Fill Protection	20	MSF	\$ 47.50	\$ 950
	Wash Crossing 10' x 4' CBC	312	LF	\$ 310.00	\$ 96,720
a	Headwall	720	SF	\$ 161.75	\$ 116,460
b	Concrete	10	CY	\$ 266.00	\$ 2,660
					\$ 312,000

02220-875-1710
Assume no cost
Allowance

12.1-214
Allowance

Historical

02310-440-3300

02720-200-0300

02720-215-0100

02740-300-0120

02740-300-0300

02370-300-0100

02920-510-4600

2530-730-0300

02830-100-2200

Allowance also page 441

Sombrero Road					
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$
DEMO/REMOVE EXISTING STRUCTURES					
	Demo/Remove Existing Road Surface				
a	Demo Existing Pavement 3" thick	1,778	SY	\$ 3.85	\$ 6,845
b	Disposal of Debris	1	LS	\$ -	\$ -
CONSTRUCT NEW FEATURES					
	Earthwork				
a	Excavation	250	CY	\$ 2.10	\$ 525
b	50' haul	250	CY	\$ 0.82	\$ 205
c	Water wagon	3,050	CY	\$ 0.43	\$ 1,312
d	Backfill Material	2,800	CY	\$ 11.25	\$ 31,500
e	Backfill 50' haul	2,800	CY	\$ 0.82	\$ 2,296
f	Compaction	2,800	CY	\$ 2.79	\$ 7,812
g	Grading	1,400	SY	\$ 1.13	\$ 1,582
	Construct New Road Surface				
a	12" Gravel Base	1,256	SY	\$ 14.75	\$ 18,526
b	Prepare Base	1,256	SY	\$ 0.82	\$ 1,030
c	2" Binding Course	1,256	SY	\$ 3.57	\$ 4,484
d	1" Wearing Course	1,256	SY	\$ 2.17	\$ 2,726
	3' Currugated Steel Guardrail Post @ 6' 3" O.C.	240	LF	\$ 13.25	\$ 3,180
	Outlet Protection (Rip Rap)	107	CY	\$ 39.00	\$ 4,173
	Embankment Fill Protection	20	MSF	\$ 47.50	\$ 950
	Wash Crossing 20'-4" x 4'-6"	144	LF	\$ 1,270.00	\$ 182,880
	Wash Crossing 54" CMP	70	LF	\$ 139.00	\$ 9,730
a	Headwall 54" CMP	1	LS	\$ 3,775.00	\$ 3,775
b	Headwall 20'-4" x 4'-6"	788	SF	\$ 161.75	\$ 127,459
c	Concrete footings	108	CY	\$ 266.00	\$ 28,728
					\$ 440,000

02220-875-1710
Assume no cost

12.1-214
Allowance

Historical

02310-440-3300

02720-200-0300

02720-215-0100

02740-300-0120

02740-300-0300

R02700-130

02370-300-0100

02920-510-4600

Contech Construction products

02530-730-2090

Allowance also page 441

02830-100-2200

Allowance also page 441

Pima Road						
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$	
DEMO/REMOVE EXISTING STRUCTURES						
	Demo/Remove Existing Road Surface					
a	Demo Existing Pavement 3" thick	1,900	SY	\$ 3.85	\$	7,315
b	Disposal of Debris	1	LS	\$ -	\$	-
CONSTRUCT NEW FEATURES						
Earthwork						
a	Excavation	500	CY	\$ 2.10	\$	1,050
b	50' haul	500	CY	\$ 0.82	\$	410
c	Water wagon	1,837	CY	\$ 0.43	\$	790
d	Backfill Material	1,337	CY	\$ 11.25	\$	15,041
e	Backfill 50' haul	1,337	CY	\$ 0.82	\$	1,096
f	Compaction	1,337	CY	\$ 2.79	\$	3,730
g	Grading	669	SY	\$ 1.13	\$	755
Construct New Road Surface						
a	12" Gravel Base	1,900	SY	\$ 14.75	\$	28,025
b	Prepare Base	1,900	SY	\$ 0.82	\$	1,558
c	2" Binding Course	1,900	SY	\$ 3.57	\$	6,783
d	1" Wearing Course	1,900	SY	\$ 2.17	\$	4,123
	3' Currugated Steel Guardrail Post @ 6' 3" O.C.	200	LF	\$ 13.25	\$	2,650
	Outlet Protection (Rip Rap)	150	CY	\$ 39.00	\$	5,850
	Embankment Fill Protection	16	MSF	\$ 47.50	\$	760
	Wash Crossing 11'-0" x 3'-6" CMPA	185	LF	\$ 150.00	\$	27,750
a	Headwall	467	SF	\$ 161.75	\$	75,537
b	Concrete	76	CY	\$ 266.00	\$	20,216
					\$	204,000

02220-875-1710
Assume no cost

12.1-214
Allowance

Historical

02310-440-3300

02720-200-0300

02720-215-0100

02740-300-0120

02740-300-0300

R02700-130

02370-300-0100

02920-510-4600

Contech Construction products

02830-100-2200

Allowance also page 441

Cave Creek Road - 3						
	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE \$	EXTENDED TOTAL AMOUNT \$	
DEMO/REMOVE EXISTING STRUCTURES						
	Demo/Remove Existing Road Surface					
	a Demo Existing Pavement 3" thick	620	SY	\$ 3.85	\$	2,387
	b Disposal of Debris	1	LS	\$ 2,500.00	\$	2,500
CONSTRUCT NEW FEATURES						
	Cut and Fill Common Earth					
	a Excavation	2,700	CY	\$ 2.10	\$	5,670
	b 50' haul	2,700	CY	\$ 0.82	\$	2,214
	c Water wagon	5,400	CY	\$ 0.43	\$	2,322
	d Backfill Material	1,612	CY	\$ 11.25	\$	18,135
	e Backfill 50' haul	1,612	CY	\$ 0.82	\$	1,322
	f Compaction	1,612	CY	\$ 2.79	\$	4,497
	g Sediment Removal	300	CY	\$ 2.10	\$	630
	h Grading	2,600	SY	\$ 1.13	\$	2,938
	Construct New Road Surface					
	a 12" Gravel Base	620	SY	\$ 14.75	\$	9,145
	b Prepare Base	620	SY	\$ 0.82	\$	508
	c 2" Binding Course	620	SY	\$ 3.57	\$	2,213
	d 1" Wearing Course	620	SY	\$ 2.17	\$	1,345
	Outlet Protection (Rip Rap)	93	CY	\$ 39.00	\$	3,627
	Embankment Fill Protection	23	MSF	\$ 47.50	\$	1,093
	Wash crossing 71" x 41" CMPA	408	LF	\$ 150.00	\$	61,200
	a Headwall	876	SF	\$ 161.75	\$	141,693
	b Concrete	52	CY	\$ 266.00	\$	13,832
					\$	278,000

02220-875-1710

12.1-214
Allowance

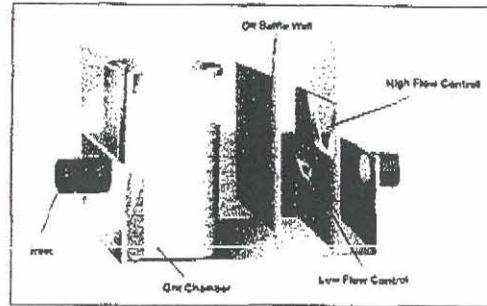
Historical

No hauling fee
02310-440-3300

02720-200-0300
02720-215-0100
02740-300-0120
02740-300-0300
02370-300-0100
02920-510-4600

Contech Construction Products
02830-100-2200
Allowance also page 441

CONTECH
 CONSTRUCTION PRODUCTS INC.
 260 North El Mirage Road
 El Mirage, AZ 85131
 (623) 935-6000 Fax (623) 935-6100



Vortechs System

EPA award-winning design efficiently removes contaminated sediment, floating oil and debris from surface runoff. It is a compact, below grade system that is fabricated near the jobsite from precast concrete and marine grade aluminum. Its unique design allow for easy inspection and unobstructed maintenance access. Features include low capital cost per unit of treatment and a shallow excavation depth that reduces installation costs.

Phone: 623-935-6000
 Fax: 623-935-6100

FAX COVER SHEET

Date:	January 9, 2003	From:	MAX BALDWIN, E.I.T. SALES ENGINEER
To:	LINDA JOHNSON	9	Total Pages (including cover sheet)
Company:	CH2M HILL		
Fax:	480-784-6273		
Subject:	WASH CROSSINGS		

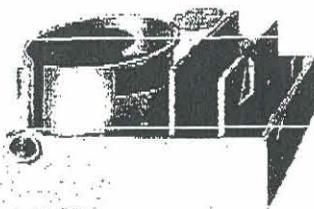
LINDA,

PLEASE FIND ATTACHED A FEW ALTERNATIVES FOR THE WASH CROSSINGS THAT I SPOKE WITH YOU ABOUT EARLIER TODAY. I HAVE ALSO REQUESTED A PROPOSAL FOR A FULL SPAN STEADFAST VEHICULAR BRIDGE IN EACH LOCATION AND WILL KEEP YOU POSTED WITH THOSE COST ESTIMATES AS SOON AS POSSIBLE. PLEASE CALL ME TO DISCUSS THE PROJECT AFTER YOU HAVE A CHANCE TO REVIEW.

THANKS,

MAX

Your Single-Source For Environmental BMPs



Stormwater Quality Units—The Vortechs System, a hydrodynamic separator, provides 80% TSS removal (Total Suspended Solids) from stormwater runoff. They cost less per CFS than any other system

Underground Stormwater Detention—CONTECH's system controls the flow of stormwater on newly-developed

and renovated sites where parking lots, roads and buildings have replaced open land. (See EPA Fact Sheet 832-F-01-005.)

Erosion Control—On slopes, Landlok Turf Reinforcement Mats; in waterway channels and on banks, Petraflex articulating concrete blankets; for stabilizing walls of earth, Keystone and Bin-Wall retaining walls and Gabions.

CONTECH
 CONSTRUCTION PRODUCTS INC.

visit us at www.cortech-cpi.com

INNOVATIVE SITE SOLUTIONS & STORMWATER MANAGEMENT



260 North El Mirage Road
P.O. Box 65
El Mirage, Arizona 85335
(623) 935-6000 FAX (623) 935-6100

SITE # 1 RISING SUN ROAD

OPTION 1

5-BARREL CONTECH 6'-1" X 4'-7" CORRUGATED METAL PIPE-ARCH

For this structure 36 feet long with square ends, the estimated price is **\$550.00 per linear foot (\$110.00 per linear foot per barrel x 5-barrels)**. This price includes all the materials required – CMP, bands, nuts and bolts. We have also included in this price freight delivered to the jobsite. We have not included concrete headwalls, excavation of the trench, installation or backfilling of the structure.

The pipe shall be 12-gage Aluminized Steel Type II Corrugated Metal Pipe Arch. Minimum cover shall be 18"; maximum cover shall be 24 feet. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for H 20 and HS 25 loads. Height of cover is based on 2 tons per square foot corner bearing pressures. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.

OPTION 2

5-BARREL CONTECH 8'-0" SPAN x 3'-4" RISE MULTI-PLATE ARCH

For this structure 36 feet long with square ends, the estimated price is **\$600.00 per linear foot (\$120.00 per linear foot per barrel x 5-barrels)**. This price includes all the materials required – galvanized steel structural plate, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included concrete footings, headwalls, excavation of the trench or backfilling of the structure.

The structure shall be 12-gage. Minimum cover shall be 12 inches. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for H 20, HS 20, H 25 and HS 25 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.



760 North El Mirage Road
P.O. Box 65
El Mirage, Arizona 85335
(623) 935-6000 FAX (623) 935-6100

SITE # 2 PIMA ROAD

OPTION 1

5-BARREL CONTECH 11'-0" SPAN x 3'-6" RISE MULTI-PLATE ARCH

For this structure 36 feet long with square ends, the estimated price is **\$750.00 per linear foot (\$150.00 per linear foot per barrel x 5-barrels)**. This price includes all the materials required – galvanized steel structural plate, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included concrete footings, headwalls, excavation of the trench or backfilling of the structure.

The structure shall be 12-gage. Minimum cover shall be 18 inches. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for H 20, HS 20, H 25 and HS 25 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.



260 North El Mirage Road
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El Mirage, Arizona 85335
(623) 935-6000 FAX (623) 935-6100

SITE # 3 SUNDANCE ROAD

OPTION 1

6-BARREL CONTECH #54C 20'-4" SPAN x 4'-6" RISE ALUMINUM BOX CULVERTS WITH FULL INVERT

For this structure 36 feet long with square ends, the estimated price is **\$7620.00 per linear foot (\$1270.00 per linear foot per barrel x 6-barrels)**. This price includes all the materials required – aluminum structural plate shell, aluminum structural plate invert, toe plates, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included headwalls, excavation of the trench or backfilling of the structure.

The structure shall be a CONTECH #54C Aluminum Box Culvert. Minimum cover shall be 1.4 feet; maximum cover shall be 4 feet. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for HS 20 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.

OPTION 2

6-BARREL CONTECH #54C 20'-4" SPAN x 4'-6" RISE ALUMINUM BOX CULVERT SHELL (box culvert to be set on concrete footings)

For this structure 36 feet long with square ends, the estimated price is **\$5940.00 per linear foot (\$990.00 per linear foot per barrel x 6-barrels)**. This price includes all the materials required – aluminum structural plate shell, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included headwalls, excavation of the trench or backfilling of the structure.

The structure shall be a CONTECH #54C Aluminum Box Culvert. Minimum cover shall be 1.4 feet; maximum cover shall be 5 feet. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for HS 20 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.



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El Mirage, Arizona 85335
(623) 935-6000 FAX (623) 935-6100

SITE # 4 SOMBRERO ROAD

OPTION 1

4-BARREL CONTECH #54C 20'-4" SPAN x 4'-6" RISE ALUMINUM BOX CULVERTS WITH FULL INVERT

For this structure 36 feet long with square ends, the estimated price is **\$5080.00 per linear foot (\$1270.00 per linear foot per barrel x 4-barrels)**. This price includes all the materials required – aluminum structural plate shell, aluminum structural plate invert, toe plates, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included headwalls, excavation of the trench or backfilling of the structure.

The structure shall be a CONTECH #54C Aluminum Box Culvert. Minimum cover shall be 1.4 feet; maximum cover shall be 4 feet. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for HS 20 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.

OPTION 2

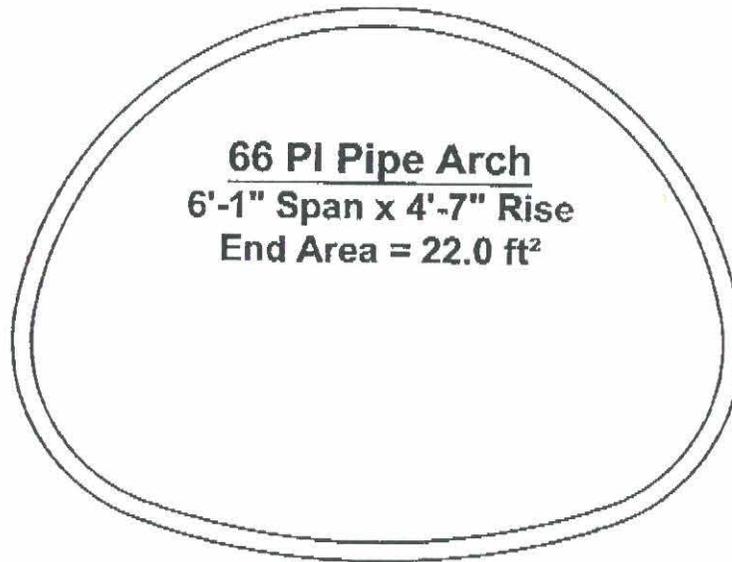
4-BARREL CONTECH #54C 20'-4" SPAN x 4'-6" RISE ALUMINUM BOX CULVERT SHELL (box culvert to be set on concrete footings)

For this structure 36 feet long with square ends, the estimated price is **\$3960.00 per linear foot (\$990.00 per linear foot per barrel x 4-barrels)**. This price includes all the materials required – aluminum structural plate shell, nuts and bolts. We have also included in this price freight delivered to the jobsite and erection of the plate. We have not included headwalls, excavation of the trench or backfilling of the structure.

The structure shall be a CONTECH #54C Aluminum Box Culvert. Minimum cover shall be 1.4 feet; maximum cover shall be 5 feet. Cover is measured from top of pipe to bottom of flexible pavement or top of pipe to top of rigid pavement. Minimum and maximum cover given is for HS 20 loads. For heavy construction loads, please contact us. Minimum cover must be maintained in unpaved traffic areas.



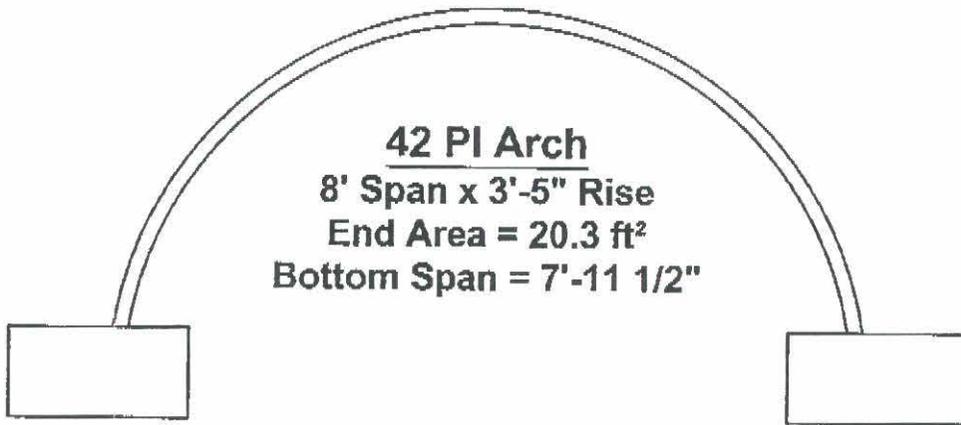
260 North El Mirage Road
P.O. Box 65
El Mirage, Arizona 85335
(623) 935-6000 FAX (623) 935-6100



Arc	PI	Radius
Top	33	37"
Corner	9	18"
Bottom	15	77"

Not for final design or construction purposes

visit us at www.contech-cpi.com

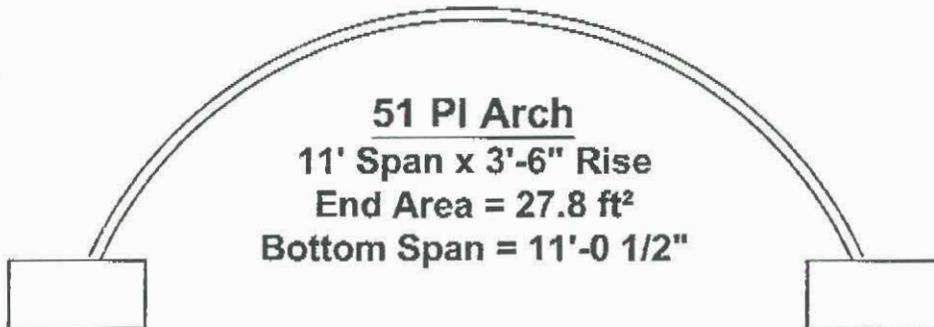


Arc	PI	Radius
Top	42	48 1/2"

Not for final design or construction purposes



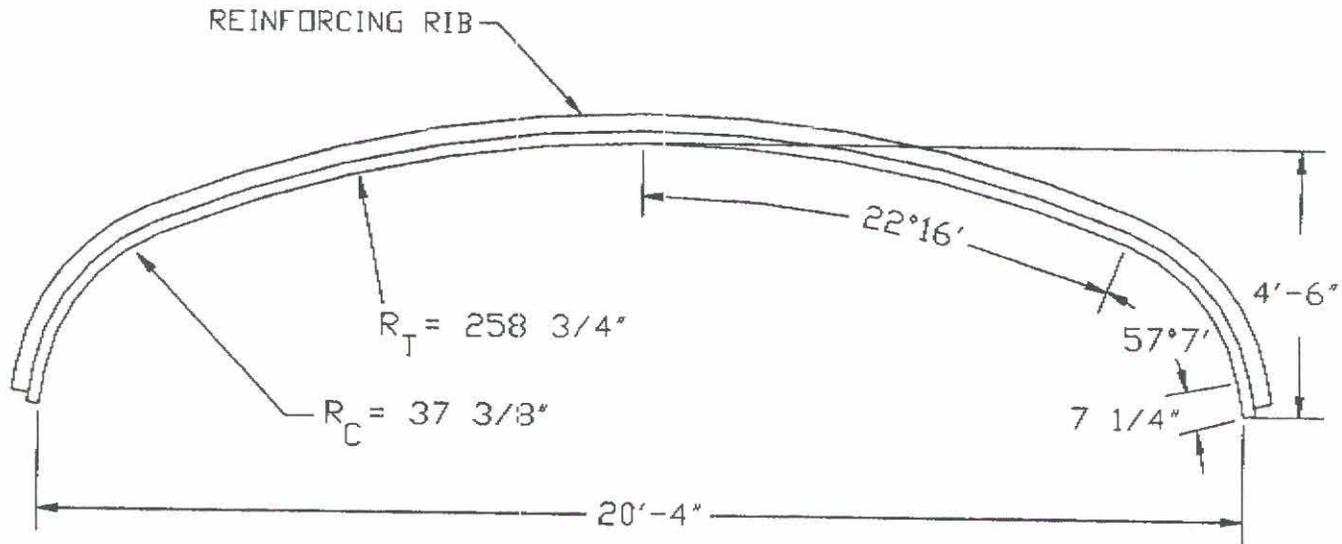
760 North El Mirage Road
 P.O. Box 65
 El Mirage, Arizona 85335
 (623) 935-6000 FAX (623) 935-6100



Arc	PI	Radius
Top	51	73"

Not for final design or construction purposes

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SCALE: 3/8" = 1'-0"
 APPROX. AREA = 73.1 SQ. FT.

ALUMINUM BOX CULVERT
 STRUCTURE #54
 20'-4" SPAN x 4'-6" RISE

Original Dwg. Date:	Last Revision Date:	Drawing Number:
S.A.V. 7-22-96	R.L.S. 7-28-97	1009742B



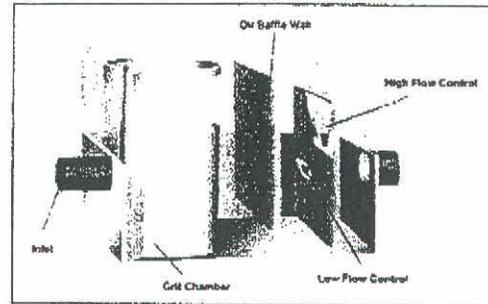
CAD file is in \Library\ALBC\1009742.DWG on the CD

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 NOTE: This view may not print to scale



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El Mirage, AZ 85335

Phone: 623-935-6000
Fax: 623-935-6100



Vortechs System

EPA award-winning design efficiently removes contaminated sediment, floating oil and debris from surface runoff. It is a compact, below grade system that is fabricated near the jobsite from precast concrete and marine grade aluminum. Its unique design allow for easy inspection and unobstructed maintenance access. Features include low capital cost per unit of treatment and a shallow excavation depth that reduces installation costs.

FAX COVER SHEET

Date:	February 4, 2003	From:	MAX BALDWIN, E.I.T. SALES ENGINEER
To:	LINDA JOHNSON	14	Total Pages (including cover sheet)
Company:	CH2M HILL		
Fax:	480-784-6273		
Subject:	WASH CROSSINGS		

LINDA,

PLEASE FIND ATTACHED A PRELIMINARY ESTIMATE FOR THE VEHICULAR BRIDGE ALTERNATIVES THAT I SPOKE WITH YOU ABOUT FOR YOUR WASH CROSSINGS LAST WEEK. THE ATTACHED PRICE IS FOR MATERIAL ONLY – TYPICAL INSTALLED COSTS RANGE FROM 1-3/4 TO 2 X THE MATERIAL COST OF THE BRIDGE (E.G. RISING SUN BRIDGE MATERIAL COST = \$120,00, INSTALLATION COST = \$90,000 – \$120,000, TOTAL COST = \$210,000 - \$240,000). PLEASE CALL ME AFTER YOU GET A CHANCE TO REVIEW TO DISCUSS.

THANKS,

MAX

Your Single-Source For Environmental BMPs



Stormwater Quality Units—The Vortechs System, a hydrodynamic separator, provides 80% TSS removal (Total Suspended Solids) from stormwater runoff. They cost less per CFS than any other system.

Underground Stormwater Detention—CONTECH's system controls the flow of stormwater on newly-developed

and renovated sites where parking lots, roads and buildings have replaced open land. (See EPA Fact Sheet 832-F-01-005.)

Erosion Control—On slopes, Landlok Turf Reinforcement Mats; in waterway channels and on banks, Petraflex articulating concrete blankets; for stabilizing walls of earth, Keystone and Bin-Wall retaining walls and Gabions.





DATE: February 4, 2003
 COMPANY: CH2M HILL
 ATN: LINDA JOHNSON
 PHONE: 480-377-6273
 FAX: 480-784-6273
 RE: BRIDGE ESTIMATE

We are pleased to quote you a price on the Steadfast Bridges described below. The concrete floor will be a 22 gage galvanized composite floor deck. Pouring of the lightweight concrete shall be the responsibility of the owner or contractor. The bridge can be fabricated from A588 Weathering Steel. This will provide a "maintenance free" bridge. The bridge can also be sandblasted and painted with an epoxy primer and an aliphatic urethane finish coat. All Steadfast Bridges carry a 10 year limited warranty. Shop drawings signed and sealed by a Professional Engineer registered in the State of Arizona will be provided.

Location: PHOENIX, ARIZONA

Bridge Type: Capstone	Rising Sun Rd	Pima Rd	Sundance Rd (two spans)		Sombrero Rd (two spans)	
Width in feet	36'-0"	36'-0"	40'-0"	40'-0"	36'-0"	36'-0"
Span in feet	50'-0"	130'-0"	100'-0"	100'-0"	100'-0"	100'-0"
Type steel	A588 WX	A588 WX	A588 WX	A588 WX	A588 WX	A588 WX
Type floor	ASPHALT	ASPHALT	ASPHALT	ASPHALT	ASPHALT	ASPHALT
Floor thickness	4"	4"	4"	4"	4"	4"
Field splice	YES	YES	YES	YES	YES	YES
Number of pieces	6	13	11	11	11	11
Dead Load PSF	100	100	100	100	100	100
Live Load PSF	AASHTO	AASHTO	AASHTO	AASHTO	AASHTO	AASHTO
Vehicle Load LBS.	HS - 25	HS - 25	HS - 25	HS - 25	HS - 25	HS - 25
Design stresses	AASHTO	AASHTO	AASHTO	AASHTO	AASHTO	AASHTO
Lifting Weight LBS.	113495	316320	261418	261418	231823	231823
Vert. abutment load KIPS	236.25	403	363.25	363.25	343.25	343.25
Horiz. abutment load KIPS	11.25	29.25	22.5	22.5	22.5	22.5
Truss height in feet	8	11	11	11	11	11
Interior panel points	8	18	14	14	14	14
Toe plates	NO	NO	NO	NO	NO	NO
Railing height	54"	54"	54"	54"	54"	54"
Maximum rail openings	6"	6"	6"	6"	6"	6"
Bridge cost delivered	\$120,000	\$340,000	\$275,000	\$275,000	\$250,000	\$250,000

This bridge to be shipped in a knocked down version for field assembly.
 Delivery: 12 to 14 weeks (delivery schedule subject to backlog at time of drawing approval).
 Bridge will be delivered to nearest location easily accessible to over-the-road trucks.
 Teflon slip pads and setting plates shipped with bridge.
 Anchor bolts, sales tax, unloading, erection, supports, and abutment designs not included.
 Terms: 1/3 down, balance 20 days after delivery, pending credit approval.
 This quote is valid for 90 days. Please call if you have any questions (800-749-7515).

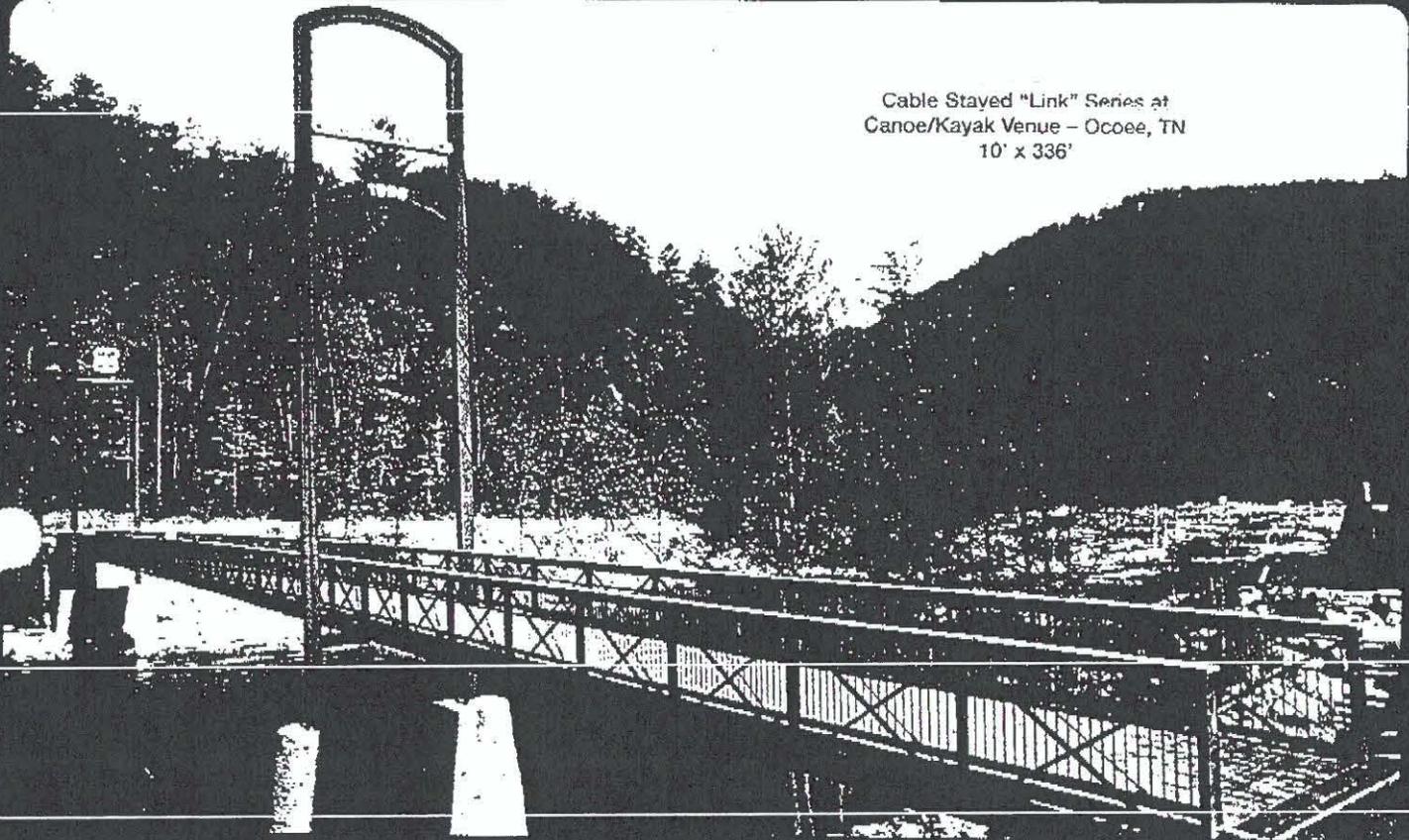
Max Baldwin, E.I.T.
 Sales Engineer

Accepted By: _____
 Title / Date: _____



02852/BIL
BuyLine 9266

CROSSING THE NATION WITH BRIDGES YOU CAN DEPEND ON



Cable Stayed "Link" Series at
Canoe/Kayak Venue - Ocoee, TN
10' x 336'

STEADFAST engineers appreciate a challenge... no bridge is standard at STEADFAST. Every bridge is special! STEADFAST professional engineers with their many years of experience in bridge design and fabrication can assist you with your project.



Cast Stone Series at
Life College, Marietta, GA
10' x 310'

1-800-749-7515 • www.steadfastbridge.com

Cleveland, OH

Greenville, SC

Great Miami Riverwalk, Sidney, OH

10' x 120'

8' x 120'

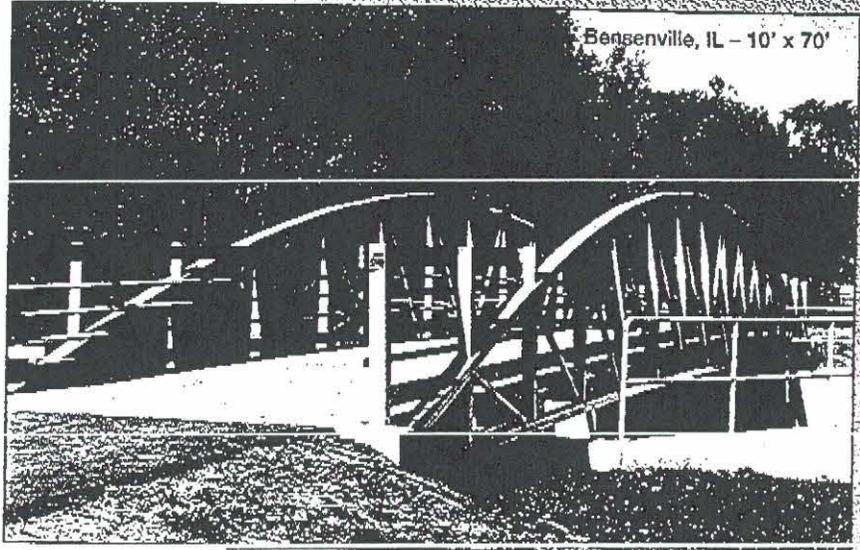
14' x 170'

The "KEYSTONE" Bow Truss

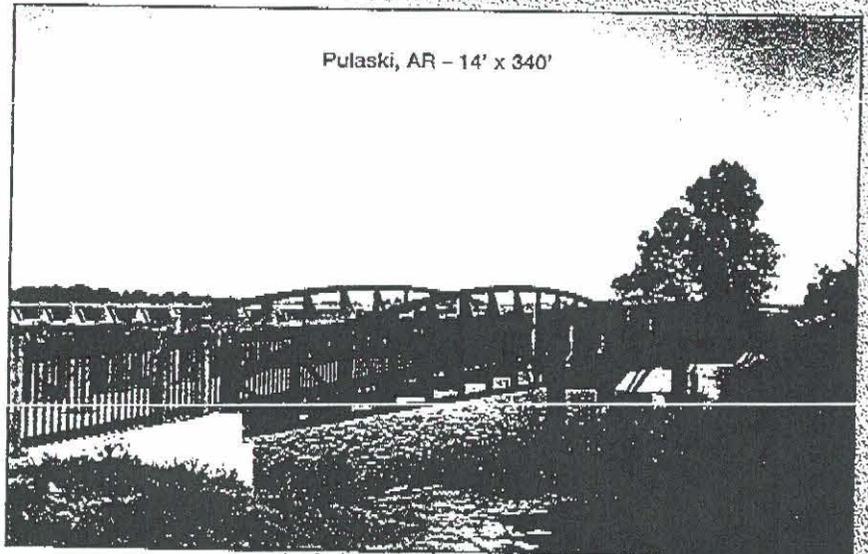


Steadfast Bridge Company is responsible for bringing this old favorite back to the marketplace. Standard designs go to 120' clear span. The "Keystone" can be furnished for spans to 250'.

The properties of the ageless parabolic curve still offer one of the most efficient structural designs. The nostalgic appearance of the popular bow truss is still in high demand. The depth at the center is usually 10% of the clear span. With longer spans, the center depth may be reduced to 7% of the span.



Bensenville, IL - 10' x 70'



Pulaski, AR - 14' x 340'

✓ *Steadfast provides custom engineering, quality fabrication and nationwide delivery.*

Nantahala River, NC

Murphreesboro, TN

Walden Golf Course, Crofton, MD

2-8' x 72'

10' x 166'

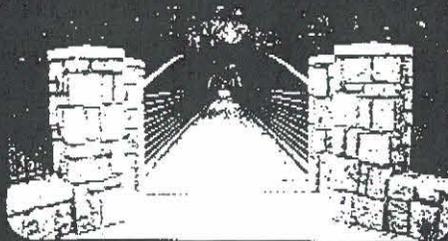
9' x 120'

Clearwater, FL



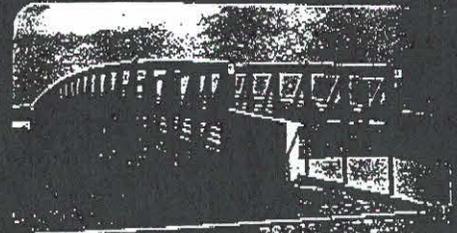
8' x 100'

Life University, Marietta, GA



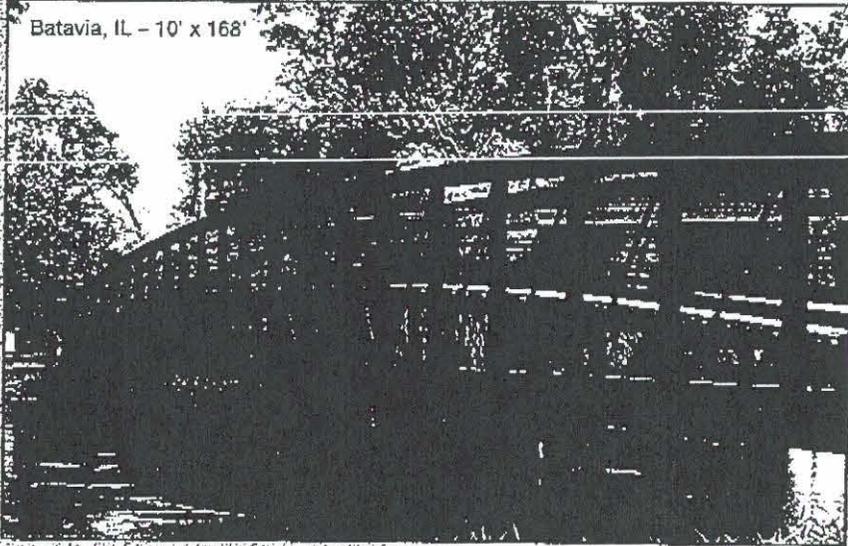
3-10' x 100'

Houston, TX



12' x 140'

Batavia, IL - 10' x 168'

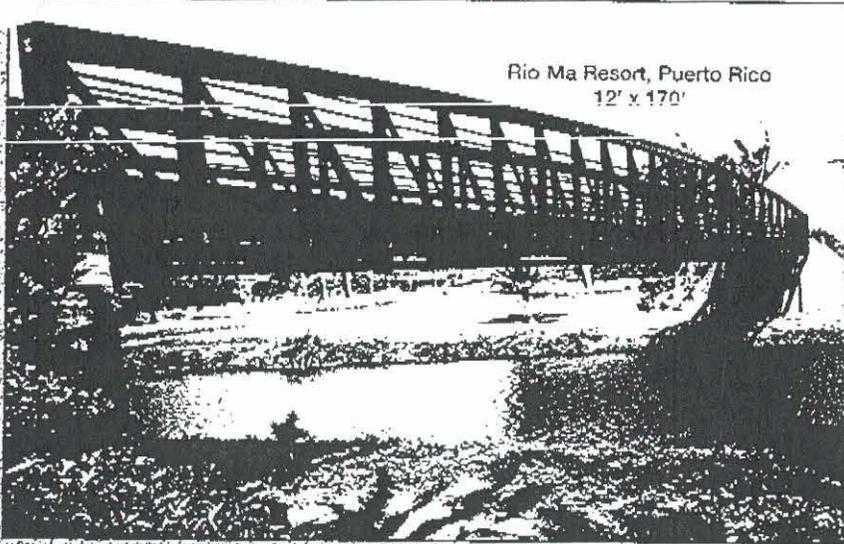


The "CAPSTONE" Modified Bow



Steadfast Bridge Company introduces the "Capstone" Series for projects requiring a long span bridge with limited approach space. The truss height of the "Capstone" varies to allow a low abutment backwall while still maintaining maximum truss depth at the center. This modified bow truss design also allows a constant rail height for an unobstructed view over the top chord. The "Capstone" is perfect for longer spans up to 250'.

Rio Ma Resort, Puerto Rico
12' x 170'



✓ *Virtually all Steadfast Bridges can be installed in less than one day.*

02852/BIL

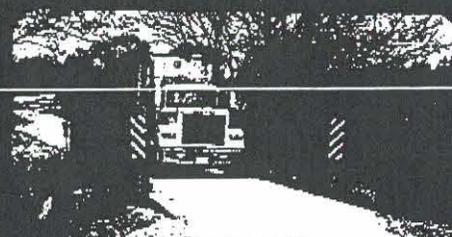
BuyLine 9266

Omaha, NE



10' x 160'

Lebanon, AL



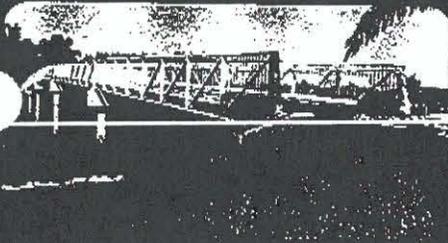
13' x 95'

Albuquerque, NM



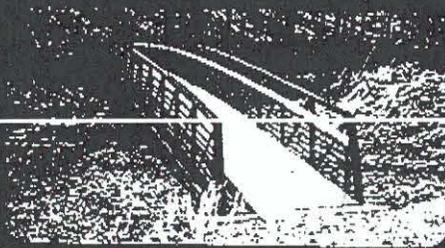
10' x 150'

Jupiter, FL



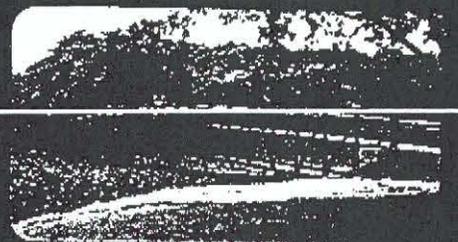
8.5' x 250'

Mills Road Park, Independence, KY



8' x 100'

Valparaiso, IN



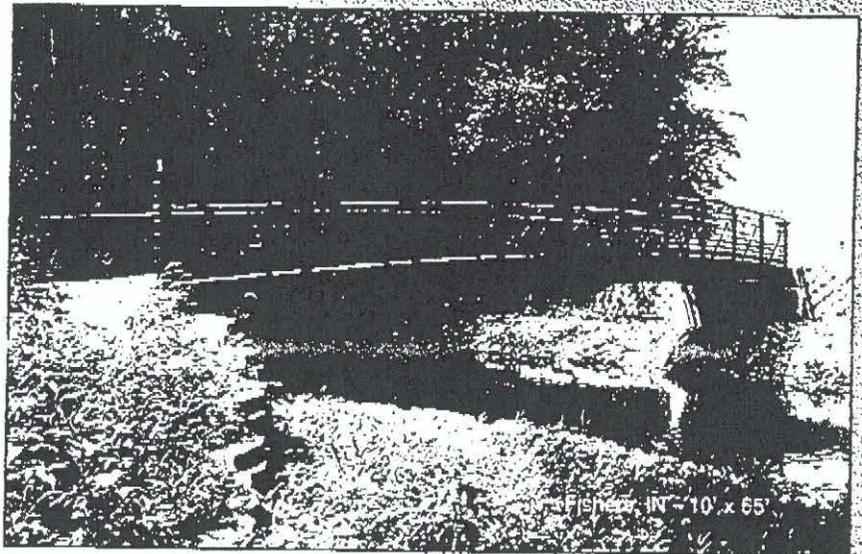
10' x 150'

The "CONNECTOR" Pratt Truss

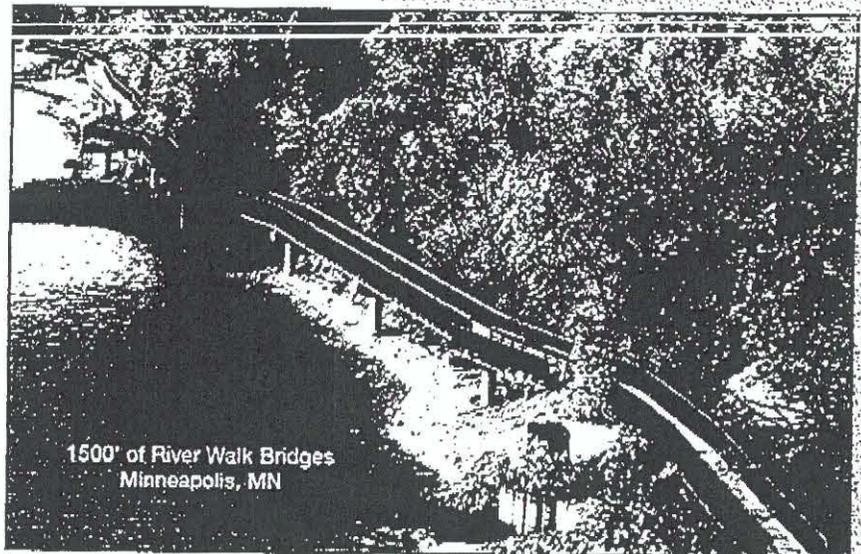


The "Connector" is the most familiar truss design. Our standard designs go to the 120' clear span range. By increasing the truss depth and raising the floor to form an "H", these spans can be increased to 220' for an efficient design.

- ✓ A Weathering Steel finish provides a virtually maintenance free bridge.
- ✓ Bridges may be cambered up to 2% of the span length. Flat bridges are also available.

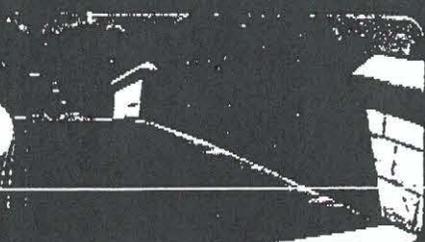


Fishers, IN - 10' x 65'



1500' of River Walk Bridges
Minneapolis, MN

Oceanview Golf Course, Bermuda



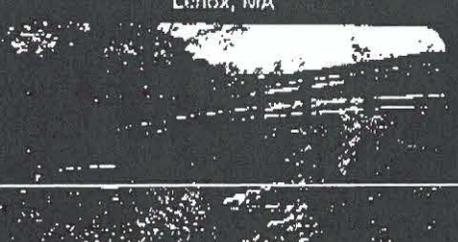
10' x 25'

Buckley, WV



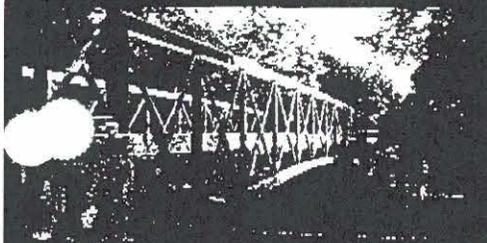
6' x 82'

Lenox, MA



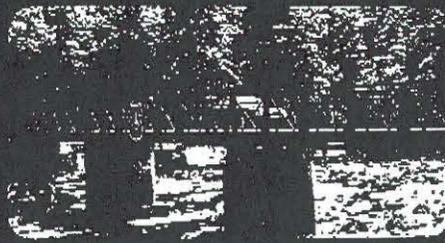
6' x 110'

Indianapolis, IN



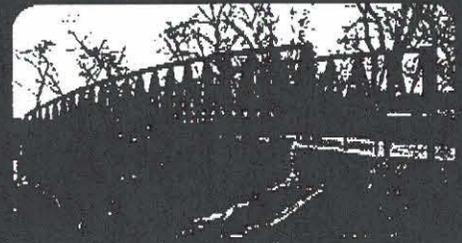
10' x 71.6'

Ocoee, TN

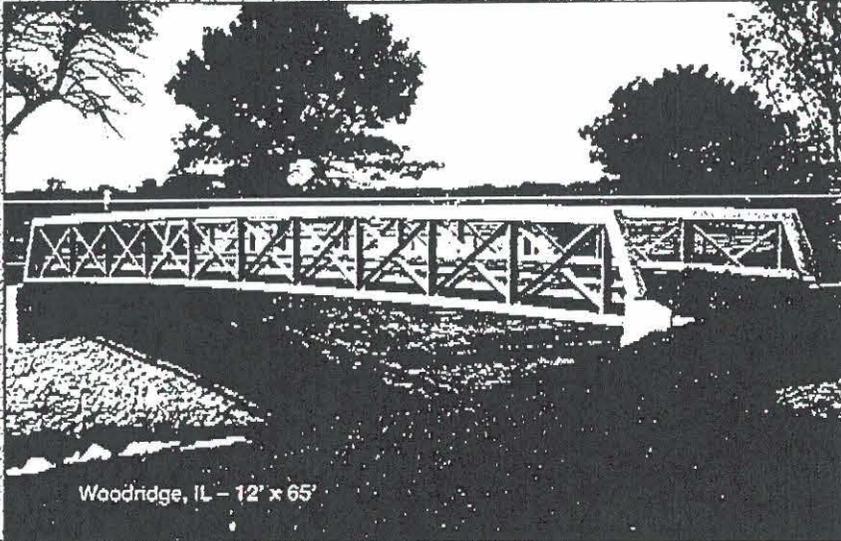


4-14' x 49'

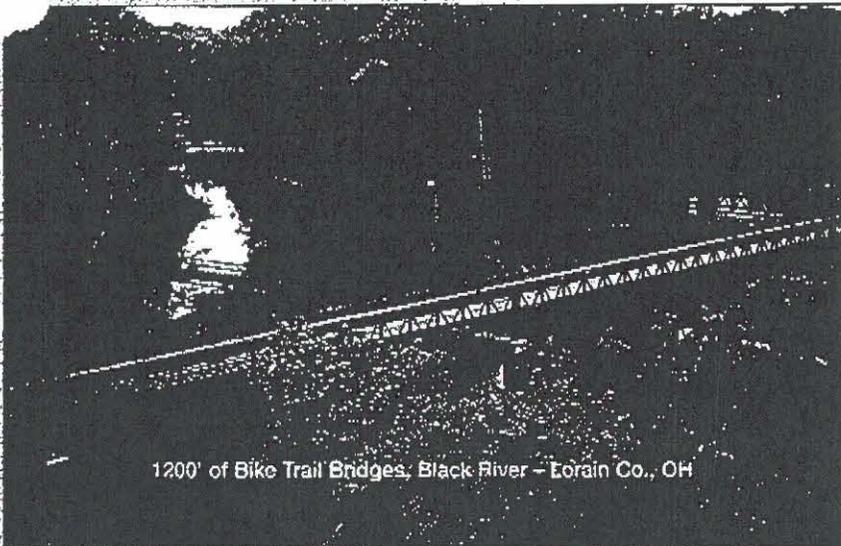
Rancho Cahada Golf Course, Carmel, CA



12' x 140'

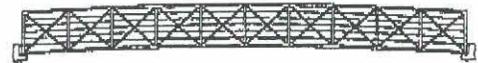


Woodridge, IL - 12' x 65'



1200' of Bike Trail Bridges, Black River - Loraín Co., OH

The "LINK" X-Brace Truss



This attractive companion to the "Connector" design is only slightly more expensive. The X brace panels add to the symmetry and beauty of the "Link" series. The "Link" is also available in spans to 220' similar to the "Connector."

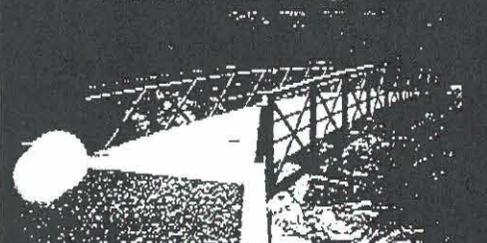
✓ *Our bridges can be painted with a wide variety of colors.*

✓ *Bridges up to 12' x 70' can be shipped in one piece.*

02852/BI1

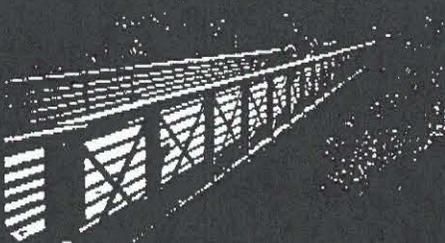
BuyLine 9266

Lula Lake, Walker County, GA



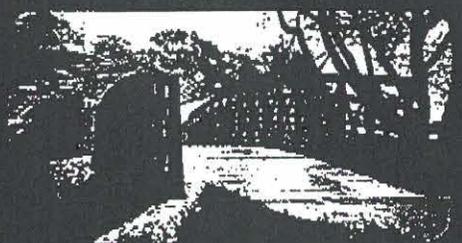
10' x 65'

UCSC College Ten, Santa Cruz, CA



10' x 300'

Grafton, IL



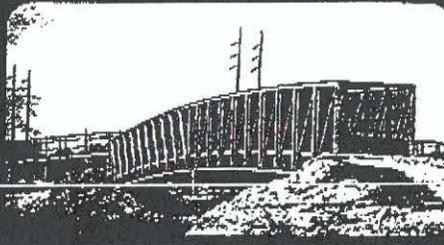
12' x 90'

Las Vegas, NV



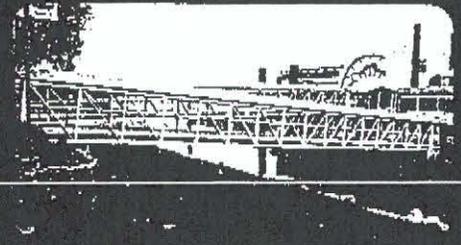
8' x 130'

Gadsden, AL



8' x 140'

Argosy Casino, Riverside, MO



2 - 8' x 110'

THE "GATEWAY" Portal Bridge



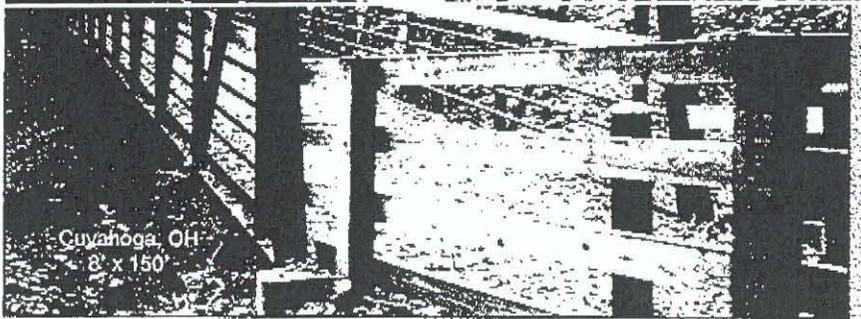
The box or portal bridge is the most common truss design for vehicular bridges. We rely on the stability of the box girder for longer spans up to 240' and when heavier loading conditions may be required.

Even these longer, heavier spans can usually be erected in less than one day!

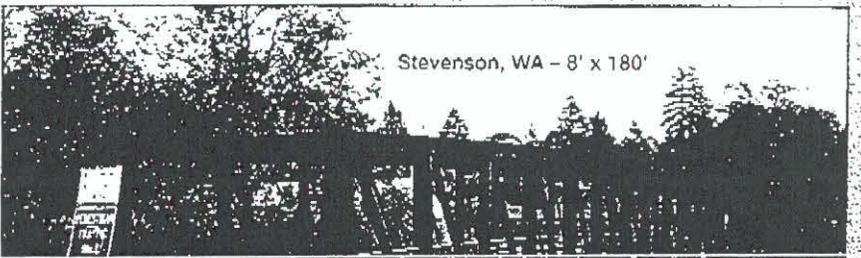
This design is particularly useful in highway and railroad overpasses where a security chain link fence is factory installed.

✓ *Our factory installed pressure treated Southern Yellow Pine floors feature a limited lifetime warranty against rot and decay.*

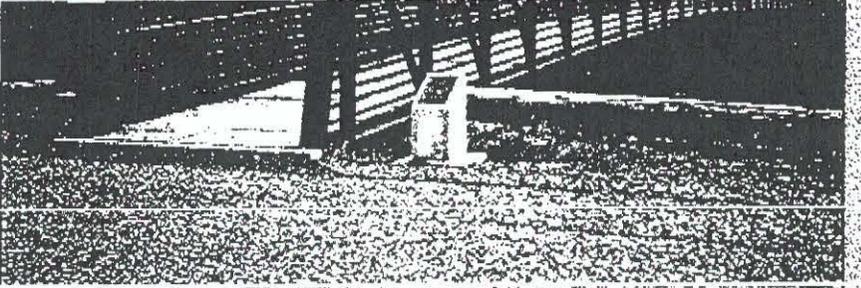
✓ *Bridges with concrete or asphalt floors are furnished with a galvanized composite form deck. Pouring of the concrete or asphalt and furnishing reinforcement steel is by others.*



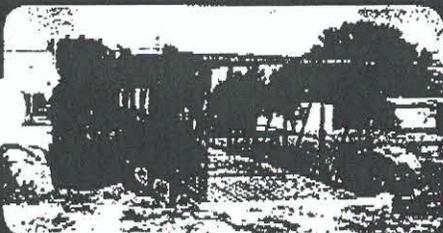
Cuyahoga, OH
8' x 150'



Stevenson, WA - 8' x 180'



Lake Fran Bike Trail, Orlando, FL



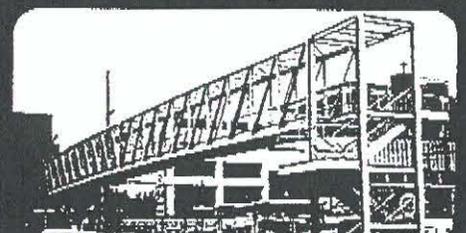
10' x 70'

Farmington, NM



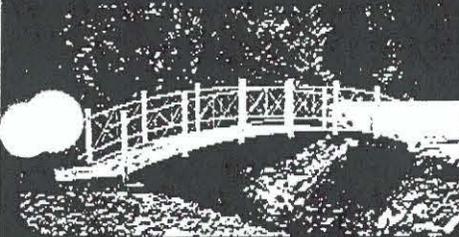
8' x 180'

Jefferson City, MO



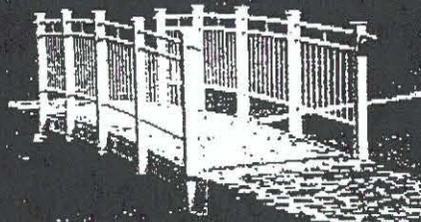
6' x 130'

Fairfield Recreation Area, Morrow, GA



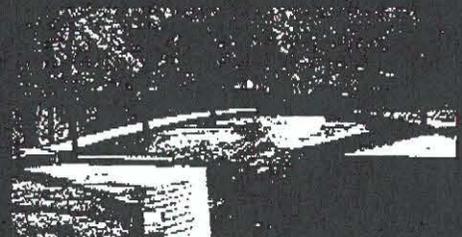
6' x 30'

Auburn, AL

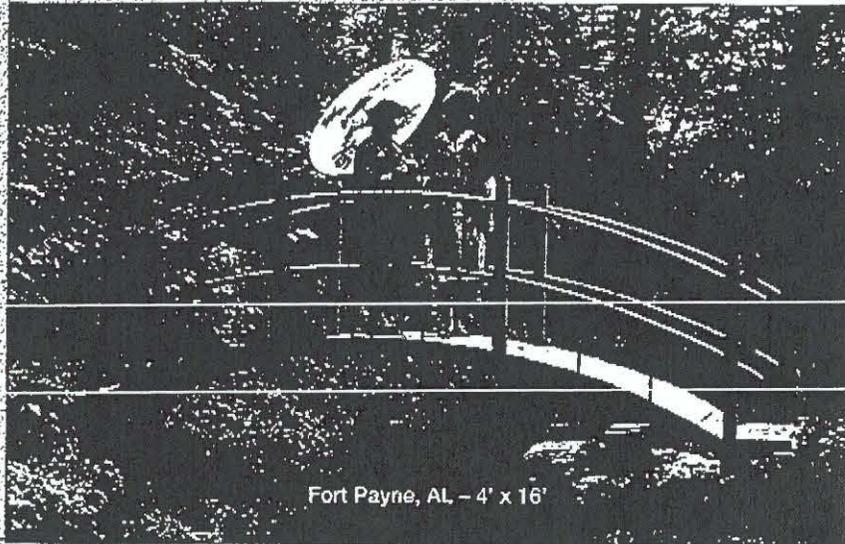


5' x 18'

Granbury, TX

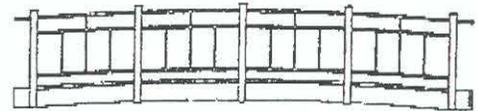


6' x 30'

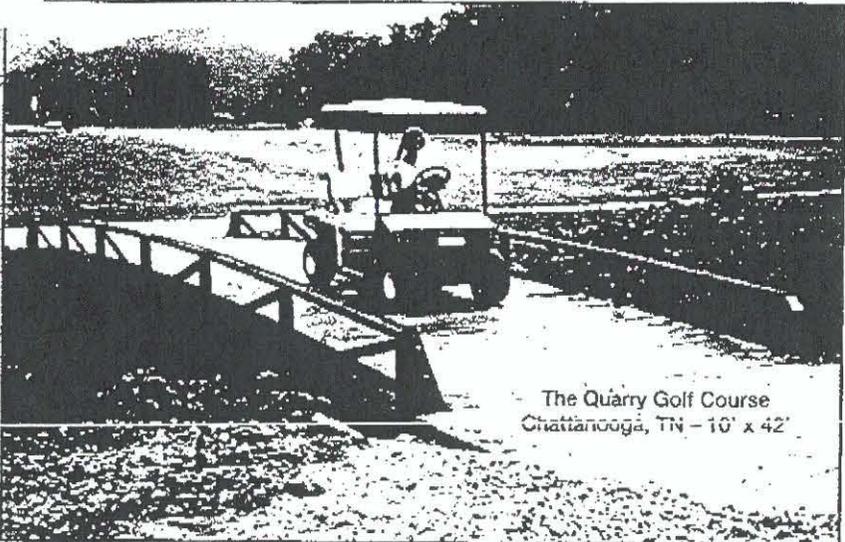


Fort Payne, AL - 4' x 16'

THE "EDO" Oriental Style

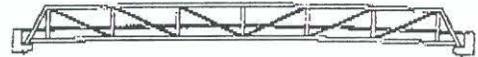


Although our original thought was to provide an attractive bridge for the landscape architect, the Oriental look has been applied to many other uses, even vehicular bridges. "Edo" is the ancient name for Tokyo and this style bridge has been popular all over the United States. The "Edo" has been particularly useful on golf courses and as an architectural feature for buildings and gardens.



The Quarry Golf Course
Chattanooga, TN - 10' x 42'

THE "EXPRESSWAY" Low Rail Height

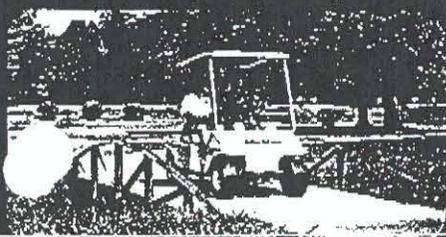


Golf course bridges are one of our specialties at Steadfast. The variety of designs is the main reason for our leadership in this field. We attach every plank of our wood floors with at least two plated fasteners at each crossing support and thru-bolting a high-strength steel bar along each edge. This method prevents noisy slapping of boards for golf cart use and inhibits warping of the wood. Our rugged design also provides the needed capacity for maintenance vehicles and pick-up trucks.

02852/BIL

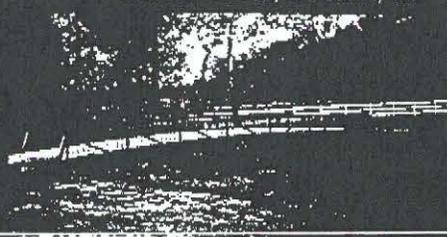
BuyLine 9266

DeSoto Country Club, Fort Payne, AL



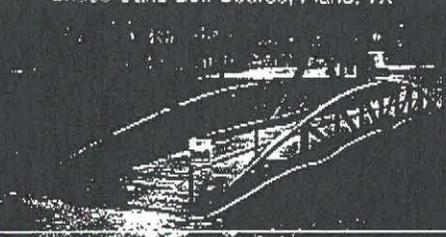
10' x 30'

Pine Creek Golf Course, Mt. Juliet, TN



10' x 50'

Chase Oaks Golf Course, Plano, TX



10' x 50'

Pipe Support s, Tampa, FL

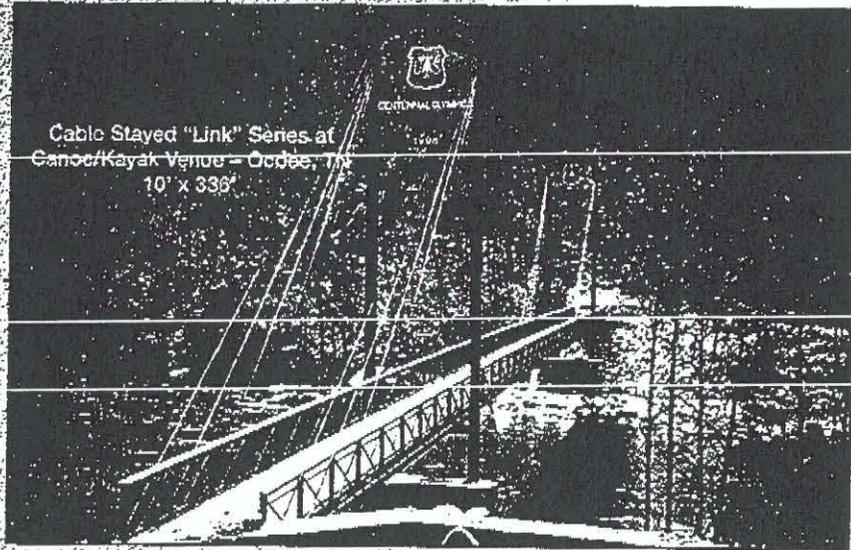
Football Stadium, Baltimore, MD

Conveyor Supports, Oxford, MS

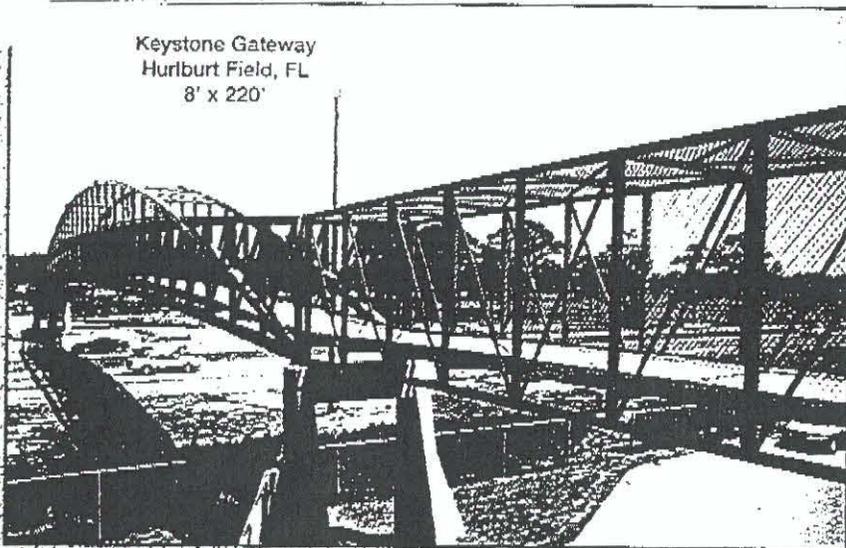
16' x 53'

20' x 87', 20' x 45' Plus 6-70' Ramps

8' x 194'



Cable Stayed "Link" Series at
Canoe/Kayak Venue - Ocoee, TN
10' x 336'



Keystone Gateway
Hurlburt Field, FL
8' x 220'

SPECIAL PROJECTS

With over 30 years of bridge design experience, Steadfast has the ability to meet almost any bridge need. Steadfast is ready to accept any challenge from long span pedestrian overpasses and cable stayed bridges to industrial conveyor and pipe support bridges.

The Steadfast Cable Stayed design is an economical solution to long clear span pedestrian and light vehicular bridges. The Cable Stayed Bridge has been a popular design option since Steadfast made it available. Quite often it is the best answer to staying completely out of flood plains and environmentally sensitive wetland areas. The cost is low and the beauty and aesthetics are invaluable on the Cable Stayed Bridges spanning 180' to 400'.

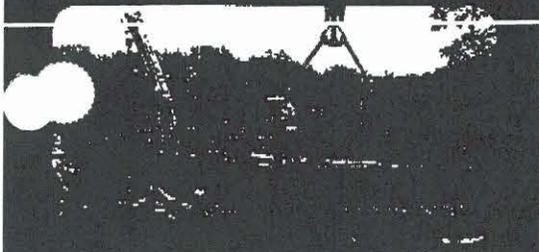
For long spans over 200' that require a deep truss design, a modified version of the "Keystone" bow truss bridge can be utilized. By incorporating a horizontal splice in the truss, depths of 18' can be achieved allowing clear spans up to and over 250' when the use of a center pier is either impractical or impossible.

02852/BIL
BuyLine 9266

Cook County, IL

2-10' x 100'

Sidney, OH - Installation

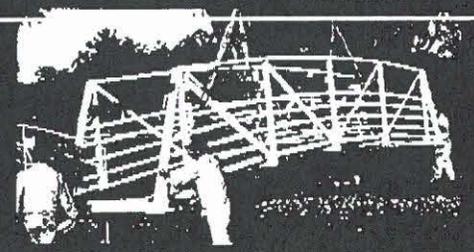


10' x 170'

Columbia Lake, TX - Installation



Installation of Steadfast wood flooring is unequalled



4' x 30'

STEADFAST BRIDGE COMPANY...

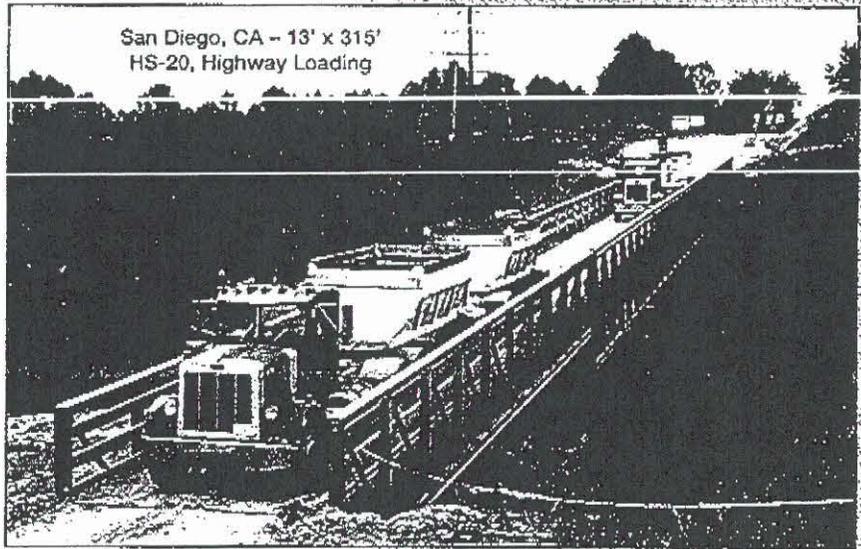
...will assist you step by step through your bridge project. Whether you are an experienced Bridge Specifier or is this is your first bridge job, our team of engineers is available for your technical and budget requirements. Our engineering staff, licensed in 48 states, has designed thousands of bridges from small pedestrian bridges to AASHTO specified highway bridges.

STEADFAST BRIDGE COMPANY has been certified by the American Institute of Steel Construction for fabrication of Simple Bridges, Major Bridges and Conventional Steel Building Structures. With a Sophisticated Paint and Fracture Critical Endorsement. Our Quality Assurance Program guarantees you the very best in design and workmanship.

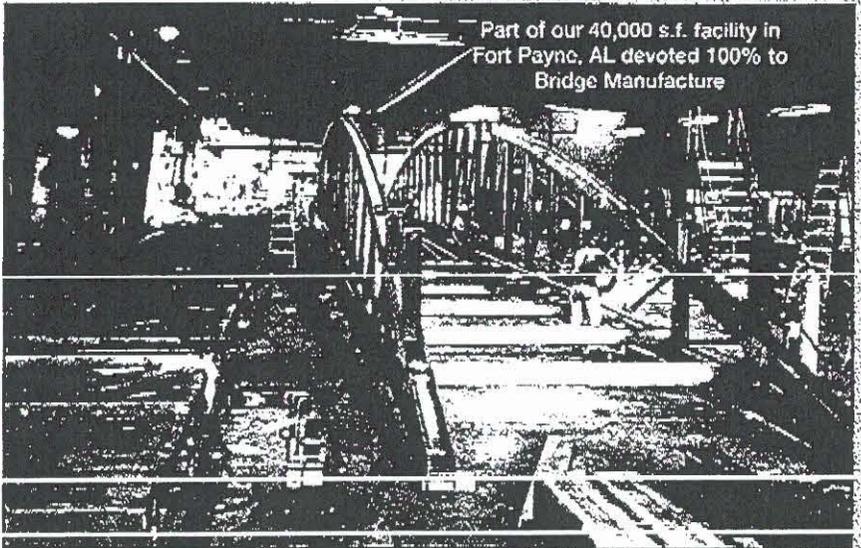
Call our toll free number for immediate pricing and additional information.

- ✓ One and two lane vehicular bridges with HS-20 and HS-25 loading are available.
- ✓ Steadfast's galvanized Vehicular Bridges are guaranteed rust-free for 35 years, providing low maintenance and a long life.

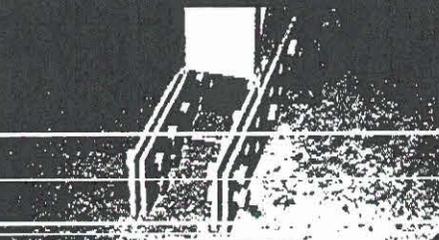
San Diego, CA - 13' x 315'
HS-20, Highway Loading



Part of our 40,000 s.f. facility in Fort Payne, AL devoted 100% to Bridge Manufacture



Personal Delivery

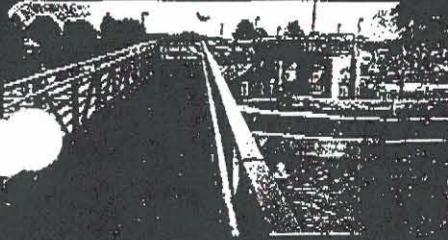


Typical Bolted Splice



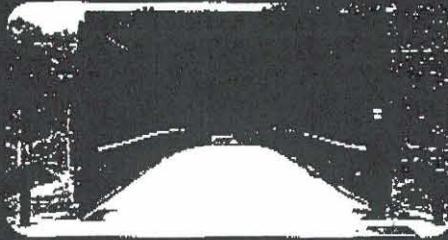
No Field Welding

Dorney Park, Allentown, PA



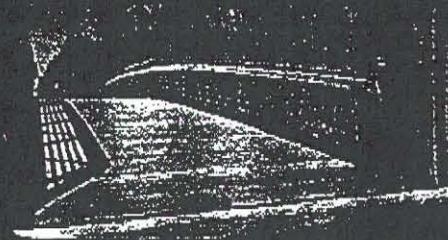
Fiberglass Floor Grating

U.S. Military Academy, West Point, NY



Concrete Floor, Pipe Handrail, Chain Link Fence

Bike Trail, Hawthorne, FL



Wood Floor, 2 x 6 Wood Handrail, Toe Plate

Bridge Data Sheet



A CONTECH COMPANY

4021 Gault Avenue South
Fort Payne, Alabama 35967
1-800-749-7515
256-845-0154
FAX 1-256-845-9730

COMPANY NAME: _____

CONTACT NAME: _____

MAILING ADDRESS: _____

STREET ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

PHONE: _____ FAX: _____

PROJECT NAME: _____

LOCATION: _____



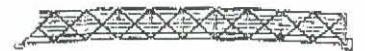
Keystone



Capstone



Connector



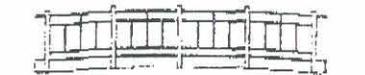
Link



Gateway



Expressway



E-do



Cable Stay

WIDTH	LENGTH	QUANTITY	STYLE	FINISH		FLOOR				LOADING
				WEATHERING STEEL	PAINTED	WOOD	CONCRETE	ASPHALT	OTHER	

Total number of bridges needed: _____

RAILINGS & ACCESSORIES:

Rail Height (Top Chord): 42" Pedestrian 54" Bicycle Other _____

Handrail: Galvanized Pipe 2 x 6 Wood None Other _____

Safety Rail Style: Horizontal Vertical Picket 2 x 6 Wood _____

Maximum Safety Rail Opening: 4" 6" 9" Other _____

Are Toe Plates Required? Yes No

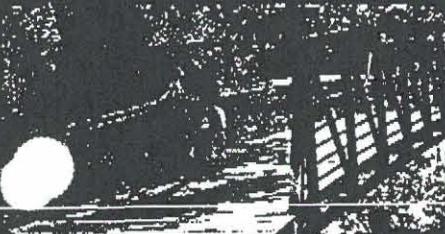
Security Fence: Yes (Galvanized or Vinyl Coated) No

Comments: _____

02852/BIL

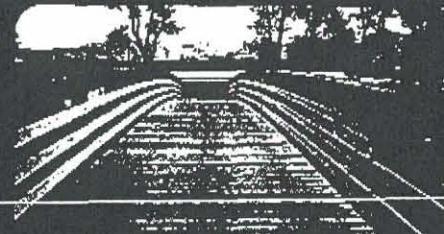
BuyLine 9266

Shawnee, KS



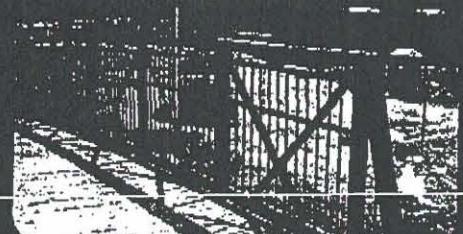
Horizontal Safety Rails

Steamboat Springs, CO



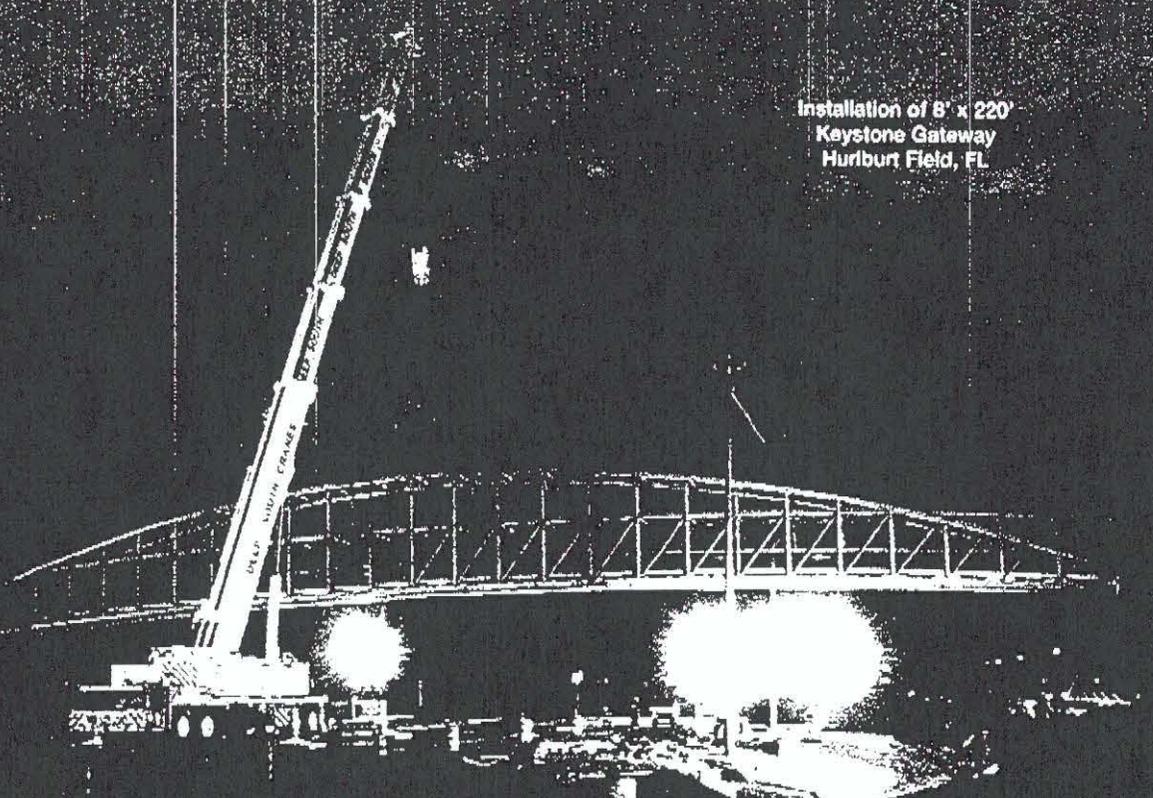
2 x 6 Wood Rails

Ocoee, TN



Vertical Pickets, Galvanized Handrail

Installation of 8' x 220'
Keystone Gateway
Hurlburt Field, FL

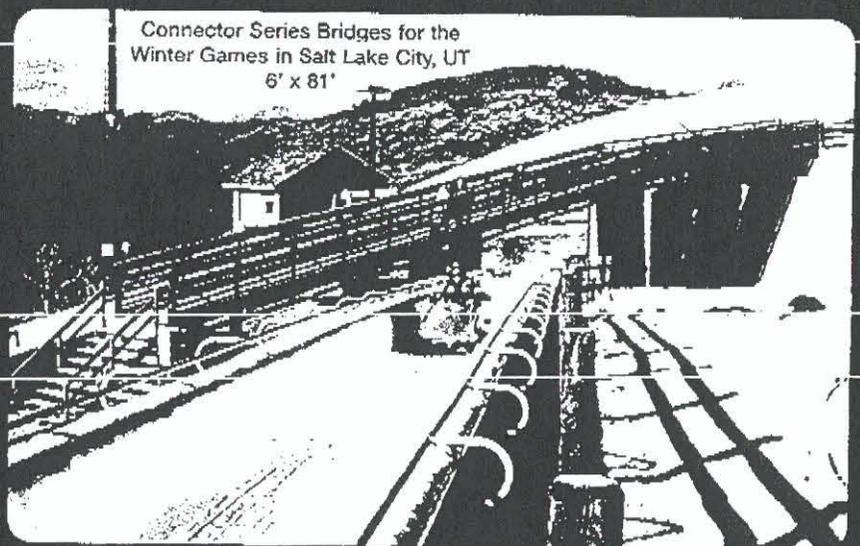


Building Bridges For The 21st Century



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www.steadfastbridge.com



Connector Series Bridges for the
Winter Games in Salt Lake City, UT
6' x 81'



Catalog No. 1998

PAVEMENT & EARTHWORK QUANTITY SUMMARY

SITE	NAME	ROAD CONSTRUCTION (sf)	FILL (CY)
1	CAVE CREEK ROAD - 6	0	0
2	TRANQUIL TR - 35 (JEF) & 55 (JEF)	16,000 ⁹ (1778 sy)	640
3	RISING SUN ROAD - 53 (JEF)	6,000 (734 sy)	300
4	GOLDEN SPUR LANE - 52 (JEF)	12,700 (1411 sy)	3,200
5	SOMBRENO ROAD - 44 (JEF)	11,300 (1256)	2,800
6	PIMA ROAD - 32 (JEF)	17,100 (1900 sy)	1,600

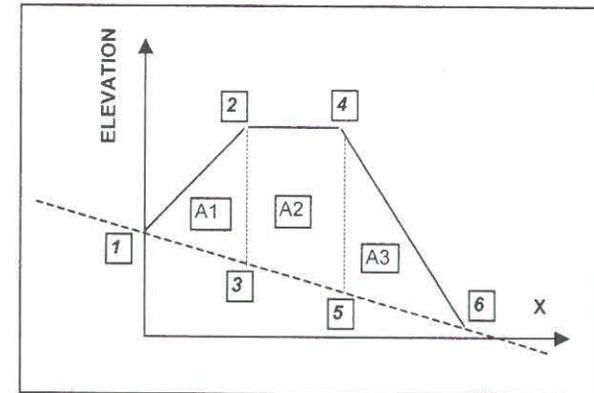
Road Prism Volume Calculator.xls

(This is not a precise calculator, consider the numbers rough)

Tranquil Trail

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2376	0	
2 Edge of Road	12	2377.5	1.5	0.8
3 Point on Existing Ground below Edge of Road (Calculated)	12	2376.0	1.5	
4 2nd Edge of Road	50	2377.5	1.7	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	50	2375.8	1.7	1.6
6 Ending Toe of Slope (Catch line)	65	2375.8	0	0.8

Cross sectional Sub Area	A1	9	sf
Cross sectional Sub Area	A2	61	sf
Cross sectional Sub Area	A3	13	sf
<u>Total Cross Sectional Area</u>	<u>AT</u>	<u>82</u>	<u>sf</u>
	L	210	ft
	V	17286	cf
	V	640	cy



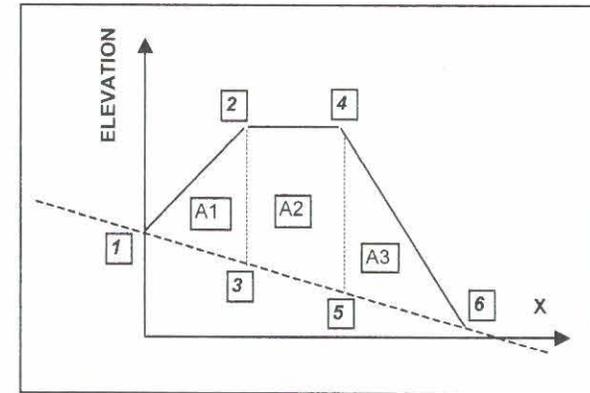
Road Prism Volume Calculator.xls

(This is not a precise calculator, consider the numbers rough)

Golden Spur Lane

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2464	0	
2 Edge of Road	12	2467	3	1.7
3 Point on Existing Ground below Edge of Road (Calculated)	12	2463.2	3.8	
4 2nd Edge of Road	36	2467	7	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	36	2461.6	5.4	4.6
6 Ending Toe of Slope (Catch line)	61	2460	0	3.1

Cross sectional Sub Area	A1	20	sf
Cross sectional Sub Area	A2	110	sf
Cross sectional Sub Area	A3	77	sf
<u>Total Cross Sectional Area</u>	<u>AT</u>	<u>207</u>	<u>sf</u>
	L	420	ft
	V	87102	cf
	V	3226	cy



\\phoenix\PROJ\162944\Preliminary Design Sites\

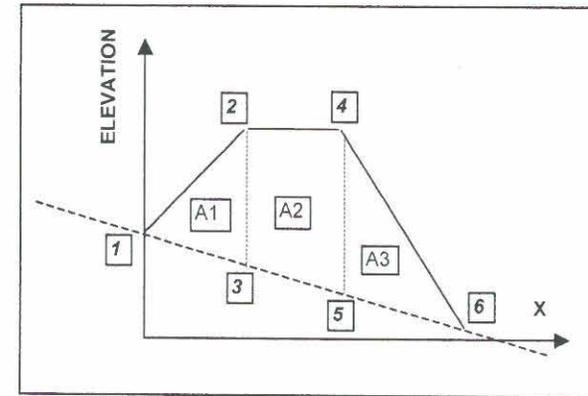
Road Prism Volume Calculator.xls

(This is not a precise calculator, consider the numbers rough)

Sombrero Road

	x	Elevation	h	Avg
	(ft)	(ft)	(ft)	
1 Beginning Toe of Slope (Catch line)	0	2546	0	
2 Edge of Road	17	2551.5	5.5	2.9
3 Point on Existing Ground below Edge of Road (Calculated)	17	2545.5	6.0	
4 2nd Edge of Road	45	2551.5	7.5	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	45	2544.6	6.9	6.5
6 Ending Toe of Slope (Catch line)	64	2544	0	3.6

Cross sectional Sub Area	A1	49	sf
Cross sectional Sub Area	A2	181	sf
Cross sectional Sub Area	A3	68	sf
<u>Total Cross Sectional Area</u>	<u>AT</u>	<u>299</u>	<u>sf</u>
	L	80	ft
	V	23885	cf
	V	885	cy



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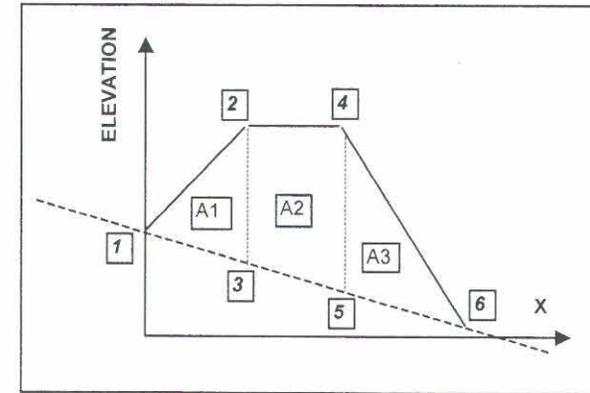
Road Prism Volume Calculator.xls

Sombrero Road

(This is not a precise calculator, consider the numbers rough)

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2545.5	0	
2 Edge of Road	18	2551.5	6	3.1
3 Point on Existing Ground below Edge of Road (Calculated)	18	2545.0	6.5	
4 2nd Edge of Road	42	2551.5	8	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	42	2544.4	7.1	6.8
6 Ending Toe of Slope (Catch line)	75	2543.5	0	3.8

Cross sectional Sub Area	A1	56	sf
Cross sectional Sub Area	A2	163	sf
Cross sectional Sub Area	A3	125	sf
Total Cross Sectional Area	AT	344	sf
L		110	ft
V		37851	cf
V		1402	cy



\\phoenix\PROJ\162944\Preliminary Design Sites\

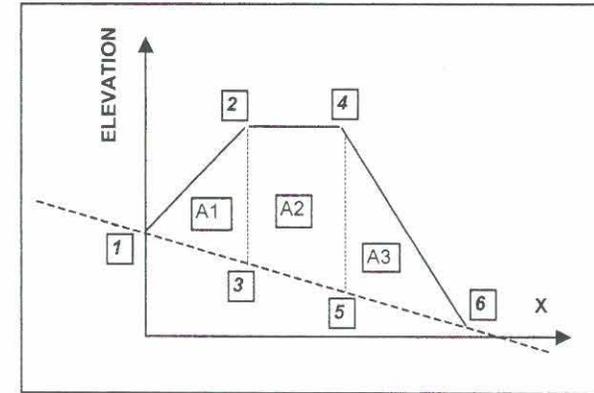
Road Prism Volume Calculator.xls

Sombrero Road

(This is not a precise calculator, consider the numbers rough)

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2548	0	
2 Edge of Road	24	2551.5	3.5	1.8
3 Point on Existing Ground below Edge of Road (Calculated)	24	2547.9	3.6	
4 2nd Edge of Road	49	2551.5	3.7	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	49	2547.8	3.7	3.6
6 Ending Toe of Slope (Catch line)	65	2547.8	0	1.8

Cross sectional Sub Area	A1	42	sf
Cross sectional Sub Area	A2	90	sf
Cross sectional Sub Area	A3	29	sf
Total Cross Sectional Area	AT	162	sf
	L	90	ft
	V	14594	cf
	V	541	cy



\\phoenix\PROJ\162944\Preliminary Design Sites\

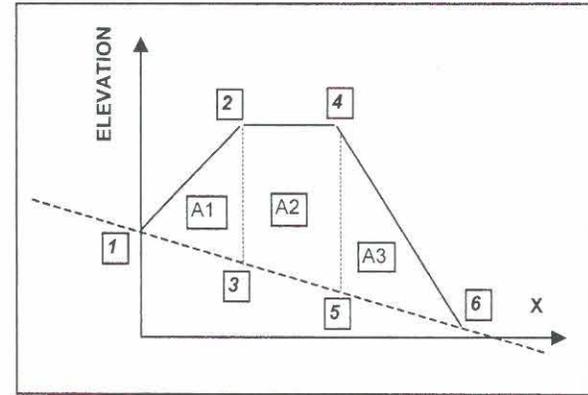
Road Prism Volume Calculator.xls

Pima Road

(This is not a precise calculator, consider the numbers rough)

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2584	0	
2 Edge of Road	8	2587.3	3.3	1.7
3 Point on Existing Ground below Edge of Road (Calculated)	8	2583.8	3.5	
4 2nd Edge of Road	32	2587.3	4.3	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	32	2583.4	3.9	3.7
6 Ending Toe of Slope (Catch line)	50	2583	0	2.1

Cross sectional Sub Area	A1	14	sf
Cross sectional Sub Area	A2	89	sf
Cross sectional Sub Area	A3	37	sf
<u>Total Cross Sectional Area</u>	<u>AT</u>	<u>139</u>	<u>sf</u>
	L	200	ft
	V	27880	cf
	V	1033	cy



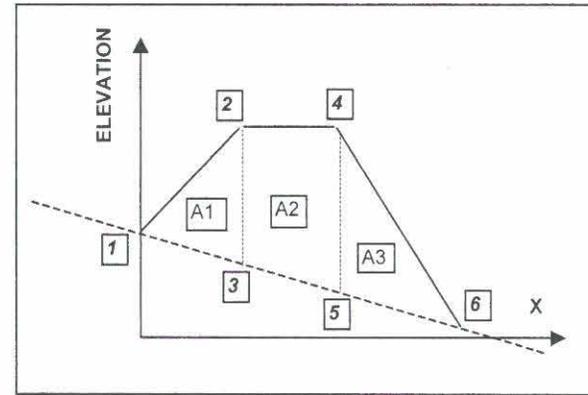
\\phoenix\PROJ\162944\Preliminary Design Sites\

Road Prism Volume Calculator.xls

Pima Road

(This is not a precise calculator, consider the numbers rough)

		x (ft)	Elevation (ft)	h (ft)	Avg
1	Beginning Toe of Slope (Catch line)	0	2584	0	
2	Edge of Road	8	2586	2	1.0
3	Point on Existing Ground below Edge of Road (Calculated)	8	2584.0	2.0	
4	2nd Edge of Road	36	2586	2.1	
5	Point on Existing Ground below 2nd Edge of Road (Calculated)	36	2583.9	2.1	2.0
6	Ending Toe of Slope (Catch line)	44	2583.9	0	1.0
Cross sectional Sub Area		A1	8	sf	
Cross sectional Sub Area		A2	57	sf	
Cross sectional Sub Area		A3	8	sf	
Total Cross Sectional Area		AT	74	sf	
L		200	ft		
V		14760	cf		
V		547	cy		



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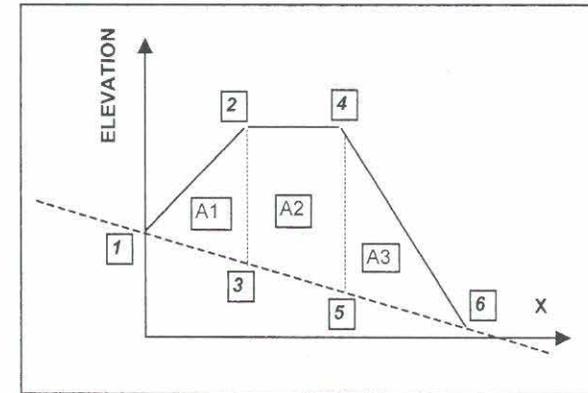
Road Prism Volume Calculator.xls

(This is not a precise calculator, consider the numbers rough)

Rising Sun Road

	x (ft)	Elevation (ft)	h (ft)	Avg
1 Beginning Toe of Slope (Catch line)	0	2430.5	0	
2 Edge of Road	8	2432.25	1.75	1.0
3 Point on Existing Ground below Edge of Road (Calculated)	8	2430.0	2.3	
4 2nd Edge of Road	36	2430.25	0.75	
5 Point on Existing Ground below 2nd Edge of Road (Calculated)	36	2430.0	0.3	1.3
6 Ending Toe of Slope (Catch line)	44	2429.5	0	0.3

Cross sectional Sub Area	A1	8	sf
Cross sectional Sub Area	A2	35	sf
Cross sectional Sub Area	A3	2	sf
<u>Total Cross Sectional Area</u>	<u>AT</u>	<u>45</u>	<u>sf</u>
	L	475	ft
	V	21375	cf
	V	792	cy



\\phoenix\PROJ\162944\Preliminary Design Sites\

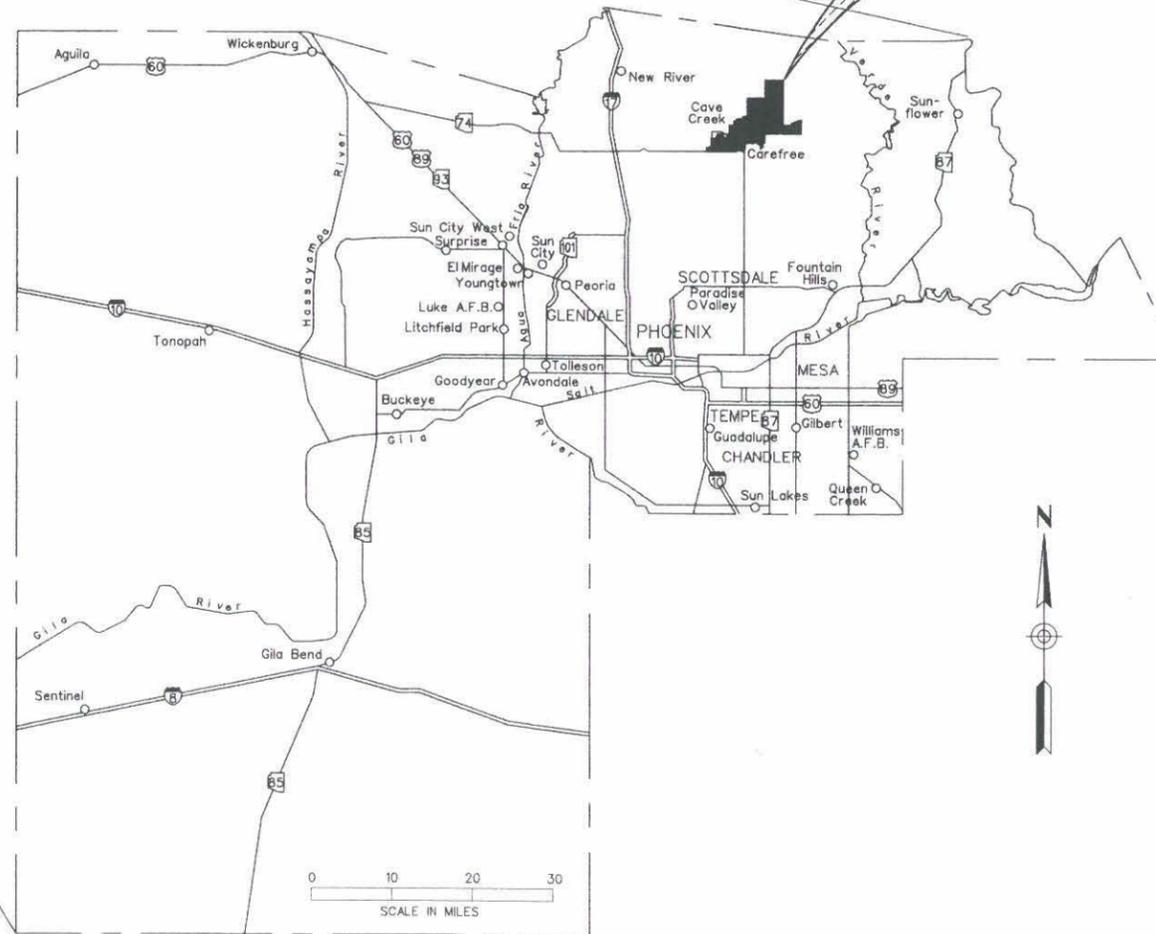
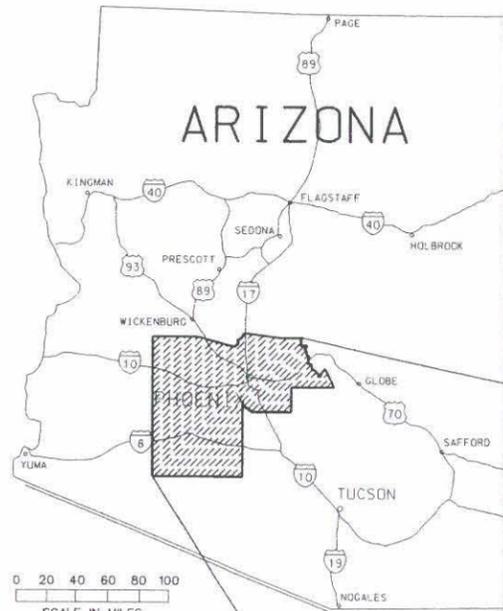
Appendix H
Floodplain Delineation

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

IN COOPERATION WITH
THE TOWN OF CAREFREE

FLOODPLAIN DELINEATION STUDY OF
GALLOWAY WASH MIDDLE BRANCH, WINDMILL
WASH, EASTERN PIMA WASH, UNNAMED
TRIBUTARY TO STAGECOACH PASS WASH, AND
UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK

FCD 2000C037



STUDY
AREA

NOTES

1. ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
2. ALL HORIZONTAL COORDINATES ARE BASED ON ARIZONA STATE PLANE COORDINATES BASED ON THE 1983 NORTH AMERICAN DATUM.

STATEMENTS OF PROFESSIONAL REGISTRANTS

THE GROUND CONTROL SURVEY WAS PREPARED UNDER MY DIRECT SUPERVISION.



THE FLOODPLAIN AND FLOODWAY DELINEATIONS WERE PERPARED UNDER MY DIRECT SUPERVISION USING HYDROLOGY FROM FCD 99-14, FCD 01-09 AND NEW HYDROLOGY UNDER THIS CONTRACT.



CH2MHILL
2625 SOUTH PLAZA
DRIVE SUITE 300
TEMPE, AZ
85282-3397

LOCATION MAP

MAY, 2004

UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
Main					Main				
2.2214	2267	1652	9.76	7.49	1.5812	2210.25	2622	7.37	2.86
2.2064	2262.25	1652	9.21	5.22	1.5549	2207.91	2622	7.26	2.48
2.1828	2258.25	2335	10.15	8.13	1.5234	2204.98	2822	6.36	2.96
2.1694	2257.6	2335	9.53	8.49	1.4875	2199.3	2779	6.19	2.95
2.1443	2257.51	2363	8.41	9.48	1.4233	2194.7	2779	5.34	2.87
2.1206	2256.17	2363	10.23	9.02	1.3724	2189.13	2779	5.7	2.23
2.0829	2252.47	2363	11.49	7.72	1.3235	2183.71	2854	5.03	1.47
2.0456	2248.54	2391	9.04	5.72	1.2701	2178.28	2274	5.52	1.91
2.0048	2245.97	2391	10.26	5.05	1.2176	2174.69	2274	5.91	2.3
1.9633	2243.44	2391	10.32	5.29	1.1824	2171.81	2764	4.47	4
1.9389	2241.2	2391	9.78	4.31	1.1329	2166.32	2764	5.28	3.07
1.9192	2239.28	2447	8.33	3.66	1.0627	2159	2764	5.99	3.65
1.9042	2238.8	2447	4.73	5.89	1.0158	2153.21	2764	5.93	3.13
1.8876	2237.97	2447	5.85	6.27	0.9888	2150.92	2849	5.87	3.15
1.8644	2235.19	2447	6.85	4.7	0.9593	2147.95	2849	5.35	3.61
1.8424	2232.64	2447	7.51	3.95	North				
1.8096	2230.46	2467	5.2	4.04	0.9285	2144.98	2092	4.38	3.81
1.7593	2226.87	2467	5.29	2.84	0.9094	2141.46	2092	7.34	4.07
1.7007	2220.63	2467	5.94	2.66	South				
1.6442	2215.52	2467	6.18	2.08	0.9065	2141.86	704	3.97	3.16
1.6113	2213.12	2467	5.12	1.92	0.8919	2141.45	562	1.4	2.86

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER
- CROSS SECTION
- FLOW DIVERSION (CFS)
- ELEVATION REFERENCE MARK
- BASE FLOOD ELEVATIONS
- ZONE DESIGNATIONS
- CORPORATE LIMITS
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 23	2222.05	SET 1/2" REBAR N: 1,018,508.59 E: 694,139.41
ERM 27	2162.46	SET 1/2" REBAR N: 1,018,265.15 E: 691,045.66
ERM 30	2186.40	SET 1/2" REBAR N: 1,018,385.94 E: 692,219.86

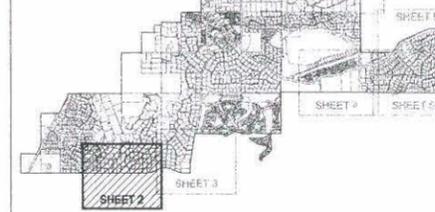
- NOTES
- HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
 - TOWN LIMITS APPROXIMATE.



MATCH LINE SEE SHEET 3

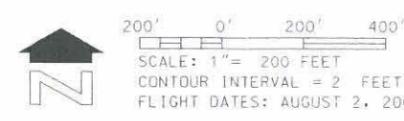


SHEET INDEX MAP



NO.	REVISION	BY	DATE
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
 UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK
 CAREFREE FLOODPLAIN DELINEATION
 F.C.D. CONTRACT NO. 2000 C037



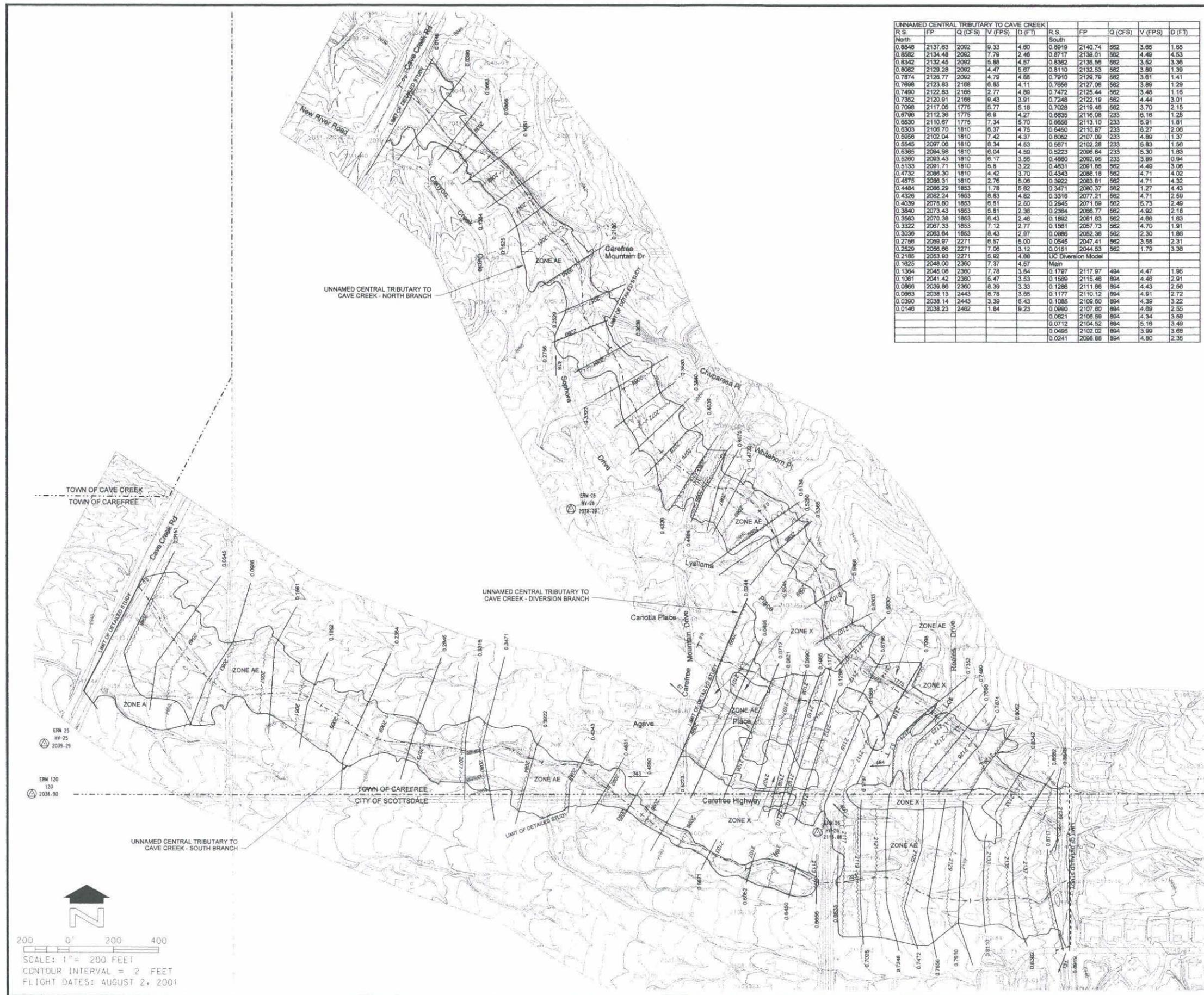
CH2MHILL		BY	DATE
DESIGN	ROL		03/07/03
DESIGN CHK.	LAP		03/07/03
PLANS	ROL		09/04/03
PLANS CHK.	TAB		09/04/03



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

MAPPING COMPANY: M&S AERIAL
 INTERNAL JOB # FCD-1184

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING



UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North					South				
0.8848	2137.63	2062	6.33	4.80	0.8619	2140.74	862	3.86	1.85
0.8582	2134.48	2092	7.78	2.46	0.8717	2138.01	862	4.48	4.53
0.8342	2132.45	2092	5.88	4.57	0.8362	2135.95	862	3.52	3.36
0.8082	2129.28	2092	4.47	6.67	0.8110	2132.53	862	3.89	1.39
0.7874	2126.77	2092	4.79	4.88	0.7910	2129.79	862	3.61	1.41
0.7698	2123.83	2108	6.85	4.11	0.7656	2127.06	862	3.89	1.29
0.7490	2122.83	2108	2.77	4.86	0.7472	2125.44	862	3.46	1.16
0.7352	2120.91	2108	6.43	3.91	0.7248	2122.19	862	4.44	3.01
0.7098	2117.05	1775	5.77	5.18	0.7028	2118.46	862	3.70	2.15
0.6798	2112.39	1775	6.9	4.27	0.6835	2116.09	233	6.18	1.28
0.6530	2110.67	1775	7.34	5.70	0.6856	2113.10	233	5.91	1.81
0.6303	2108.70	1810	6.37	4.75	0.6450	2110.87	233	6.27	2.08
0.5956	2102.04	1810	7.42	4.37	0.6062	2107.06	233	4.89	1.37
0.5545	2097.06	1810	6.34	4.63	0.5671	2102.28	233	5.83	1.58
0.5385	2084.98	1810	6.04	4.69	0.5223	2098.64	233	5.30	1.83
0.5280	2083.43	1810	6.17	3.95	0.4880	2092.95	233	3.89	0.94
0.5133	2081.71	1810	5.8	3.22	0.4831	2081.85	862	4.48	3.06
0.4732	2068.30	1810	4.42	3.70	0.4343	2068.18	862	4.71	4.02
0.4575	2066.31	1810	2.76	5.06	0.3922	2063.81	862	4.71	4.32
0.4484	2066.29	1863	1.78	5.82	0.3471	2060.37	862	1.27	4.43
0.4328	2062.24	1863	8.83	4.82	0.3318	2077.21	862	4.71	2.59
0.4039	2075.60	1853	6.51	2.50	0.2945	2071.69	862	5.73	2.49
0.3840	2073.43	1863	5.61	2.38	0.2384	2066.77	862	4.82	2.18
0.3563	2070.38	1863	8.43	2.48	0.1892	2061.83	862	4.86	1.63
0.3322	2067.33	1853	7.12	2.77	0.1561	2057.73	862	4.70	1.91
0.3036	2063.64	1853	8.43	2.97	0.0886	2052.36	862	2.30	1.88
0.2756	2059.97	2271	6.57	5.00	0.0545	2047.41	862	3.58	2.31
0.2529	2056.66	2271	7.06	3.12	0.0161	2044.53	862	1.79	3.38
0.2186	2053.63	2271	5.92	4.88	UC Diversion Model				
0.1825	2048.00	1360	7.37	4.57	Main				
0.1364	2042.08	2380	7.78	3.84	0.1787	2117.97	484	4.47	1.86
0.1061	2041.42	2380	6.47	3.53	0.1689	2115.46	894	4.46	2.91
0.0866	2039.86	2360	6.39	3.33	0.1286	2111.66	894	4.43	2.72
0.0663	2038.13	2443	8.78	3.85	0.1177	2110.12	894	4.91	2.72
0.0360	2038.14	2443	3.39	6.43	0.1085	2109.60	894	4.39	3.22
0.0146	2038.23	2462	1.84	9.23	0.0960	2107.80	894	4.89	2.55
					0.0621	2106.99	894	4.34	3.59
					0.0712	2104.52	894	5.16	3.49
					0.0485	2102.02	894	3.99	3.69
					0.0241	2098.88	894	4.80	2.35

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER
- CROSS SECTION
- FLOW DIVERSION (CFS)
- ELEVATION REFERENCE MARK
- BASE FLOOD ELEVATIONS
- ZONE DESIGNATIONS
- CORPORATE LIMITS
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 25	2039.29	SET 1/2" REBAR N: 1,018,548.93 E: 685,766.84
ERM 26	2115.68	SET 1/2" REBAR N: 1,018,159.48 E: 689,226.01
ERM 28	2078.20	SET CONCRETE NAIL N: 1,019,592.46 E: 688,127.48
ERM 120	2038.90	TOP OF PAVEMENT N: 1,018,325.30 E: 685,711.48

NOTES

- 1.) HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES. ARIZONA CENTRAL ZONE.
- 2.) TOWN LIMITS APPROXIMATE.

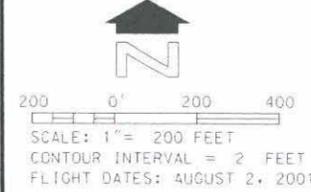


NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
 UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK
 CAREFREE FLOODPLAIN DELINEATION
 F.C.D. CONTRACT NO. 2000 C037



DESIGN	BY	DATE
DESIGN CHK.	RDL	03/07/03
PLANS	LAP	03/07/03
PLANS CHK.	RDL	09/04/03
	TAB	09/04/03



MATCH LINE SEE SHEET 2



LEGEND

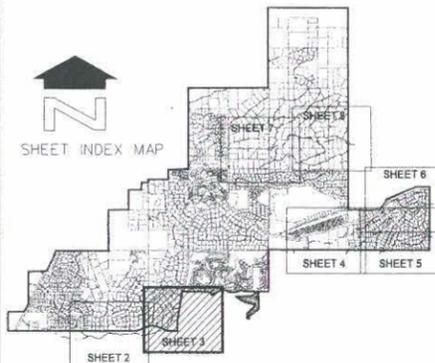
100-YR FLOODPLAIN BOUNDARY	---
FLOODWAY BOUNDARY	- - - - -
HYDRAULIC BASE LINE WITH RIVER MILE	---+---+---+---+---
SECTION LINE	-----
SECTION CORNER	26.25 35.36
CROSS SECTION	----- 02100
FLOW DIVERSION (CFS)	--- ---
ELEVATION REFERENCE MARK	⊕
BASE FLOOD ELEVATIONS	~~~~~
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
CONVERSION FACTOR 1988 NAVD = -2.23
AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 21	2272.97	SET 1/2" REBAR N: 1,019,414.95 E: 696,559.70
ERM 22	2254.61	SET CONCRETE NAIL N: 1,019,292.83 E: 695,534.40

- NOTES**
- HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
 - TOWN LIMITS APPROXIMATE.



UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK

R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
2.2214	2287	1652	9.78	7.48	1.6812	2210.25	2822	7.37	2.80
2.2084	2262.25	1652	9.21	5.22	1.5649	2207.91	2622	7.28	2.48
2.1828	2258.25	2335	10.15	6.13	1.5234	2204.86	2822	6.36	2.88
2.1984	2257.6	2326	9.53	8.48	1.4878	2199.3	2779	6.18	2.95
2.1443	2257.51	2363	8.41	9.48	1.4333	2194.7	2778	5.34	2.87
2.1205	2255.17	2363	10.23	9.02	1.3724	2188.13	2778	5.7	2.23
2.0828	2252.47	2363	11.48	7.72	1.3235	2183.71	2854	5.03	1.47
2.0488	2248.54	2361	9.04	5.72	1.2701	2179.28	2274	5.52	1.81
2.0048	2245.97	2361	10.38	5.06	1.2175	2174.86	2274	5.91	2.3
1.9633	2243.44	2361	10.32	5.28	1.1824	2171.81	2764	4.47	4
1.9388	2241.2	2361	9.78	4.31	1.1320	2166.32	2764	5.28	3.07
1.9182	2238.28	2447	8.33	3.88	1.0827	2159	2764	5.98	3.65
1.8842	2238.6	2447	4.73	5.88	1.0158	2153.21	2764	5.83	3.13
1.8875	2237.97	2447	5.85	6.27	0.9888	2150.12	2848	5.87	3.15
1.8644	2235.19	2447	6.85	4.7	0.9583	2147.35	2848	5.35	3.81
1.8424	2232.84	2447	7.51	3.85	North				
1.8098	2230.48	2487	5.2	4.04	0.9285	2144.98	2082	4.38	3.81
1.7983	2228.87	2487	5.29	2.84	0.9084	2141.45	2082	7.34	4.07
1.7007	2225.63	2487	5.94	2.88	South				
1.6442	2215.52	2487	6.18	2.08	0.8085	2141.86	704	3.87	3.18
1.6113	2213.12	2487	5.12	1.82	0.8919	2141.45	562	1.4	2.98



200' 0' 200' 400'
SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: AUGUST 2, 2001

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037



CH2MHILL

DESIGN	BY	DATE
DESIGN CHK.	RDL	03/07/03
PLANS CHK.	LAP	03/07/03
PLANS CHK.	RDL	09/04/03
PLANS CHK.	TAB	09/04/03

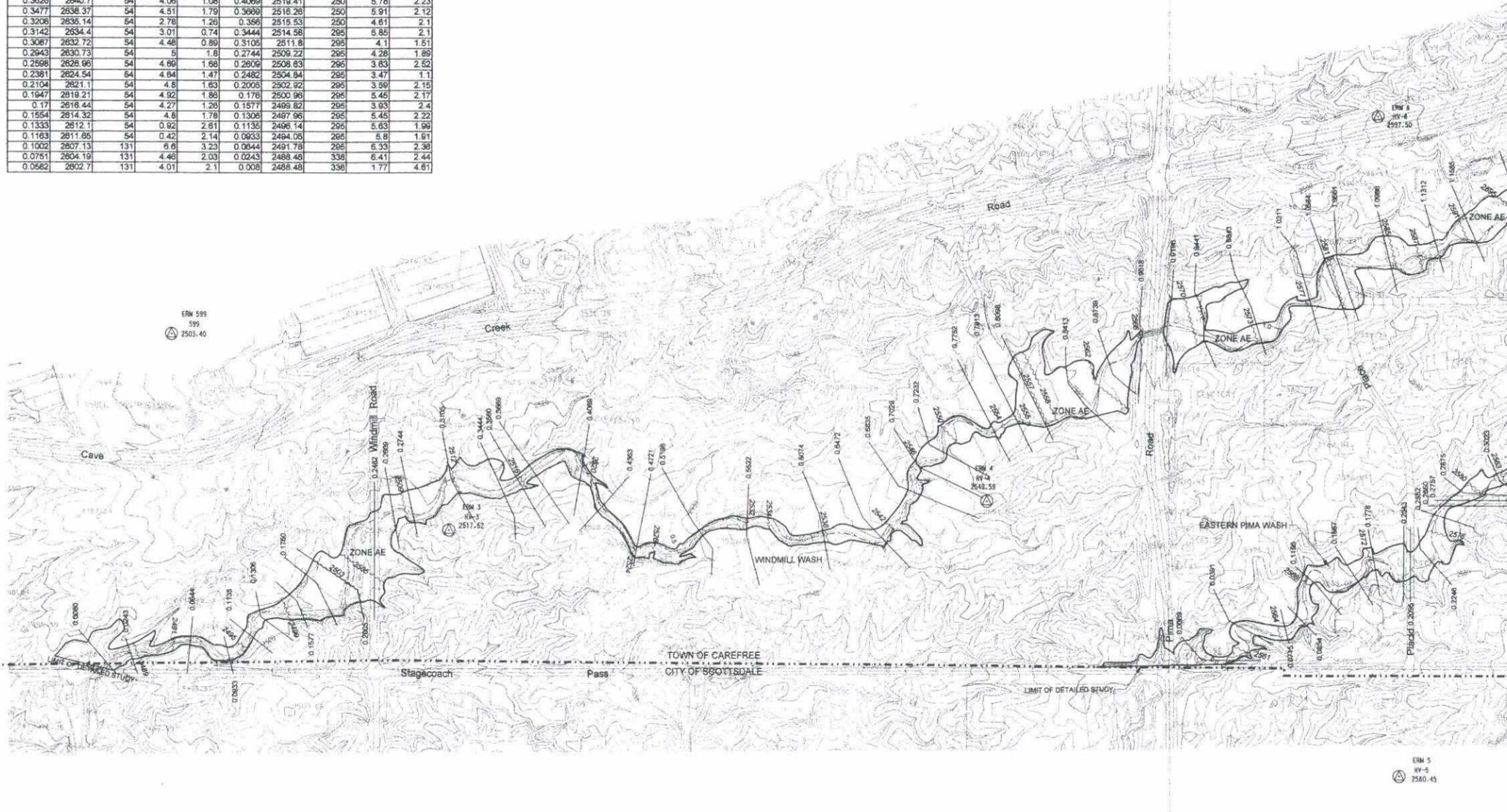
THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

MAPPING COMPANY: M&B AERIAL
(INTERNAL JOB # FCD-1184)

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING

WINDMILL WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch									
1.6576	2646.16	64	5.29	1.94	Combined Branch	131	3.27	1.8	
1.6599	2641.73	64	2.5	1.58	1.1975	2595.59	162	3.46	2.87
1.5345	2638.04	64	4.18	1.32	1.1595	2591.94	162	3.38	2.11
1.5334	2634.16	64	3.83	0.98	1.1312	2688.84	162	4.54	1.9
1.5241	2632.89	64	3.72	0.65	1.0888	2584.64	162	3.59	2.31
1.518	2631.73	64	4	0.99	1.0881	2581.93	162	2.48	1.58
1.4884	2628.39	64	4.52	1.72	1.0584	2580.7	162	3.41	0.98
1.4665	2625.6	64	5.33	2.06	1.0311	2577.22	162	5.97	2.73
1.4494	2624.48	64	4.65	1.74	0.9843	2573.23	162	3.66	2.04
1.4322	2622.37	64	3.98	1.48	0.9441	2569.84	162	5.31	2.25
1.4212	2621.5	64	4.75	1.35	0.9198	2569.7	198	1.35	3.78
1.3883	2620.22	64	2.09	2.82	0.9018	2566.1	198	5.75	1.78
1.3677	2616.61	64	0.94	3.39	0.8759	2563.38	198	2.81	2.07
1.3468	2615.61	64	0.82	3.87	0.8413	2560.22	198	2.25	2.17
1.3431	2615.61	64	0.34	4.13	0.8098	2557.08	198	0.92	1.97
1.3364	2612.98	64	1.65	2.54	0.7913	2554.83	198	8.84	1.83
1.3215	2612.98	64	0.45	4.23	0.7752	2553.56	198	4.99	2.14
1.311	2612.98	77	0.31	5.58	0.7232	2548.34	198	3.73	2.31
1.293	2607.4	131	4.38	2.91	0.7029	2545.95	198	6.08	1.85
1.283	2602.71	131	5.54	2.4	0.6836	2544.08	198	5.32	1.87
1.2388	2599.46	131	5.79	3.11	0.6472	2541.08	250	4.91	2.05
South Branch									
0.4414	2648.44	54	3.32	1.55	0.5822	2531.98	250	6.12	1.82
0.4246	2647.82	54	4.81	1.67	0.5198	2529.69	250	6.99	5.84
0.4084	2645.54	54	3.07	1.23	0.4721	2524.2	250	5.93	2.55
0.3881	2643.7	54	3.37	0.79	0.4363	2521.83	250	5.86	1.97
0.3626	2640.7	54	4.05	1.08	0.4099	2519.41	250	5.78	2.23
0.3477	2638.37	54	4.51	1.79	0.3909	2518.26	250	5.91	2.12
0.3208	2635.14	54	2.78	1.29	0.366	2515.53	250	4.61	2.1
0.3142	2634.4	54	3.01	0.74	0.3444	2514.88	295	5.85	2.1
0.3087	2632.72	54	4.48	0.89	0.3105	2511.8	295	4.1	1.51
0.2843	2630.73	54	5	1.8	0.2744	2509.22	295	4.28	1.89
0.2598	2628.96	54	4.99	1.68	0.2806	2508.83	295	3.63	2.82
0.2381	2624.54	54	4.84	1.47	0.2482	2504.84	295	3.47	1.1
0.2104	2621.1	54	4.8	1.63	0.2005	2502.92	295	3.99	2.15
0.1947	2619.21	54	4.92	1.86	0.178	2500.98	295	5.45	2.17
0.17	2618.44	54	4.27	1.28	0.1577	2499.82	295	3.63	2.2
0.1554	2614.32	54	4.8	1.78	0.1308	2487.96	295	5.45	2.22
0.1333	2612.1	54	0.92	2.61	0.1135	2486.14	295	5.83	1.98
0.1183	2611.86	54	0.42	2.14	0.0833	2484.05	295	6.8	1.61
0.1002	2607.13	131	6.6	3.23	0.0844	2481.78	295	6.33	2.38
0.0751	2604.19	131	4.46	2.03	0.0243	2488.48	338	6.41	2.44
0.0582	2602.7	131	4.01	2.1	0.008	2488.48	338	1.77	4.81

EAST PIMA WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
1.0178	2691.71	71	4.98	1.52	0.4988	2601.90	134	4.23	2.54
0.9829	2687.50	71	4.82	1.77	0.4801	2600.30	134	4.23	2.98
0.9653	2683.04	71	4.19	1.26	0.4600	2598.00	134	4.96	2.04
0.9247	2647.46	71	3.13	1.84	0.4378	2594.96	134	5.54	2.78
0.9088	2646.19	71	5.17	1.98	0.4040	2591.87	134	4.24	2.40
0.8923	2644.06	71	4.54	1.05	0.3898	2590.84	134	4.13	2.59
0.8747	2641.85	71	2.91	1.33	0.3722	2589.32	134	4.19	2.13
0.8590	2639.81	71	3.38	1.07	0.3647	2587.82	134	4.24	2.32
0.8342	2637.29	71	4.25	1.10	0.3381	2585.85	134	3.90	3.06
0.8168	2636.40	71	1.81	1.02	0.3266	2585.89	134	6.08	3.28
0.8111	2636.02	71	3.84	0.69	0.3023	2582.66	134	3.73	2.19
0.8056	2634.01	71	3.79	0.80	0.2875	2579.75	134	3.76	0.90
0.7856	2630.90	71	5.66	2.25	0.2757	2578.76	134	2.30	1.12
0.7881	2628.29	71	4.53	1.72	0.2650	2576.51	134	3.11	1.99
0.7351	2624.58	71	4.89	1.56	0.2352	2577.83	134	4.51	1.98
0.7049	2621.18	71	4.90	1.63	0.2245	2575.38	295	3.90	1.96
0.6852	2619.19	71	4.69	1.78	0.2096	2574.16	295	4.87	1.35
0.6541	2616.40	71	4.98	1.88	0.2043	2573.72	295	3.34	1.79
0.6387	2614.73	71	3.66	2.22	0.1778	2572.11	295	4.55	3.02
0.6098	2612.35	71	3.78	1.94	0.1687	2571.03	295	4.06	3.98
0.5931	2610.90	71	4.27	1.83	0.1156	2568.36	295	5.82	2.73
0.5707	2608.41	71	3.38	1.31	0.0854	2566.71	295	4.03	2.00
0.5548	2608.05	134	3.94	1.19	0.0715	2564.83	295	4.40	2.24
0.5494	2607.73	134	4.12	0.80	0.0381	2562.81	295	4.17	2.07
0.5427	2606.26	134	5.11	2.16	0.0088	2560.50	323	2.43	2.73
0.5234	2603.89	134	3.70	2.38					



LEGEND

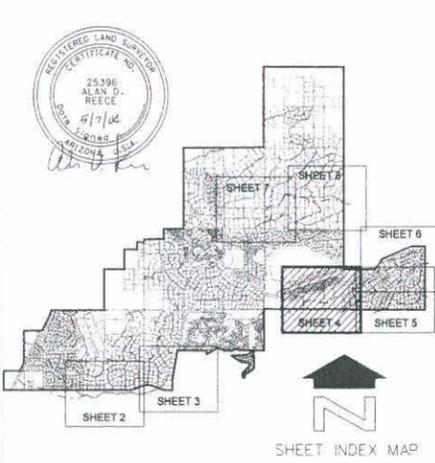
- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER
- CROSS SECTION
- FLOW DIVERSION (CFS)
- ELEVATION REFERENCE MARK
- BASE FLOOD ELEVATIONS
- ZONE DESIGNATIONS
- CORPORATE LIMITS
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NAVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 3	2517.52	SET 1/2" REBAR N: 1,024,086.51 E: 705,346.82
ERM 4	2549.59	SET 1/2" REBAR N: 1,024,186.50 E: 707,133.53
ERM 5	2580.45	SET 1/2" REBAR N: 1,023,285.90 E: 708,498.80
ERM 8	2597.50	SET 1/2" REBAR N: 1,025,458.46 E: 708,433.00
ERM 599	2503.40	USGS BRASS CAP N: 1,024,733.04 E: 704,426.50

- ### NOTES
- HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
 - TOWN LIMITS APPROXIMATE.



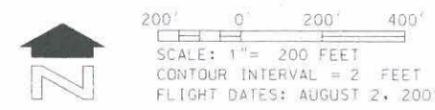
NO.	REVISION	BY	DATE
2			
1			

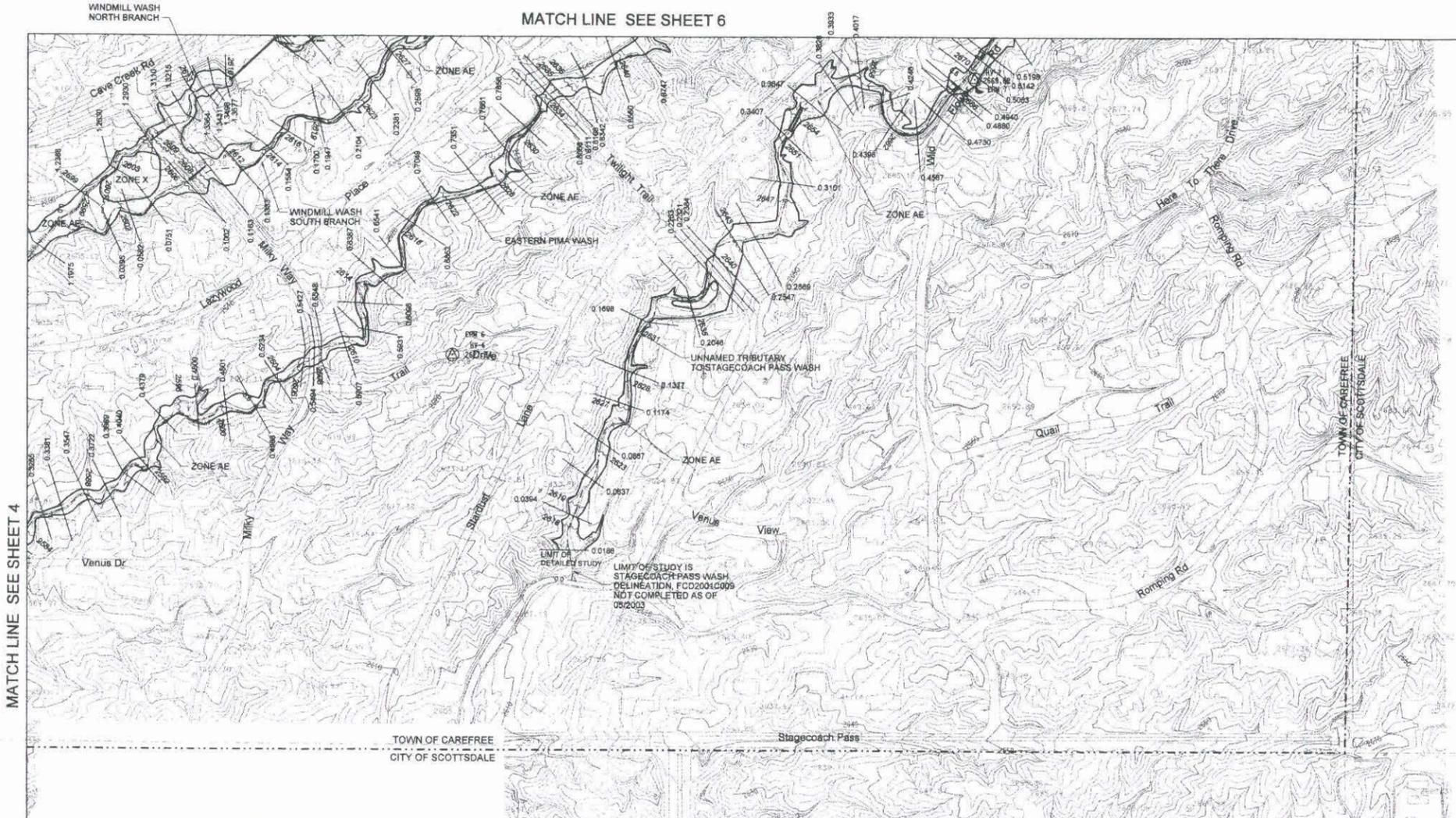
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WINDMILL WASH AND EASTERN PIMA WASH CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037

DESIGN	ROL	03/07/03
DESIGN CHK.	LAP	03/07/03
PLANS	ROL	09/04/03
PLANS CHK.	TAB	09/04/03

BY: ROL DATE: 03/07/03





MATCH LINE SEE SHEET 4

MATCH LINE SEE SHEET 6

WINDMILL WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch									
1.6576	2646.16	64	5.29	1.94	0.0365	2601.37	131	3.27	1.6
1.6369	2641.73	64	2.5	1.99	1.1975	2595.09	162	3.46	2.87
1.5545	2636.04	64	4.16	1.33	1.1585	2591.84	162	3.38	2.11
1.5334	2634.16	64	3.63	0.98	1.1312	2588.84	162	4.54	1.19
1.5241	2632.96	64	3.72	0.95	1.0986	2584.54	162	3.59	2.31
1.518	2631.73	64	4	0.99	1.0651	2581.83	162	2.48	1.58
1.4884	2626.39	64	4.52	1.72	1.0584	2580.7	162	3.41	0.98
1.4666	2625.6	64	5.33	2.05	1.0311	2577.22	162	5.97	2.73
1.4494	2624.46	64	4.85	1.74	0.9843	2573.23	162	3.86	2.04
1.4322	2622.37	64	3.98	1.48	0.9441	2569.84	162	5.31	2.25
1.4212	2621.5	64	4.75	1.35	0.9196	2566.7	198	1.35	3.76
1.3983	2620.22	64	2.99	2.92	0.8768	2562.1	198	5.75	1.78
1.3577	2615.61	64	0.94	3.36	0.8739	2563.38	198	2.81	2.07
1.3498	2615.61	64	0.82	3.87	0.8413	2560.22	198	2.28	2.17
1.3431	2615.61	64	0.34	4.13	0.8098	2557.06	198	0.62	1.97
1.3364	2612.98	64	1.85	2.54	0.7913	2554.53	198	5.64	1.63
1.3215	2612.98	64	0.45	4.23	0.7752	2553.66	198	4.59	2.14
1.311	2612.98	77	0.31	5.56	0.7232	2548.34	198	3.73	2.31
1.293	2607.4	131	4.38	2.91	0.7029	2545.95	198	6.08	1.85
1.283	2602.71	131	6.54	2.4	0.6836	2544.08	198	5.32	1.97
1.2386	2599.46	131	5.79	3.11	0.6472	2541.08	250	4.91	2.05
South Branch									
0.4414	2646.44	54	3.32	1.55	0.5522	2531.98	250	6.12	1.92
0.4246	2647.52	54	4.81	1.67	0.5198	2529.69	250	6.96	5.64
0.4054	2645.54	54	3.07	1.23	0.4721	2524.2	250	5.93	2.55
0.3881	2643.7	54	3.37	0.79	0.4363	2521.63	250	5.88	1.97
0.3626	2640.7	54	4.06	1.08	0.4069	2519.41	250	5.78	2.23
0.3477	2638.37	54	4.51	1.79	0.3669	2516.26	250	5.91	2.12
0.3206	2636.14	54	2.78	1.26	0.356	2515.53	250	4.61	2.1
0.3142	2634.4	54	3.01	0.74	0.3444	2514.68	295	5.85	2.1
0.3087	2632.72	54	4.48	0.89	0.3105	2511.9	295	4.1	1.51
0.2943	2630.73	54	5	1.81	0.2744	2509.22	295	4.28	1.86
0.2598	2626.96	54	4.69	1.68	0.2609	2508.83	295	3.63	2.52
0.2381	2624.54	54	4.94	1.47	0.2482	2504.84	295	3.47	1.11
0.2104	2621.1	54	4.8	1.63	0.2006	2502.92	295	3.59	2.15
0.1947	2619.21	54	4.92	1.86	0.176	2500.96	295	5.45	2.17
0.17	2616.44	54	4.27	1.26	0.1577	2499.82	295	3.93	2.4
0.1554	2614.32	54	4.8	1.78	0.1306	2497.96	295	5.45	2.22
0.1335	2612.1	54	0.92	2.61	0.1135	2496.14	295	5.63	1.99
0.1183	2611.85	54	0.42	2.14	0.0933	2494.05	295	5.9	1.91
0.1002	2607.13	131	6.5	3.23	0.0844	2491.78	295	6.33	2.35
0.0751	2604.19	131	4.46	2.03	0.0243	2488.48	338	6.41	2.44
0.0582	2602.7	131	4.01	2.1	0.008	2488.48	338	1.77	4.61

EAST PIMA WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
1.0178	2661.71	71	4.96	1.52	0.4886	2601.90	134	4.23	2.54
0.9829	2657.50	71	4.62	1.77	0.4801	2600.30	134	4.23	2.98
0.9653	2653.04	71	4.19	1.28	0.4600	2598.00	134	4.96	2.04
0.9247	2647.48	71	5.13	1.84	0.4379	2594.96	134	5.54	2.78
0.9086	2646.19	71	5.17	1.98	0.4040	2591.87	134	4.24	2.40
0.8903	2644.06	71	4.54	1.05	0.3889	2590.94	134	4.13	2.59
0.8747	2641.85	71	2.91	1.33	0.3722	2588.32	134	4.19	2.13
0.8560	2639.61	71	3.38	1.07	0.3547	2587.82	134	4.24	2.32
0.8342	2637.29	71	4.25	1.10	0.3381	2586.85	134	3.90	3.05
0.8168	2635.40	71	1.81	1.02	0.3265	2585.86	134	6.06	3.28
0.8111	2635.02	71	3.94	0.86	0.3023	2582.86	134	3.73	2.19
0.8056	2634.01	71	3.79	0.80	0.2875	2579.75	134	3.78	0.90
0.7856	2630.90	71	6.56	2.25	0.2757	2578.76	134	2.30	1.12
0.7681	2628.29	71	4.53	1.72	0.2650	2578.51	134	3.11	1.99
0.7351	2624.58	71	4.86	1.55	0.2552	2577.93	134	4.51	1.86
0.7049	2621.18	71	4.90	1.83	0.2246	2575.38	295	3.60	1.96
0.6852	2618.19	71	4.69	1.78	0.2095	2574.18	295	4.67	1.35
0.6541	2616.40	71	4.98	1.86	0.2043	2573.72	295	3.34	1.79
0.6387	2614.73	71	3.66	2.22	0.1778	2572.11	295	4.55	3.02
0.6098	2612.35	71	3.78	1.84	0.1567	2571.03	295	4.06	3.98
0.5931	2610.90	71	4.27	1.63	0.1158	2568.38	295	5.82	2.73
0.5707	2608.41	71	3.39	1.31	0.0854	2565.71	295	4.03	2.00
0.5548	2608.05	134	3.94	1.19	0.0715	2564.93	295	4.40	2.24
0.5494	2607.73	134	4.12	0.80	0.0391	2562.91	295	4.17	2.07
0.5427	2606.28	134	5.11	2.16	0.0089	2560.50	323	2.43	2.73
0.5234	2603.99	134	3.70	2.38					

UNNAMED TRIBUTARY TO STAGECOACH PASS WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
0.8707	2712.74	84	5.51	2.28	0.4398	2691.51	162	3.50	2.51
0.844	2710.16	84	5.38	2.33	0.4248	2689.92	152	5.14	1.94
0.8171	2708.75	84	5.17	1.83	0.4017	2687.81	152	2.71	1.53
0.7934	2704.80	84	4.14	1.85	0.3833	2687.30	162	4.54	1.44
0.7826	2702.86	84	1.05	1.97	0.3828	2686.96	125	3.19	2.51
0.7448	2697.97	84	6.46	2.63	0.3647	2686.57	225	0.88	3.93
0.7285	2694.20	84	5.98	2.46	0.3407	2685.27	225	8.20	1.98
0.6776	2688.72	84	5.47	2.74	0.3101	2684.77	225	6.06	2.57
0.6446	2685.16	84	8.20	2.83	0.2899	2684.43	225	4.52	1.82
0.6242	2682.71	84	6.83	2.80	0.2547	2684.15	225	4.16	2.04
0.6025	2679.65	152	4.32	2.73	0.2384	2684.00	225	3.97	0.92
0.583	2679.47	152	1.84	5.08	0.2321	2684.00	225	2.19	1.21
0.5624	2674.57	152	5.33	2.14	0.2263	2683.66	225	4.03	1.83
0.5394	2672.52	152	4.25	1.80	0.2048	2683.06	225	5.39	2.33
0.5198	2671.28	152	2.41	2.92	0.1998	2683.16	225	6.86	2.40
0.5142	2670.47	152	4.40	2.73	0.1377	2682.31	225	6.40	3.12
0.5063	2669.86	152	4.26	2.85	0.1174	2682.26	225	5.34	2.89
0.484	2669.78	152	1.46	4.79	0.0867	2682.77	225	4.48	3.18
0.468	2666.03	152	5.74	1.88	0.0637	2682.57	225	5.40	2.45
0.473	2664.42	152	5.16	2.79	0.0394	2681.33	225	6.50	3.06
0.4567	2662.62	152	5.82	2.41	0.0196	2681.10	225	1.71	3.71

LEGEND

100-YR FLOODPLAIN BOUNDARY ————

FLOODWAY BOUNDARY - - - - -

HYDRAULIC BASE LINE WITH RIVER MILE ————

SECTION LINE ————

SECTION CORNER

CROSS SECTION

FLOW DIVERSION (CFS)

ELEVATION REFERENCE MARK

BASE FLOOD ELEVATIONS

ZONE DESIGNATIONS

CORPORATE LIMITS

COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY

ELEVATION REFERENCE MARKS

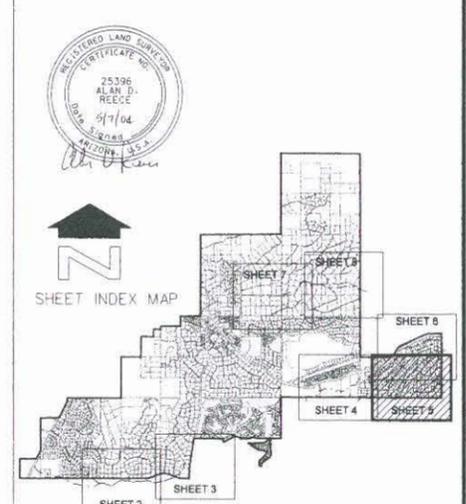
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.25 AVERAGE TO 1929 NAVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 6	2627.94	SET CONCRETE NAIL N: 1,024,842.08 E: 710,190.25
ERM 7	2669.62	SET CONCRETE NAIL N: 1,025,707.02 E: 711,819.77

NOTES

1.) HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.

2.) TOWN LIMITS APPROXIMATE.



NO.	REVISION	BY	DATE
1			
2			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WINDMILL, EASTERN PIMA AND UNNAMED TRIBUTARY TO STAGECOACH PASS WASH CAREFREE FLOODPLAIN DELINEATION

F.C.D. CONTRACT NO. 2000 C037

	BY	DATE
DESIGN	ROL	03/07/03
DESIGN CHK.	LAP	03/07/03
PLANS	ROL	09/04/03
PLANS CHK.	TAB	09/04/03

WINDMILL WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch									
1.8578	2846.16	64	5.29	1.94	0.0369	2801.37	131	3.27	1.8
1.6069	2841.73	64	2.5	1.56	1.1975	2695.59	162	3.46	2.87
1.5545	2836.04	64	4.16	1.32	1.1585	2591.64	162	3.38	2.11
1.5334	2834.16	64	3.63	0.98	1.1312	2588.64	162	4.54	1.9
1.5241	2832.89	64	3.72	0.85	1.0986	2584.54	162	3.59	2.31
1.518	2831.73	64	4	0.96	1.0661	2581.83	162	2.46	1.58
1.4864	2828.39	64	4.52	1.72	1.0584	2580.7	162	3.41	0.98
1.4665	2825.6	64	5.33	2.05	1.0311	2577.22	162	5.97	2.73
1.4464	2824.48	64	4.85	1.74	0.9843	2573.23	162	3.66	2.04
1.4322	2822.37	64	3.98	1.48	0.9441	2569.64	162	5.31	2.26
1.4212	2821.5	64	4.75	1.35	0.9196	2569.7	198	1.35	3.76
1.3963	2820.22	64	2.09	2.92	0.9018	2566.1	198	5.75	1.78
1.3577	2815.81	64	0.94	3.39	0.8739	2563.36	198	2.81	2.07
1.3486	2815.81	64	0.62	3.87	0.8413	2560.22	198	2.25	2.17
1.3431	2815.81	64	0.34	4.13	0.8098	2557.08	198	0.92	1.97
1.3364	2812.98	64	1.65	2.54	0.7913	2554.53	198	5.54	1.63
1.3215	2812.99	64	0.45	4.23	0.7752	2553.56	198	4.59	2.14
1.311	2812.99	77	0.31	5.56	0.7232	2548.34	198	3.73	2.31
1.293	2807.4	131	4.38	2.91	0.7029	2545.95	198	6.08	1.85
1.263	2802.71	131	5.54	2.4	0.6835	2544.08	198	5.32	1.97
1.2386	2596.46	131	5.79	3.11	0.6472	2541.06	250	4.91	2.05
South Branch									
0.4414	2848.44	54	3.32	1.55	0.5522	2531.88	250	6.12	1.92
0.4246	2847.52	54	4.61	1.87	0.5198	2529.69	250	6.99	5.64
0.4064	2846.54	54	3.07	1.23	0.4721	2524.2	250	5.93	2.55
0.3881	2843.7	54	3.37	0.79	0.4363	2521.63	250	5.86	1.97
0.3626	2840.7	54	4.06	1.06	0.4069	2519.41	250	5.78	2.23
0.3477	2838.37	54	4.51	1.79	0.3699	2516.28	250	5.91	2.12
0.3206	2835.14	54	2.78	1.26	0.356	2515.53	250	4.81	2.1
0.3142	2834.4	54	3.01	0.74	0.3444	2514.58	295	5.85	2.1
0.3087	2832.72	54	4.48	0.89	0.3195	2511.8	295	4.1	1.51
0.2943	2830.73	54	5	1.6	0.2744	2508.22	295	4.29	1.89
0.2699	2828.98	54	4.69	1.86	0.2809	2508.63	295	3.83	2.52
0.2381	2824.54	54	4.54	1.47	0.2482	2504.84	295	3.47	1.1
0.2104	2821.1	54	4.8	1.83	0.2005	2502.82	295	3.59	2.15
0.1947	2819.21	54	4.92	1.86	0.178	2500.66	295	5.45	2.17
0.17	2818.44	54	4.27	1.26	0.1577	2499.82	295	3.83	2.4
0.1564	2814.32	54	4.8	1.78	0.1306	2497.99	295	5.45	2.22
0.1333	2812.1	54	0.92	2.81	0.1135	2495.14	295	5.53	1.99
0.1163	2811.65	54	0.42	2.14	0.0933	2494.05	295	5.8	1.91
0.1002	2807.13	131	6.8	3.23	0.0844	2491.79	295	6.33	2.38
0.0751	2804.19	131	4.48	2.03	0.0243	2488.48	338	6.41	2.44
0.0562	2802.7	131	4.01	2.1	0.008	2488.48	338	1.77	4.61

UNNAMED TRIBUTARY TO STAGECOACH PASS WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
0.8707	2712.74	84	5.51	2.25	0.4398	2691.51	152	3.50	2.51
0.844	2710.16	84	5.39	2.33	0.4246	2689.82	152	5.14	1.94
0.811	2708.75	84	5.17	1.83	0.4017	2687.81	152	2.71	1.53
0.7934	2704.80	84	4.14	1.85	0.3633	2687.30	152	4.54	1.44
0.7626	2702.66	84	1.05	1.97	0.3828	2686.98	225	3.19	2.51
0.7448	2697.97	84	6.45	2.63	0.3647	2686.67	225	0.88	3.93
0.7285	2694.20	84	5.98	2.46	0.3407	2685.27	225	6.20	1.96
0.6778	2688.72	84	5.47	2.74	0.3101	2684.77	225	6.05	2.57
0.6449	2685.16	84	6.20	2.83	0.2989	2684.43	225	4.52	1.82
0.6242	2682.71	84	6.83	2.80	0.2547	2683.15	225	4.18	2.04
0.6025	2678.65	152	4.32	2.73	0.2384	2640.79	225	3.97	0.62
0.583	2676.47	152	1.84	5.06	0.2321	2640.00	225	2.19	1.21
0.5634	2674.57	152	6.33	2.14	0.2283	2639.68	225	4.03	1.83
0.5394	2672.02	152	4.25	1.80	0.2046	2635.08	225	5.36	2.33
0.5196	2671.28	152	2.41	2.92	0.1698	2631.78	225	8.68	2.40
0.5142	2670.47	152	4.40	2.73	0.1377	2628.31	225	5.40	3.12
0.5053	2669.86	152	4.26	2.85	0.1174	2627.28	225	5.34	2.89
0.494	2668.78	152	1.48	4.79	0.0987	2625.77	225	4.48	3.18
0.488	2666.03	152	5.74	1.86	0.0637	2620.57	225	5.40	2.45
0.473	2664.42	152	5.18	2.79	0.0394	2618.33	225	6.50	3.08
0.4567	2662.62	152	5.82	2.41	0.0186	2617.10	225	1.71	3.71

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER
- CROSS SECTION
- FLOW DIVERSION (CFS)
- ELEVATION REFERENCE MARK
- BASE FLOOD ELEVATIONS
- ZONE DESIGNATIONS
- CORPORATE LIMITS
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY

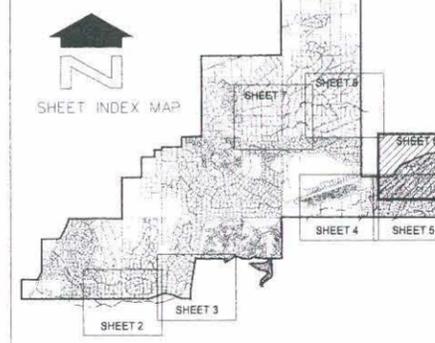
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23. AVERAGE TO 1929 NAVD.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
381	2612.05	
382	301.59	

NOTES

- HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
- TOWN LIMITS APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

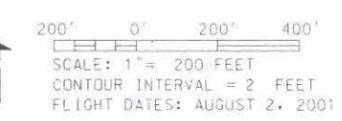
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
 WINDMILL, PIMA AND UNNAMED TRIBUTARY TO STAGECOACH PASS WASH
 CAREFREE FLOODPLAIN DELINEATION
 F.C.D. CONTRACT NO. 2000 C037



	BY	DATE
DESIGN	ROL	03/07/03
DESIGN CHK.	LAP	03/07/03
PLANS	ROL	09/04/03
PLANS CHK.	TAB	09/04/03



MATCH LINE SEE SHEET 5



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

MAPPING COMPANY: MIB AERIAL (INTERNAL JOB # FCD-1184)

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING

GALLOWAY WASH MIDDLE BRANCH											
R.S	FP	FW	Q (CFS)	V (FPS)	D (FT)	R.S	FP	FW	Q (CFS)	V (FPS)	D (FT)
Middle Branch 2											
0.2437	2482.66	2483.20	206	3.12	1.68	0.9360	2513.66	2513.95	2153	5.50	3.30
0.2045	2458.98	2458.33	228	4.32	1.64	0.9152	2510.87	2511.08	2179	6.25	2.98
0.1760	2455.76	2456.37	228	4.25	1.26	0.8808	2506.43	2506.91	2179	6.75	2.98
0.1668	2453.81	2454.24	228	4.07	1.18	0.8441	2501.84	2502.32	2179	6.88	2.45
0.1285	2451.00	2451.56	228	3.80	1.52	0.8041	2496.89	2497.40	2179	5.78	1.85
0.1105	2449.20	2448.70	228	4.33	1.38	0.7960	2491.34	2491.38	2179	6.35	2.89
0.1010	2448.40	2448.89	247	4.92	1.32	0.7272	2487.63	2488.09	2179	9.82	2.57
0.0654	2447.75	2447.85	247	4.11	2.09	0.6777	2481.71	2481.71	2179	5.79	3.44
0.0792	2444.93	2445.01	247	3.98	1.07	0.6468	2477.93	2478.34	2204	7.03	3.09
0.0439	2439.81	2440.23	247	4.12	1.81	0.5954	2472.24	2472.47	2204	5.75	3.37
Middle Branch						0.5644	2468.70	2468.97	2204	5.70	3.02
1.6190	2599.95	2600.45	2094	5.25	3.35	0.5272	2464.27	2464.49	2210	5.98	3.12
1.6060	2596.35	2597.22	2094	7.54	4.38	0.5212	2463.79	2464.03	2210	5.38	3.11
1.6884	2593.49	2594.31	2124	9.90	2.91	0.5157	2463.25	2463.49	2210	6.44	3.74
1.5702	2590.43	2590.44	2124	7.84	4.79	0.5006	2459.60	2460.14	2210	8.23	3.83
1.5371	2587.34	2587.91	2124	3.39	5.97	0.4858	2458.28	2458.45	2210	7.57	4.59
1.5177	2584.71	2585.29	2124	3.78	5.02	0.4997	2455.67	2455.57	2210	9.88	3.72
1.4952	2581.75	2581.79	2124	5.00	5.40	0.4428	2452.44	2452.48	2210	8.92	3.53
1.4839	2578.24	2578.57	2124	4.48	5.09	0.4243	2450.23	2450.19	2210	8.63	3.51
1.4317	2573.67	2574.22	2153	4.95	4.19	0.4037	2448.12	2448.07	2210	7.52	3.91
1.4056	2570.55	2571.08	2153	5.11	3.91	0.3785	2445.02	2444.94	2210	8.34	4.00
1.3818	2567.77	2568.37	2153	5.58	3.62	0.3517	2442.41	2442.37	2210	6.13	4.84
1.3679	2565.15	2565.91	2153	5.74	3.40	Combined					
1.3323	2562.27	2562.85	2153	5.73	3.45	0.3065	2438.66	2438.82	2423	8.70	4.40
1.2985	2558.94	2559.48	2153	5.38	3.75	0.2829	2430.38	2430.40	2423	9.50	3.19
1.2890	2555.13	2555.73	2153	4.93	3.43	0.2268	2428.94	2428.92	2423	10.18	4.01
1.2395	2551.21	2551.48	2153	5.09	3.23	0.2090	2424.87	2424.90	2423	10.23	4.07
1.1974	2546.81	2547.33	2153	4.98	3.27	0.1786	2421.55	2421.87	2423	10.45	4.37
1.1895	2542.66	2543.70	2153	5.49	2.98	0.1837	2419.63	2419.93	2423	9.35	4.35
1.1825	2543.89	2544.84	2153	6.59	5.24	0.1482	2417.32	2417.30	2423	9.82	3.61
1.1548	2539.25	2539.37	2153	7.33	4.27	0.1223	2414.89	2414.82	2423	8.96	3.81
1.1118	2534.97	2535.06	2153	8.82	4.42	0.1024	2411.49	2411.44	2423	9.60	3.38
1.0760	2532.01	2532.53	2153	6.06	4.62	0.0806	2408.73	2408.73	2423	9.71	3.54
1.0256	2524.78	2524.81	2153	6.01	4.21	0.0843	2406.96	2406.96	2423	9.20	3.80
0.9784	2519.32	2519.86	2153	6.15	4.29	0.0415	2404.07	2404.13	2423	8.94	3.40
0.9552	2518.30	2518.51	2153	5.32	3.98	0.0184	2400.03	2400.03	2423	8.33	2.98
						0.0000	2398.18	2398.17	2423	8.84	2.73



LEGEND

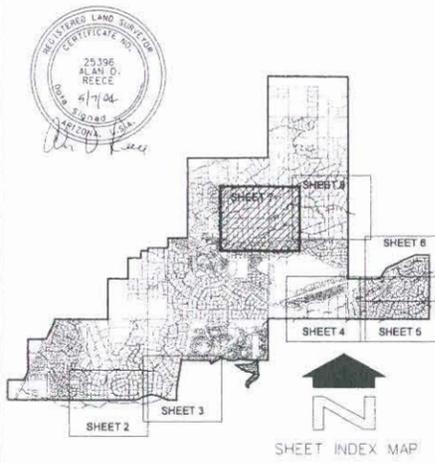
- 100-YR FLOODPLAIN BOUNDARY: ---
- FLOODWAY BOUNDARY: - - - - -
- HYDRAULIC BASE LINE WITH RIVER MILE SECTION LINE: ---+---+---+---+---
- SECTION CORNER: 26.25, 35.56
- CROSS SECTION: --- 0.2186
- FLOW DIVERSION (CFS): --- 381
- ELEVATION REFERENCE MARK: (circle with crosshair)
- BASE FLOOD ELEVATIONS: --- 2505
- ZONE DESIGNATIONS: ZONE AE
- CORPORATE LIMITS: --- Corporate Limits
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY: --- County Boundary

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 13	2389.27	SET CONCRETE NAIL N: 1,030,286.91 E: 699,907.76
ERM 14	2480.95	SET CONCRETE NAIL N: 1,030,272.32 E: 702,422.18
ERM FEMA5	2373.71	BRASS CAP N: 1,028,893.59 E: 699,813.40
ERM FEMA6	2443.33	BRASS CAP N: 1,028,625.68 E: 702,432.55

- ### NOTES
- HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
 - TOWN LIMITS APPROXIMATE.



NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GALLOWAY WASH MIDDLE BRANCH
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037

	BY	DATE
DESIGN	ROL	03/07/03
DESIGN CHK.	LAP	03/07/03
PLANS	ROL	09/04/03
PLANS CHK.	TAB	09/04/03



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1" = 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

MAPPING COMPANY: MAS AERIAL (INTERNAL JOB # FCD-1184)

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING

MATCH LINE SEE SHEET 7



GALLOWAY WASH MIDDLE BRANCH											
R.S.	FP	FW	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	FW	Q (CFS)	V (FPS)	D (FT)
Middle Branch 2											
0.2437	2462.65	2463.20	209	3.12	1.68	0.9096	2513.86	2513.95	2153	5.50	3.36
0.2045	2458.96	2459.33	228	4.32	1.64	0.9152	2510.67	2511.08	2179	6.29	2.98
0.1790	2455.75	2456.37	228	4.25	1.26	0.8808	2508.43	2508.91	2176	6.75	2.98
0.1586	2453.81	2454.24	228	4.07	1.18	0.8441	2501.84	2502.32	2176	6.85	2.45
0.1295	2451.00	2451.55	228	3.60	1.52	0.8041	2496.89	2497.40	2176	5.78	1.85
0.1105	2449.20	2449.70	228	4.33	1.38	0.7560	2491.34	2491.36	2176	6.35	2.89
0.1010	2448.40	2448.89	247	4.92	1.32	0.7272	2487.63	2488.09	2176	5.82	2.57
0.0954	2447.75	2447.86	247	4.11	2.09	0.6777	2481.71	2481.71	2179	5.79	3.44
0.0792	2444.93	2445.01	247	3.98	1.07	0.6488	2477.93	2478.34	2204	7.03	3.06
0.0439	2436.81	2440.23	247	4.12	1.81	0.5954	2472.24	2472.47	2204	6.75	3.37
Middle Branch											
1.6190	2596.95	2600.45	2094	5.25	3.35	0.5272	2468.70	2468.97	2204	5.70	3.02
1.6060	2596.35	2597.22	2094	7.54	4.38	0.5212	2463.79	2464.03	2210	5.36	3.11
1.5884	2593.49	2594.31	2124	5.60	2.91	0.5157	2463.25	2463.49	2210	5.44	3.74
1.5702	2590.43	2590.44	2124	7.84	4.79	0.5006	2456.60	2460.14	2210	6.33	3.83
1.5371	2587.34	2587.91	2124	3.39	5.97	0.4858	2458.28	2458.45	2210	7.57	4.69
1.5177	2584.71	2585.29	2124	3.76	5.92	0.4697	2455.57	2455.57	2210	9.58	3.72
1.4862	2581.75	2581.78	2124	5.00	5.40	0.4428	2452.44	2452.48	2210	8.92	3.53
1.4639	2578.24	2578.57	2124	4.48	5.09	0.4243	2450.23	2450.19	2210	8.63	3.51
1.4317	2573.87	2574.22	2153	4.96	4.19	0.4037	2448.12	2448.07	2210	7.52	3.91
1.4096	2570.65	2571.08	2153	5.11	3.91	0.3785	2445.02	2444.94	2210	8.34	4.00
1.3815	2567.77	2568.37	2153	5.58	3.82	0.3517	2442.41	2442.37	2210	6.13	4.84
1.3576	2565.15	2565.91	2153	5.74	3.40	Combined					
1.3323	2562.27	2562.85	2153	5.73	3.45	0.3065	2439.66	2436.62	2423	8.70	4.40
1.2965	2558.94	2559.48	2153	5.38	3.75	0.2629	2430.38	2430.40	2423	9.50	3.19
1.2690	2555.13	2555.73	2153	4.93	3.43	0.2268	2426.94	2426.92	2423	10.18	4.01
1.2355	2551.21	2551.48	2153	5.09	3.23	0.2090	2424.87	2424.90	2423	10.23	4.07
1.1974	2546.81	2547.33	2153	4.99	3.27	0.1798	2421.55	2421.87	2423	10.45	4.37
1.1695	2545.45	2545.70	2153	5.49	2.98	0.1637	2419.93	2419.93	2423	9.91	4.36
1.1625	2543.89	2544.64	2153	6.59	5.24	0.1462	2417.32	2417.30	2423	9.92	3.91
1.1546	2539.25	2539.37	2153	7.33	4.27	0.1223	2414.89	2414.82	2423	8.66	3.81
1.1118	2534.97	2535.08	2153	8.82	4.42	0.1024	2411.49	2411.44	2423	9.60	3.98
1.0780	2532.01	2532.63	2153	8.06	4.92	0.0806	2408.73	2408.73	2423	9.71	3.54
1.0256	2524.78	2524.81	2153	6.01	4.21	0.0643	2406.96	2406.96	2423	9.20	3.60
0.9784	2519.32	2519.66	2153	6.15	4.29	0.0415	2404.07	2404.13	2423	8.94	3.40
0.9552	2516.30	2516.51	2153	5.32	3.98	0.0184	2400.03	2400.03	2423	8.33	2.96
						0.0000	2398.16	2398.17	2423	8.64	2.73

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER
- CROSS SECTION
- FLOW DIVERSION (CFS)
- ELEVATION REFERENCE MARK
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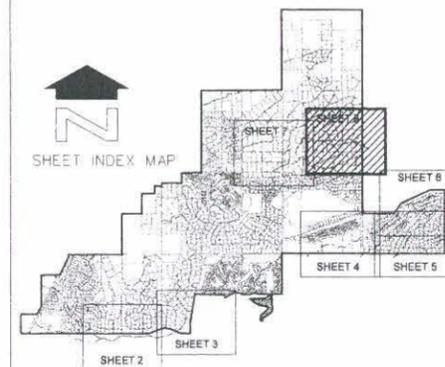
ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 15	2529.97	SET 1/2" REBAR N: 1,030,814.22 E: 705,127.55
ERM 16	2576.35	SET CONCRETE NAIL N: 1,030,955.12 E: 706,419.30

NOTES

- 1.) HORIZONTAL DATUM IS NAD 83 STATE PLANE GRID COORDINATES, ARIZONA CENTRAL ZONE.
- 2.) TOWN LIMITS APPROXIMATE.



NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GALLOWAY WASH MIDDLE BRANCH
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037



	BY	DATE
DESIGN	RGL	03/07/03
DESIGN CHK.	LAP	03/07/03
PLANS	ROL	09/04/03
PLANS CHK.	TAB	09/04/03



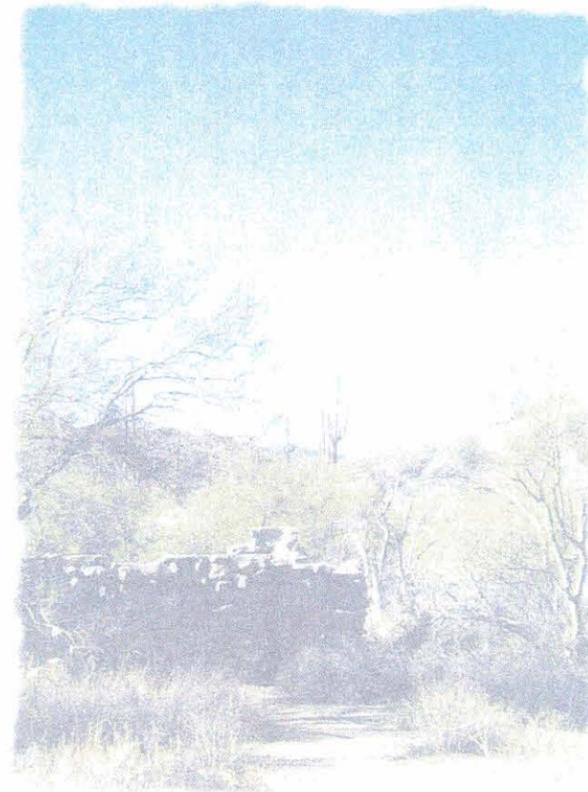
SCALE: 1" = 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: AUGUST 2, 2003

Appendix I
Wash Access Study

TOWN OF CAREFREE

DRAINAGE MASTER PLAN

WASH ACCESS STUDY



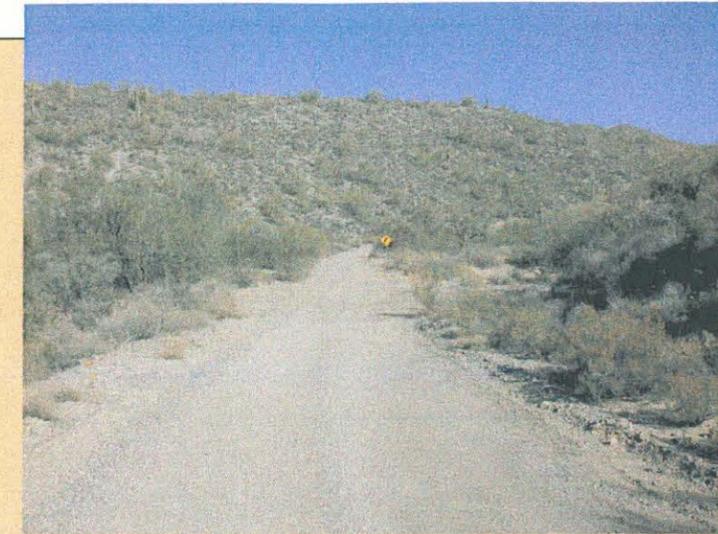
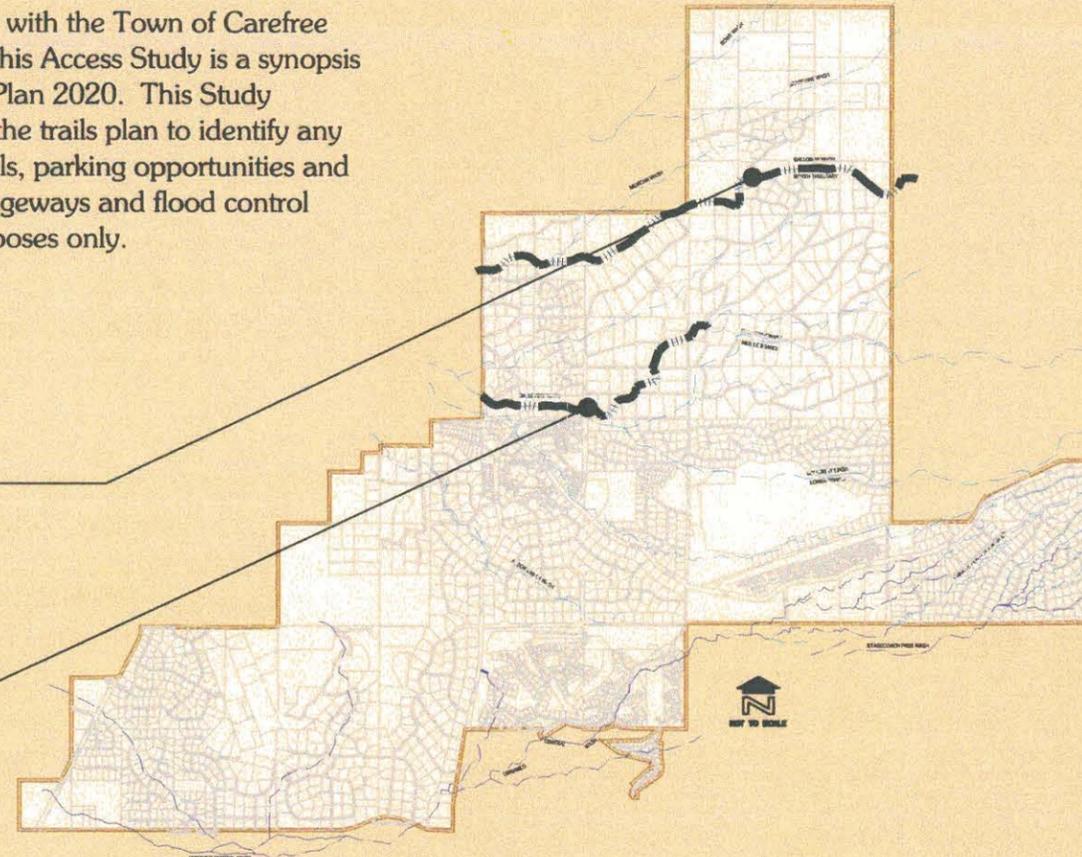
prepared by: HDR Engineering, Inc.
prepared for: Flood Control District of Maricopa County and the Town of Carefree
February 3, 2002

INTRODUCTION

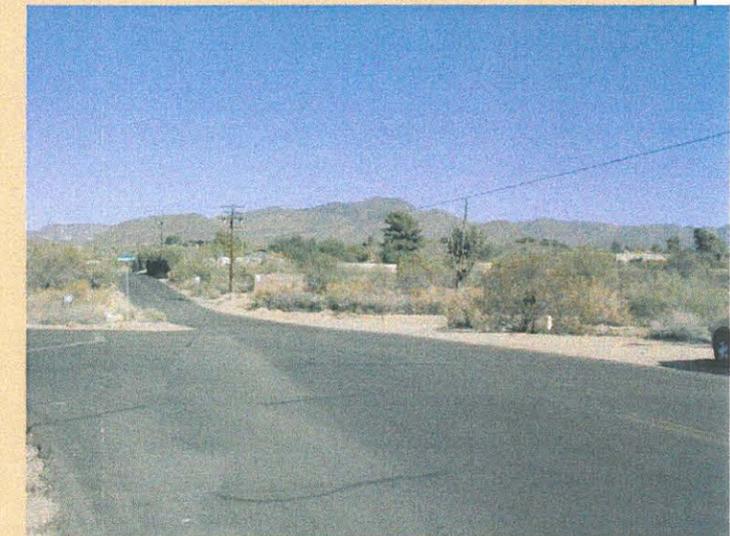
This Wash Access Study was prepared in conjunction with the Town of Carefree Drainage Master Plan that was completed in 2003. This Access Study is a synopsis of the town's Trails Plan as it appears in the General Plan 2020. This Study compared the proposed flood control structures with the trails plan to identify any potential conflicts. It makes recommendations on trails, parking opportunities and signage as they might combine with the town's drainageways and flood control structures. This study is for preliminary planning purposes only.

WASH ACCESS CONSIDERATIONS

- The North Tributary of the Galloway Wash is the primary choice for wash access
 - It connects to both Scottsdale and Cave Creek washes
 - It's wide - providing a good hiking or riding environment
- A portion of the Main Galloway Wash is the secondary choice for wash access
 - It is centrally located
 - It connects to Cave Creek washes
- Consider using the right-of-way for pull-out parking.
- Consider shared parking opportunities where they occur adjacent to washes
- Consider coordinating flood level markers with wash access signage
- New flood control structures should be designed so that easy access to washes is not prohibited



Road Crossing at the Galloway Wash North Tributary
Location of possible flood control structure



Road Crossing at the Galloway Wash Main Tributary
Location of possible flood control structure

TOWN OF CAREFREE DRAINAGE MASTER PLAN WASH ACCESS STUDY

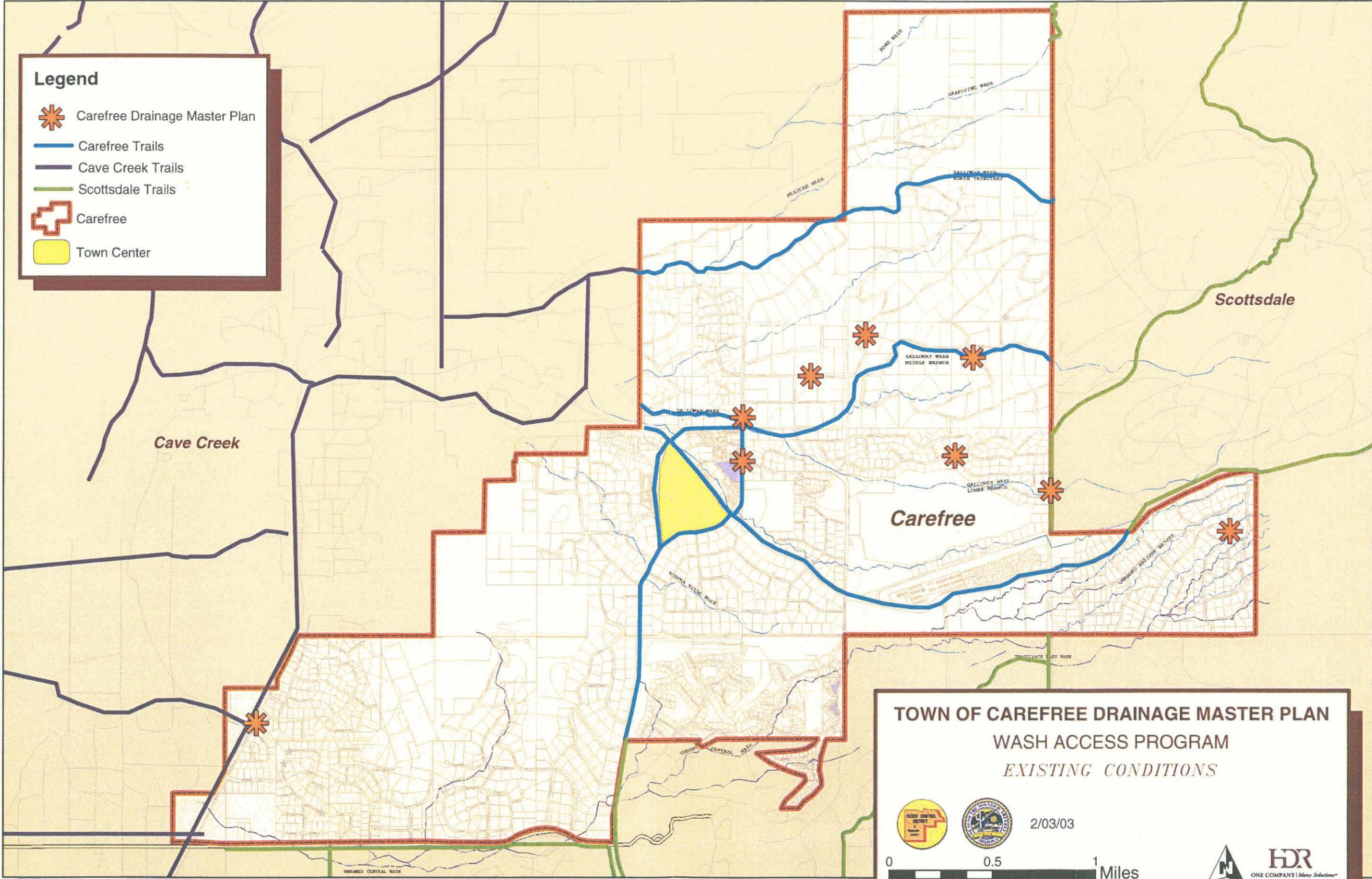


February 3, 2003



Legend

-  Carefree Drainage Master Plan
-  Carefree Trails
-  Cave Creek Trails
-  Scottsdale Trails
-  Carefree
-  Town Center



TOWN OF CAREFREE DRAINAGE MASTER PLAN
WASH ACCESS PROGRAM
EXISTING CONDITIONS

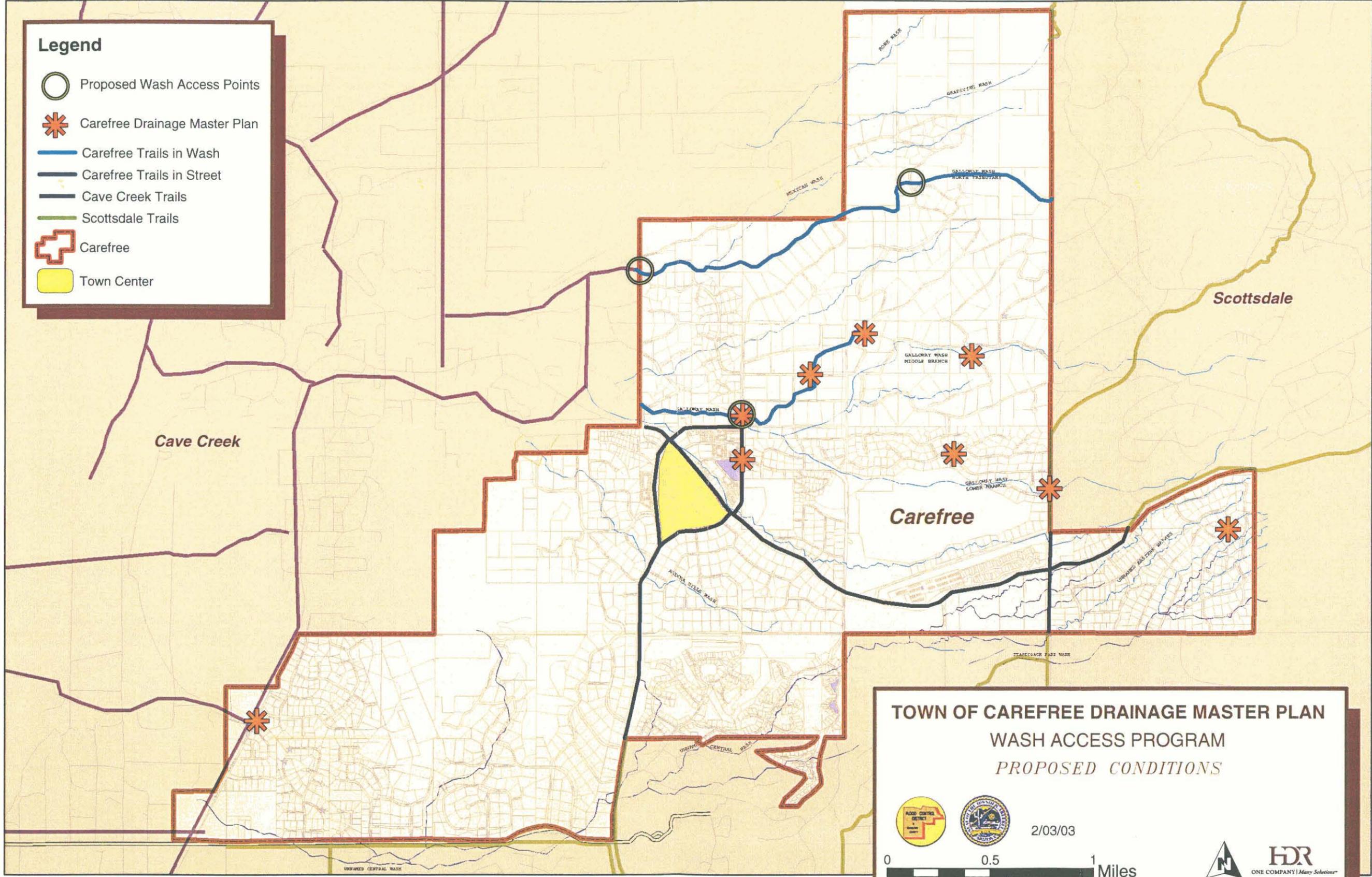
  2/03/03

0 0.5 1 Miles

 **HDR**
ONE COMPANY | Many Solutions™

Legend

-  Proposed Wash Access Points
-  Carefree Drainage Master Plan
-  Carefree Trails in Wash
-  Carefree Trails in Street
-  Cave Creek Trails
-  Scottsdale Trails
-  Carefree
-  Town Center

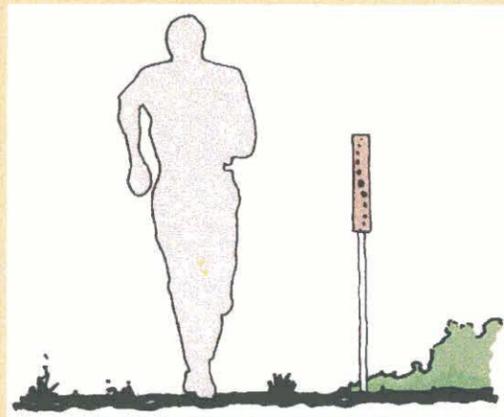


TOWN OF CAREFREE DRAINAGE MASTER PLAN
WASH ACCESS PROGRAM
PROPOSED CONDITIONS

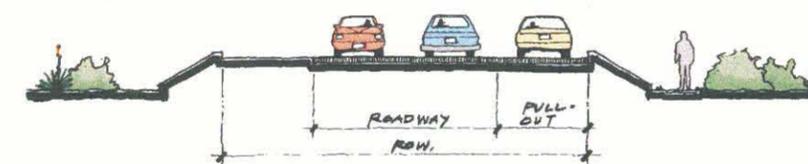
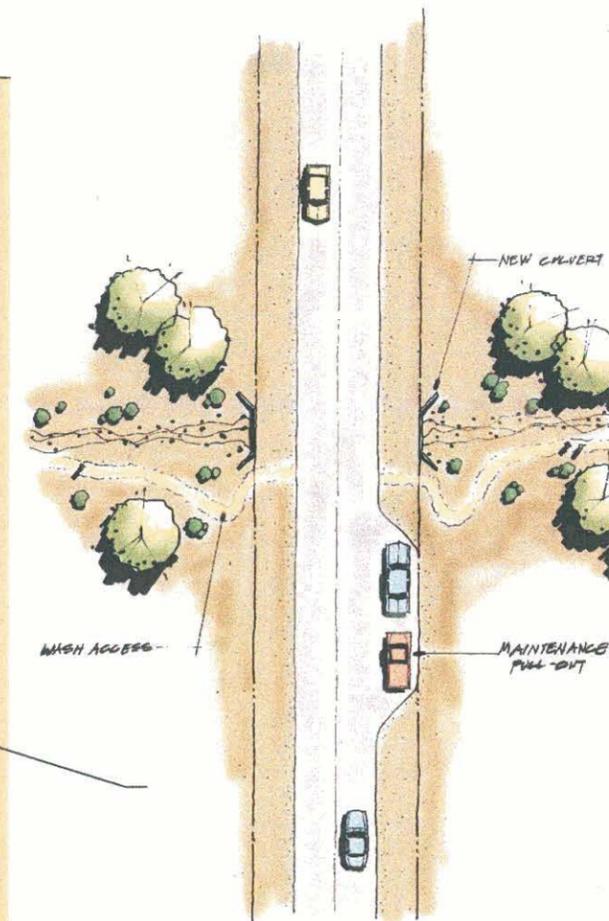


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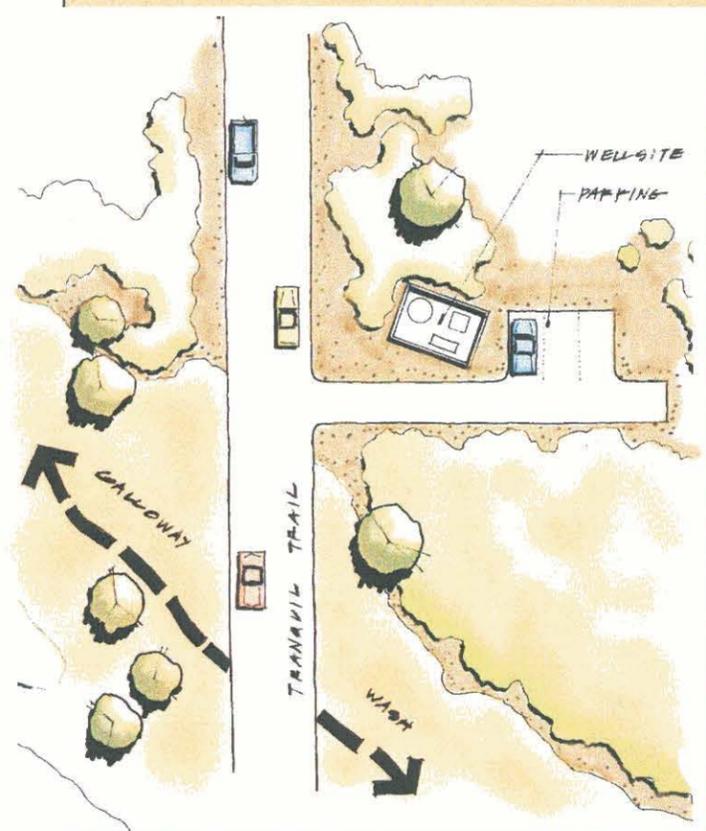
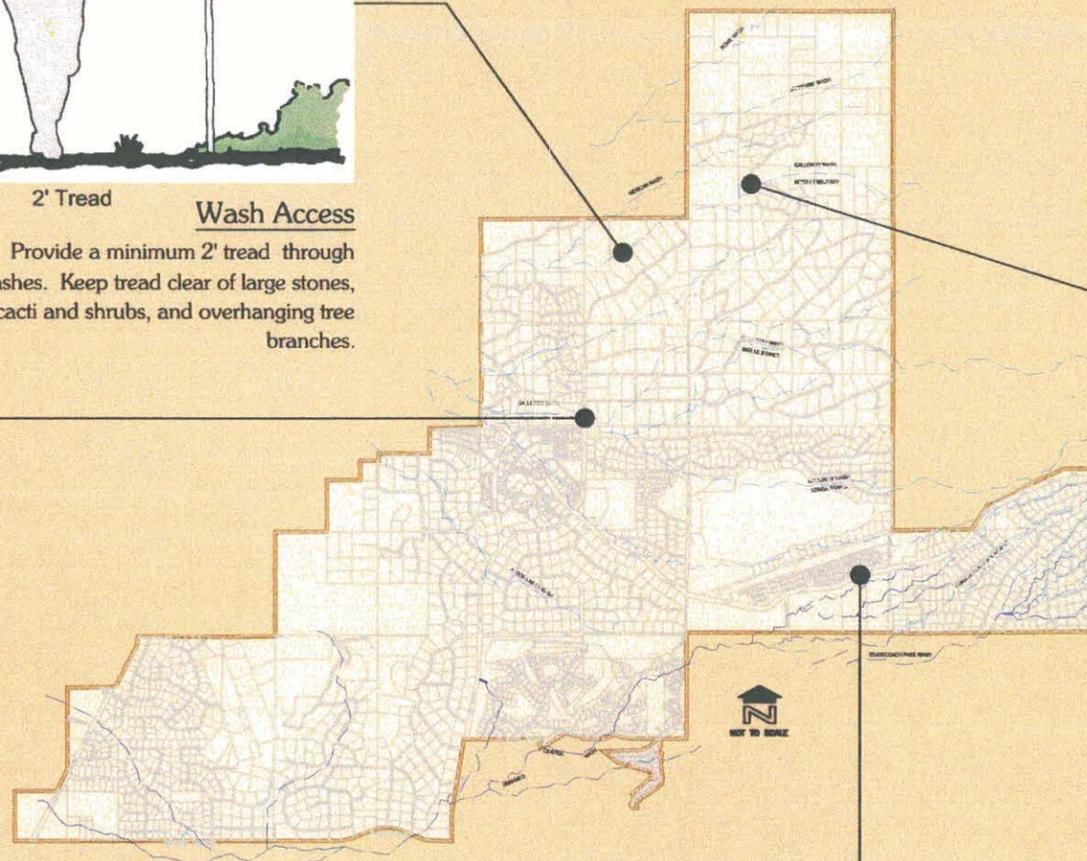




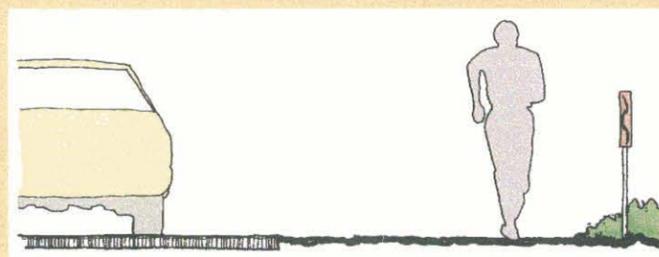
2' Tread
Wash Access
 Provide a minimum 2' tread through washes. Keep tread clear of large stones, cacti and shrubs, and overhanging tree branches.



Pull-out for Maintenance and Wash Access
 At crossings where visibility is good and the R.O.W. is available, provide pull-outs for maintenance parking and for wash access parking.



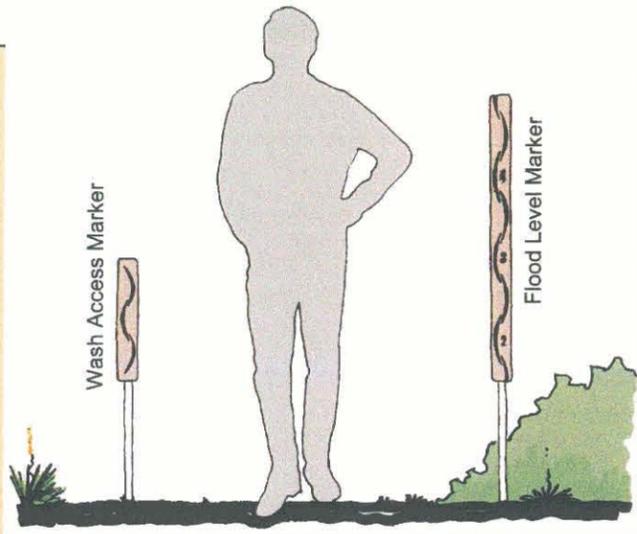
Shared Parking at Well Sites
 Explore shared parking options with other agencies or businesses.



Street Access
8' Shoulder
 Keep R.O.W. and shoulder clear for access alignments.

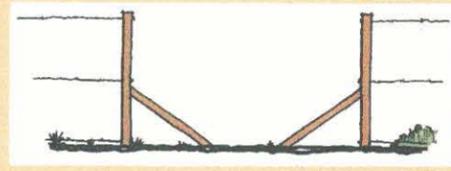
TOWN OF CAREFREE DRAINAGE MASTER PLAN
WASH ACCESS STUDY

February 3, 2003



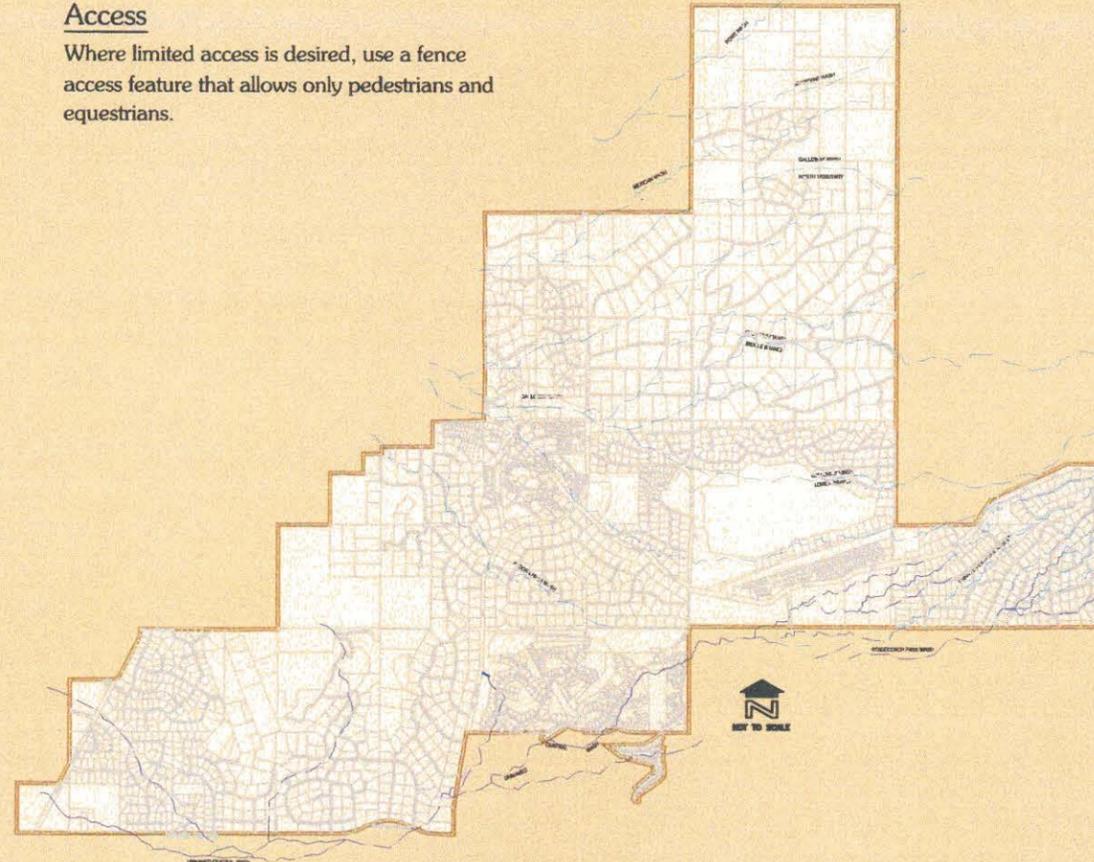
Coordinated Signage

Design a unique flood level marker that coordinates with the wash access signage.



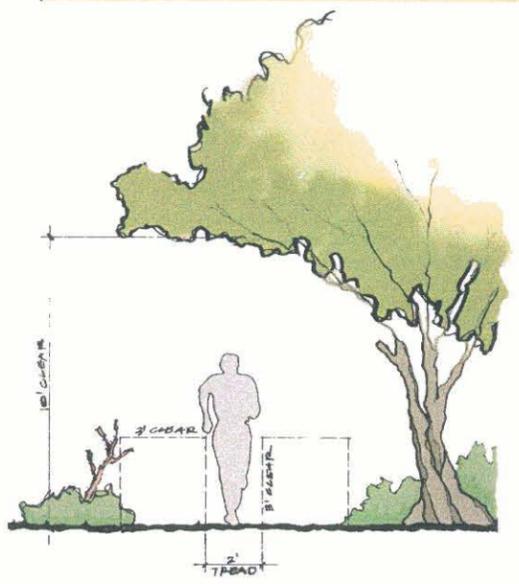
Access

Where limited access is desired, use a fence access feature that allows only pedestrians and equestrians.



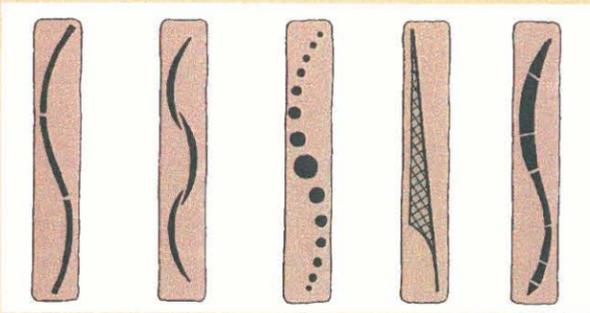
Shared Parking

Consider alternative paving materials other than asphalt.



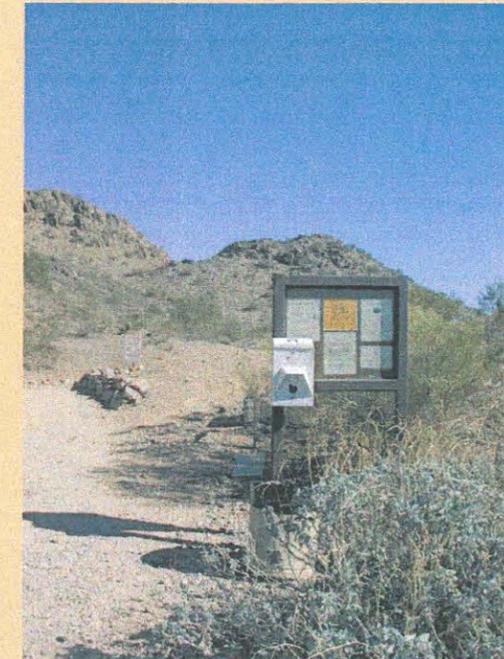
Clearance

Provide adequate clearance where needed.



Wash Access Signage

Design a wash access marker that is subtle but recognizable by Carefree residents.



Wash Access Points

Consider providing simple amenities at wash access points such as a message board and trash can.

**TOWN OF CAREFREE DRAINAGE MASTER PLAN
WASH ACCESS STUDY**



February 3, 2003

