CAREFREE DRAINAGE MASTER PLAN
EXECUTIVE SUMMARY REPORT

Carefree, Arizona

Prepared for

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

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Executive Summary

Carefree Drainage Master Plan Executive Summary

Submitted to

Flood Control District of Maricopa County

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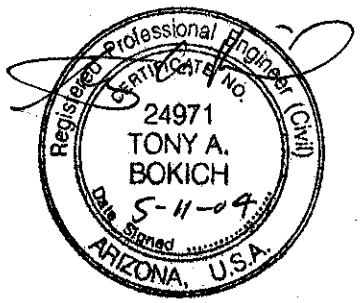

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Acronyms

ADWR	Arizona Department of Water Resources
ALERT	Automated Local Evaluation in Real Time
cfs	Cubic Feet per Second
CIP	Capital Improvements Projects
DEI	DEI Professional Services, LLC
DMP	Drainage Master Plan
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FY	Fiscal Year
IGA	Intergovernmental Agreement
LIDs	Local Improvement Districts
MAG	Maricopa Association of Governments
MDC	Municipal Development Corporation
TDN	Technical Data Notebook
Town	Town of Carefree
URS	Urban Revenue Sharing
USACE	U.S. Army Corps of Engineers
USGS	U. S. Geological Survey

SECTION 1

Introduction and Background

The Flood Control District of Maricopa County (FCDMC) initiated the Carefree Drainage Master Plan (DMP) study in June 2001. The purpose of the Carefree DMP is to provide a regional approach to watershed management thereby reducing the potential damage to property or loss of life from flooding hazards. Within the context of the Carefree DMP, existing and potential flooding problems were identified. Erosion and sedimentation issues were evaluated and analyzed. Flooding, sedimentation, and erosion information was compiled and distributed to the Town of Carefree (Town), the FCDMC, and the public.

The Carefree DMP study area encompasses the entire Town of Carefree, which contains approximately 9 square miles, as shown in Figure 1. The Carefree DMP provides a multidisciplinary approach to regional watershed management that works to minimize the public cost of protecting citizens from flooding hazard. Within the parameters of the Carefree DMP, flood control management alternatives are developed that take into account environmental, engineering, landscape and aesthetic, social and economic factors. In the Carefree DMP, the preferred flood control management alternative is a nonstructural plan that defines a corridor by the 100-year floodplain and allows the washes to function naturally within that corridor. A major goal of this DMP is to preserve natural wash conditions to the largest extent possible. Where nonstructural management is not possible, such as in areas that have existing development, low-impact design alternatives are preferred.

The Carefree DMP should be used as a tool for guiding development and growth in the area to minimize impacts of urbanization to the drainage features while recognizing the values of the community and the opportunity to protect the unique characteristics associated with the area. The Carefree DMP identifies improvement projects as well as management practices. The intent of the Carefree DMP is to work in conjunction with other planning documents and ordinances developed by the Town and Maricopa County. The Carefree DMP is to be used by policymakers in the Town and Maricopa County, future residents, and developers.

This Executive Summary contains a brief overview of the entire Carefree DMP study. For more detailed information, please refer to the related reports (under separate cover):

- Carefree Drainage Master Plan
- Data Collection Report – hydrology, existing conditions
- Technical Data Notebook
- Flood Accessibility Emergency Routes Evaluation
- Engineering Design Guidelines
- Inspection, Maintenance and Monitoring Plan
- Implementation and Funding Plan
- Improvement Cost Information
- Floodplain Delineation

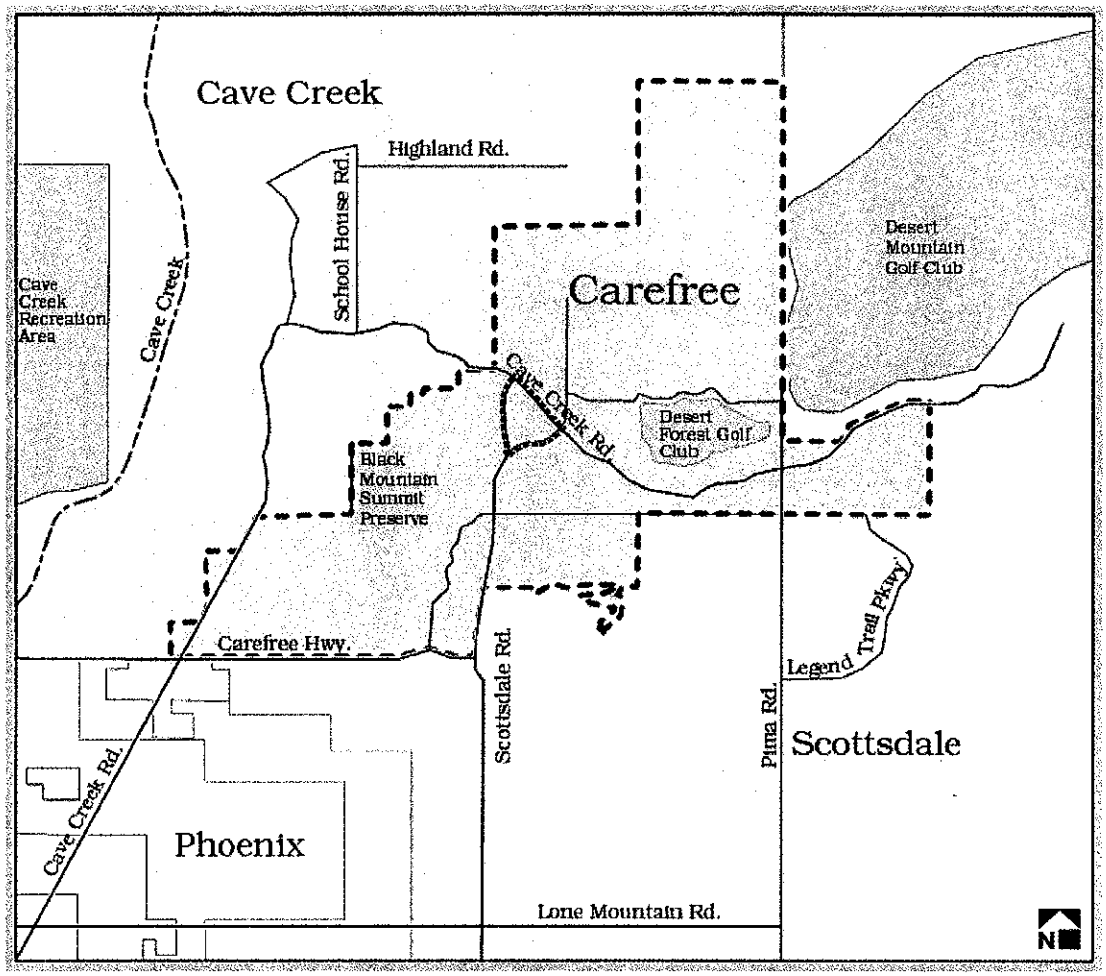

FIGURE 1. STUDY AREA

1.1 Data Collection

1.1.1 Watershed Characteristics

The Carefree area watershed encompasses approximately 24 square miles. The northern watershed boundary is formed by Continental Mountain and Apache Peak, at elevations more than 4,500 feet above mean sea level. Black Mountain and Lone Mountain are located within the watershed. The watershed slopes are relatively steep, ranging from over 40 percent in the steeper mountain areas, to around 2.5 percent in the lower portion. Tributaries are generally well defined and incised in the upper portions of the watershed, becoming less confined in the lower reaches with numerous flow braids.

The majority of the upper portion of the watershed is either undeveloped, or developed with large lot single-family residences and golf courses. The portion of the watershed located within the Town generally contains large-lot residential development, with areas of concentrated commercial and residential development.

1.1.2 Existing Studies

Numerous previous studies of the area exist. Flood Insurance studies were previously completed for Andora Hills Wash, Grapevine Wash, and Galloway Wash in January 1979, April 1988, and July 2001. Copies of portions of these studies are located in Appendix A.1 of the *Technical Data Notebook* (TDN), under separate cover. An ongoing study exists for Stagecoach Pass Wash, which crosses into the far northeast corner of the Town. This is the North Scottsdale Delineation Study being performed by DEI Professional Services, LLC, (DEI) under contract FCD 2001C009, WO#2 for the FCDMC. Additionally, numerous small-scale drainage reports were prepared by the many developers in the area.

Of the washes mapped as part of this floodplain delineation, the Galloway Wash Middle Branch has existing floodplain and floodway mapping, and a small portion of the Unnamed Central Tributary to Cave Creek has existing floodplain mapping. The Eastern Pima Wash, most of the Unnamed Central Tributary to Cave Creek, Unnamed Tributary to Stagecoach Pass Wash, and Windmill Wash were not mapped previously.

1.1.3 Multiuse Opportunities

The natural washes that exist in the Town provide opportunities for trails and other multiuse opportunities such as recreation areas and open space. Interviews were conducted with representatives from the Town of Carefree, Town of Cave Creek, City of Scottsdale, and Sonoran Foothills Land Trust. These interviews were conducted to obtain information on the various jurisdictions' capacities for multiuse opportunities, their future plans, and their willingness to extend multiuse opportunities across jurisdictional boundaries.

In general, the Town prefers to see informal trail alignments. The residents of Carefree have historically allowed access to the trails and washes, but most landowners are not amenable to granting easements and right-of-ways. The Town of Cave Creek and the City of Scottsdale have identified important connectivity points between the jurisdictions, which occur at the washes. All jurisdictions indicate that providing horse and trail access to the washes is important in conjunction with any flood control structures or easements.

1.2 Data Collection Results

Data pertinent to the scope of the project and project area was collected and reviewed. The categories of data sought included:

- Existing drainage studies and reports for the study area
- Existing and proposed improvement plans
- Existing topographic mapping and aerial photography
- Field surveys
- Historical flooding documentation
- Stream gauging
- Interviews with residents, Town personnel, and regulatory personnel.

Figure 2 in Appendix F and Table ES-1 in Appendix E depict the inventory of existing drainage structures created for the data collection phase of the project.

1.3 Hydrologic Methodology

The hydrology for the project was completed as part of the Carefree DMP *Data Collection Report*. This report used the U.S. Army Corps of Engineers (USACE) HEC-1 software package to generate a rainfall-runoff model for the 100-year, 24-hour and 100-year, 6-hour storm events.

Hydrologic analyses were performed for both the existing and future land use conditions. For modeling purposes, the watershed that encompasses the Town's boundaries was subdivided into four models. The first two models were previously created as part of the *Floodplain Delineation Study of Andora Hills and Galloway Washes* (FCD 99-14), and are referred to as Andora Hills Wash and Galloway Wash. The third model was created as part of the *North Scottsdale Floodplain Delineation Study*, a project currently being performed for the Flood Control District of Maricopa County (Contract No. FCD 2001C009) by DEI on an unnamed wash. For the purposes of this study, this wash is referred to as the North Scottsdale Wash. The remaining model was also created on an unnamed wash, located to the south and east of the Andora Hills and Galloway Washes. For the purposes of the hydrology model, this wash was given the naming convention of Unnamed Central Tributary to Cave Creek.

1.4 Hydrology Results

Table ES-2 in Appendix E contains a summary of flows for the hydrology models for the Unnamed Central Tributary to Cave Creek for the 10-year and 100-year frequencies for the 6- and 24-hour durations. Figures 3 and 4 in Appendix F are the basin maps and watershed boundary. Figure 3 shows the limits of the hydrologic study along with each basin boundary and Figure 4 shows the location of each drainage concentration point.

1.4.1 Comparison of Results with Regional Regression Equations

The hydrology results were compared with two regional regression equations. These equations were developed as a means to estimate the flood magnitudes on ungauged streams, and use the variables of drainage area, mean basin elevation, and mean annual precipitation. The two methods are the "USGS Method," as found in the Arizona Department of Transportation (ADOT) *Highway Drainage Design Manual Hydrology*, dated March of 1993, and the "ADWR Method," found in the Arizona Department of Water Resources (ADWR), *A Study to Evaluate Existing Methods for Determining Peak Discharges for Ungauged Watersheds in Arizona - Phase II and III Report*," dated 1995.

1.5 Hydraulic Methodology

The hydraulic model for the floodplain mapping was created using the USACE HEC-RAS (River System Analysis) computer software program, version 3.0.1.

Floodplain delineations were performed on Unnamed Central Tributary to Cave Creek, Unnamed Tributary to Stagecoach Pass Wash, Windmill Wash, and Eastern Pima Wash.

Floodplain and floodway delineations were performed on the Galloway Wash Middle Branch. These delineations were performed using the USACE HEC-RAS computer software program for the peak 100-year discharges for the 6-hour or 24-hour durations, whichever was greater. HEC-RAS results can be found in the *Technical Data Notebook* (TDN) under separate cover. Floodplain maps, Figures 5-12 are included in Appendix F.

Flow information was analyzed at major roadway crossings in addition to the Town's watershed hydrology. Crossings were analyzed for overtopping during the 100-year, future conditions event (greater of the 6-hour or 24-hour storm).

The following methods or software programs were used to obtain the depth and velocity information used in the impassable flow analysis:

- Grade information at roadway sections and culverts was obtained through field surveys, or topographic contour mapping. Where no detailed topographic information was available, a generic dip section profile was used of either 200 or 400 feet in width. Any critical site identified by the generic profile was advanced for further survey, and a detailed survey was obtained. In general, the passability cutoff for generic sections was approximately 250 cubic feet per second (cfs).
- Haestad Method's CulvertMaster software program or Federal Highway Administration's (FHWA's) HY-8 culvert analysis software program was used to obtain the amount of flow carried by culverts at crossings.
- Haestad Method's FlowMaster software program (using standard Manning's rating) was used to analyze flow over dip crossings.
- Various HEC-RAS models, created as part of the Carefree DMP, were used at crossings covered by floodplain mapping. This includes Galloway Wash, Galloway Wash Middle Branch, Stagecoach Pass Wash, Windmill Wash, Pima Wash, Unnamed Central Tributary to Cave Creek, Grapevine Wash, Rowe Wash, and Andora Hills Wash.
- Published floodplain elevations from Federal Emergency Management Agency (FEMA) in conjunction with existing crossing geometry were used to derive information at crossings where the HEC-RAS models were not available.
- Calculation information for each drainage crossing analyzed as part of this study is included as Appendix B of the *Flood Accessibility Emergency Routes Evaluation*, which is Appendix C of the Carefree DMP under separate cover.

1.5.1 Duration

Durations of impassable flow over roadway were obtained from examination of the design hydrograph at each crossing from the HEC-1 model created for the Town as part of the *Data Collection Report*, under separate cover. Please note that the hydrology of the Town is based upon a theoretical, design hydrograph, and actual flood hydrographs may have longer durations. No lot was found to be inaccessible in excess of the criteria of 10 hours.

1.5.2 Depth, Velocity, Duration Summary

Table ES-1 in Appendix E contains a summary of the hydraulic properties, crossing structures, and hydrology of each of the crossings analyzed during this study. This information is additionally contained on Figure 13 in Appendix F, along with the locations of these sites.

The Town currently has several washes mapped with regulatory floodplains, and numerous unmapped washes. Floodplain delineation was performed on five of the washes in the Town. Some of the washes were new delineation areas, and others were a re-delineation using the more accurate data available for this project. These washes are:

- Galloway Wash Middle Branch
- Unnamed Central Tributary to Cave Creek
- Eastern Pima Wash
- Unnamed Tributary to Stagecoach Pass Wash
- Windmill Wash

Figure 14 shows the locations of the washes mapped as part of the Carefree DMP, under separate cover. The *Technical Data Notebook,* under separate cover, contains the methodology and results of the floodplain delineation study.

The floodplain study is anticipated to be submitted to FEMA in the spring of 2003. Typical review times at FEMA are approximately 1 year or more, and therefore these areas will not be placed within a regulatory floodplain until the review process is finished. However, the residents should be made aware of the potential flooding hazards as soon as possible. The floodplain delineation maps, Figures 5-12 , are included for reference.

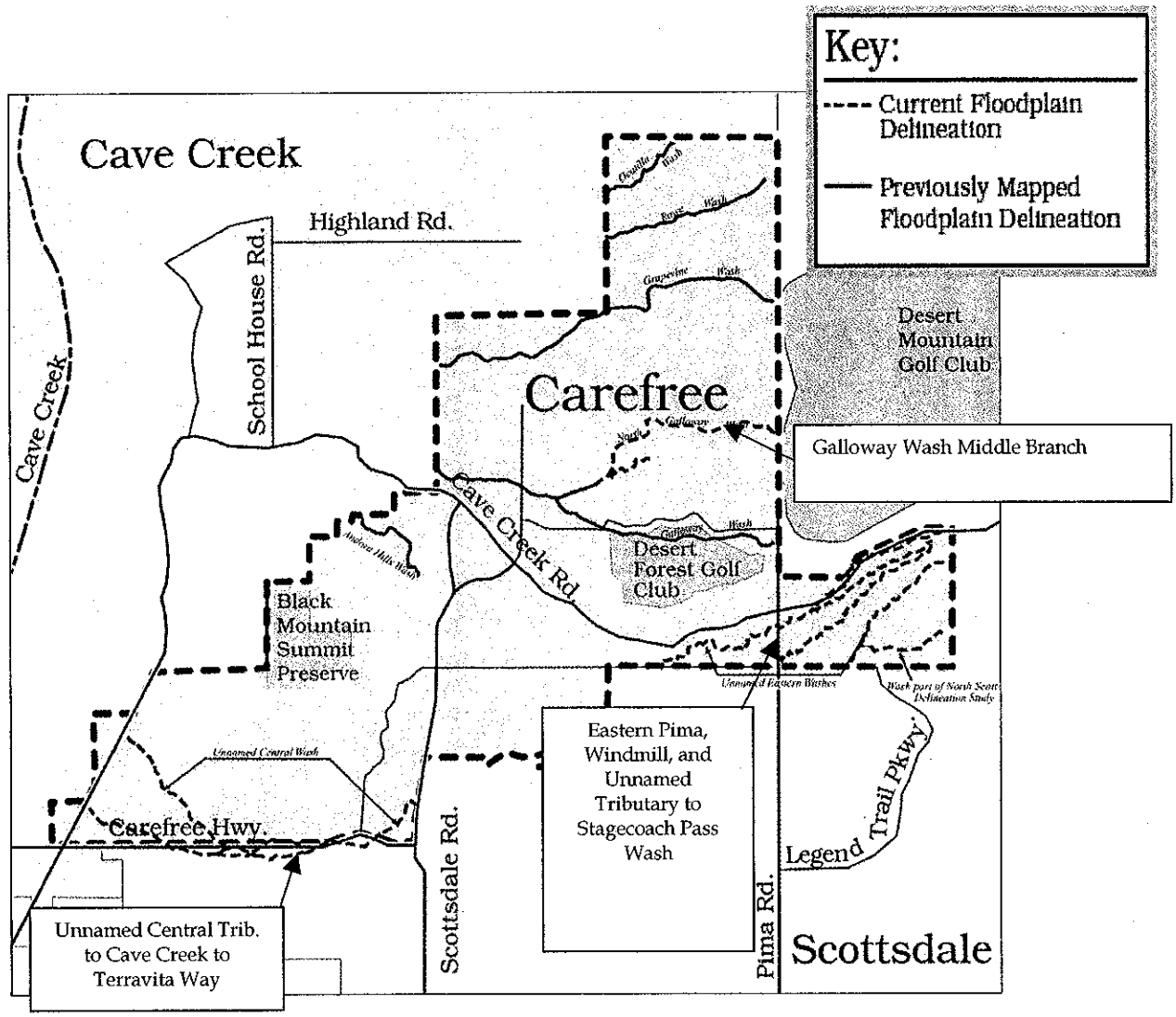

FIGURE 14. FLOODPLAIN DELINEATIONS

SECTION 2

Existing Problems and Constraints

Drainage crossings of roadways typically occur at grade (i.e., flows are perpetuated over the pavement section). These at-grade crossings can prevent access to residents during storm events, prohibit emergency access, and pose a hazard to the public.

Development has occurred immediately adjacent to drainage pathways. Several residences and commercial developments have suffered erosion damage, flooding, and sediment deposition. Large amounts of sediment are often deposited upstream of roadway crossings, with erosion located immediately downstream. This deposition of sediments, or aggradation, is evident throughout the Town.

Drainage facilities that exist within the Town consist of numerous culverts, at-grade dip crossings, ditches, and bridges. An Existing Facilities map is attached as Figure 2 in Appendix F. Table ES-1 in Appendix E contains an inventory of all existing facilities.

FIGURE 16. WATER OVER ROADWAY – PIMA ROAD NEAR SHORT PUTT PL.

2.1 Existing Problem Sites

The Town has approximately 250 improved drainage features. Of these, approximately 71 locations were determined to be "problematic" and had one or more of the following problem category characteristics:

- Recent flooding reported
- Localized or regional sedimentation
- Localized or regional erosion
- Damaged facility
- Undersized facility
- Flow over the roadway during a storm runoff event
- Encroachment into erosion setbacks by structures

Figure 15 in Appendix F contains a graphical representation of the problem sites, and Table ES-1 in Appendix E contains specific information about each site.

2.1.1 Localized Problems

Many of the problems within the Town can be considered nuisance problems, without immediate danger to loss of life or property damage. Additionally, some of the problems are considered localized and affect only the immediate area surrounding the drainage feature. (Figures 16 and 17.)

FIGURE 17. LOCALIZED EROSION AT UNPROTECTED CULVERT OUTLET

2.1.1.1. Erosion and Sedimentation

Localized erosion and sedimentation is common in the Town. At culverts, unprotected ends at the downstream side of culverts will have an area of erosion surrounding the outlet. On the upstream side, undersized culverts will cause sediment deposition to occur. Due to the steep slopes that exist in the Town, most of these conditions are localized and only affect a few hundred feet on either side of the structure. Although the damage due to erosion is localized around the outlet, damage to upstream features such as roadways can occur.

Localized sedimentation and erosion is also evident at dip crossings (also referred to as "at-grade" crossings), where the wash flows over the roadway. At-grade crossings can cause both localized and regional sediment deposition upstream and erosion downstream.

Localized erosion also contributes to damage (Figure 18), particularly on the downstream side of culverts and at-grade crossings. Failure of many erosion protection measures is evident in the Town. Continued erosion could cause damage to roadways and private properties. Table ES-1 in Appendix E contains a list of the locations of damaged facilities.

FIGURE 18. DAMAGE TO DOWNSTREAM CUT-OFF WALL

Sediment

The bed material in the washes in the Town tends to be composed of highly mobile sands, and sediment transport occurs through the washes. The washes in the Town are highly sensitive to changes in the sediment supply, and many of the existing problems in the Town can be attributed to impacts to the sediment supply.

Aggradation, or rise in grade due to sediment deposition, tends to occur anywhere the sediment-carrying capability of the wash is reduced, such as at an undersized culvert crossing, or upstream of an at-grade roadway crossing where the geometry has been changed from the natural conditions. Erosion or degradation tends to occur downstream of culverts and roadway crossings. This is caused by the increased sediment-carry capability of the water due to increased velocities as the flow crosses the roadway.

Lateral Channel Movement and Avulsions

The *Sediment Alternative Analyses* in Appendix B of the Carefree DMP identified areas of active bank erosion throughout the study area. Additionally, former wash channels that have been naturally abandoned (also called avulsive channels) exist next to the major washes. Development has occurred in many of these former wash channels. Minor shifts in sediment balances could cause water to once again occupy these abandoned channels, some of which have been protected by non-engineered berms. These berms are subject to failure during major runoff events.

2.1.1.2. Erosion Setbacks

Development in the Town has encroached on the natural washes. Erosion setbacks are often not met, putting structures at risk in the future due to the natural meandering of the washes. Active bank erosion was observed in the study area. This in turn has also affected the

natural processes of the washes, with encroachment into the floodplains and upset of the sediment carrying capabilities of the washes. Appendix B in the Carefree DMP under separate cover, contains further information on erosion setback policies and sedimentation effects of encroachment.

2.1.1.3. Roadway At-Grade Crossings and Undersized Drainage Facilities

The Town contains many at-grade crossings where water in a wash flows over the road during runoff events. Overtopping also happens at culverts that are undersized for the runoff event. (Figure 19.) The danger from these crossings occurs when residents attempt to cross a flooded roadway.

FIGURE 19. SEDIMENTATION AT CULVERT INLET

The roadway at-grade crossings can also affect the sediment balance in the wash system. Roadways can act like sediment dams, causing sediment to be deposited upstream of the roadway crossing, which in turn causes clear water scour to occur at the downstream side of the crossing. The water accelerates as it passes over the smooth, flat pavement surface and causes scour to occur at the downstream end of the crossing. The roadways often have a much flatter cross slope than the wash slope, which leads to a grade differential between the bottom of the wash and the edge of the pavement. Table ES-3 in Appendix E and Figure 20 in Appendix F contain further information on the effect of the roadway crossings on the overall wash sediment and erosion system.

SECTION 3

Solutions to Drainage Problems

As described above, numerous areas for potential drainage improvements were identified in the Town. Undertaking all potential improvements immediately is not financially feasible, and, therefore, a prioritization process is necessary.

3.1 Solution Categories

Drainage problem areas were found to range from simple solutions to extremely expensive improvements. The Town employs an existing engineering and maintenance staff, a potential resource for some of the improvements. Additionally, some of the sites are burdened by many constraints. Therefore, the problem sites were grouped into four different solution categories:

- Simple solutions using the Town's existing maintenance staff (2 sites)
- Private projects (on private property, homeowners associations) (12 sites)
- Intermediate solutions (40 sites)
- Complex solutions - high cost/low benefit, outside Town's jurisdiction (10 sites)

3.2 Alternative Evaluation

Further evaluation of the 42 sites in the Simple and Intermediate solution category was performed. A prioritization process was initiated to determine which sites should be advanced to the preliminary design stage. This procedure may also be used by the Town in preparing a Capital Improvements Plan.

3.3 Procedure for Ranking Problem Sites

The following procedure was used in developing prioritization for proposed improvements. In general, this procedure takes criteria elements, gives them a weight of importance, and then compares individual sites against each other.

Criteria elements are necessary to determine what is important to the Town. The project team developed the following criteria elements:

- Maintenance - How frequently must maintenance be performed at the problem site?
- Safety - Is there a public safety concern?
- Severity of Damage - How severe is the damage?
- Frequency - How often does the problem happen?
- Local Impact - How many properties does this problem affect?

For the Town's future use, they may want to consider other factors, such as cost, when creating a Capital Improvements Plan.

Once the criteria elements were developed, a weight of importance was developed for each criteria using a decision matrix. This is determined by comparing each criteria element against every other criteria element, and deciding how much one is preferred over the other. This is translated into a numerical score, which becomes a weighting factor for the criteria element. An example scoring matrix is shown in Figure 21. A blank form is included as Figure 22.

After the weighting factors for the criteria elements have been determined, each individual problem location in the Town is scored against the criteria, based on the site-specific characteristics. For instance, a specific site is looked at for required maintenance. A different score is given if the site requires frequent maintenance over infrequent maintenance. A score is given, then the score is multiplied by the previously determined weight of importance for the criteria element. This procedure is completed for all criteria elements, and an overall numerical score for the site is obtained. The higher the numerical score, the higher priority the site should be given.

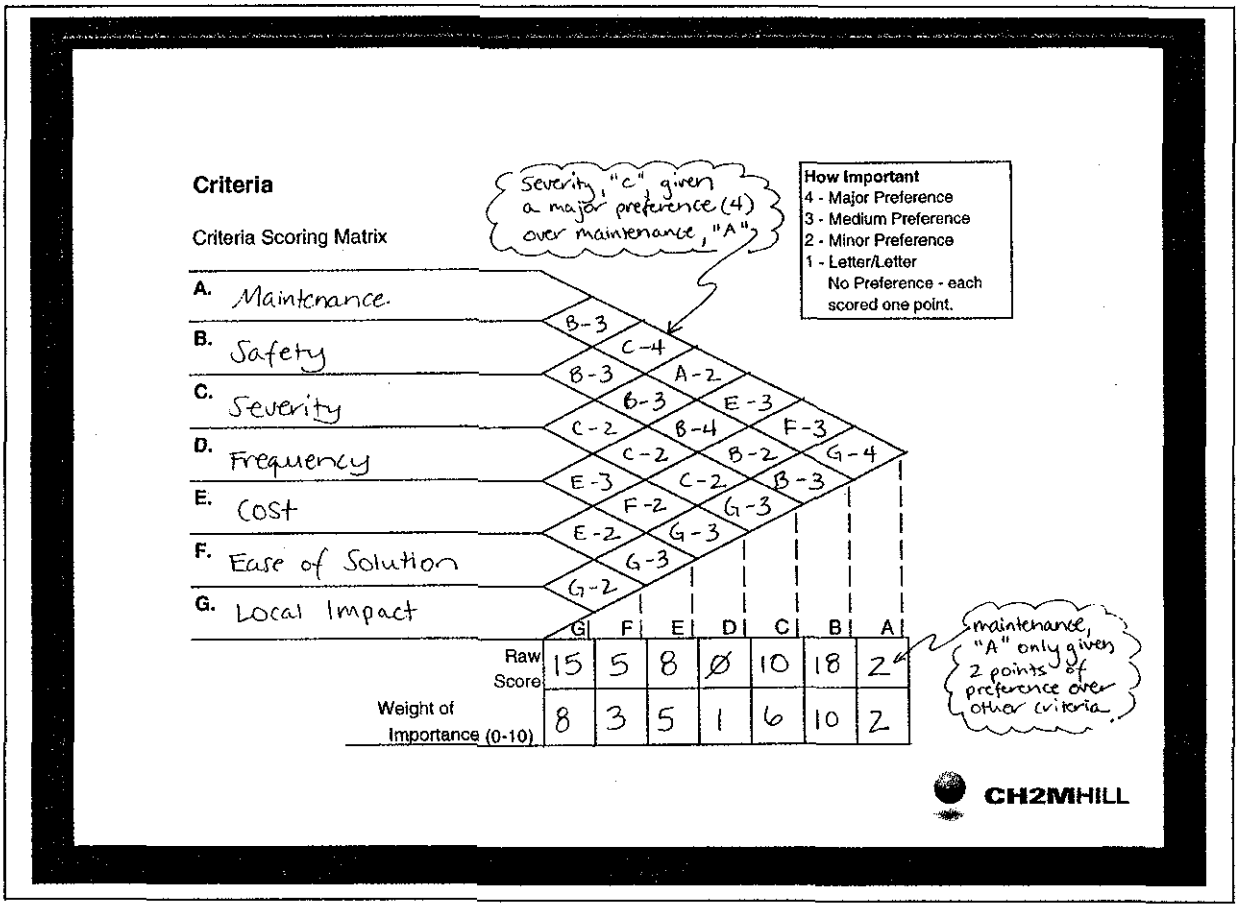

FIGURE 21. EXAMPLE SCORING MATRIX

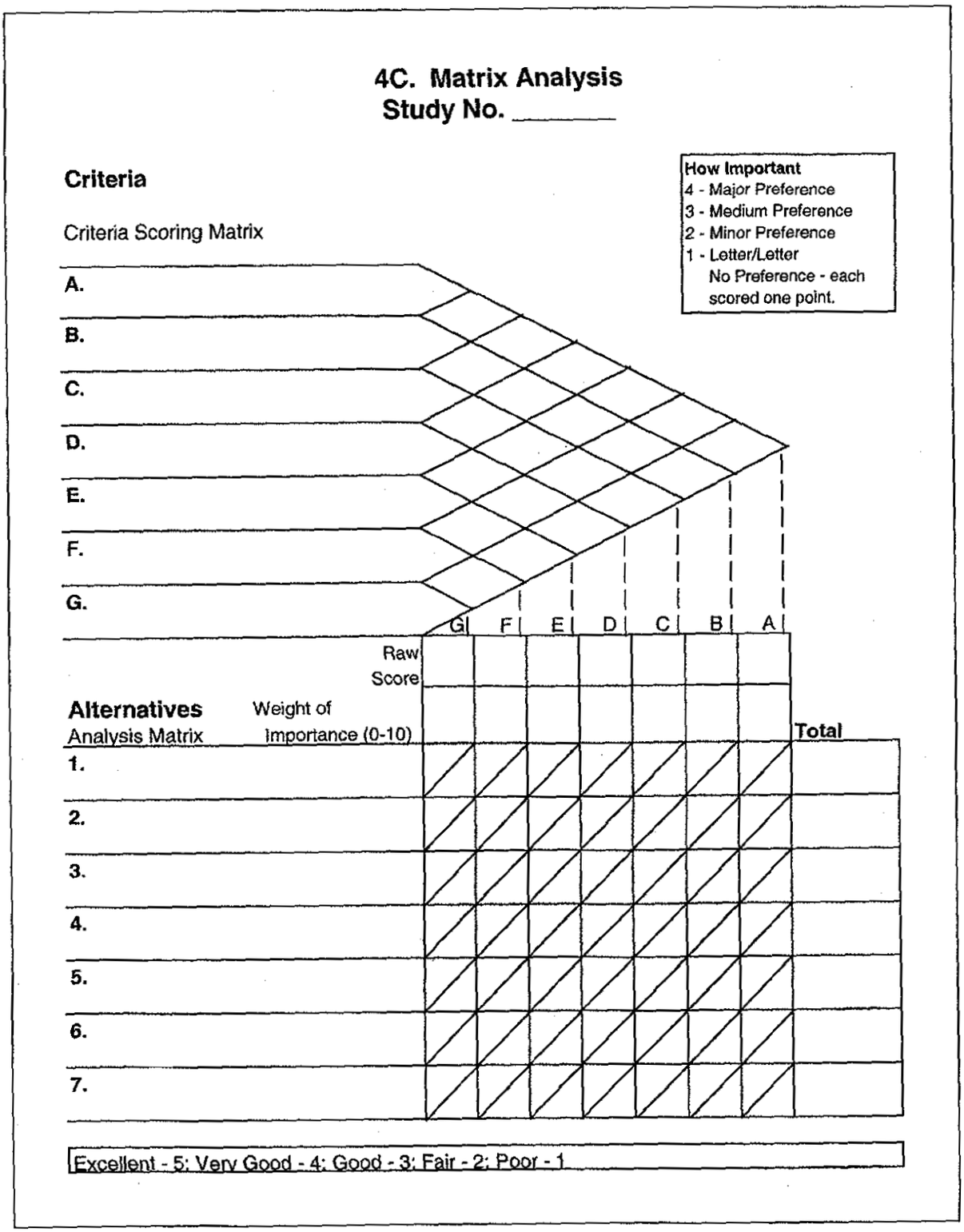

FIGURE 22. BLANK CRITERIA ANALYSIS FORM

SECTION 4

Proposed Improvements

Out of the 71 sites identified as problematic, 7 have been advanced to a preliminary design stage. These sites are discussed in detail in the Preliminary Design Plans section of this Executive Summary. This section covers improvements at the remaining 64 sites.

4.1 Preliminary Design Plans

Preliminary Design Plans were created for seven sites. Each site is discussed near the end of this section, and the plan sheets are included as Figures 23 through 30 in Appendix F.

4.1.1 Utilities

Many utilities exist in the Town. Research was performed at the following utility companies:

- Cox Communications
- Black Mountain Gas
- Arizona Public Service
- Qwest Communications
- Cave Creek Water Company
- Carefree Water Company
- Town of Carefree

Utility locations are shown on the design plans for each site, Figures 23 through 30 in Appendix F.

4.1.2 Environmental Documents

A research of hazardous materials, archeological resources, and ecological resources was performed as part of the Carefree DMP. The following reports are included in Appendix A of the Carefree DMP, under separate cover:

- *Preliminary Initial Site Assessment* - hazardous materials
- *Literature Review for the Carefree Drainage Master Plan* – cultural and archeological resources
- *Carefree Drainage Master Plan – Ecological Assessment* – ecological resources
- *Carefree Drainage Improvements Permitting Summary* – required permits

4.1.3 Hazardous Materials

The *Preliminary Initial Site Assessment* researched the proposed improvement sites for the presence or likely presence of hazardous substances or petroleum products. No sites were found that pose a significant environmental impact; however, further research of an open leaking underground storage tank was recommended prior to initiating work.

4.1.4 Cultural Resources

The *Literature Review for the Carefree Drainage Master Plan* was performed to determine whether any previously recorded cultural resources are located with the improvements' area of potential effect. Two prehistoric sites that were recommended as potentially eligible for the National Register are located within 0.25 miles of the proposed sites #3 and #6 on Cave Creek Road, refer to Figure 23 in Appendix F. Additionally, four historical properties have been identified in the Town that may extend into the projects' area of potential effect. These four sites are historic roadways and travel corridors. All project sites should be surveyed for cultural resources prior to construction and, should resources be found, avoided if at all possible.

4.1.5 Ecological Assessment

The *Carefree Drainage Master Plan – Ecological Assessment* surveyed ecologically significant areas, defined as areas supporting native or natural vegetation. Protected native plants, such as saguaros, cholla, palo verde, and other species are found adjacent or in all of the proposed improvement areas. Avoidance of these protected plants is recommended, and the Arizona Department of Agriculture must be notified in writing at least 60 days in advance of planned destruction of these plants. Additionally, although not specifically protected by the Arizona Native Plant Law, the crucifixion thorn and other large shrubs that provide high resource values for wildlife should also be avoided.

4.1.6 Permitting

The *Carefree Drainage Improvements Permitting Summary* describes the federal, state, and local permits, approvals, reviews, and similar actions that may be required for the construction of the proposed drainage improvements.

4.2 Structure Options

Numerous options were investigated for providing wash crossings. In all cases, a passable crossing for vehicles was crucial, and therefore separation of the road grade and wash grade was necessary. Additionally, because of the dynamic nature of the washes in the Town, spanning as much of the wash as possible is important, with a crossing that does not impact the wash at all preferred (i.e., the structure spans the wash and floodplain). Preservation of the Town's unique character and an aesthetically pleasing look is important to residents and staff. Three general categories of options for the crossings exist, each with their own advantages and disadvantages, as shown in Table ES-4.

TABLE ES-4
Improvement Options and Generalized Pros/Cons

Type	Pros	Cons
Conventional Culverts – boxes, pipes, etc.	Cost	Aesthetics/Floodplain Impacts
Conventional Bridges – slab bridge with piers, etc.	Spans entire floodplain	Cost, Aesthetics
Pipe Arch Bridges – an arch-type multiplate culvert with bridge-like facing	Aesthetics	Some floodplain impact

4.2.1 Advanced Design Sites

As a result of the prioritization procedure, seven impassable sites were advanced to the preliminary design phase, as shown in Table ES-5 in Appendix E, and Figure 31 in Appendix F. It is assumed for the purpose of the access plan that these sites will be improved in the foreseeable future.

TABLE ES-5
Impassable Sites to be advanced to Design Phase

Impassable Site Location	Identifier	Flow amount, 100-year Future Event (cfs)
Rising Sun Road	#190	834
Pima Road near Short Putt Place	#JEF32	1260
Cave Creek Road near New River Road	#6	2462[b]
Cave Creek Road near Carefree Highway[a]	#3	566[b]
Tranquil Trail near Sundance Trail	#JEF35, JEF55	4379
Sombrero Road near Cow Track	#JEF44	2990
Golden Spur Lane	#JEF52	747

Reference Figure 31 for a map of these sites

[a] *The road becomes impassible further to the south near the intersection of Carefree Highway and Cave Creek Road, as a result of the change in roadway profile and ponding water elevations*

[b] *Flow rate obtained from floodplain model*

4.2.2 Aesthetics

Numerous aesthetics treatments are available for pipe arch bridges. One pipe arch bridge currently exists in the Town, which has an adobe-type stucco treatment. Additional treatments, such as rock facings, are available. A picture of a rock-face treatment is shown in Figure 32. Applying facades and aesthetic treatments are recommended in the future improvements for the Town.

Facing facades can be placed on culverts and wingwalls that help them blend into the surrounding environment. Figure 33 shows and example of a culvert facing treatment.

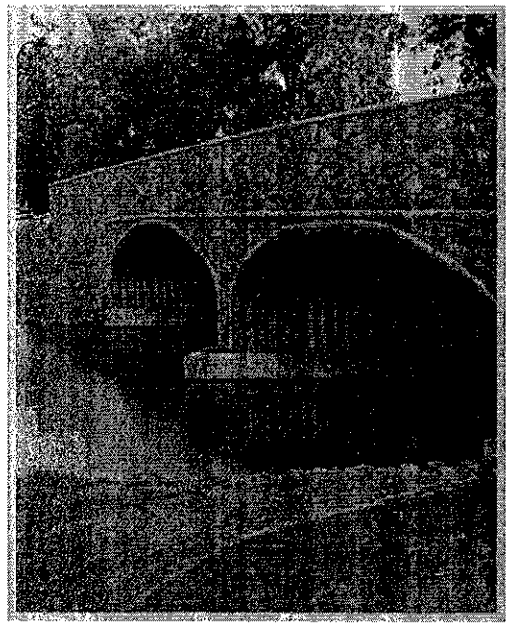

FIGURE 32. EXAMPLE OF A ROCK FACADE ON A PIPE ARCH BRIDGE

4.2.3 Design Sites

Additional site-specific sedimentation impacts and recommendations for the design sites and general

recommendations for flood control improvements can be found in the *Sedimentation Alternative Analysis – Level II*, Appendix B of the Carefree DMP under separate cover. All of these sites will result in conflicts with existing utilities. See Figures 23-30 for plan sheets of the design sites. See Figure 31 for a map of the design sites.

4.2.3.1. Tranquil Trail near Sundance Trail, Site Numbers JEF 35 and JEF 55

Galloway Wash currently flows over the road at Tranquil Trail, with a 100-year future flow amount of 3,460 cfs. Additionally, the confluence of a smaller tributary to Galloway Wash joins the main wash in this same location, with a tributary flow of 919 cfs. Two small, undersized culverts exist in the location of the tributary.

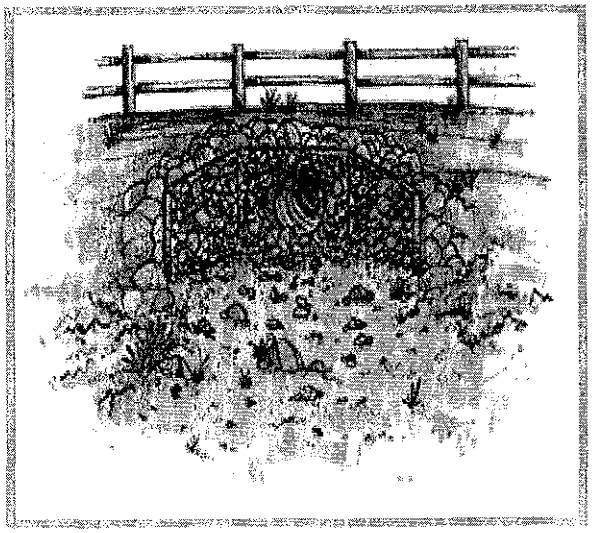

FIGURE 33. EXAMPLE OF CULVERT FACING TREATMENT

To provide a passable crossing at this location, a total of six-20 feet 4 inches by 4 feet 6 inches corrugated metal pipe arches are proposed: four at the main wash crossing and two at the tributary wash crossing. This will require reconstruction of approximately 16,000 square feet of pavement, and placement of fill. Utility conflicts in this location are possible, and temporary construction easement (or permanent drainage easement) will need to be obtained from the property owner.

4.2.3.2. Sombrero Road near Cow Track Drive, Site Number JEF 44

Galloway Wash Middle Branch currently flows over Sombrero Road. The floodplain has braided flow conditions, and is relatively wide. A 100-year future flow of 2,990 cfs is expected at this location. Because of the braided flow conditions, relief culverts are proposed in addition to the main drainage structure.

To provide a passable crossing at this location, four-20 feet 4 inches by 4 feet 6 inches corrugated metal pipe arches and two 54 inch-diameter corrugated metal pipes are proposed. Approximately 11,000 square feet of pavement will require reconstruction, along with the placement of fill. A potential for utility conflicts exist. Additionally, an easement will be necessary for the fill slopes and downstream rip-rap protection.

4.2.3.3. Golden Spur Lane, Site Number JEF 52

An at-grade crossing currently exists on Golden Spur Lane, with a 100-year future flow of 747 cfs. In order to provide a passable crossing in this location, four-10 feet by 4 feet concrete box culverts are proposed. This will require approximately 13,000 square feet of pavement reconstruction, roadway fill, and right-of-way acquisition. Additionally, easements will be required for the roadway fill. Potential conflicts with cable and telephone utilities exist.

4.2.3.4. Cave Creek Road near New River Road, Site Number 6

Three-66-inch-diameter corrugated metal pipes exist under Cave Creek Road in this location. However, these pipes will not handle the 2,462 cfs expected for the 100-year event. The culvert site is located directly adjacent to a sewage lift station, and many other utilities exist in this area.

Installation of three-20 feet 4 inches by 4 feet 6 inches corrugated metal pipe arches are proposed at this location. Since the average wash width will increase due to this proposed culvert, a berm is recommended to prevent the low flows from entering the third barrel. The only time flows will enter the third barrel will be when the berm height is exceeded.

4.2.3.5. Pima Road near Short Putt Place, Site Number JEF 32

Galloway Wash flows over Pima Road near Short Putt Place, with a 100-year future flow of 1,260 cfs. An existing floodplain and floodway map shows the overtopping flow to split to the north and south and surround an existing house with floodwaters. The proposed improvements, five-11 feet x 3 feet 6 inches corrugated metal pipe arches, are designed to eliminate the flow around one side of the house, thus improving the flooding situation on that property. Revising the floodplain map with FEMA and Maricopa County showing this change in condition would be advantageous.

Reconstruction of approximately 17,000 square feet of roadway, including portions of Short Putt Place and the residential driveway, are necessary. An easement is required from the property owner for construction of these improvements. Utility conflicts are possible at this location.

4.2.3.6. Rising Sun Road, Site Number 190

Two undersized culverts exist across Rising Sun Road. A flow of 834 cfs is expected in the future in a 100-year event. Five-6 feet 1 inch by 4 feet 7 inches corrugated metal pipe arches are proposed in this location, requiring approximately 7,000 square feet of roadway reconstruction. One utility, cable television, was reported to exist on this road. An easement from the property owners would be necessary for construction.

4.2.3.7. Cave Creek Road, Site Number 3

An existing double barrel 71 inches x 47 inches corrugated metal pipe arch exists under Cave Creek Road north of Carefree Highway. A flow of 566 cfs arrives at this location during a 100-year event. The existing culverts' capacities are severely compromised by sediment.

The addition of three more barrels is proposed at this location to increase the capacity so that the roadway remains passable during a 100-year runoff event. Due to the amount of sediment accumulation that has occurred in this wash, a depressed inlet apron is proposed instead of substantial wash grading. Additionally, due to the width of the floodplain at this point, the grading of a channel next to the roadway is proposed to direct runoff into the culvert.

A development is currently underway at the property immediately downstream of this culvert. According to Dr. Erich Korsten, the Town Engineer for the Town of Carefree, the

developer of this property was required to improve the downstream ditch so that it handles all of the flow anticipated at this location.

4.3 Conceptual Cost Information for Proposed Improvements

A conceptual-level cost estimate was created for the seven proposed improvement sites. Table ES-6 contains a summary of the cost information, and Appendix G in the Carefree DMP, under separate cover, contains more detailed information on how the costs were obtained. Due to the conceptual level of these plans, a 30 percent contingency was added to the costs.

TABLE ES-6
Proposed Improvements Cost Summary

Site	Estimated Construction Costs	Overhead and Profit (15%)	Contingency (30%)	Total
Tranquil Trail (JEF 35/55)	$ 592,000	$ 88,800	$ 177,600	$ 860,000
Sombrero Road (JEF 44)	$ 440,000	$ 66,000	$ 132,000	$ 638,000
Golden Spur Lane (JEF 52)	$ 312,000	$ 46,800	$ 93,600	$ 453,000
Cave Creek Road near New River (6)	$ 711,000	$ 106,700	$ 213,300	$ 1,031,000
Pima Road (JEF 32)	$ 204,000	$ 30,600	$ 61,200	$ 296,000
Rising Sun Road (190)	$ 119,000	$ 17,900	$ 35,700	$ 173,000
Cave Creek Road north of Carefree Highway (3)	$ 278,000	$ 41,700	$ 83,400	$ 404,000

SECTION 5

Public Involvement

Public involvement was an important component of the Carefree DMP. Three public meetings and four Town Council presentations were given during the development of the plan. Information was gathered from the public during these meetings, including photos during flood events and listings of problem areas. Two flyers were created for the project and posted at Town Hall to disseminate information to the general public. Additionally, written notification was sent to all property owners within 200 feet of the floodplains delineated as part of this project. Throughout the project, individual meetings were held with owners, engineers, and/or planners representing the interests of development projects and floodplain issues.

Records of the public involvement components are contained in the *Technical Data Notebook* for the floodplain delineation portion of the project.

SECTION 6

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Appendix A. Flood Accessibility Emergency Routes Evaluation

Flood Accessibility Emergency Routes Evaluation

A flood accessibility evaluation of emergency routes was performed for the Town as part of the Carefree DMP, and is Appendix G of the Carefree DMP, under separate cover. Drainage crossings at streets were analyzed for depth and velocity of water flow over the roadway during the 100-year flood event. The following is a summary of the evaluation.

Criteria

The following criteria were used for determination of the flood accessibility:

- Accessibility shall be performed for the 100-year runoff event.
- Road overflows (Figure 34), or longitudinal flows at the roadway crown, of more than 1-foot deep are considered impassable.
- Improvements are desired in the Town such that no more than 30 single-family residential lots, or equivalent multifamily or commercial/industrial areas, are inaccessible due to design flood flows in any given wash; and, no lot is inaccessible for more than 10 hours.

FIGURE 34. FLOW OVER ROADWAY DIP CROSSING GALLOWAY WASH AT PIMA ROAD

The term "inaccessible," as used in this Executive Summary, refers to the time and flow rate of water flowing over the roadway during a runoff event. This does not include inaccessibility due to damage of the roadway, debris accumulation, or sedimentation over the roadway.

Existing Conditions Accessibility Evaluation

All drainage crossings of washes with greater than 15 cfs were analyzed for depth, velocity, and duration of flood flows over the roadway. Crossings were characterized as either passable or impassable based upon the aforementioned criteria. More than 120 roadway crossings will have water over the road, and of these sites, more than 50 will be considered impassable. This results in more than 50 percent of the residential parcels in the Town being inaccessible during a 100-year runoff event. Figure 35 in Appendix F shows a graphical representation of these sites.

Proposed Improvements

Drainage features were identified during the Data Collection Phase of the project that are considered problematic. Each area fits into one of these general categories:

- Roadways that are impassable during flood events
- Localized or regional sedimentation
- Localized or regional erosion
- Damaged facilities
- Undersized facilities/drainage facilities not provided
- Erosion setback encroachments

Access Plan

An access plan was created based upon the results of the prioritization process and route evaluation. There are three proposed stages of the access plan, and these are reflected in Figures 13 and 36, both in Appendix F. The stages are:

Access Plan Stage 1 - Improvement of the 7 advanced design sites. Figure 13 in Appendix F was created to reflect the access plan once these impassable sites are improved and upgraded to passable. Although many sites are shown on Figure 2 in Appendix F as accessible, 209 lots will still be without access.

- ***Access Plan Stage 2 - Improvement of 2 additional roadway crossings necessary to fulfill the project scope criteria.*** Figure 3, in the *Flood Accessibility Emergency Routes Evaluation*, Appendix C of the Carefree DMP under separate cover, was created to show the two additional roadway crossings that must be improved to fulfill the project scope criteria that no more than 30 single-family lots (or equivalent) are inaccessible from a single crossing during the 100-year runoff event. A total of 104 lots will remain inaccessible.

- ***Access Plan Stage 3 - Complete Accessibility.*** Figure 36 in Appendix F represents the additional crossings that must be improved to provide complete accessibility to all lots within the Town during a 100-year storm event.

Figure 37 in Appendix F contains a detailed summary of the depths, velocities, and durations of flow at the roadway crossings. This information is additionally contained in Table ES-1.

Conclusions and Recommendations

Drainage crossings at streets within the Town were analyzed for depth, velocity and duration of water flow over the roadway during the 100-year flood event. The maximum duration that any lot will be inaccessible, according to the design hydrograph, is slightly more than 5 hours.

The access plan for the Town is composed of three stages: improvement of the seven advanced design sites, improvements necessary to meet the project scope criteria, and

improvements resulting in complete accessibility. Table ES-7 summarizes the improvements.

TABLE ES-7
Improvement Summary — Carefree Access Plan

Access Plan Stage	Improvement Location	Add'l Parcels Accessible	% of Town Accessible**
Existing Conditions		1437	66.8%
Stage 1	Tranquil Tr. At Sundance	156	75.8%
	Cave Creek near Carefree Highway	36	68.5%
	Rising Sun Road	12	76.3%
	Pima Road near Short Putt Place	63	79.3%
	Cave Creek Road near New River Road	123	85.0%
	Sombrero Road near Cow Track	20	85.9%
	Golden Spur Lane	85	89.9%
Stage 2	Father Kino Trail	52	92.3%
	Carefree Hwy at Carefree Mountain Drive	53	94.7%
Stage 3	Various*	104	100%

*See Figure 4 in the Flood Accessibility Emergency Routes Evaluation, Appendix C of the Carefree DMP under separate cover, for locations

**Based on parcel count, not acreage, approx. 2,150 total parcels in Town

Figure 13 in Appendix F contains the recommended crossing improvements for Stage 1 that will render approximately 90 percent of the Town with access during the 100-year flood event; however, 209 lots will remain inaccessible. This is the recommended improvement plan for the Town, that takes into account the cost/benefit ratio for improvements.

Figure 3 in the *Flood Accessibility Emergency Routes Evaluation*, Appendix C of the Carefree DMP under separate cover, contains Stage 2 of the access plan, which is the recommended improvements from Figure 13 in Appendix F plus the additional roadway crossings that must be improved to fulfill all of the project criteria. This results in making approximately 95 percent of the Town accessible, with only 104 lots remaining inaccessible.

Figure 36 in Appendix F contains the additional crossings that must be improved to provide complete accessibility to all lots in the Town.

In addition to the recommended crossing improvements, the following safety measures or further study are recommended for implementation in the Town.

Safety Improvements

Public Education

The public should be made aware of particularly dangerous crossings to be avoided, such as crossings where greater flow volumes, depths, and velocities exist, and where a greater

probability of pavement damage exists. Additionally, as crossings are improved, the public should be made aware of the preferred routes of access.

Signage

There are certain crossings within the Town where improvement strictly for the purpose of access during flood events is not required, as alternate routes exist. Based on the fact that alternate routes are available, signage is recommended at these crossings indicating that the public should not attempt to cross that location when water is present over the roadway. These crossings are shown on Figure 31 in Appendix F.

Depth Markers

The installation of depth markers may provide an increased level of safety if installed at all crossings where flow over the road is anticipated. Additionally, depth markers can be coordinated with trailhead markers or information if the Town chooses to adopt trails along major wash corridors in the future.

Flood Warning System Gauges

The installation of stream flow gauges or precipitation gauges in the upper part of the watershed could be used to create a flood warning system for the Town. The FCDMC operates and maintains the ALERT (Automated Local Evaluation in Real Time) system, which contributes to the early detection of flooding by measuring rainfall and streamflow using gauge sensors. If ALERT gauges were installed in the watershed, the lag time could be related to the crossings and a warning system developed. Coordination and implementation of this system should be accomplished through the FCDMC.

Distribution to Emergency Personnel

A copy of the *Flood Accessibility Emergency Routes Evaluation*, Appendix C of the Carefree DMP under separate cover, should be distributed to local emergency personnel as a general guide. Figure 37 in Appendix F of this Executive Summary, which is from that report, is particularly useful as it summarizes the crossings that are anticipated to be impassable during major flood events. As improvements are made, a map should be distributed to emergency personnel indicating passable routes.

Limitations

Many assumptions are inherent to the hydrologic and hydraulic analyses used to calculate the depths, velocities, and durations used to determine the passability of roadway crossings. During flood flows over roadways, many other hazards exist at road crossings during flood events in addition to water flow quantity and duration. Additionally, it is impossible to predict the duration, intensity, and frequency of storms that may happen in the Carefree watershed in the future.

Although there are 16 other road crossings that currently violate the Town's new construction criteria for flow depths over the road during the 100-year flood, the depth at these crossings is below the threshold of 1.0 feet of depth used for evaluating accessibility in this study. The new construction criteria of 0.5 feet of depth over the road is not intended to be retroactive to all existing crossings. This is true throughout the unincorporated areas of

Maricopa County as well. If these crossings are improved in the future they should be reconstructed to meet the new construction criteria.

Appendix B. Engineering Design Guidelines

Engineering Design Guidelines

Engineering Design Guidelines were developed for the Town as part of the Carefree DMP, and are Appendix D of the Carefree DMP, under separate cover. The purpose of these 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. The guidelines are summarized below.

Floodplain Delineations

Floodplain delineations in the Town shall be conducted in conformance with the most recent National Flood Insurance Program regulations, state standards, and FCDMC guidelines. Refer to *Engineering Design Guidelines*, Appendix D of the Carefree DMP under separate cover, for further information.

Erosion Hazard Zone Delineations

Erosion Hazard Zone Delineations in the Town shall be conducted in conformance with SS 5-96 guidelines and *Drainage Design Manual for Maricopa County, Arizona, Volume II-Hydraulics* guidelines. Refer to *Engineering Design Guidelines*, Appendix D of the Carefree DMP under separate cover, for further information.

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 modeling, sediment yield, and gradation analysis.

Floodplain Encroachment

Where floodway fringe areas do exist, 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.

Low-Impact Structural Alternatives

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.

Channelization

Any engineered channel with alteration of the natural watercourse or banks, bank 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. 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) (Figure 38). Approval of the Town Engineer is necessary for any proposed channelization project.

FIGURE 38. EXAMPLE OF EROSION CAUSED BY CHANNELIZATION REQUIRING MITIGATION

Channelization is not recommended as a development alternative. Additionally, in washes that have floodplain delineations, the floodplain must be reanalyzed to determine the effects of the channelization on the floodplain elevations.

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 re-vegetated, 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 39. EXAMPLE OF SCOUR AT CULVERT OUTLET DUE TO LACK OF OUTLET PROTECTION

Outlet Protection

Outlet protection should be designed to reduce impacts of high-exit velocities and scour potential downstream of culverts. The design of outlet protection, including adequate size and bedding material, is required in compliance with *Drainage Design Manual for Maricopa County, Arizona, Volume II-Hydraulics.*

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 (Figures 39 and 40). 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 *Drainage Design Manual for Maricopa County, Arizona, Volume II-Hydraulics.*

Roadway Crossing Drainage Structures

Scour and sedimentation problems 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.

At-Grade Crossings

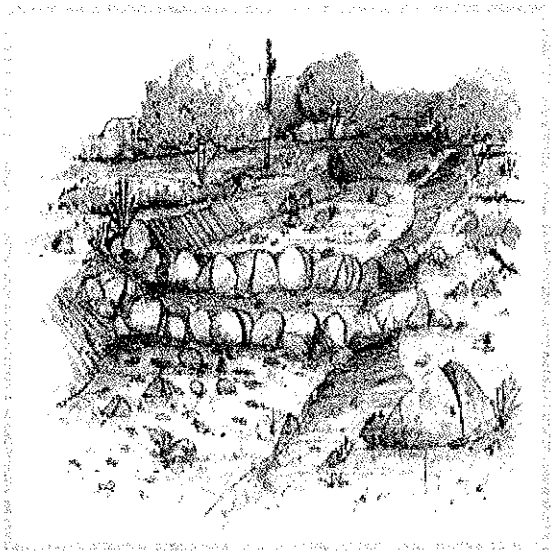


FIGURE 40. ARTISTIC RENDERING OF AN AESTHETICALLY DESIGNED GRADE CONTROL STRUCTURE

At-grade crossings 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.

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.

A culvert that is undersized creates a channel obstruction and results in a headwater ponding condition. This condition often leads to sediment deposition (Figure 41), 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 *Drainage Design Manual for Maricopa County, Arizona, Volume II-Hydraulics.*

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

FIGURE 41. EXAMPLE OF SEDIMENTATION IN CAREFREE

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.

Some generic design elements are included in this Executive Summary as Figures 42-46 in Appendix F.

Appendix C. Inspection, Maintenance, and Monitoring Plan

Inspection, Maintenance, and Monitoring Plan

An *Inspection, Maintenance, and Monitoring Plan* was developed for the Town as part of the Carefree DMP, and is Appendix E of the Carefree DMP, under separate cover. The purpose of this plan is to provide a general framework for operation, maintenance, and monitoring of drainage facilities. The Town can implement, modify, or make obsolete any portion of the plan's guidelines to meet changes in the condition of drainage facilities. The plan is summarized below.

When to Monitor

Regular maintenance and monitoring of drainage facilities 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 three years. 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. The rainfall gauge data can be accessed by calling the FCDMC office at (602) 506-1501.

Long-Term Monitoring

The inspection, maintenance, and monitoring 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. A checklist has been provided in Appendix B of the *Inspection, Maintenance and Monitoring Plan,* Appendix E of the Carefree DMP under separate cover, 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.

Monitoring Sites

Monitoring sheets have been created for each of the recommended sites and are included in Appendix C of the *Inspection, Maintenance and Monitoring Plan,* which is Appendix E of the Carefree DMP under separate cover. 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 an aerial photograph, a detailed plan view with topographical

information, 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.

When to Maintain

Photographs of post-storm drainage facilities are included in Appendix A in the *Inspection, Maintenance and Monitoring Plan*, which is Appendix E of the Carefree DMP under separate cover, to illustrate standard maintenance issues for the Carefree area. Typical criteria for when maintenance is required for drainage facilities includes:

- Channel grade aggradation (sedimentation) or degradation (erosion) of over 6-inches
- 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 roadway, structure, residence, or building
- Hydraulic structure capacity (sediment has blocked drainage structure) has decreased over 15 percent
- 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
- Undermining (erosion of soil supporting) of drainage structure
- Sediment and debris buildup at at-grade crossings
- 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

Maintenance Activities

Table ES-8 identifies various maintenance criteria and the recommended maintenance activity to correct a maintenance problem.

TABLE ES-8
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 in 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 large diameter rock.
Formation of avulsive channels	Construct engineered levee to redirect water into main channel.**
Damage occurs or is eminent at 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% 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 A, of the *Inspection, Maintenance 7 Monitoring Plan*, Appendix E of the Carefree DMP under separate cover.)
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 A of the *Inspection, Maintenance 7 Monitoring Plan*, Appendix E of the Carefree DMP.)
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 ES-8
Maintenance Criteria and Activities

Maintenance Criteria	Recommended Maintenance Activity*

*Any addition or removal of fill material within a channel cross-section will require an 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.

Regional Recommendations

Recurring problems such as plugging of culverts due to sediment, debris, or severe erosion that constantly undermines drainage facilities may be a sign of inadequacy of the current drainage facility system in place. 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 *Engineering Design Guidelines* prepared for the Town as part of the Carefree DMP and contained in Appendix D of the Carefree DMP, under separate cover, for a detailed discussion on the different types of drainage facilities and recommendations.

Appendix D. Implementation and Funding Plan

Implementation and Funding Plan

An *Implementation and Funding Plan* was developed for the Town as part of the Carefree DMP, and is Appendix B of the Carefree DMP, under separate cover. The purpose of this plan is to provide a guide for future development and analyses within the Town. It is recommended that the Town of Carefree adopt this plan. This will ensure that future developments in Town implement appropriate drainage planning and construction elements. The plan is summarized below.

Existing Conditions

Improvements to existing features are recommended in the Carefree DMP. Figure 47 in Appendix F presents a flow chart of the Implementation Plan.

Creation of a Capital Improvement Plan

After adoption of the Carefree 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 Implementation Plan*, below).

The Carefree DMP 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

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

Funding Implementation 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 ES-9 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 ES-9
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.

[1]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

The following discussion presents funding options that may facilitate or contribute to financing portions of the Carefree 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 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 and sponsors must show that it meets all applicable federal requirements. A discussion of the planned FY 2004 – FY 2008 Transportation

Improvement Program Guidance Report is included in the *Implementation and Funding Plan*, Appendix B of the Carefree DMP under separate cover.

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, which is included as Appendix C of the *Implementation and Funding Plan*, Appendix B of the Carefree DMP under separate cover. Once a project has priority and is part of the District's CIP process, the District and the partnering agency must enter into an Intergovernmental Agreement (IGA).

Local Improvement Districts

Local improvement districts (LIDs) are legally designated geographic areas in the Town that, 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.

General Obligation and Revenue Bonds

General Obligation 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. All projects funded with General Obligation bonds must receive voter approval through a citywide bond referendum. According to Arizona law, any projects to be funded through either general obligation or revenue bonds must receive prior approval by Carefree citizens.

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.

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.

Appendix E. Tables

INVENTORY OF EXISTING DRAINAGE FACILITIES TABLE ES-1											
See Figure 2 in Appendix F for Facility Locations			Carefree Drainage Master Plan- Executive Summary								
	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable			Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)		Analysis Done?***
1	76	123	18" CMP CULVERT				6.21				
1 (JEF)	*62	*109	AT GRADE CROSSING (PAVED)				n/a				
2	48	83	49" X 39" CMPA CULVERT	0.68	1.4	0.95	9.00	78	49		YES
2 (JEF)	*101	*180	AT GRADE CROSSING (PAVED)				n/a				
3	177	**566	2-71" X 47" CMPA CULVERTS	0.68	1.40	0.95	9.00				YES
3 (JEF)	*360	*639	AT GRADE CROSSING (PAVED)				n/a				
4	43	82	42" CMP CULVERT				10.64				
5	52	88	36" CMP CULVERT				9.92	88			
5 (JEF)	*708	*1258	AT GRADE CROSSING (PAVED)	2.14	5.66	12.11	n/a	175	49		YES
6	1861	**2462	3-66" CMP CULVERTS	1.76	5.18	9.12	13.88	1300	62		YES
6 (JEF)	*909	*1626	AT GRADE CROSSING (PAVED)	2.96	8.04	23.80	n/a	170	70		
7	117	194	3- 64" X 43" CMPA CULVERTS				10.18	347			
7 (JEF)	*1187	*2135	AT GRADE CROSSING	2.98	8.06	24.02		150	72		YES
8	46	76	2- 42" X 29" CMPA CULVERTS				8.15	91			
8 (JEF)	*1249	*2246	AT GRADE CROSSING (PAVED)	3.49	8.57	29.91	n/a	260	68		YES
9	178	293	2- 49" X 33" CMPA CULVERTS				9.05	293			
9 (JEF)	*1281	*2304	AT GRADE CROSSING (PAVED)	3.43	9.76	33.48	n/a	150	84		YES
10	19	*33	21" CMP CULVERT	0.50			8.52	33			
10 (JEF)	*1297	*2334	AT GRADE CROSSING (PAVED)	4.16	9.50	39.52	n/a	75	112		YES
11	133	219	3-57" X 38" CMPA				9.00	293			
12	5	9	18" CMP CULVERT				7.81	13			
13	0	0	36" RGRCP CULVERT				11.49	78			
13 (JEF)	*1359	*2456	AT GRADE CROSSING	4.20	11.75	49.35	n/a	60	124		YES
14	6	11	24" CMP CULVERT				7.63	21			
14 (JEF)	*315	*583	AT GRADE CROSSING (PAVED)				n/a				
15	6	12	24" RCP CULVERT				8.85	25			
15(JEF)	62	112	CULVERT CROSSING								
16	3	6	24" RCP CULVERT				8.66	26			
16(JEF)	150	267	AT GRADE CROSSING (PAVED)				n/a				
17	11	18	24" RCP CULVERT				10.68	23			
18	12	20	24" RCP CULVERT				8.51	21			
19	5	8	24" RCP CULVERT				8.77	26			
20	1753	**1851	2- 8'x3' CBC CULVERTS	1.58	2.78	4.39	11.72	1500	48		YES
21	26	43	2- 24" RCP CULVERTS				9.13	52			
22			NOT FOUND IN FIELD				n/a				
22(JEF)	*89	*145	AT GRADE CROSSING (PAVED)				n/a				
23	249	418	2- 4' X 10' CBC CULVERTS				16.19	828			
23A	10	16	24" RCP CULVERT				10.02	17			
24	19	34	24" RCP CULVERT				8.09	34			
24 (JEF)	*522	*855	AT GRADE CROSSING (PAVED)	1.81	5.01	9.07	n/a	175	105		YES
25	54	96	2- 42" RCP CULVERTS				10.90	120			
25 (JEF)	*546	*894	AT GRADE CROSSING (PAVED)	1.85	5.08	9.40	n/a	175	105		YES
26	65	117	2- 42" RCP CULVERTS				11.63	117			
27	1717	**2289	4-10' X 4' RCB CULVERTS	2.02	3.07	6.20	12.79	1150	58		YES
27(JEF) (71)	*759	*1244	30" CMP CULVERT	1.88	6.60	12.41	9.37	266	90		YES
28	9	15	2-24" CMP CULVERTS				11.57	72			
28(JEF)	*693	*1135	AT GRADE CROSSING (PAVED)				n/a				
29	38	63	2- 24" CMP CULVERTS				7.80	64			
29 (JEF)	*719	*1178	AT GRADE CROSSING (PAVED)	1.84	5.18	9.53	n/a	235	95		YES
30	132	263	2- 36" CMP CULVERTS				10.45	263			
30(JEF) (70)	*791	*1296	48" CMP CULVERT	1.61	5.61	9.03	11.90	448	65		YES
31	29	48	18" CMP CULVERT				8.70	49			
31 (JEF)	*875	*1432	AT GRADE CROSSING (PAVED)	2.15	8.42	18.10	n/a	300	85		YES
32	14	23	24" CMP CULVERT				10.71	23			
32 (JEF)	*688	*1259	AT GRADE CROSSING (PAVED)	1.81	7.66	13.86	n/a	390	70		YES

	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable		Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)	Analysis Done?***
33	125	207	4- 36" CMP CULVERTS				13.86	207		
33 (JEF)	931	1783	AT GRADE CROSSING (PAVED)	2.86	10.67	30.52	n/a	110	120	YES
34	135	222	2- 36" CMP CULVERTS				13.29	222		
34(JEF)	988	1893	CULVERT							
35	92	151	30" CMP CULVERT				12.27	151		
35 (JEF)	2112	3635	AT GRADE CROSSING (PAVED)	2.84	9.69	27.52	n/a	340	145	YES
36 (JEF)	2599	4560	AT GRADE CROSSING (PAVED)	3.34	11.02	36.81	n/a	290	160	YES
36	1408	**1652	3-60" CMP CULVERT	3.42	5.48	18.74	12.55	560	68	YES
37	333	*552	60" CMP CULVERT				11.05	552		
37(JEF) (170)	210	377	AT GRADE CROSSING (PAVED)	1.27	4.68	5.94	n/a	220	40	YES
38	38	62	18" CMP CULVERT				8.44	62		
39	60	100	24" CMP CULVERT				8.88	101		
40	91	162	24" CMP CULVERT				7.03	162		
40 (JEF)	*42	*75	AT GRADE CROSSING (PAVED)				n/a			
41	43	77	18" CMP CULVERT				6.93	76		
41A	33	58	18" CMP CULVERT				7.06	58		
41(JEF)	*127	*226	AT GRADE CROSSING (PAVED)				n/a			
42	708	1258	60" CMP CULVERT				10.75	1258		
42(JEF)	*150	*267	AT GRADE CROSSING (PAVED)	0.91	4.22	3.84	n/a			
43	6	11	24" CMP CULVERT				8.24	24		
43 (JEF)	1158	2126	AT GRADE CROSSING (PAVED)	2.34	2.69	6.29	n/a	900	70	YES
44	76	127	18" CMP CULVERT				9.38	127		
44 (JEF)	1191	2186	AT GRADE CROSSING (PAVED)	2.98	5.49	16.36	n/a	170	140	YES
45	3	6	24" CMP CULVERT				9.27	28		
45 (JEF)	1219	2237	AT GRADE CROSSING (PAVED)	3.42	6.78	23.19	n/a	160	165	YES
46	*214	*382	30" CMP CULVERT	0.67	3.00	2.01				YES
46 (JEF)	1222	2244	AT GRADE CROSSING (PAVED)	3.11	5.36	16.67	n/a	230	150	YES
47	53	87	DOWNTOWN STORM DRAIN				8.70	87		
47 (JEF)	*168	*302	AT GRADE CROSSING (PAVED)	1.26	6.10	7.69	n/a	175	100	YES
48	29	47	SINGLE GRATE CATCH BASIN							
48 (JEF)	*191	*344	AT GRADE CROSSING (PAVED)	1.20	5.38	6.46	n/a	200	95	YES
49	43	37	3-36" CMP CULVERTS				16.03	338		
49(JEF)	*11	*20	AT GRADE CROSSING (PAVED)				n/a			
50	11	20	18" CMP CULVERT				8.67	20		
50(JEF)	*92	*165	AT GRADE CROSSING (PAVED)				n/a			
51	5	8	18" CMP CULVERT				10.78	10		
51(JEF)	*122	*219	AT GRADE CROSSING (PAVED)				n/a			
52	5	10	18" CMP CULVERT				11.02	14		
52 (JEF)	*416	*747	AT GRADE CROSSING (PAVED)	1.11	5.33	5.92	n/a	600	50	YES
53	11	20	18" CMP CULVERT				7.73	20		
53 (JEF) (190)	*464	*834	60" X 36" CMPA + 54" CMP CULVERTS	1.15	5.08	5.84	9.39	650	50	YES
54	15	26	18" CMP CULVERT				12.85	26		
54 (JEF)	*481	*864	AT GRADE CROSSING	2.19	6.33	13.86	n/a	105	120	YES
55	71	126	4-36" CMP CULVERTS				10.04	260		
55(JEF)	*513	*922	AT GRADE CROSSING (PAVED)				n/a			
56	14	27	24" CMP CULVERT				7.53	26		
57	4	7	24" X 18" CMPA CULVERT				5.85	11		
57(JEF) (131)	*45	*81	1- 36" + 2- 58" CMPA CULVERTS				12.02	270		
58	15	25	2- 24" X 18" CMPA CULVERTS				5.85	24		
59	37	62	4- 24" X 18" CMPA CULVERTS				5.85	61		
60	30	50	24" CMP CULVERT				8.85	50		
60(JEF)	*7	*13	AT GRADE CROSSING				n/a			
61	6	10	24" CMP CULVERT				14.76	32		
61(JEF)	*16	*28	AT GRADE CROSSING				n/a			
62	182	324	30" CMP CULVERT				8.53	324		
62(JEF)	*24	*43	AT GRADE CROSSING				n/a			
63	*578	*947	36" CMP CULVERT	1.68	5.03	8.45	10.75	291	85	YES

	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable		Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)	Analysis Done?***
63(JEF)	*40	*72	AT GRADE CROSSING (PAVED)				n/a			
64	23	40	24" CMP CULVERT				9.41	39		
65	*141	*231	24" CMP CULVERT				11.10	230		
65 (JEF)	*279	*496	AT GRADE CROSSING (PAVED)	1.45	4.19	6.08	n/a	175	70	YES
66	161	263	24" CMP CULVERT				10.67	263		
67	*500	*819	30" CMP CULVERT	0.92	3.69	3.39				YES
68	*186	*304	2-30" CMP CULVERTS	0.61	2.80	1.71				YES
68 (JEF)	3937	6408	AT GRADE CROSSING	4.30	10.00	43.00	n/a	175	295	YES
69	17	31	30" CMP CULVERT				10.04	47		
69 (JEF)	*10	*19	AT GRADE CROSSING				n/a			
70 (30 JEF)	791	1296	48" CMP CULVERT	1.61	5.61	9.03	11.90	448	65	YES
70(JEF)	*26	*48	AT GRADE CROSSING				n/a			
71 (27 JEF)	759	1244	30" CMP CULVERT	1.88	6.60	12.41	9.37	266	90	YES
71 (JEF)	416	683	AT GRADE CROSSING	1.65	4.66	7.69	n/a	175	305	YES
72	*333	*546	24" CMP CULVERT	1.32	5.13	6.77	9.36	264	90	YES
73	13	21	15" CMP CULVERT				7.36	21		
74	9	15	15" CMP CULVERT				7.51	15		
75	2	4	18" CMP CULVERT				9.74	10		
76	1	2	18" CMP CULVERT				11.50	17		
77	1	3	18" CMP CULVERT				9.49	11		
78	3	6	2- 30" CMP CULVERTS				10.98	104		
79	14	24	15" RGRCP CULVERT				11.93	25		
80	9	14	2-42" STORM DRAIN				14.86	166		
81	12	21	24" CMP CULVERT				7.56	21		
82	7	12	21" CMP CULVERT				5.77	12		
83	8	14	27" CMP CULVERT				8.93	33		
84	14	22	30" CMP CULVERT				12.95	40		
85	7	12	48" CMP CULVERT				8.90	24		
86	13	23	36" CMP CULVERT				8.17	45		
87	20	35	48" CMP CULVERT				9.65	97		
88	26	42	48" CMP CULVERT				10.50	112		
89	126	209	48" CMP CULVERT				11.67	209		
90	165	294	30" CMP CULVERT				9.70	294		
91	79	130	24" CMP CULVERT				8.58	130		
92	81	145	24" CMP CULVERT				7.96	145		
93	197	351	30" CMP CULVERT				11.33	351		
94	7	13	24" CMP CULVERT				7.86	22		
95	23	40	24" CMP CULVERT				8.64	40		
96	5	9	30" CMP CULVERT				10.12	43		
97			8' WIDE GROUTED RIPRAP CHANNEL				n/a			
98			8' WIDE GROUTED RIPRAP CHANNEL				n/a			
99	63	112	24" CMP CULVERT				9.77	112		
100	28	47	24" CMP CULVERT				9.76	48		
101	11	19	2-24" CMP CULVERTS				6.02	26		
102	14	24	24" CMP CULVERT				5.78	25		
103	2	3	18" CMP CULVERT				5.93	8		
104	249	**338	3-48" CMP CULVERTS	1.52	3.02	4.59	7.95	180	36	YES
105	6	10	18" X 27" CMPA CULVERT				5.74	10		
106	4	8	24" CMP CULVERT				6.66	16		
107	2	3	18" CMP CULVERT				5.56	7		
108	10	18	18" X 27" CMPA CULVERT				3.97	18		
109	0	1	18" RCP CULVERT				8.06	14		
110	11	20	36" RCP CULVERT				9.02	34		
111	171	323	36" CMP CULVERT	0.59	2.96	1.75	2.96	322		
112	1	1	24" CMP CULVERT				9.75	30		
113	3	6	24" CMP CULVERT				17.67	35		
114	3	6	24" CMP CULVERT				13.78	33		

	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable		Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)	Analysis Done?***
115	5	8	24" CMP CULVERT				14.78	40		
116	593	1140	AT GRADE CROSSING (PAVED)	2.51	5.23	13.13	n/a	120	251	YES
117	7	13	24" CMP CULVERT				15.90	37		
118			18" CATTLE GUARD				n/a			
119			18" CATTLE GUARD				n/a			
120	2	4	24" CMP CULVERT				9.05	27		
121	6	11	24" CMP CULVERT				12.01	37		
122	1	1	24" CMP CULVERT				12.40	27		
123	988	1893	30' WIDE 12' HIGH BRIDGE					2218		
124	4	7	24" CMP CULVERT				12.40	24		
125	2	4	18" CMP CULVERT				6.46	10		
126	1	2	18" CMP CULVERT				7.17	12		
127	62	111	1- 58" X 36" CMPA CULVERT				12.34	279		
128	249	442	4-42" CMP CULVERTS				12.58	598		
129	138	246	24" RGRCP CULVERT							
130	139	247	20 SY RIPRAP PROTECTION				n/a			
131 (57 JEF)	*45	*81	1- 36" + 2-58" CMPA CULVERTS				12.02	270		
132	*1361	*2449	2-20' X 4' RCB	2.38	7.99	19.02	6.97	887	40	YES
133	3	5	18" CMP CULVERT				7.91	10		
134	6	10	18" CMP CULVERT				10.72	19		
135	23	43	2- 21" X 15" ARCH CMP CULVERTS				5.28	43		
136	22	36	2- 18" CMP CULVERTS				7.96	36		
137	27	47	36" X 24" CMPA CULVERTS				9.37	47		
138	103	211	AT GRADE CROSSING (RIPRAP)				n/a			
139	4	7	24" CMP CULVERT				7.71	20		
140	460	912	AT GRADE CROSSING	1.82	6.89	12.54	n/a	185	68	YES
141	13	24	24" CMP CULVERT				8.48	24		
142	121	248	AT GRADE CROSSING				n/a			
143	23	46	30" CMP CULVERT				7.99	46		
144	49	89	AT GRADE CROSSING				n/a			
145	75	151	2-30" CMP CULVERTS				9.27	151		
146	27	55	24" CMP CULVERT	0.87	2.41	2.10		Passable		YES
147	76	152	3-30" CMP CULVERTS	1.39	2.57	3.57	3.73	150	94	YES
148	77	155	3-30" CMP CULVERTS	0.67	5.18	3.47		Passable		
149	14	29	24" CMP CULVERT				7.37	29		
150	13	26	24" CMP CULVERT				6.70	26		
151	21	41	2- 36" CMP CULVERTS				8.72	41		
152	54	108	24" CMP CULVERT				7.36	108		
153	122	**82	2-36" CMP CULVERTS	0.76	1.84	1.40		Passable		
154	24	41	24" CMP CULVERT				6.91	42		
155	16	27	24" CMP CULVERT				5.50	27		
156	6	11	AT GRADE CROSSING				n/a			
157	1	2	24" CMP CULVERT				6.79	12		
158	112	225	AT GRADE CROSSING	1.21	2.19	2.65	n/a	150	28	YES
159	256	517	AT GRADE CROSSING	1.80	6.73	12.11	n/a	130	98	YES
160	71	134	AT GRADE CROSSING				n/a			
161	*156	*295	AT GRADE CROSSING	1.35	4.67	6.30	n/a	150	29	YES
162		**131	AT GRADE CROSSING	1.12	2.30	2.58	n/a	110	36	YES
163	46	81	24" CMP CULVERT	0.88	1.91	1.68		Passable		
164	46	*77	30" CMP CULVERT	0.27	0.96	0.26		Passable		
165	33	56	AT GRADE CROSSING (CONCRETE)				n/a			
166	38	67	AT GRADE CROSSING (CONCRETE)				n/a			
167	38	71	AT GRADE CROSSING (CONCRETE)				n/a			
168	3	6	18" CMP CULVERT				7.30	12		
169	229	410	AT GRADE CROSSING	0.88	6.91	6.08	n/a			
170 (37 JEF)	210	377	AT GRADE CROSSING	1.27	4.68	5.94	n/a	220	40	YES
171	154	276	AT GRADE CROSSING	1.17	3.43	4.01	n/a	175	50	YES

	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable		Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)	Analysis Done?***
172	168	301	AT GRADE CROSSING	0.97	5.88	5.70	n/a	Passable		
173	62	112	30" CMP CULVERT				10.07	112		
174	14	24	24" CMP CULVERT				8.00	25		
175	112	201	18" CMP CULVERT				7.56	201		
176	50	90	18" CMP CULVERT				7.03	90		
177	104	186	18" CMP CULVERT				7.11	186		
178	96	173	24" CMP CULVERT				9.50	173		
179	91	163	2-36" CMP CULVERTS				9.70	163		
180	2	3	18" CMP CULVERT							
181	4	7	18" CMP CULVERT							
182	3	5	18" CMP CULVERT							
183	3	5	2-18" CMP CULVERTS							
184	34	62	18" CMP CULVERT							
185	10	18	18" CMP CULVERT							
186	22	36	18" HDPE CULVERT				12.65	36		
187	42	75	18" CMP CULVERT				2.27	75		
188	24	44	18" CMP CULVERT				3.44	44		
189	2	3	18" CMP CULVERT				5.92	8		
190 (53 JEF)	464	834	60" X 36" CMPA + 54" CMP CULVERTS	1.15	5.08	5.84	9.39	650	50	YES
191	27	49	18" CMP CULVERT				7.93	49		
192	12	19	24" CMP CULVERT				6.31	19		
193	3	5	18" CMP CULVERT				5.44	7		
194	71	117	24" CMP CULVERT				6.35	117		
195	8	13	15" CMP CULVERT				6.40	13		
196	12	21	15" CMP CULVERT				4.41	21		
197	3	6	24" CMP CULVERT				7.40	6		
198	19	32	15" CMP CULVERT				4.80	32		
199	2	3	15" CMP ELLIPTICAL CULVERT				6.13	7		
200	101	165	2- 36" CMP CULVERTS				10.21	165		
201	76	123	2-36" CMP CULVERTS				13.57	123		
202	7	12	18" CMP CULVERT				2.27	12		
203	126	210	2-36" CMP CULVERTS				10.28	210		
204	10	16	36" CMP CULVERT				14.21	16		
205	22	37	15" CMP CULVERT				7.39	37		
206	46	77	36" CMP CULVERT				14.09	77		
207	2	3	18" CMP CULVERT					3		
208	32	55	18" X 30" CMPA CULVERT				7.99	55		
209	42	81	18" X 30" CMPA CULVERT				8.13	81		
210	*1269	*2293	AT GRADE CROSSING (PAVED)	4.11	10.81	44.43	n/a	75	113	YES
211	49	86	15" CMP CULVERT				5.90	86		
212	7	12	18" X 30" CMPA CULVERT				7.20	12		
213	*198	*325	2-30" CMP CULVERTS	0.63	3.16	4.05				YES
214	73	130	24" CMP CULVERT				7.40	130		
215	158	283	2-20" X 27" CMPA CULVERTS				7.57	283		
216	45	79	18" RCP CULVERT				3.16	79		
217	2	3	36" CMP CULVERT				6.65	10		
218	5	8	36" CMP CULVERT				7.72	39		
219			NOT USED				n/a			
220			4" PVC SLEEVE, NOT FOR DRAINAGE							
221	6	10	24" CMP CULVERT							
222	266	449	2-36" RCP CULVERTS							
223	19	33	30" CMP CULVERT							
224	8	13	36" CMP CULVERT							
225	13	22	30" CMP CULVERT							
226	0	0	30" CMP CULVERT							
227	19	31	30" CMP CULVERT							
228	74	123	30" CMP CULVERT							

	Total Future Flows (cfs)			Overtopping	Overtopping	Overtopping	Culvert	Passable		Was Detailed
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Velocity(fps)	Flow**** (cfs)	Duration (min)	Analysis Done?***
229	170	279	36" CMP CULVERT							
230	57	93	DITCH				n/a			
231	26	44	CULVERT							
232	16	28	CULVERT							
233	43	72	CULVERT							
234	24	40	CULVERT							
235	80	145	AT GRADE CROSSING				n/a			
236	729	**233	AT GRADE CROSSING	1.00	3.76	3.76	n/a	244	38	YES
237	12	20	CULVERT							
238	1	3	CULVERT							
239		**2849	4-10' X 4' CBC	2.31	6.99	16.15	14.15	1182	62	YES
240		**2447	AT GRADE DIP CROSSING	4.15	5.12	21.25	n/a	650	70	YES
241 Nr 28(JEF)	*693	*1135	ARCH PIPE STORM DRAIN							
242		**685	4-36" RCP CULVERTS	0.65	1.89	1.23		Passable		
243			DRIVEWAY CULVERT							
244			DRIVEWAY CULVERT							
245			DRIVEWAY CULVERT							
*6-Hour Storm Duration										
**Taken from floodplain model										
***Detailed Analysis of these sites can be found in the Carefree DMP, Volume II, Appendix A										
****Passable flow is the total combined flow from the culvert (if applicable) plus the flow over the road that combined results in a flow of less than 1 foot over the road										

Appendix F
Flow Summary

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
UC8	39	22	81	82	40	45	82	83
UC9	49	28	83	82	42	46	83	82
CPC8	88	49	163	162	82	90	164	164
RCP89	87	49	161	159	81	87	162	160
UC18	25	12	54	56	43	46	85	82
UC19	19	10	41	39	27	29	54	53
CP1819	131	70	256	250	143	151	287	277
R1819	129	69	254	248	141	148	285	274
UC22	11	12	26	27	22	25	47	48
UC23	13	7	28	27	23	22	41	36
CP2223	150	86	304	295	175	182	356	340
R2223	149	86	301	292	173	180	354	337
UC28	33	39	79	79	66	70	135	126
R28	33	39	79	78	66	69	133	124
UC29	19	22	45	45	38	41	79	76
UC30	8	9	17	18	15	15	29	28
CP2930	204	141	438	427	278	284	573	534
R2930	204	140	436	423	276	280	566	530
UC34	33	31	71	71	59	57	112	99
CP34	232	155	496	477	309	310	630	580
R34	228	152	478	455	300	299	593	551
UC37	101	96	207	197	138	141	276	267
UC35	283	291	591	528	283	291	549	528
CP3537	453	387	917	877	610	644	1152	1158
R3537	450	384	911	872	603	636	1146	1147
UC49	78	74	134	123	78	74	134	123
UC31	215	211	473	814	361	365	748	716
CP3149	623	591	1305	1608	862	987	1668	1802
R3149	622	591	1303	1598	861	984	1663	1797
UC46	63	59	107	94	63	59	107	94
R46	62	57	104	92	62	57	104	92
UC45	157	147	266	235	157	147	266	235
UC47	50	48	87	79	50	48	87	79
CP4547	265	247	451	402	265	247	451	402
R4547	259	240	439	390	259	240	440	390
UC48	226	224	418	397	226	224	410	397
UC50	28	27	51	47	28	27	51	47
CP4850	821	954	1689	2335	1095	1309	2120	2467
R4850	821	948	1683	2308	1091	1298	2113	2449
UC51	95	92	170	156	105	99	190	164
UC57	36	40	74	72	36	40	74	72
CP5157	865	1031	1761	2447	1126	1345	2189	2551
R5157	860	1016	1756	2422	1121	1336	2180	2532
UC58	156	156	284	262	157	157	284	264
UC59	15	18	39	41	30	34	67	67
CP5859	929	1130	1881	2622	1190	1426	2315	2719
D5859S	462	562	935	1303	591	709	1151	1351
D5859N	467	569	946	1319	599	717	1164	1368
R5859N	466	562	944	1311	597	713	1160	1362
UC63	132	141	259	248	134	142	262	251
CP63	533	663	1064	1489	661	794	1285	1528
R63	532	661	1063	1480	660	793	1283	1522
UC66	31	36	68	79	37	41	78	76
UC62	408	423	791	762	417	431	819	775
CP6266	787	1065	1528	2173	906	1182	1742	2199

Appendix F
Flow Summary

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
R6266	786	1060	1527	2164	906	1177	1740	2187
D5859S	462	562	935	1303	591	709	1151	1351
R5859S	462	561	933	1288	591	707	1147	1342
UC64	6	6	5	5	6	3	12	11
CP64	465	564	935	1290	593	708	1152	1348
D64S	209	254	421	580	267	318	519	606
D64N	256	310	514	709	326	389	634	741
RD64N	255	307	512	697	325	387	630	730
UC87	9	12	24	30	19	28	50	49
CP87	259	317	527	723	331	395	643	743
RD87N	259	318	526	721	330	394	643	743
UC82	23	25	50	48	32	32	63	56
CP82	1030	1382	2017	2849	1216	1554	2343	2882
R82	1030	1380	2015	2842	1216	1550	2340	2875
D84S	93	30	279	686	9	82	432	703
D84N	938	1350	1736	2157	1208	1467	1908	2172
UC84	14	13	24	24	20	15	30	29
CP84	945	1359	1747	2174	1210	1474	1919	2183
R84	941	1329	1738	2153	1200	1454	1909	2163
UC79	58	68	138	139	61	71	145	142
UC78	275	263	103	449	266	263	491	449
CP7879	1019	1411	1837	2328	1265	1531	2076	2331
R7879	1019	1410	1837	2327	1265	1532	2075	2329
UC77	109	115	208	225	113	119	215	205
CP77	1068	1464	1913	2417	1304	1582	2169	2432
R77	1067	1460	1912	2416	1304	1580	2165	2429
UC89	54	61	119	122	74	81	153	148
CP89	1097	1500	1972	2500	1330	1613	2233	2505
R89	1094	1482	1965	2491	1323	1598	2223	2493
UC74	67	139	265	264	171	180	331	317
UC76	42	45	83	81	51	53	97	91
CP7476	81	179	342	339	219	230	426	406
R7476	81	179	341	339	219	230	424	404
UC75	180	292	368	365	220	233	431	410
CP75	246	426	699	692	434	453	852	808
R75	246	424	696	684	432	452	841	795
UC90	16	21	46	50	33	37	78	76
UC91	39	41	86	84	76	82	153	147
CP90EN	1263	1706	2383	3132	1517	1838	2692	3188
D84S	93	30	279	686	9	82	432	703
RD84S	83	31	279	685	9	84	432	706
D84iiN	80	30	249	576	9	82	372	592
D84iiS	4	1	31	110	1	3	60	114
RD84iS	2	0	21	79	0	1	47	85
UC94	12	11	22	18	12	11	22	18
CP94DS	10	10	37	94	9	10	63	101
R94DS	10	9	36	89	8	10	61	96
D84iiN	80	30	249	576	9	82	372	592
RD84iN	53	6	203	445	5	29	320	471
UC88	38	33	69	58	38	33	69	58
CP88EN	88	43	280	566	39	64	416	603
UC95	34	34	63	58	50	44	82	71
UC93	27	29	53	53	44	12	82	78
UC96	34	35	72	70	65	70	128	124

North Scottsdale Delineation - from DEI Professional Services

	Total Existing Flows (cfs)				Total Future Flows (cfs)			
Identifier	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr	10-yr 6-hr	10-yr 24-hr	100-yr 6-hr	100-yr 24-hr
SCP-7c					154		315	
SCP-7b					87		173	
SCP-7a					131		263	
RSCP7b					82		164	
SCP-7d					42		76	
RSCP7c					150		306	
CSCP7d					256		517	
RSCP7d					256		517	
SCP-4b					182		343	
CSCP07					580		1116	
RSCP07					576		1234	
RSCP4B					165		317	
SCP-4A					97		178	
CSCP06					620		1308	
RSCP06					617		1305	
CSCP04					884		1752	
Andora Hills and Galloway Washes Subbasin Flows - From JE Fuller (Appendix C of this report)								
GVW1	2199	2522	3749	4141	2270	2586	3860	4242
GVW2	2564	3256	4686	5492	3164	3937	5447	6408
GWW1_1	1269	1431	2427	2571	1301	1472	2473	2634
GWW1_2	609	593	1155	1110	688	660	1259	1206
GWW1_3	1026	1068	1876	1916	1026	1068	1876	1916
GWW1_4	682	646	1229	1170	686	649	1233	1173
GWW1_5	801	739	1345	1258	914	837	1497	1400
GWW1_6	503	439	899	794	509	443	904	797
GVW3_1	656	633	1227	1178	694	677	1294	1254
GVW3_2	716	682	1303	1248	739	711	1340	1294
GVW3_3	376	318	643	551	385	325	657	562
AHW1	698	553	1255	811	708	561	1258	814
AHW2	105	82	181	117	105	82	177	121
AHW3	326	265	666	464	422	337	781	520
AHW4	212	168	388	262	214	169	382	271
AHW5	240	191	447	289	299	239	514	321
AHW6	381	329	896	716	704	595	1344	986
AHW7	478	378	862	584	499	393	872	607
AHW8	845	678	1419	849	855	685	1416	862
AHW9	419	337	829	554	458	366	853	595

Table ES-3. * List of Sedimentation and Erosion Problem Areas			
River Mile	**Location**	**Problem Description**	**Priority**
Galloway Wash			
4.65	Pima Road	Downstream scour, paved at-grade crossing, sediment deposition on road, sedimentation during irrigation tailwater (?) runoff from development upstream of Pima Road	High
4.60	Residence (Pruett), right bank	Potential reflective scour on left bank Home in former avulsive channel path, flow split around home Home outside 100-year floodplain per most recent FIS modeling	Medium
4.55	Residence, left bank	Gunite bank protection – undercutting and flanking	Medium
4.43	Residence, right bank	Home above cut bank, no setback, no erosion protection	High
4.15	Golf course, left bank	Grass lined bank – slumping failures Timber pole bank protection – flanking, scour	Low
3.65	Tennis club, left bank	Lateral bank erosion, cutbanks, outside of bend	Low
3.57	Well, left bank	Earthen berm of loose sand vulnerable to erosion	Low
3.55	Carefree Drive	Paved at-grade crossing, upstream deposition, minor scour downstream	Low
3.51	Footbridge reach	Aggradation reported by resident, increases floodplain elevation	Medium
3.37	Dream St. bridge reach	Several headcuts progressing upstream of bridge, downstream scour Channel excavation oversteepened, devegetated, destabilized banks Bridge capacity less than 100-year – possible overtopping erosion hazards	Medium
3.30	Residence, left bank	Home within Level 1 setback near cutbanks	Medium
3.1-3.3	Rocking Chair Rd., residences	Homes built in former avulsion area, near aggrading reach	Medium
2.87	Downstream of Tranquil Ln.	Unprotected earthen berm blocks former active braid Large headcut and active bank erosion on left bank, vertical cut banks	Low High
2.66	Residence, left bank	Home located in former avulsive channel path Vertical block wall bank protection with downstream flanking and erosion undercutting bank vegetation	Medium
2.6	Residence, right bank	Home located in former active channel braid, unprotected earthen berm blocks flow into former braid, home encroaches natural floodplain	Medium
2.51	Scopa Trail at-grade crossing	Downstream scour, undercutting road section	Medium
2.3	Upstream Scopa Trail, left bank	Block retaining wall flanking on upstream end	Medium
2.28	Galloway Dr culverts	Overwidened cross section, sediment deposition in fringe cells	Medium
	Entire stream	Many homes within SS 5-96 Level 1 setback (33-59 ft.), subject to erosion Long-term degradation during large floods Lateral bank erosion during large floods	Medium

Table ES-3. *
List of Sedimentation and Erosion Problem Areas

River Mile	Location	Problem Description	Priority
Galloway Wash North Branch			
0.48	Residence, right bank	Unstable, unvegetated slope above gabion bank protection *Flanking of downstream end of gabion baskets	Medium
0.52	Paint Pony Dr. at-grade crossing	Downstream scour	Medium
1.00	Cow Track Dr. bank protection	Undercutting of grouted riprap along road embankment	Medium
0.5-1.6	Upstream of Cow Track Dr. at-grade crossing	Braided, avulsive channel pattern occupies entire floodplain	Low
	Entire stream	Long-term degradation during large floods Lateral bank erosion during large floods Channel avulsions during large floods	Low
Andora Hills Wash			
2.76	Holiday Ln. at-grade crossing	Downstream scour Upstream deposition	Low
2.66	Lazy Burro Rd. bridge	Undersized bridge, *scour from overtopping & flanking	Medium
2.31	Driveway crossing upstream of Town limit	Downstream scour Ponding upstream	Low
Grapevine Wash			
2.65	Montezuma Rd. at-grade crossing	Unpaved crossing, deposition in floodplain	Low
	Entire stream	Low floodplain with high avulsion potential, active braiding Floodplain development should be avoided Localized bank erosion, long-term degradation, and avulsions during floods	Low
Rowe Wash			
	Entire stream	Low floodplain with high avulsion potential, active braiding Floodplain development should be avoided Localized bank erosion, long-term degradation, and avulsions during floods	Low

See JEF, 2002 Table 4-1 and Exhibit 4-1 for an index of road crossing sedimentation problems.
See JEF, 2002 Exhibit 2-1 for a plot of historical channel positions and lateral channel movement.

*Table 1 in Carefree DMP Sedimentation Analysis by JE Fuller located in Carefree DMP Volume 2.

(1) 18" CMP CULVERT
(2) 49" X 39" CMPA CULVERT
(3) 2 - 71" X 47" CMPA CULVERTS
(4) 42" CMP CULVERT
(5) 36" CMP CULVERT
(6) 3 - 66" CMP CULVERTS
(7) 3 - 64" X 43" CMPA CULVERTS
(8) 2 - 42" X 29" CMPA CULVERTS
(9) 2 - 49" X 33" CMPA CULVERTS
(10) 21" CMP CULVERT
(11) 3 - 57" X 38" CMPA CULVERTS
(12) 18" CMP CULVERT
(13) 36" RGRCP CULVERT
(14) 24" RCP CULVERT
(15) 24" RCP CULVERT
(16) 24" RCP CULVERT
(17) 24" RCP CULVERT
(18) 24" RCP CULVERT
(19) 24" RCP CULVERT
(20) 2 - 8' X 3' CBC
(21) 2 - 24" RCP
(22) NOT FOUND IN FIELD
(23) 2 - 4' X 10' CBC
(23a) 24" RCP
(24) 24" RCP CULVERT
(25) 2 - 42" RCP CULVERTS
(26) 2 - 42" RCP CULVERTS
(27) 4 - 10' X 4' RCB CULVERTS
(28) 2 - 24" CMP CULVERTS
(29) 2 - 24" CMP CULVERTS
(30) 2 - 36" CMP CULVERTS
(31) 18" CMP CULVERTS
(32) 24" CMP CULVERTS
(33) 4 - 36" CMP CULVERTS
(34) 2 - 36" CMP CULVERTS
(35) 30" CMP CULVERTS
(36) 3 - 60" CMP
(37) 60" CMP CULVERT
(38) 18" CMP CULVERT
(39) 24" CMP CULVERT
(40) 24" CMP CULVERT
(41) 18" CMP CULVERT
(41a) 18" CMP CULVERT
(42) 60" CMP CULVERT
(43) 24" CMP CULVERT
(44) 18" CMP CULVERT
(45) 24" CMP CULVERT
(46) 30" CMP CULVERT
(47) DOWTOWN STORM DRAIN SYSTEM
(48) SINGLE GRATE CB
(49) 3 - 36" CMP CULVERTS
(50) 18" CMP CULVERT
(51) 18" CMP CULVERT
(52) 18" CMP CULVERT
(53) 18" CMP CULVERT
(54) 18" CMP CULVERT
(55) 4-36" CMP CULVERTS
(56) 24" CMP CULVERT
(57) 24" x 16" CMPA CULVERT
(58) 2 - 24" X 18" CMPA CULVERTS
(59) 4 - 24" X 18" CMPA CULVERTS
(60) 24" CULVERT
(61) 24" CULVERT
(62) 30" CMP CULVERT
(63) 36" CMP CULVERT
(64) 24" CMP CULVERT
(65) 24" CMP CULVERT
(66) 24" CMP CULVERT
(67) 30" CMP CULVERT
(68) 2-30" CMP CULVERTS
(69) 30" CMP CULVERT
(70) 48" CMP CULVERT (REFER TO 30)
(71) 30" CMP CULVERT (REFER TO 27)
(72) 24" CMP CULVERT
(73) 15" CMP CULVERT
(74) 15" CMP CULVERT
(75) 18" CMP CULVERT
(76) 18" CMP CULVERT
(77) 18" CMP CULVERT
(78) 2 - 30" CMP CULVERT
(79) 15" RGRCP
(80) 2-42" SD
(81) 24" CMP CULVERTS
(82) 21" CMP CULVERTS
(83) 27" CMP CULVERTS
(84) 30" CMP CULVERTS
(85) 48" CMP CULVERTS
(86) 36" CMP CULVERTS
(87) 48" CMP CULVERTS
(88) 48" CMP CULVERTS
(89) 48" CMP CULVERTS
(90) 30" CMP CULVERTS
(91) 24" CMP CULVERT
(92) 24" CMP CULVERT
(93) 30" CMP CULVERT
(94) 24" CMP CULVERT
(95) 24" CMP CULVERT
(96) 30" CMP CULVERT
(97) 6' WIDE GROUTED RIPRAP CHANNEL 6" D50
(98) 6' WIDE GROUTED RIPRAP CHANNEL 6" D50
(99) 24" CMP CULVERT
(100) 24" CULVERT
(101) 2 - 24" CMP CULVERTS
(102) 24" CMP CULVERT
(103) 18" CMP CULVERT
(104) 3-48" CMP CULVERTS
(105) 18" X 27" CMPA
(106) 24" CMP CULVERT
(107) 18" CMP CULVERT
(108) 18" X 27" CMPA CULVERT
(109) 18" RCP CULVERT
(110) 36" RCP CULVERT
(111) 36" PIPE CULVERT
(112) 24" PIPE CULVERT
(113) 24" PIPE CULVERT
(114) 24" PIPE CULVERT
(115) 24" PIPE CULVERT
(116) PAVED DIP CROSSING
(117) 24" PIPE CULVERT
(118) 18" CATTLE GUARD
(119) 18" CATTLE GUARD
(120) 24" PIPE CULVERT
(121) 24" PIPE CULVERT
(122) 24" PIPE CULVERT
(123) 30' WIDE 12' HIGH BRIDGE OVER GALLOWAY WASH
(124) 24" PIPE
(125) 18" PIPE
(126) 18" PIPE
(127) 1 - 58" X 36" CMPA
(128) 4-42" CMP CULVERTS
(129) 24" RGRCP
(130) 20 SY RIPRAP PROTECTION
(131) 1 - 36" + 2 - 58" CMPA CULVERTS (REFER TO 57)
(132) 2 - 20' X 4' RCB CULVERTS
(133) 1-18" CMP CULVERT
(134) 1-18" CMP CULVERT
(135) 2-21" X 15" ARCH CMP CULVERTS
(136) 2-18" CMP CULVERTS
(137) 36" X 24" CMPA CULVERTS
(138) AT-GRADE CROSSING W/ DUMPED RIPRAP
(139) 24" CMP CULVERT
(140) AT-GRADE CROSSING W/ CONC. CUTOFF WALL D/S CONC. PROTECTION OF EOP, SOME RIPRAP
(141) 24" CMP CULVERT
(142) AT-GRADE DIP CROSSING W/ CONC. SPILLWAY DWNSTRM
(143) 30" CMP CULVERT
(144) AT-GRADE DIP CROSSING W/ CONC CUTOFF WALL DWNSTRM
(145) 2, 30" CMP CULVERTS
(146) 24" CMP CULVERT
(147) 3 -30" CMP CULVERTS
(148) 3 - 30" CMP DRIVEWAY WASH CROSSING
(149) 24" CMP CULVERT
(150) 24" CMP CULVERT
(151) 2 - 36" CMP CULVERTS
(152) 24" CMP CULVERTS
(153) 2 - 36" CMP CULVERTS
(154) 24" CMP CULVERT
(155) 24" CMP CULVERT
(156) AT-GRADE CROSSING
(157) 30" CMP CULVERT
(158) AT-GRADE DIP CROSSING
(159) AT-GRADE DIP CROSSING
(160) AT-GRADE DIP CROSSING
(161) AT-GRADE DIP CROSSING
(162) AT-GRADE DIP CROSSING
(163) 24" CMP CULVERT
(164) 36" CMP CULVERT
(165) CONCRETE AT-GRADE DIP CROSSING
(166) CONCRETE AT-GRADE DIP CROSSING
(167) CONCRETE AT-GRADE DIP CROSSING
(168) 18" CMP CULVERT
(169) AT-GRADE DIP CROSSING
(170) AT-GRADE DIP CROSSING (REFER TO 37)
(171) AT-GRADE DIP CROSSING
(172) AT-GRADE DIP CROSSING
(173) 30" CMP CULVERT
(174) 24" CULVERT
(175) 18" CMP CULVERT
(176) 18" CMP CULVERT
(177) 18" CMP CULVERT
(178) 24" CMP CULVERT
(179) 2 - 36" CMP CULVERTS
(180) 18" CMP W/ GRATE INLET
(181) 18" CMP W/ GRATE INLET
(182) 18" CMP W/ GRATE INLET
(183) 2 - 18" CMP W/ GRATE INLET
(184) 18" CMP W/ GRATE INLET
(185) 18" CMP W/ GRATE INLET
(186) 18" HDPE CULVERT
(187) 18" CMP CULVERT
(188) 18" CMP CULVERT
(189) 18" CMP CULVERT
(190) 60" x 36" CMPA + 54" CMP, GROUTED OVERFLOW (REFER TO 53)
(191) 18" CMP CULVERT
(192) 24" CMP CULVERT
(193) 18" CMP CULVERT
(194) 24" CMP CULVERT
(195) 15" CMP CULVERT
(196) 15" CMP CULVERT
(197) 24" CMP CULVERT
(198) 15" CMP ELLIPTICAL CULVERT
(199) 2 - 36" CMP CULVERTS
(201) 2 - 36" CMP CULVERTS
(202) 18" CMP CULVERT
(203) 2 - 36" CMP CULVERTS
(204) 36" CMP CULVERT
(205) 15" CMP CULVERT
(206) 36" CMP CULVERT
(207) 18" CMP CULVERT
(208) 18" X 30" CMPA CULVERT
(209) 18" X 30" CMPA CULVERT
(210) PAVED DIP CROSSING
(211) 15" CMP CULVERT
(212) 18" X 30" CMPA CULVERT
(213) 2 - 30" CMP CULVERTS
(214) 24" CMP CULVERT
(215) 24" CMP CULVERT
(216) 2 - 20" X 27" CMPA CULVERTS
(217) 18" RCP CULVERT
(218) 36" CMP CULVERT
(219) NOT USED
(220) 4" PVC SLEEVE
(221) 24" CMP CULVERT
(222) 2 - 36" RCP CULVERTS
(223) 30" CMP CULVERT
(224) 36" CMP CULVERT
(225) 30" CMP CULVERT
(226) 30" CMP CULVERT
(227) 30" CMP CULVERT
(228) 30" CMP CULVERT
(229) 36" CMP CULVERT
(230) DITCH
(231) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(232) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(233) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(234) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(235) AT-GRADE DIP CROSSING
(236) AT-GRADE DIP CROSSING
(237) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(238) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(239) AT-GRADE DIP CROSSING
(240) AT-GRADE DIP CROSSING
(241) ARCH PIPE STORM DRAIN SYSTEM
(242) 4 - 36" RCP CULVERTS
(243) DRIVEWAY CULVERT
(244) DRIVEWAY CULVERT
(245) DRIVEWAY CULVERT

1 PAVED DIP CROSSING
2 PAVED DIP CROSSING
3 PAVED DIP CROSSING
4 PAVED DIP CROSSING
5 PAVED DIP CROSSING
6 PAVED DIP CROSSING
7 CULVERT CROSSING
8 PAVED DIP CROSSING
9 PAVED DIP CROSSING
10 PAVED DIP CROSSING
13 UNPAVED DIP CROSSING
14 PAVED DIP CROSSING
15 CULVERT CROSSING
16 PAVED DIP CROSSING
22 PAVED DIP CROSSING
24 PAVED DIP CROSSING
25 PAVED DIP CROSSING
27 CULVERT CROSSING (REFER TO 71)
28 PAVED DIP CROSSING
29 PAVED DIP CROSSING
30 CULVERT CROSSING (REFER TO 70)
41 PAVED DIP CROSSING
42 PAVED DIP CROSSING
43 PAVED DIP CROSSING
44 CULVERT CROSSING
45 PAVED DIP CROSSING
46 PAVED DIP CROSSING
47 PAVED DIP CROSSING
48 PAVED DIP CROSSING
49 PAVED DIP CROSSING
50 PAVED DIP CROSSING
51 PAVED DIP CROSSING
52 PAVED DIP CROSSING
53 CULVERT CROSSING (REFER TO 90)
54 UNPAVED DIP CROSSING
55 PAVED DIP CROSSING
57 CULVERT CROSSING (REFER TO 131)
60 UNPAVED DIP CROSSING
61 UNPAVED DIP CROSSING
62 UNPAVED DIP CROSSING
63 PAVED DIP CROSSING
65 PAVED DIP CROSSING
66 UNPAVED DIP CROSSING
69 UNPAVED DIP CROSSING
70 UNPAVED DIP CROSSING
71 UNPAVED DIP CROSSING

ROWE WASH
GRAPEVINE WASH
MEXICAN WASH
GALLOWAY WASH NORTH TRIBUTARY
GALLOWAY WASH MIDDLE BRANCH
GALLOWAY WASH
GALLOWAY WASH LOWER BRANCH
SANDRA HILLS WASH
WINDMILL WASH
STAGECOACH PASS WASH TRIB
STAGECOACH PASS WASH
S. PIMA WASH
STAGECOACH PASS WASH
UNNAMED CENTRAL TRIB. TO CAVE CREEK

NOT TO SCALE

LEGEND

(53) DRAINAGE FEATURE AND NUMBER IDENTIFIER
(A1) DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

CULVERT LOCATIONS TAKEN FROM VARIOUS IMPROVEMENT PLANS, AS-BUILT PLANS, REPORTS, AND FIELD SURVEYS.

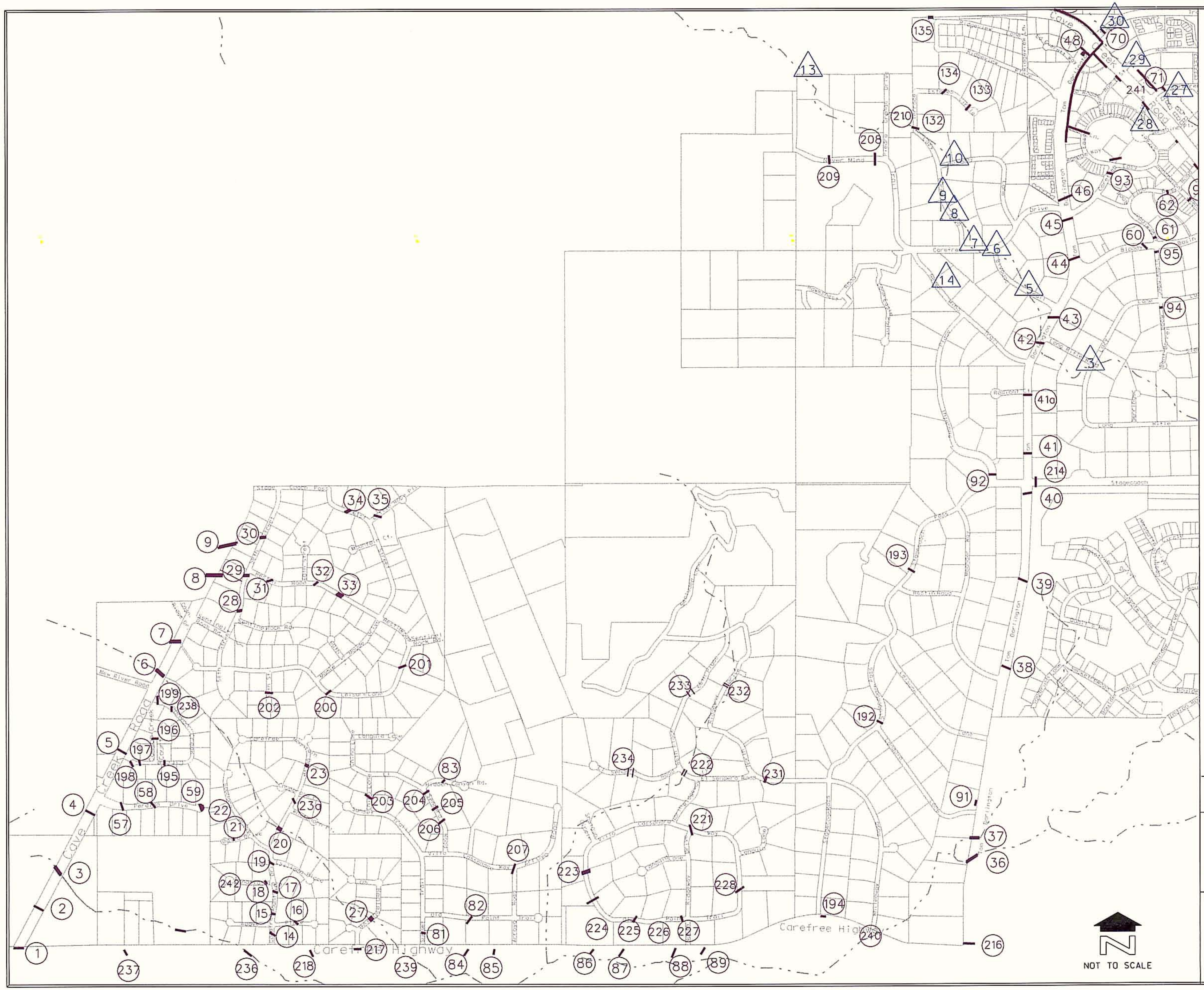
ACRONYMS:

CBC = CONCRETE BOX CULVERT
CMP = CORREGATED METAL PIPE
CMPA = CORREGATED METAL PIPE ARCH
HDPE = HIGH DENSITY POLYETHYLENE
PVC = POLYVINYL CHLORIDE
RCP = REINFORCED CONCRETE PIPE
RGRCP = RUBBER GASKETED REINFORCED CONCRETE PIPE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2 - EXISTING FACILITIES
CAREFREE DRAINAGE MASTER PLAN
F.C.D. CONTRACT NO. 2000C037



LEGEND

DRAINAGE FEATURE AND NUMBER IDENTIFIER

DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

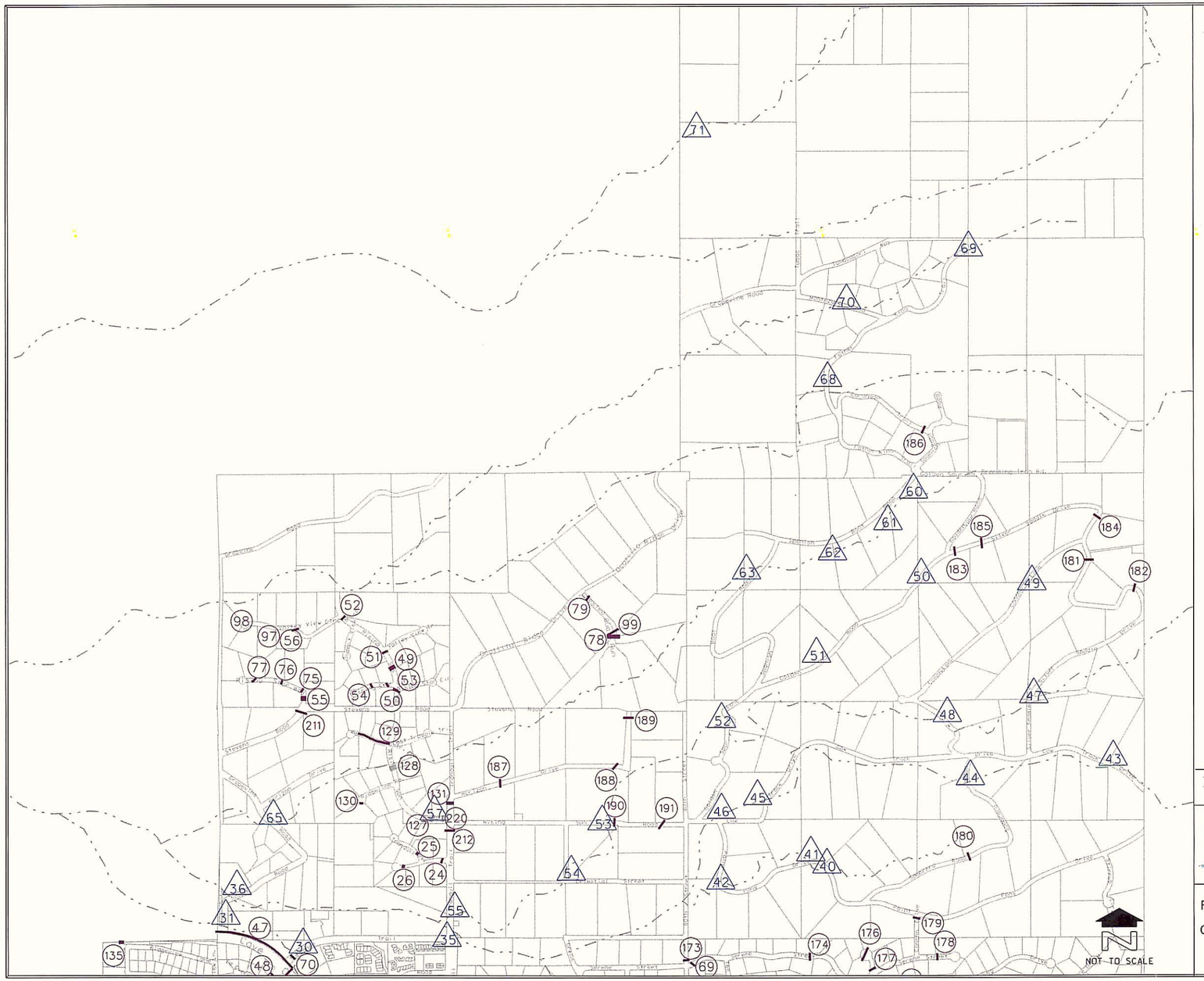
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2A - EXISTING FACILITIES

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

DRAINAGE FEATURE AND NUMBER IDENTIFIER

DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

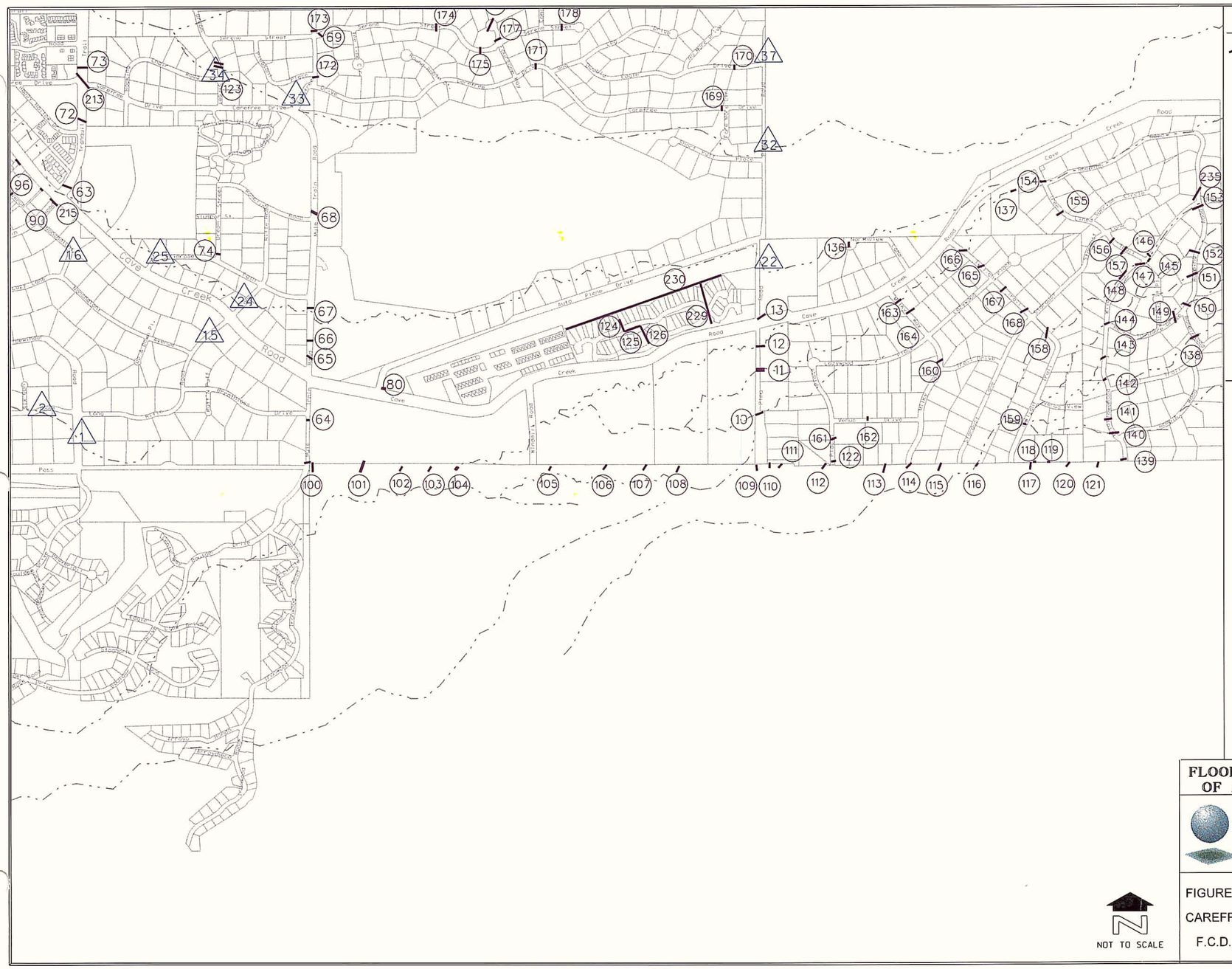
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2B - EXISTING FACILITIES

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

DRAINAGE FEATURE AND NUMBER IDENTIFIER

DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

NOT TO SCALE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2C - EXISTING FACILITIES

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

CAREFREE
DRAINAGE MASTER PLAN

Legend

Thalweg

Stream Station 25

Sedimentation and Erosion Problem Area

Reach with Sedimentation and Erosion Problem

N

SCALE

1000 0 500 1000 2000

(IN FEET)
1 inch = 1000 ft.

Figure 1
Level 1 Sedimentation Analysis

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

In conjunction with:

CH2MHILL

Flood Control District of Maricopa County

(1) 18" CMP CULVERT
(2) 49" X 39 " CMPA CULVERT
(3) 2 - 71" X 47 " CMPA CULVERTS
(4) 42 " CMP CULVERT
(5) 36 " CMP CULVERT
(6) 3 - 66" CMP CULVERTS
(7) 3 - 64" X 43" CMPA CULVERTS
(8) 2 - 42" X 29" CMPA CULVERTS
(9) 2 - 49" X 33" CMPA CULVERTS
(10) 21" CMP CULVERT
(11) 3 - 57" X 38" CMPA CULVERTS
(12) 18" CMP CULVERT
(13) 36" RGRCP CULVERT
(14) 24" RCP CULVERT
(15) 24" RCP CULVERT
(16) 24" RCP CULVERT
(17) 24" RCP CULVERT
(18) 24" RCP CULVERT
(19) 24" RCP CULVERT
(20) 2 - 8' X 3' CBC
(21) 2 - 24" RCP
(22) NOT FOUND IN FIELD
(23) 2 - 4' X 10' CBC
(23a) 24" RCP
(24) 24" RCP CULVERT
(25) 2 - 42" RCP CULVERTS
(26) 2 - 42" RCP CULVERTS
(27) 4 - 10' X 4' RCB CULVERTS
(28) 2 - 24" CMP CULVERTS
(29) 2 - 24" CMP CULVERTS
(30) 2 - 36" CMP CULVERTS
(31) 18" CMP CULVERTS
(32) 24" CMP CULVERTS
(33) 4 - 36" CMP CULVERTS
(34) 2 - 36" CMP CULVERTS
(35) 30" CMP CULVERTS
(36) 3 - 60" CMP
(37) 60" CMP CULVERT
(38) 18" CMP CULVERT
(39) 24" CMP CULVERT
(40) 24" CMP CULVERT
(41) 18" CMP CULVERT
(41a) 18" CMP CULVERT
(42) 24" CMP CULVERT
(43) 18" CMP CULVERT
(44) 18" CMP CULVERT
(45) 24" CMP CULVERT
(46) 30" CMP CULVERT
(47) DOWTOWN STORM DRAIN SYSTEM
(48) SINGLE GRATE CB
(49) 3 - 36" CMP CULVERTS
(50) 18" CMP CULVERT
(51) 18" CMP CULVERT
(52) 18" CMP CULVERT
(53) 18" CMP CULVERT
(54) 18" CMP CULVERT
(55) 4-36" CMP CULVERTS
(56) 24" CMP CULVERT
(57) 24" x 18" CMPA CULVERT
(58) 2 - 24" X 18" CMPA CULVERTS
(59) 4 - 24 ' X 18" CMPA CULVERTS
(60) 24" CULVERT
(61) 24" CULVERT
(62) 30" CMP CULVERT
(63) 36" CMP CULVERT
(64) 24" CMP CULVERT
(65) 24" CMP CULVERT
(66) 24" CMP CULVERT
(67) 30" CMP CULVERT
(68) 2-30" CMP CULVERTS
(69) 30" CMP CULVERT
(70) 48" CMP CULVERT (REFER TO 30)
(71) 30" CMP CULVERT (REFER TO 27)
(72) 24" CMP CULVERT
(73) 15" CMP CULVERT
(74) 15" CMP CULVERT
(75) 18" CMP CULVERT
(76) 18" CMP CULVERT
(77) 18" CMP CULVERT
(78) 2 - 30" CMP CULVERT
(79) 15" RGRCP
(80) 2-42" SD
(81) 24" CMP CULVERTS
(82) 21" CMP CULVERTS
(83) 27" CMP CULVERTS
(84) 30" CMP CULVERTS
(85) 48" CMP CULVERTS
(86) 36" CMP CULVERTS
(87) 48" CMP CULVERTS
(88) 48" CMP CULVERTS
(89) 48" CMP CULVERTS
(90) 30" CMP CULVERTS
(91) 24" CMP CULVERT
(92) 24" CMP CULVERT
(93) 30" CMP CULVERT
(94) 24" CMP CULVERT
(95) 24" CMP CULVERT
(96) 30" CMP CULVERT
(97) 8' WIDE GROUTED RIPRAP CHANNEL 6" D50
(98) 8' WIDE GROUTED RIPRAP CHANNEL 6" D50
(99) 24" CMP CULVERT
(100) 24" CULVERT
(101) 2 - 24" CMP CULVERTS
(102) 24" CMP CULVERT
(103) 18" CMP CULVERT
(104) 3-48" CMP CULVERTS
(105) 18" X 27" CMPA
(106) 24" CMP CULVERT
(107) 18" CMP CULVERT
(108) 18" X 27" CMPA CULVERT
(109) 18" RCP CULVERT
(110) 36" RCP CULVERT
(111) 36" PIPE CULVERT
(112) 24" PIPE CULVERT
(113) 24" PIPE CULVERT
(114) 24" PIPE CULVERT
(115) 24" PIPE CULVERT
(116) PAVED DIP CROSSING
(117) 24" PIPE CULVERT
(118) 18" CATTLE GUARD
(119) 18" CATTLE GUARD
(120) 24" PIPE CULVERT
(121) 24" PIPE CULVERT
(122) 24" PIPE CULVERT
(123) 30' WIDE 12' HIGH BRIDGE OVER GALLOWAY WASH
(124) 24" PIPE
(125) 18" PIPE
(126) 18" PIPE
(127) 1 - 58" X 36" CMPA
(128) 4-42" CMP CULVERTS
(129) 24" RGRCP
(130) 20 SY RIPRAP PROTECTION
(131) 1 - 36" + 2 - 58" CMPA CULVERTS (REFER TO 57)
(132) 2 - 20' X 4' RCB CULVERTS
(133) 1-18" CMP CULVERT
(134) 1-18" CMP CULVERT
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(136) 2-18" CMP CULVERTS
(137) 36" X 24" CMPA CULVERTS
(138) AT-GRADE CROSSING W/ DUMPED RIPRAP
(139) 24" CMP CULVERT
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(141) 24" CMP CULVERT
(142) AT-GRADE DIP CROSSING W/ CONC. SPILLWAY DWNSTRM
(143) 30" CMP CULVERT
(144) AT-GRADE DIP CROSSING W/ CONC CUTOFF WALL DWNSTRM
(145) 2, 30" CMP CULVERTS
(146) 24" CMP CULVERT
(147) 3 -30" CMP CULVERTS
(148) 3 - 30" CMP DRIVEWAY WASH CROSSING
(149) 24" CMP CULVERT
(150) 24" CMP CULVERT
(151) 2 - 36" CMP CULVERTS
(152) 24" CMP CULVERTS
(153) 2 - 36" CMP CULVERTS
(154) 24" CMP CULVERT
(155) 24" CMP CULVERT
(156) AT-GRADE CROSSING
(157) 30" CMP CULVERT
(158) AT-GRADE DIP CROSSING
(159) AT-GRADE DIP CROSSING
(160) AT-GRADE DIP CROSSING
(161) AT-GRADE DIP CROSSING
(162) AT-GRADE DIP CROSSING
(163) 24" CMP CULVERT
(164) 36" CMP CULVERT
(165) CONCRETE AT-GRADE DIP CROSSING
(166) CONCRETE AT-GRADE DIP CROSSING
(167) CONCRETE AT-GRADE DIP CROSSING
(168) 18" CMP CULVERT
(169) AT-GRADE DIP CROSSING
(170) AT-GRADE DIP CROSSING (REFER TO 37)
(171) AT-GRADE DIP CROSSING
(172) AT-GRADE DIP CROSSING
(173) 30" CMP CULVERT
(174) 24" CULVERT
(175) 18" CMP CULVERT
(176) 18" CMP CULVERT
(177) 18" CMP CULVERT
(178) 24" CMP CULVERT
(179) 2 - 36" CMP CULVERTS
(180) 18" CMP W/ GRATE INLET
(181) 18" CMP W/ GRATE INLET
(182) 18" CMP W/ GRATE INLET
(183) 2 - 18" CMP W/ GRATE INLET
(184) 18" CMP W/ GRATE INLET
(185) 18" CMP W/ GRATE INLET
(186) 18" HDPE CULVERT
(187) 18" CMP CULVERT
(188) 18" CMP CULVERT
(189) 18" CMP CULVERT
(190) 60" x 36" CMPA + 54" CMP, GROUTED OVERFLOW (REFER TO 53)
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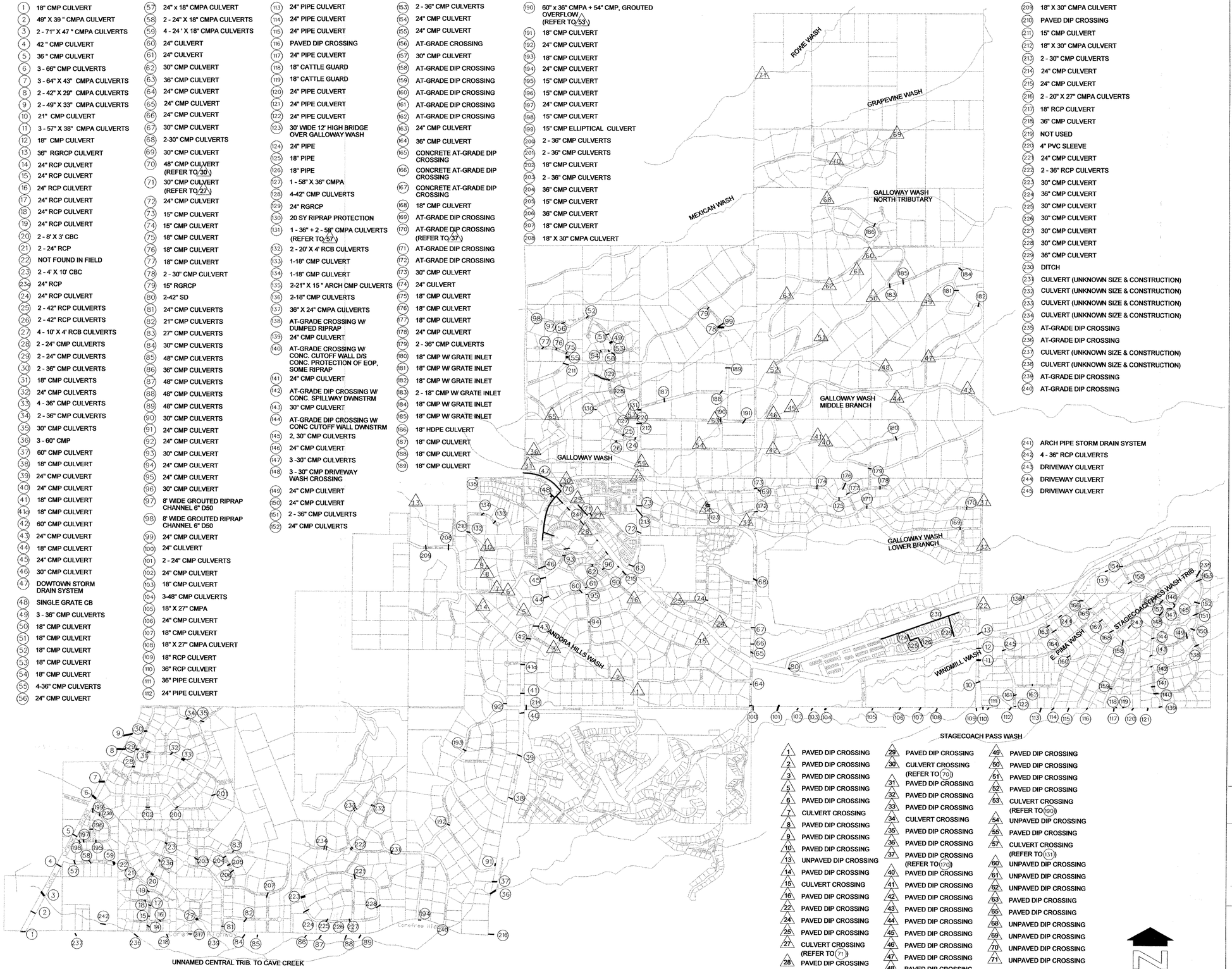
(193) 18" CMP CULVERT
(194) 24" CMP CULVERT
(195) 15" CMP CULVERT
(196) 15" CMP CULVERT
(197) 24" CMP CULVERT
(198) 15" CMP CULVERT
(199) 15" CMP ELLIPTICAL CULVERT
(200) 2 - 36" CMP CULVERTS
(201) 2 - 36" CMP CULVERTS
(202) 18" CMP CULVERT
(203) 2 - 36" CMP CULVERTS
(204) 36" CMP CULVERT
(205) 15" CMP CULVERT
(206) 36" CMP CULVERT
(207) 18" CMP CULVERT
(208) 18" X 30" CMPA CULVERT
(209) 18" X 30" CMPA CULVERT
(210) PAVED DIP CROSSING
(211) 15" CMP CULVERT
(212) 18" X 30" CMPA CULVERT
(213) 2 - 30" CMP CULVERTS
(214) 24" CMP CULVERT
(215) 24" CMP CULVERT
(216) 2 - 20" X 27" CMPA CULVERTS
(217) 18" RCP CULVERT
(218) 36" CMP CULVERT
(219) NOT USED
(220) 4" PVC SLEEVE
(221) 24" CMP CULVERT
(222) 2 - 36" RCP CULVERTS
(223) 30" CMP CULVERT
(224) 36" CMP CULVERT
(225) 30" CMP CULVERT
(226) 30" CMP CULVERT
(227) 30" CMP CULVERT
(228) 30" CMP CULVERT
(229) 36" CMP CULVERT
(230) DITCH
(231) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(232) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(233) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(234) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(235) AT-GRADE DIP CROSSING
(236) AT-GRADE DIP CROSSING
(237) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(238) CULVERT (UNKNOWN SIZE & CONSTRUCTION)
(239) AT-GRADE DIP CROSSING
(240) AT-GRADE DIP CROSSING
(241) ARCH PIPE STORM DRAIN SYSTEM
(242) 4 - 36" RCP CULVERTS
(243) DRIVEWAY CULVERT
(244) DRIVEWAY CULVERT
(245) DRIVEWAY CULVERT



1 PAVED DIP CROSSING
2 PAVED DIP CROSSING
3 PAVED DIP CROSSING
5 PAVED DIP CROSSING
6 PAVED DIP CROSSING
7 CULVERT CROSSING
8 PAVED DIP CROSSING
9 PAVED DIP CROSSING
10 PAVED DIP CROSSING
13 UNPAVED DIP CROSSING
14 PAVED DIP CROSSING
15 CULVERT CROSSING
16 PAVED DIP CROSSING
22 PAVED DIP CROSSING
24 PAVED DIP CROSSING
25 PAVED DIP CROSSING
27 CULVERT CROSSING (REFER TO 71)
28 PAVED DIP CROSSING
29 PAVED DIP CROSSING
30 CULVERT CROSSING (REFER TO 70)
31 PAVED DIP CROSSING
32 PAVED DIP CROSSING
33 PAVED DIP CROSSING
34 CULVERT CROSSING
35 PAVED DIP CROSSING
36 PAVED DIP CROSSING
37 PAVED DIP CROSSING (REFER TO 170)
40 PAVED DIP CROSSING
41 PAVED DIP CROSSING
42 PAVED DIP CROSSING
43 PAVED DIP CROSSING
44 PAVED DIP CROSSING
45 PAVED DIP CROSSING
46 PAVED DIP CROSSING
47 PAVED DIP CROSSING
48 PAVED DIP CROSSING
49 PAVED DIP CROSSING
50 PAVED DIP CROSSING
51 PAVED DIP CROSSING
52 PAVED DIP CROSSING
53 CULVERT CROSSING (REFER TO 190)
54 UNPAVED DIP CROSSING
55 PAVED DIP CROSSING
57 CULVERT CROSSING (REFER TO 131)
60 UNPAVED DIP CROSSING
61 UNPAVED DIP CROSSING
62 UNPAVED DIP CROSSING
63 PAVED DIP CROSSING
65 PAVED DIP CROSSING
68 UNPAVED DIP CROSSING
69 UNPAVED DIP CROSSING
70 UNPAVED DIP CROSSING
71 UNPAVED DIP CROSSING

NOT TO SCALE

LEGEND

(15.3) DRAINAGE FEATURE AND NUMBER IDENTIFIER
10 DRAINAGE FEATURE AND NUMBER IDENTIFIER FROM J.E. FULLER (APPENDIX C OF REPORT)

NOTES

CULVERT LOCATIONS TAKEN FROM VARIOUS IMPROVEMENT PLANS, AS-BUILT PLANS, REPORTS, AND FIELD SURVEYS.

ACRONYMNS:

CBC = CONCRETE BOX CULVERT
CMP = CORREGATED METAL PIPE
CMPA = CORREGATED METAL PIPE ARCH
HDPE = HIGH DENSITY POLYETHYLENE
PVC = POLYVINYL CHLORIDE
RCP = REINFORCED CONCRETE PIPE
RGRCP = RUBBER GASKETED REINFORCED CONCRETE PIPE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 2 - EXISTING FACILITIES
CAREFREE DRAINAGE MASTER PLAN
F.C.D. CONTRACT NO. 2000C037

LEGEND

- STUDY AREA AND TOWN BOUNDARIES
- UC21 BASIN NAME
- UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK BASIN BOUNDARY
- UNNAMED CENTRAL TRIBUTARY TO CAVE CREEK SUB-BASIN BOUNDARIES
- SUB-BASIN BOUNDARIES (BY OTHERS)
- MODEL REACHES
- WATERCOURSES

NOTES

ROWE WASH
GRAPEVINE WASH
MEXICAN WASH
GALLOWAY WASH NORTH TRIBUTARY
GALLOWAY AND ANDORA HILLS DELINEATION STUDY BASINS
GALLOWAY WASH MIDDLE BRANCH
GALLOWAY WASH
GALLOWAY WASH LOWER BRANCH
ANDORA HILLS WASH
WINDROCK WASH
E. PIMA WASH
UNNAMED TRIB TO STRAIGHARCH PIMA WASH
NORTH SCOTTSDALE DELINEATION STUDY BASINS
UNNAMED CENTRAL TRIB. TO CAVE CREEK

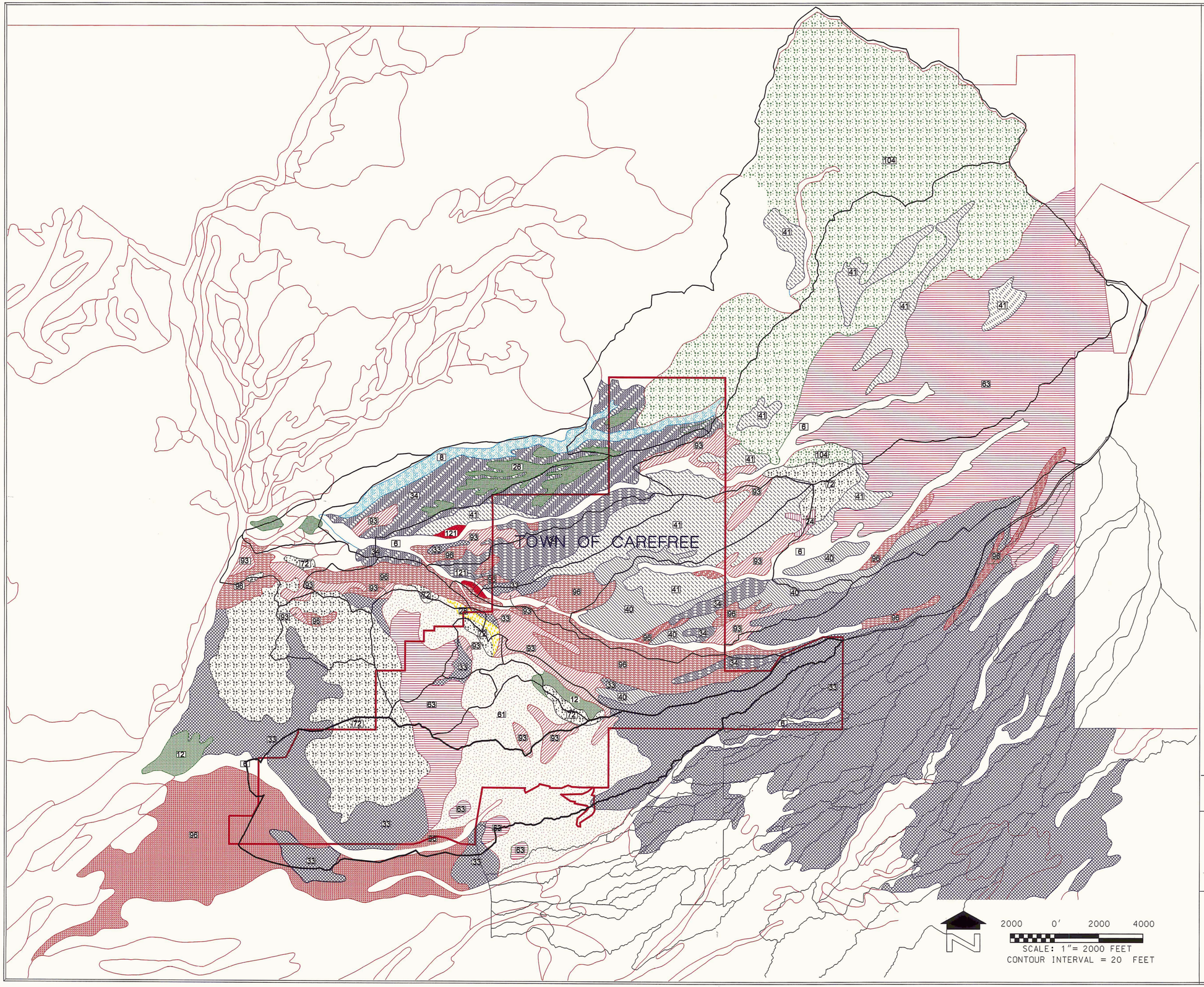
UC89 UC74 UC76 UC75 UC90 UC91 UC93 UC95 UC96 UC94 UC77 UC78 UC88 UC87 UC84 UC82 UC62 UC63 UC64 UC66 UC48 UC58 UC59 UC46 UC47 UC45 UC49 UC50 UC51 UC35 UC37 UC31 UC34 UC30 UC28 UC29 UC18 UC19 UC22 UC23 UC8 UC9

2000 0′ 2000 4000
SCALE: 1″= 2000 FEET
CONTOUR INTERVAL = 20 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 3 - HYDROLOGY BASINS
CAREFREE DRAINAGE MASTER PLAN
F.C.D. CONTRACT NO. 2000C037



LEGEND

- STUDY AREA AND TOWN BOUNDARIES
- 6 SANDY LOAM - VERY GRAVELLY SANDY LOAM
- 8 VERY COBBLY SANDY LOAM
- 12 CLAY
- 26 CLAY
- 28 CLAY
- 33 VERY GRAVELLY LOAM
- 34 VERY GRAVELLY LOAM
- 40 VERY GRAVELLY LOAM - GRAVELLY CLAY LOAM
- 41 VERY GRAVELLY LOAM - GRAVELLY CLAY LOAM
- 61 EXT. GRAVELLY SANDY - GRAVELLY SANDY LOAM
- 63 EXT. GRAVELLY SANDY CLAY - GRAVELLY SANDY LOAM - ROCK OUTCROP
- 72 CLAY LOAM - ROCK OUTCROP
- 93 GRAVELLY LOAM - LOAM
- 96 GRAVELLY CLAY LOAM - CLAY LOAM
- 104 ROCK OUTCROP - GRAVELLY CLAY LOAM
- 121 CLAY LOAM - SANDY LOAM

NOTES

TAKEN FROM DIGITAL INFORMATION SUPPLIED BY THE FCDMC AND THE USDA/SCS "SOIL SURVEY OF AGUILA-CAREFREE AREA, PARTS OF MARICOPA AND PINAL COUNTIES, ARIZONA".

SEE REFERENCES CITED ABOVE AND REPORT FOR FURTHER SOIL UNIT INFORMATION.

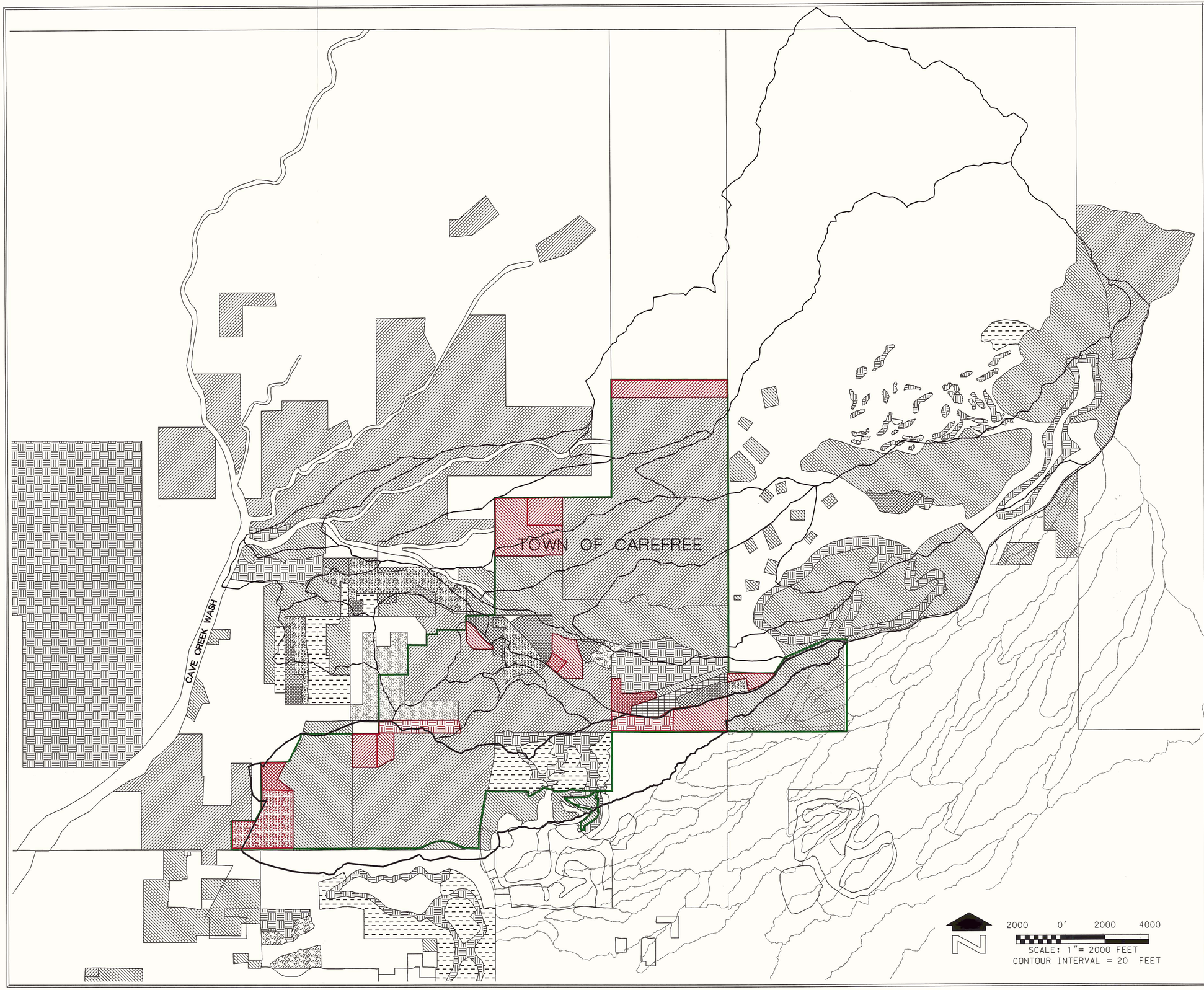
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 3 - SOILS MAP

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037



LEGEND

EXISTING LAND USAGES (BLACK)

- STUDY AREA AND TOWN BOUNDARIES
- RURAL
  1 UNIT OR LESS PER ACRE
- LARGE LOT RESIDENTIAL
  1 TO 2 UNITS PER ACRE
- MEDIUM DENSITY RESIDENTIAL
  5 TO 15 UNITS PER ACRE
- SMALL LOT RESIDENTIAL
  2 TO 5 UNITS PER ACRE
- RECREATIONAL OPEN SPACE
- EDUCATIONAL
- VACANT (*FUTURE LAND USE SHOWN)
- AIRPORT
- HOTEL, MOTEL AND RESORT
- DEDICATED OR NON-DEVELOPABLE OPEN SPACE
- NEIGHBORHOOD RETAIL CENTER

FUTURE LAND USAGES (RED)

- FUTURE RURAL
  1 UNIT OR LESS PER ACRE
- FUTURE LARGE LOT RESIDENTIAL
  1 TO 2 UNITS PER ACRE
- FUTURE MEDIUM DENSITY RESIDENTIAL
  5 TO 15 UNITS PER ACRE
- FUTURE RECREATIONAL OPEN SPACE
- SPECIAL PLANNING

NOTES

EXISTING LAND USE TAKEN FROM: DIGITAL INFORMATION AND AERIAL PHOTOGRAPHS SUPPLIED BY FCDMC, DATED 2000

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 4 - EXISTING AND FUTURE LAND USE

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

LEGEND

- UC30 — SUBBASIN
- R29 — ROUTING
- D84 — DIVERSION
- CP2138 — COMBINE
  - HEC-1 IDENTIFIER
- UNNAMED CENTRAL TRIB. TO CAVE CREEK FLOW PATH (APPROXIMATE)

NOTES

GALLOWAY AND ANDORA HILLS DELINEATION STUDY BASINS

NORTH SCOTTSDALE DELINEATION STUDY BASINS

1000′ 0′ 1000′ 2000′

SCALE: 1"= 1000 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 4 - HEC1 SCHEMATIC
UNNAMED CENTRAL TRIBUTARY
TO CAVE CREEK
CAREFREE DRAINAGE MASTER PLAN
F.C.D. CONTRACT NO. 2000C037

LEGEND

- STUDY AREA AND TOWN BOUNDARIES
- UC21 BASIN NAME
- BASIN BOUNDARIES
- FLOW PATH, WATERCOURSE, OR ROUTING REACH

NOTES

GVW1
GVW2
GVW3.2
GVW3.1
GVW3.3
GWW1.1
GWW1.4
GWW1.6
GWW1.2
GWW1.3
GWW1.5
AHW9
AHW7
AHW6
AHW8
AHW5
AHW2
AHW4
AHW3
AHW1
CAVE CREEK RECREATION AREA
CAREFREE AIRPORT
UC74
UC76
UC90
UC91
UC89
UC77
UC62
UC78
UC48
UC58
UC49
UC63
UC50
UC93
UC95
UC96
UC88
UC94
UC87
UC59
UC51
UC64
UC66
UC82
UC84
UC46
UC47
UC45
UC35
UC37
UC51
UC34
UC30
UC28
UC29
UC23
UC22
UC18
UC19
UC10
UC9
UC8
UE2
UE3
UE1
UE5
UE4
UE6
UE100
UE7
UE11
UE12
UE13
UE21

N

2000 0′ 2000 4000

SCALE: 1″= 2000 FEET
CONTOUR INTERVAL = 20 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

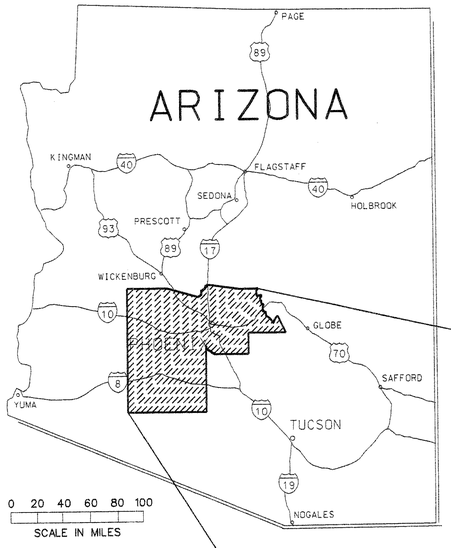
FIGURE 5 - HYDROLOGY BASINS
CAREFREE DRAINAGE MASTER PLAN
F.C.D. CONTRACT NO. 2000C037

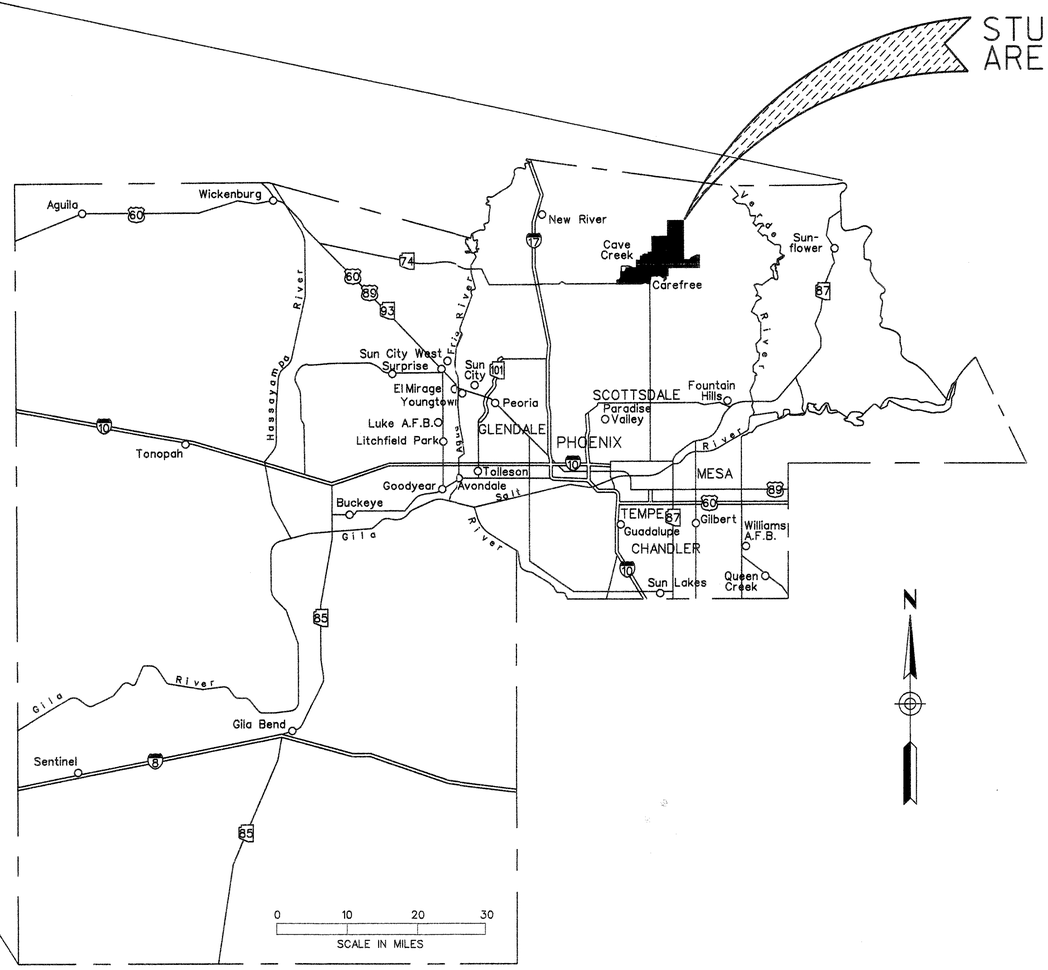
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

IN COOPORATION 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





MARICOPA COUNTY

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.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
25396
ALAN D. PEECE
Date Signed 5/7/04
ARIZONA, U.S.A.

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.

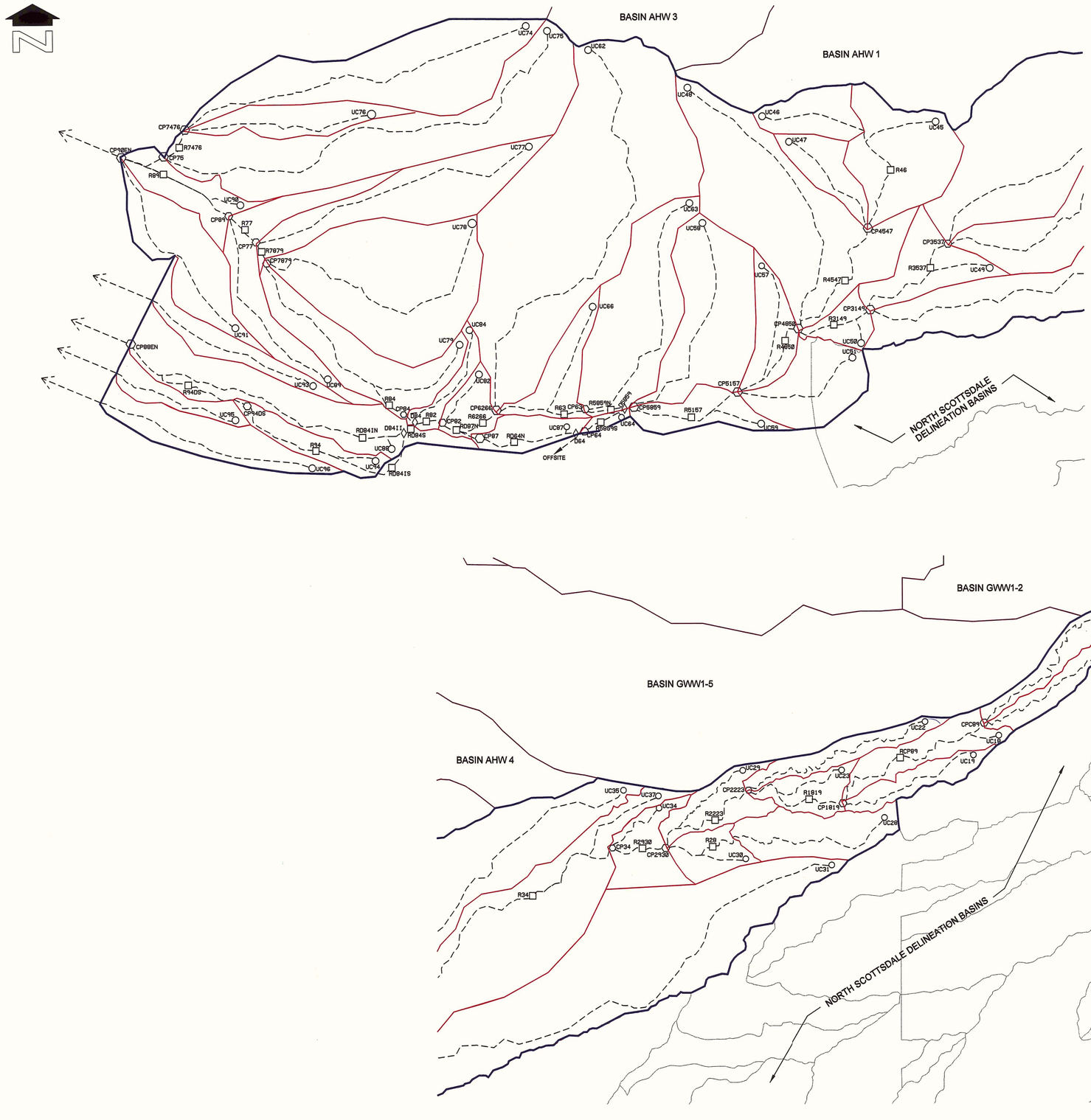
REGISTERED Professional Engineer (Civil)
CERTIFICATE NO.
24971
TONY A. BOK
Date Signed 5/6/04
ARIZONA, U.S.A.

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

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

LOCATION MAP

MAY, 2004



LEGEND

- UC30 — SUBBASIN
- R28 — ROUTING
- D84 — DIVERSION
- CP2330 — COMBINE
  - HEC-1 IDENTIFIER
- FLOW PATH (APPROXIMATE)

NOTES

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

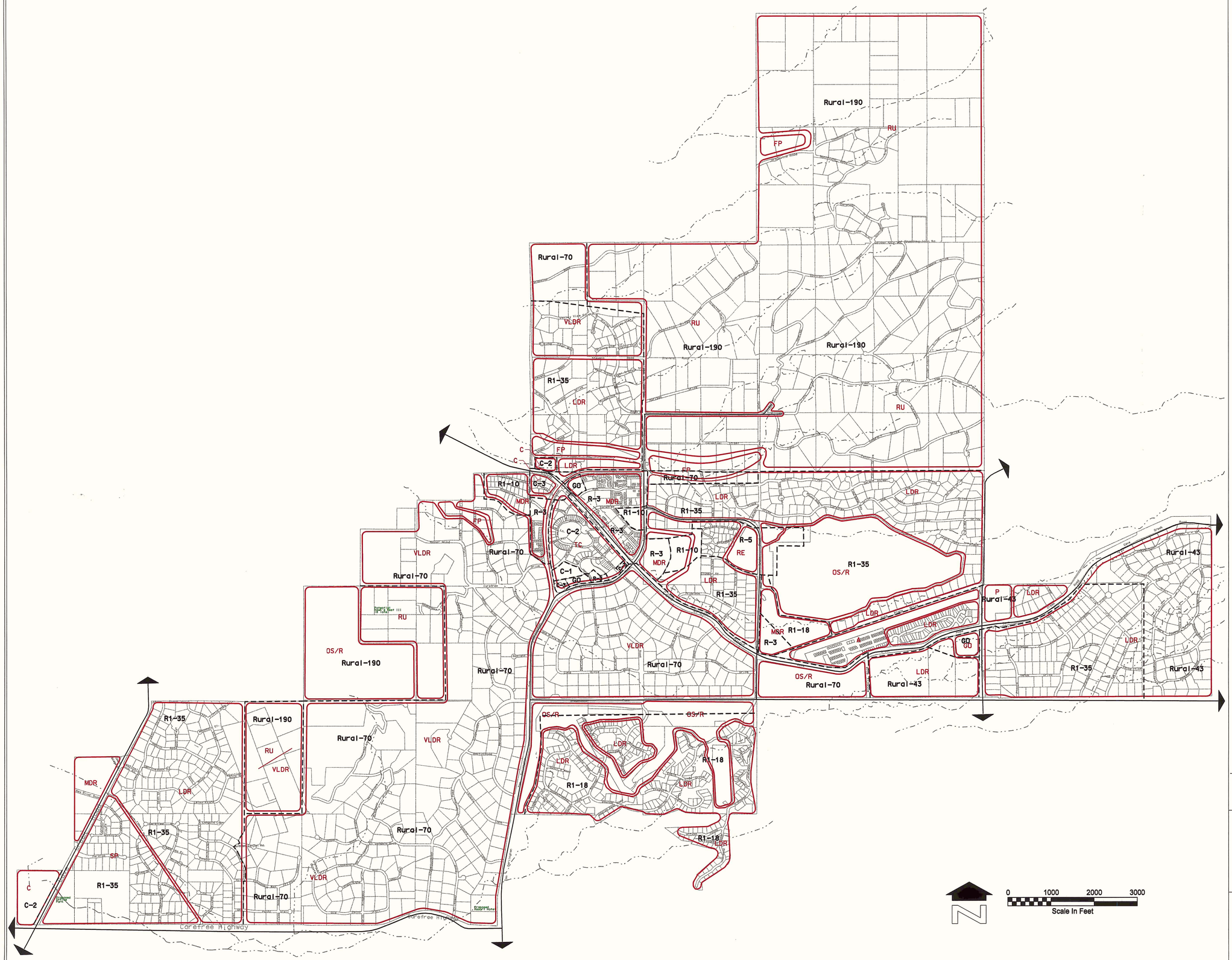
FIGURE 6 - HEC1 SCHEMATIC

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

02-JUL-2003

2944fig06.dlp



LEGEND

LAND USE PLAN

RU	RURAL RESIDENTIAL - 5 ACRES MINIMUM
VLDR	VERY LOW DENSITY RESIDENTIAL - 2 ACRES MINIMUM
LDR	LOW DENSITY RESIDENTIAL - 1 ACRE MINIMUM
MDR	MODERATE DENSITY RESIDENTIAL - 6,000 SQ FT/UNIT MINIMUM
TC	TOWN CENTER
C	COMMERCIAL
RE	RESORT HOTEL / RESORT DEVELOPMENT
GO	GARDEN OFFICE
OS/R	OPEN SPACE / RECREATION
A	AIRPORT
FP	FLOOD / WASH TO BE CONSERVED
P	PUBLIC / SEMI PUBLIC
SP	SPECIAL PLANNING AREA
←	THOROUGHFARE
—	LAND USE PLAN BOUNDARY

ZONING

Rural-190	RURAL ZONING DISTRICT--190,000 SQUARE FEET PER DWELLING UNIT
Rural-70	RURAL ZONING DISTRICT--70,000 SQUARE FEET PER DWELLING UNIT
Rural-43	RURAL ZONING DISTRICT--ONE (1) ACRE PER DWELLING UNIT
R1-35	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--35,000 SQUARE FEET PER DWELLING UNIT
R1-18	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--18,000 SQUARE FEET PER DWELLING UNIT
R1-10	SINGLE-FAMILY RESIDENTIAL ZONING DISTRICT--10,000 SQUARE FEET PER DWELLING UNIT
R-3	MULTIPLE-FAMILY RESIDENTIAL ZONING DISTRICT--6,000 SQUARE FEET LOT AREA PER DWELLING UNIT
R-5	MULTIPLE-FAMILY RESIDENTIAL ZONING DISTRICT--6,000 SQUARE FEET LOT AREA PER DWELLING UNIT
C-1	NEIGHBORHOOD COMMERCIAL ZONING DISTRICT
C-2	INTERMEDIATE COMMERCIAL ZONING DISTRICT
C-3	GENERAL COMMERCIAL ZONING DISTRICT
GO	GARDEN OFFICE ZONING DISTRICT
- - - - -	ZONING DISTRICTS BOUNDARY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 7 - MASTER PLAN AND ZONING

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

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	2.66
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	2204.66	2622	6.36	2.66
2.1684	2257.6	2335	9.53	8.49	1.4675	2199.3	2779	6.19	2.95
2.1443	2257.51	2363	6.41	9.46	1.4233	2194.7	2779	5.34	2.67
2.1205	2255.17	2363	10.23	9.02	1.3724	2189.13	2779	5.7	2.23
2.0629	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	2179.28	2274	5.52	1.91
2.0048	2245.97	2391	10.26	5.05	1.2175	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	9.76	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
1.8875	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	2225.87	2467	5.29	2.84	0.9064	2141.45	2092	7.34	4.07
1.7007	2220.63	2467	5.94	2.66	South				
1.6442	2215.52	2467	6.16	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	2.56

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	2
SECTION LINE	
SECTION CORNER	26 | 25 / 35 | 36
CROSS SECTION	0.2185
FLOW DIVERSION (CFS)	381
ELEVATION REFERENCE MARK	
BASE FLOOD ELEVATIONS	2505
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

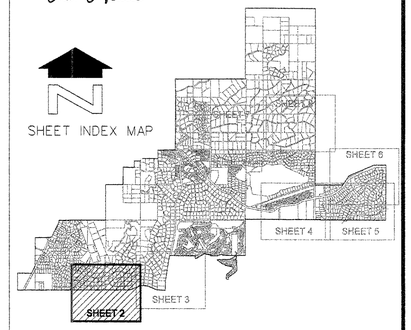
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 23	2222.05	SET ½" REBAR N: 1,018,508.59 E: 694,139.41
ERM 27	2162.46	SET ½" REBAR N: 1,018,265.15 E: 691,045.66
ERM 30	2186.40	SET ½" REBAR N: 1,018,385.94 E: 692,219.86

NOTES

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE Date Signed 5/12/04 ARIZONA, U.S.A.



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

REGISTERED Professional Engineer CERTIFICATE NO. 24971 TONY L. LAPP Date Signed 05-12-04 ARIZONA, U.S.A.

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

SHEET 2 OF 8

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

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

2944fplnd div 10-SEP-2003

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	
SECTION LINE	
SECTION CORNER	26 | 25 / 35 | 36
CROSS SECTION	0.2185
FLOW DIVERSION (CFS)	381
ELEVATION REFERENCE MARK	△
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

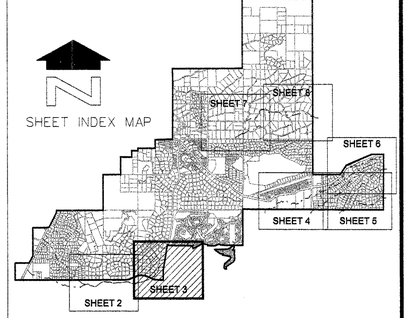
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 21	2272.97	SET 1/2" REBAR N: 1,019,414.95 E: 696,559.70
ERM 22	2254.61	SET CONCRETE NAIL N: 1,019,292.83 E: 695,534.40

NOTES

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE Date 5/12/04 MARICOPA COUNTY, ARIZONA

SHEET INDEX MAP



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

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

SHEET 3 OF 8

REGISTERED PROFESSIONAL ENGINEER (ARIZONA) CERTIFICATE NO. 24971 ANTONIA B. KITCH Date Signed 5-12-04 ARIZONA, U.S.A.

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	2.66
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	2204.66	2822	6.36	2.66
2.1684	2257.6	2336	9.53	8.49	1.4675	2199.3	2779	6.19	2.95
2.1443	2257.51	2363	8.41	6.48	1.4233	2194.7	2779	5.34	2.57
2.1305	2255.17	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	2176.28	2274	5.52	1.91
2.0048	2245.97	2391	10.28	5.05	1.2176	2174.89	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
1.8875	2237.97	2447	5.85	5.27	0.9888	2150.92	2843	5.87	3.15
1.8644	2235.19	2447	6.85	4.7	0.9593	2147.95	2843	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
1.7563	2225.87	2467	5.29	2.84	0.9094	2141.45	2092	7.34	4.07
1.7007	2220.63	2467	5.94	2.66	South				
1.6442	2215.52	2467	6.16	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	2.56

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

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

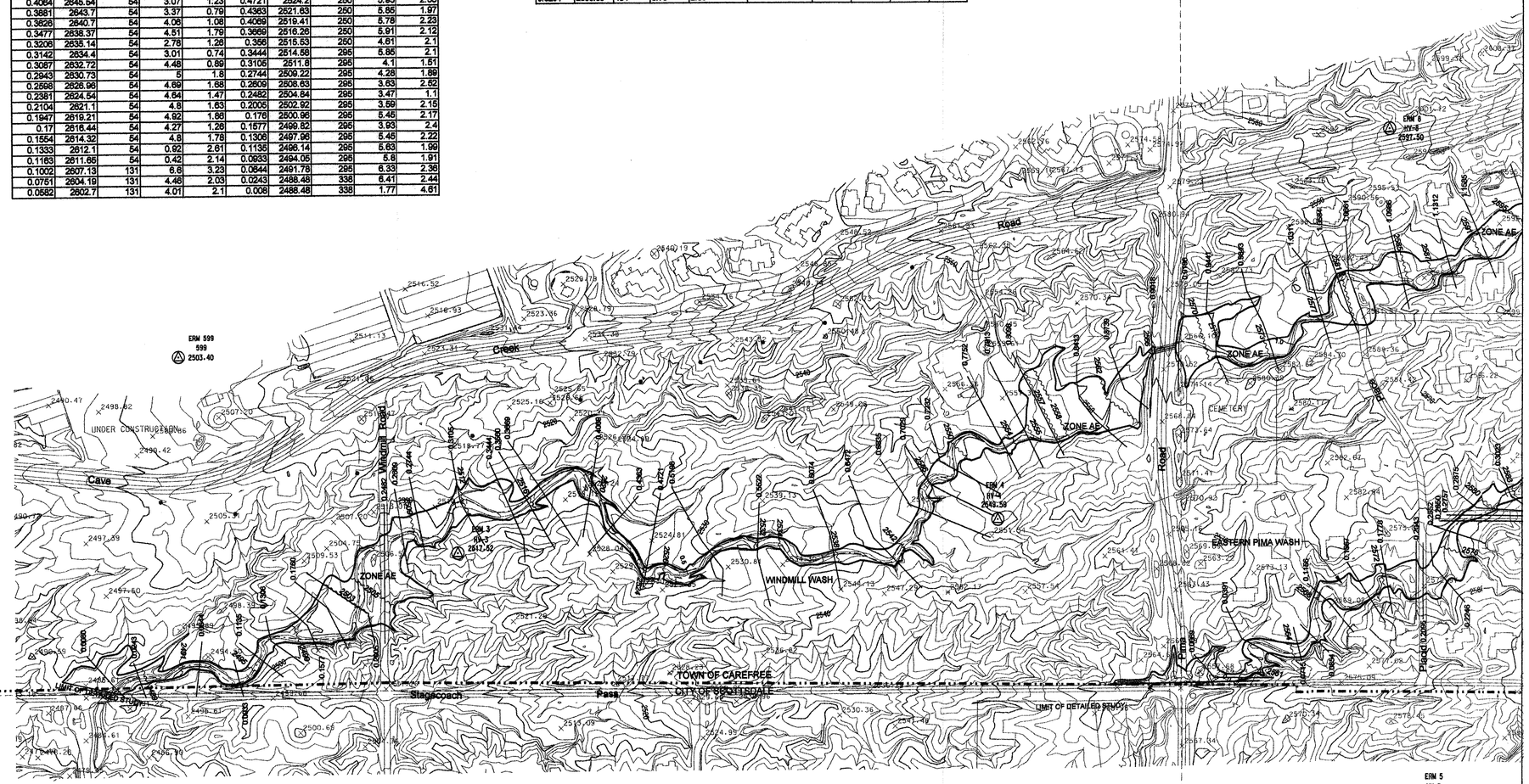
MAPPING COMPANY: M&B AERIAL (INTERNAL JOB # FCD-1184)

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING

2944fp103.div 05-SEP-2003

WINDMILL WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch					0.0395	2601.37	131	3.27	1.8
1.6578	2646.16	64	5.29	1.94	Combined Branch				
1.6099	2641.73	64	2.6	1.56	1.1975	2595.59	162	3.46	2.87
1.5545	2636.04	64	4.16	1.32	1.1585	2591.64	162	3.38	2.11
1.5334	2634.18	64	3.63	0.98	1.1312	2588.64	162	4.54	1.9
1.5241	2632.89	64	3.72	0.65	1.0986	2584.54	162	3.59	2.31
1.518	2631.73	64	4	0.99	1.0661	2581.93	162	2.48	1.58
1.4884	2628.39	64	4.62	1.72	1.0584	2580.7	162	3.41	0.96
1.4665	2625.6	64	5.33	2.05	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	3.76
1.3983	2620.22	64	2.09	2.92	0.9018	2568.1	198	5.75	1.78
1.3577	2615.61	64	0.94	3.39	0.8739	2563.38	198	2.81	2.07
1.3498	2615.61	64	0.62	3.67	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	1.85	2.54	0.7913	2554.53	198	5.64	1.63
1.3218	2612.59	64	0.45	4.23	0.7752	2553.56	198	4.59	2.14
1.311	2612.99	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	5.54	2.4	0.6835	2544.08	198	5.32	1.97
1.2368	2599.46	131	5.79	3.11	0.6472	2541.08	250	4.91	2.05
South Branch					0.6074	2537.71	250	5.36	1.99
0.4414	2649.44	54	3.32	1.55	0.5622	2531.98	250	6.12	1.92
0.4246	2647.62	54	4.61	1.67	0.5198	2529.85	250	6.99	5.54
0.4064	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	5.85	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	2635.14	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	2514.58	295	5.85	2.1
0.3087	2632.72	54	4.48	0.89	0.3105	2511.8	295	4.1	1.51
0.2943	2630.73	54	5	1.8	0.2744	2509.22	295	4.28	1.99
0.2658	2626.96	54	4.69	1.68	0.2609	2508.63	295	3.63	2.62
0.2361	2624.54	54	4.54	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	3.59	2.15
0.1947	2619.21	54	4.92	1.88	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	0.1308	2497.96	295	5.45	2.22
0.1333	2612.1	54	0.92	2.61	0.1135	2496.14	295	5.63	1.99
0.1163	2611.65	54	0.42	2.14	0.0933	2494.05	295	5.8	1.91
0.1002	2607.13	131	6.6	3.23	0.0844	2491.76	295	6.33	2.36
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	2486.48	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	4.98	1.52	0.4988	2601.90	134	4.23	2.54
0.9929	2657.50	71	4.62	1.77	0.4801	2600.30	134	4.23	2.98
0.9663	2653.04	71	4.19	1.28	0.4600	2598.00	134	4.98	2.04
0.9247	2647.48	71	3.13	1.84	0.4379	2594.98	134	5.54	2.76
0.9088	2646.19	71	5.17	1.96	0.4040	2591.97	134	4.24	2.40
0.8993	2644.06	71	4.54	1.05	0.3868	2590.94	134	4.13	2.59
0.8747	2641.85	71	2.91	1.33	0.3722	2589.32	134	4.19	2.13
0.8690	2639.91	71	3.38	1.07	0.3547	2587.82	134	4.24	2.32
0.8342	2637.29	71	4.25	1.10	0.3361	2586.85	134	3.90	3.05
0.8168	2635.40	71	1.81	1.02	0.3265	2585.89	134	6.06	3.28
0.8111	2635.02	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	5.56	2.25	0.2757	2578.76	134	2.30	1.12
0.7661	2628.29	71	4.53	1.72	0.2650	2578.51	134	3.11	1.99
0.7351	2624.58	71	4.98	1.55	0.2552	2577.93	134	4.51	1.86
0.7049	2621.18	71	4.90	1.53	0.2248	2575.38	295	3.90	1.96
0.6862	2619.19	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	3.76	1.94	0.1567	2571.03	295	4.06	3.96
0.5931	2610.90	71	4.27	1.63	0.1156	2568.38	295	5.82	2.73
0.5707	2609.41	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	0.60	0.0391	2562.91	295	4.17	2.07
0.5427	2606.28	134	5.11	2.16	0.0069	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	26 | 25 / 35 | 36
CROSS SECTION	0.2185
FLOW DIVERSION (CFS)	581
ELEVATION REFERENCE MARK	
BASE FLOOD ELEVATIONS	2505
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

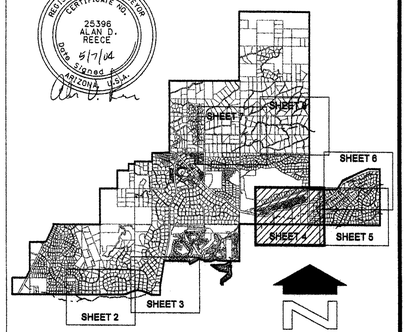
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 3	2517.52	SET ½" REBAR N: 1,024,086.51 E: 705,346.82
ERM 4	2549.59	SET ½" REBAR N: 1,024,186.50 E: 707,133.53
ERM 5	2580.45	SET ½" REBAR N: 1,023,285.90 E: 708,498.80
ERM 8	2597.50	SET ½" 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

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE 5/7/04 Date Signed ARIZONA U.S.A.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WINDMILL WASH AND
EASTERN PIMA WASH
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037

REGISTERED Professional Engineer CERTIFICATE NO. 24971 TIMOTHY L. BOKAN Date Signed 5/6/04 ARIZONA U.S.A.

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

SHEET 4 OF 8

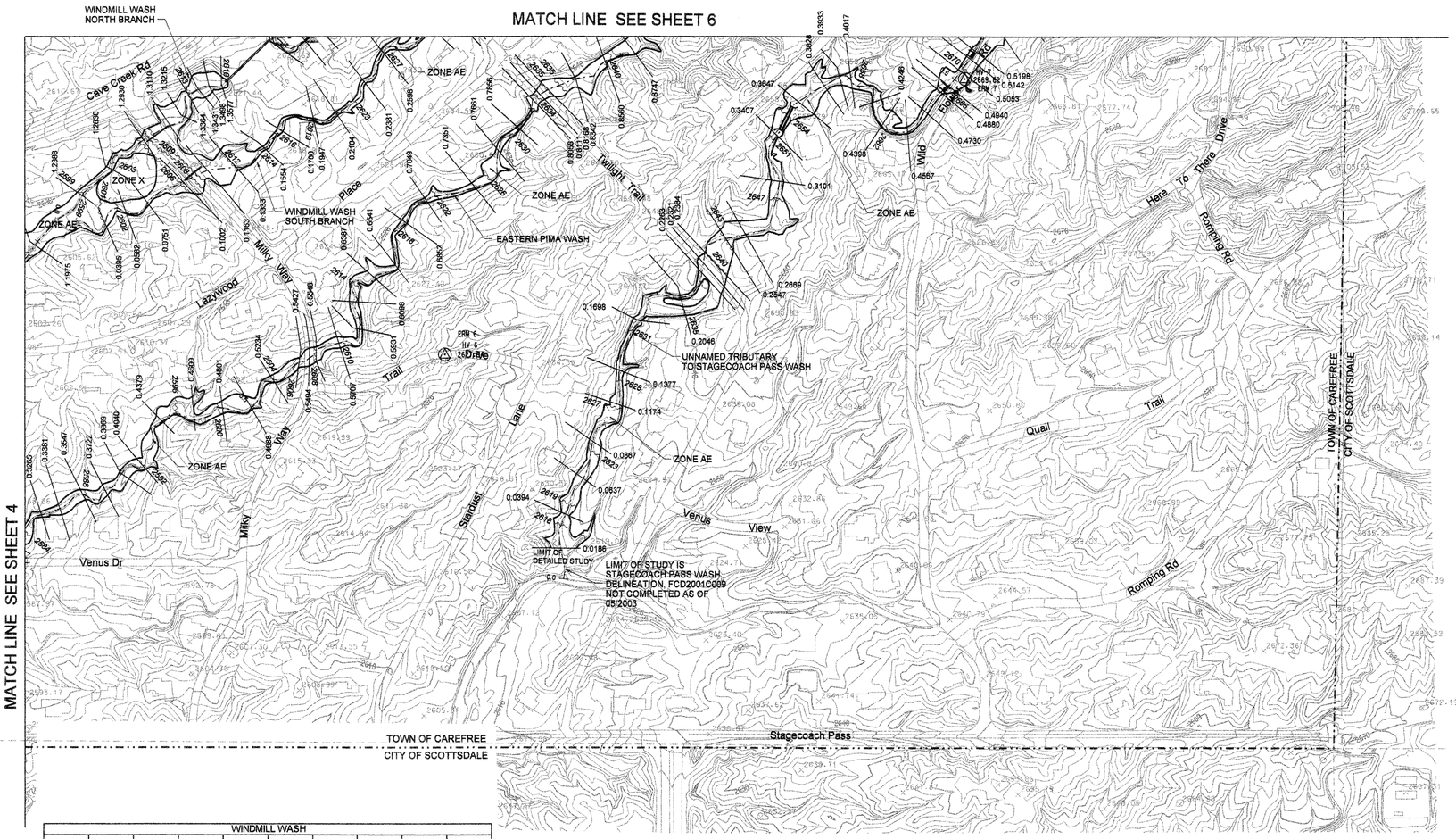
200' 0' 200' 400'
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: AUGUST 2, 2001

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

06-MAY-2004 2944fip104.div



WINDMILL WASH

R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch					0.0396	2601.37	131	3.27	1.8
1.6576	2646.16	64	5.29	1.94	Combined Branch				
1.6069	2641.73	64	2.5	1.55	1.1975	2595.59	162	3.48	2.87
1.5545	2636.04	64	4.16	1.32	1.1585	2591.64	162	3.38	2.11
1.5334	2634.18	64	3.63	0.98	1.1312	2588.64	162	4.54	1.9
1.5241	2632.89	64	3.72	0.65	1.0986	2584.54	162	3.59	2.31
1.518	2631.73	64	4	0.99	1.0661	2581.93	162	2.48	1.58
1.4684	2628.39	64	4.52	1.72	1.0584	2580.7	162	3.41	0.98
1.4665	2625.6	64	5.33	2.05	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	0.9196	2569.7	198	1.33	3.76
1.3983	2620.22	64	2.09	2.92	0.9018	2566.1	198	5.75	1.78
1.3577	2615.61	64	0.94	3.39	0.8739	2563.38	198	2.81	2.07
1.3498	2615.61	64	0.62	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	2554.53	198	5.64	1.63
1.3215	2612.99	64	0.45	4.23	0.7752	2553.56	198	4.59	2.14
1.311	2612.99	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	2545.96	198	6.08	1.85
1.283	2602.71	131	5.54	2.4	0.6835	2544.08	198	5.32	1.97
1.2388	2599.46	131	5.79	3.11	0.6472	2541.08	250	4.91	2.05
South Branch					0.6074	2537.71	250	5.36	1.99
0.4414	2649.44	54	3.32	1.55	0.5622	2531.98	250	6.12	1.92
0.4246	2647.52	54	4.61	1.67	0.5198	2529.69	250	6.99	5.64
0.4064	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	5.85	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	2635.14	54	2.78	1.26	0.358	2515.53	250	4.61	2.1
0.3142	2634.4	54	3.01	0.74	0.3444	2514.58	295	5.85	2.1
0.3087	2632.72	54	4.48	0.89	0.3105	2511.8	295	4.1	1.51
0.2943	2630.73	54	5	1.8	0.2744	2509.22	295	4.28	1.89
0.2598	2626.98	54	4.69	1.68	0.2609	2508.63	295	3.63	2.52
0.2381	2624.54	54	4.64	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	3.59	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
0.1333	2612.1	54	0.92	2.61	0.1135	2496.14	295	5.63	1.99
0.1163	2611.65	54	0.42	2.14	0.0933	2494.05	295	5.8	1.91
0.1002	2607.13	131	5.6	3.23	0.0644	2491.78	295	6.33	2.36
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	0.4988	2601.90	134	4.23	2.54
0.9929	2657.50	71	4.62	1.77	0.4801	2600.30	134	4.23	2.98
0.9653	2653.04	71	4.19	1.26	0.4600	2598.00	134	4.96	2.04
0.9247	2647.48	71	3.13	1.84	0.4379	2594.96	134	5.54	2.76
0.9088	2646.19	71	5.17	1.96	0.4040	2591.97	134	4.24	2.40
0.8993	2644.06	71	4.54	1.05	0.3869	2590.94	134	4.13	2.59
0.8747	2641.85	71	2.91	1.33	0.3722	2589.32	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
0.8188	2635.40	71	1.81	1.02	0.3265	2585.89	134	6.06	3.28
0.8111	2635.02	71	3.84	0.69	0.3023	2582.98	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	5.56	2.25	0.2757	2578.76	134	2.30	1.12
0.7661	2628.29	71	4.53	1.72	0.2650	2578.51	134	3.11	1.99
0.7351	2624.58	71	4.66	1.55	0.2552	2577.93	134	4.51	1.86
0.7049	2621.18	71	4.90	1.63	0.2246	2575.38	295	3.90	1.96
0.6852	2619.19	71	4.69	1.78	0.2065	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	3.76	1.94	0.1567	2571.03	295	4.06	3.96
0.5931	2610.90	71	4.27	1.63	0.1156	2568.38	295	5.82	2.73
0.5707	2609.41	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	0.0069	2560.50	323	2.43	2.73
0.5234	2603.69	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	2.26	0.4398	2661.51	152	3.50	2.51
0.844	2710.16	84	5.38	2.33	0.4246	2659.92	152	5.14	1.94
0.8171	2706.75	84	5.17	1.63	0.4017	2657.81	152	2.71	1.53
0.7934	2704.80	84	4.14	1.85	0.3933	2657.30	152	4.54	1.44
0.7626	2702.86	84	1.05	1.97	0.3828	2656.96	225	3.19	2.51
0.7448	2697.97	84	6.45	2.63	0.3647	2655.57	225	0.88	3.93
0.7265	2694.20	84	5.98	2.46	0.3407	2651.27	225	6.20	1.96
0.6776	2688.72	84	5.47	2.74	0.3101	2648.77	225	6.05	2.57
0.6449	2685.16	84	6.20	2.63	0.2869	2644.43	225	4.52	1.82
0.6242	2682.71	84	6.83	2.80	0.2547	2643.15	225	4.16	2.04
0.6025	2679.85	152	4.32	2.73	0.2384	2640.79	225	3.97	0.92
0.583	2679.47	152	1.64	5.08	0.2321	2640.00	225	2.19	1.21
0.5624	2674.57	152	5.33	2.14	0.2263	2639.66	225	4.03	1.83
0.5394	2672.02	152	4.25	1.80	0.2046	2635.08	225	5.39	2.33
0.5198	2671.28	152	2.41	2.92	0.1698	2631.76	225	6.68	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	2627.26	225	5.34	2.89
0.494	2669.76	152	1.49	4.79	0.0867	2623.77	225	4.48	3.18
0.488	2666.03	152	5.74	1.89	0.0637	2620.57	225	5.40	2.45
0.473	2664.42	152	5.18	2.79	0.0394	2616.33	225	6.60	3.06
0.4567	2662.62	152	5.82	2.41	0.0186	2617.10	225	1.71	3.71

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

LEGEND

- 100-YR FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- HYDRAULIC BASE LINE WITH RIVER MILE
- SECTION LINE
- SECTION CORNER (26|25 / 35|36)
- CROSS SECTION (0.2185)
- FLOW DIVERSION (CFS) (381)
- ELEVATION REFERENCE MARK
- 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

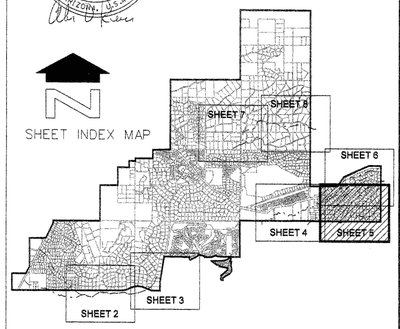
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 6	2627.94	SET CONCRETE NAIL N: 1,024,842.08 E: 710,190.25
ERM 7	2669.62	SET CONCRETE NAIL N: 1,025,707.02 E: 711,819.77

NOTES

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE 5/1/04 DATE SIGNED ARIZONA, U.S.A.

SHEET INDEX MAP



NO.	REVISION	BY	DATE
2			
1			

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

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE NO. 24971 TONY L. SOKOLICH Date Signed 5/14/04 ARIZONA, U.S.A.

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

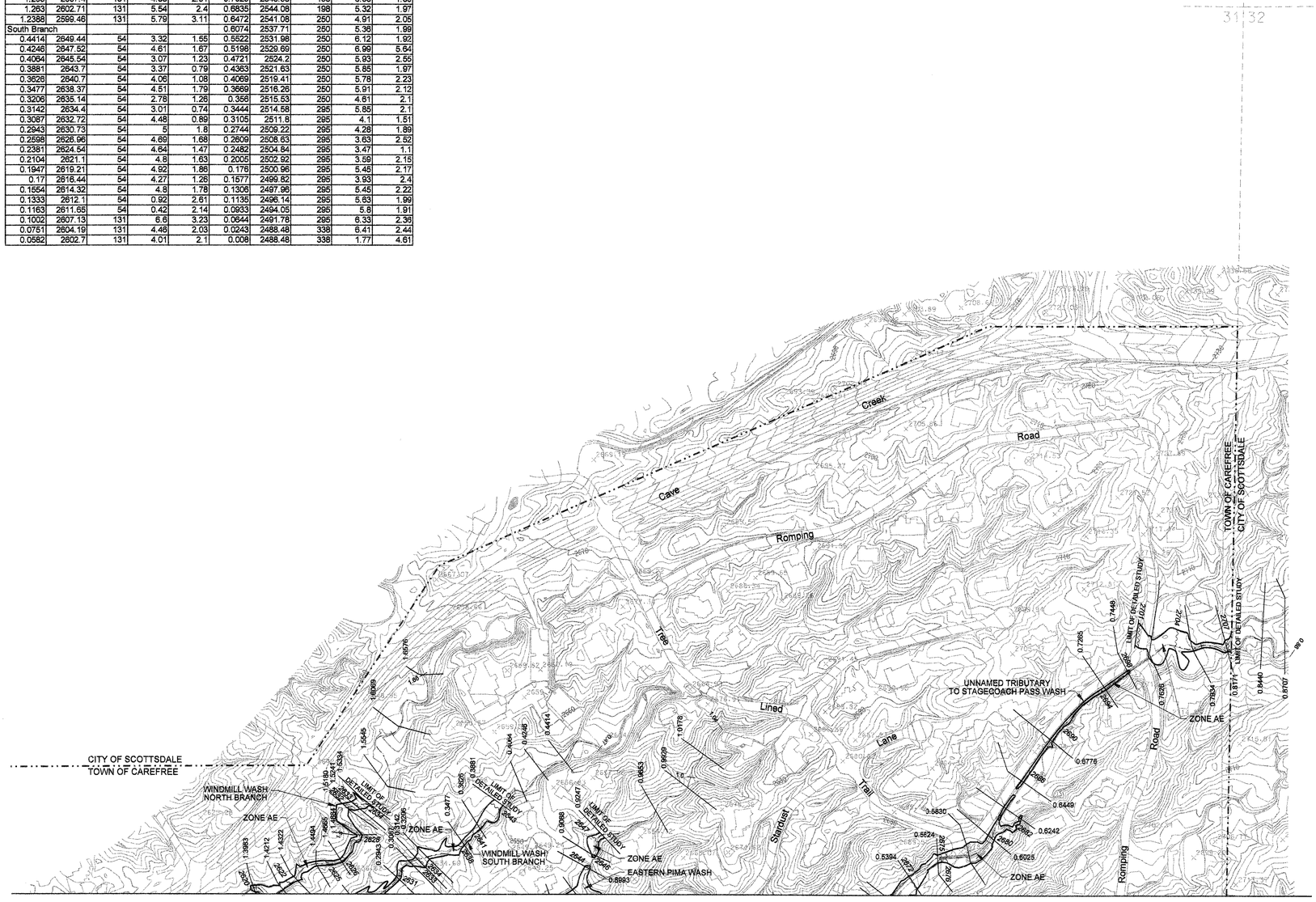
SHEET 5 OF 8

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

29444fp105.div 06-MAY-2004

WINDMILL WASH									
R.S.	FP	Q (CFS)	V (FPS)	D (FT)	R.S.	FP	Q (CFS)	V (FPS)	D (FT)
North Branch					0.0395	2601.37	131	3.27	1.8
1.6576	2648.16	64	5.29	1.94	Combined Branch				
1.6069	2641.73	64	2.5	1.56	1.1975	2595.59	162	3.46	2.87
1.5545	2636.04	64	4.16	1.32	1.1585	2591.64	162	3.38	2.11
1.5334	2634.18	64	3.63	0.98	1.1312	2588.64	162	4.54	1.9
1.5241	2632.89	64	3.72	0.65	1.0985	2584.54	162	3.59	2.31
1.518	2631.73	64	4	0.99	1.0661	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	2.05	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	0.9195	2569.7	198	1.35	3.76
1.3983	2620.22	64	2.09	2.92	0.9018	2566.1	198	5.75	1.78
1.3577	2615.61	64	0.94	3.39	0.8739	2563.38	198	2.81	2.07
1.3498	2615.61	64	0.62	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	2554.53	198	5.64	1.63
1.3215	2612.99	64	0.45	4.23	0.7752	2553.66	198	4.59	2.14
1.311	2612.99	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
1.263	2602.71	131	5.54	2.4	0.6835	2544.08	198	5.32	1.97
1.2388	2599.46	131	5.79	3.11	0.6472	2541.08	250	4.91	2.05
South Branch					0.6074	2537.71	250	5.36	1.99
0.4414	2649.44	54	3.32	1.55	0.5522	2531.98	250	6.12	1.92
0.4246	2647.82	54	4.61	1.67	0.5198	2529.69	250	6.99	5.64
0.4094	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	5.85	1.97
0.3628	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	2635.14	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	2514.58	295	5.85	2.1
0.3087	2632.72	54	4.48	0.89	0.3105	2511.8	295	4.1	1.51
0.2943	2630.73	54	5	1.8	0.2744	2509.22	295	4.28	1.89
0.2698	2628.96	54	4.69	1.68	0.2609	2508.63	295	3.63	2.52
0.2381	2624.54	54	4.64	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	3.59	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
0.1333	2612.1	54	0.92	2.61	0.1135	2496.14	295	5.63	1.99
0.1163	2611.85	54	0.42	2.14	0.0933	2494.05	295	5.8	1.91
0.1002	2607.13	131	6.6	3.23	0.0644	2491.78	295	6.33	2.36
0.0751	2604.19	131	4.48	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

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	2.26	0.4398	2651.51	152	3.50	2.51
0.844	2710.16	84	5.38	2.33	0.4246	2659.92	152	5.14	1.94
0.8171	2708.75	84	5.17	1.63	0.4017	2657.81	152	2.71	1.53
0.7934	2704.80	84	4.14	1.85	0.3933	2657.30	152	4.54	1.44
0.7626	2702.66	84	1.05	1.97	0.3826	2656.96	225	3.19	2.51
0.7448	2697.97	84	6.45	2.63	0.3647	2656.57	225	0.88	3.93
0.7265	2694.20	84	5.98	2.46	0.3407	2651.27	225	6.20	1.96
0.6776	2688.72	84	5.47	2.74	0.3101	2648.77	225	6.05	2.57
0.6449	2685.16	84	6.20	2.63	0.2869	2644.43	225	4.62	1.82
0.6242	2682.71	84	6.83	2.80	0.2547	2643.16	225	4.16	2.04
0.6025	2676.65	152	4.32	2.73	0.2384	2640.79	225	3.97	0.92
0.583	2679.47	152	1.64	5.08	0.2321	2640.00	225	2.19	1.21
0.5624	2674.67	152	5.33	2.14	0.2263	2639.66	225	4.03	1.83
0.5394	2672.02	152	4.25	1.80	0.2048	2635.08	225	5.39	2.33
0.5198	2671.28	152	2.41	2.92	0.1698	2631.76	225	5.68	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	2627.26	225	5.34	2.89
0.494	2669.76	152	1.49	4.79	0.0887	2623.77	225	4.48	3.18
0.488	2666.03	152	5.74	1.89	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	3.06
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 (26|25 / 35|36)
- CROSS SECTION (0.2165)
- FLOW DIVERSION (CFS) (381)
- ELEVATION REFERENCE MARK
- 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

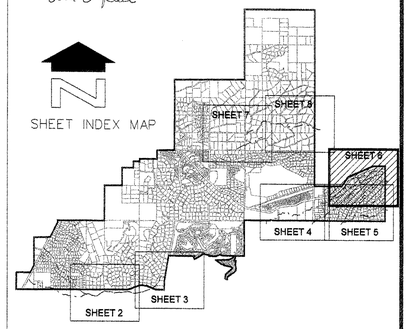
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION

NOTES

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE Date Signed 5/1/02 ARIZONA, U.S.A.

SHEET INDEX MAP



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

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE NO. 24971 TONY A. SOKOLICH Date Signed 5/1/02 ARIZONA, U.S.A.

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

SHEET 6 OF 8

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

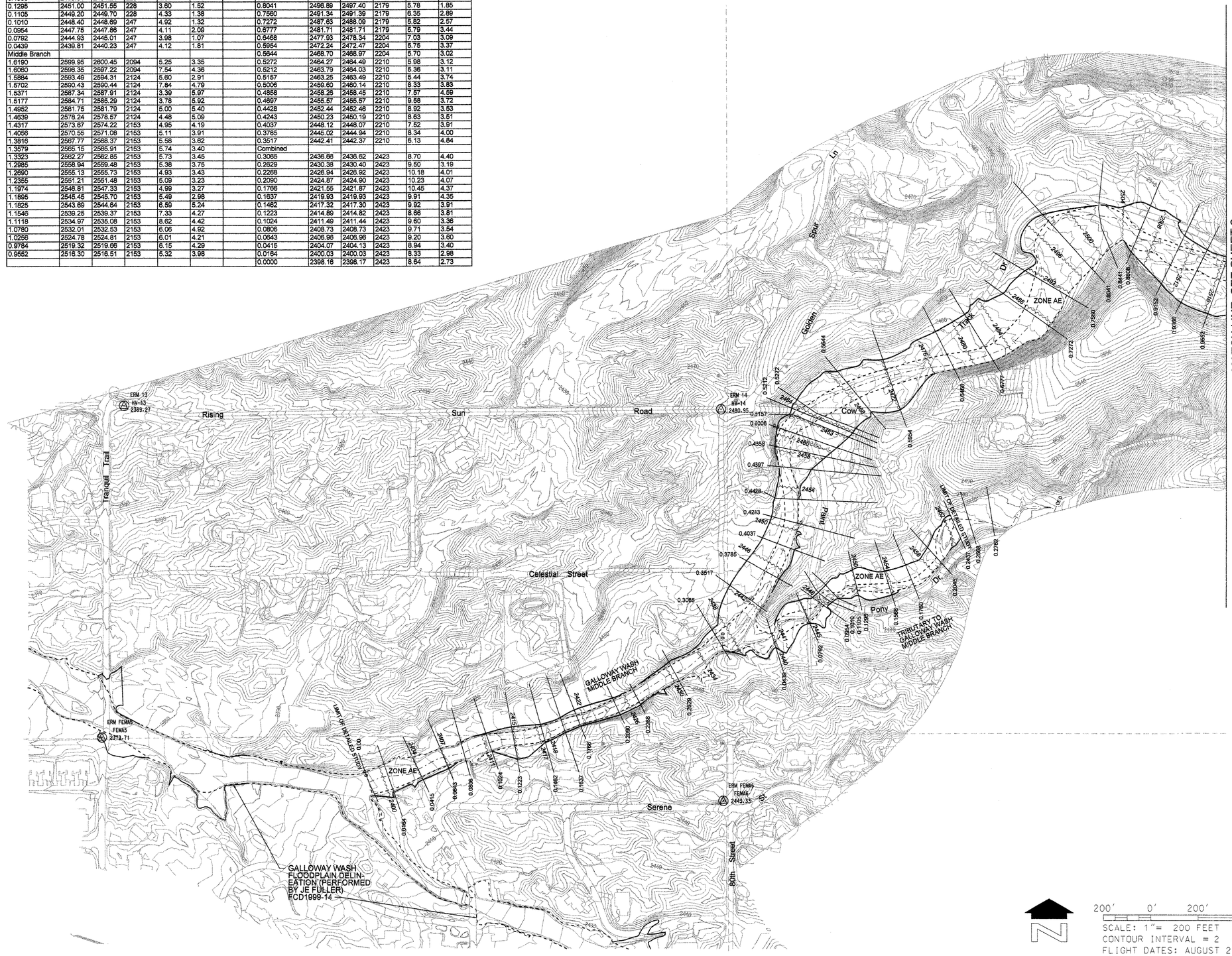
THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200′ HORIZONTAL SCALE AND 2′CONTOUR INTERVALS.

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

GROUND CONTROL SURVEY DATA PROVIDED BY AZTEC ENGINEERING

2944fld06.div 12-APR-2004

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		0.9366	2513.66	2513.95	2153	5.50	3.39
0.2045	2458.96	2459.33	228	4.32	1.64		0.9152	2510.67	2511.08	2179	6.29	2.98
0.1760	2455.75	2456.37	228	4.25	1.26		0.8808	2506.43	2506.91	2179	6.75	2.98
0.1568	2453.81	2454.24	228	4.07	1.18		0.8441	2501.84	2502.32	2179	6.66	2.45
0.1295	2451.00	2451.55	228	3.60	1.52		0.8041	2496.89	2497.40	2179	5.78	1.85
0.1105	2449.20	2449.70	228	4.33	1.38		0.7560	2491.34	2491.39	2179	5.35	2.89
0.1010	2448.40	2448.89	247	4.92	1.32		0.7272	2487.63	2488.09	2179	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		0.6468	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	4.36		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	2459.60	2460.14	2210	8.33	3.83
1.5371	2587.34	2587.91	2124	3.39	5.97		0.4858	2458.26	2458.45	2210	7.57	4.59
1.5177	2584.71	2585.29	2124	3.78	5.92		0.4697	2455.57	2455.57	2210	9.58	3.72
1.4952	2581.75	2581.79	2124	5.00	5.40		0.4428	2452.44	2452.48	2210	8.92	3.53
1.4639	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
1.4066	2570.55	2571.08	2153	5.11	3.91		0.3785	2445.02	2444.94	2210	8.34	4.00
1.3816	2567.77	2568.37	2153	5.58	3.62		0.3517	2442.41	2442.37	2210	6.13	4.84
1.3579	2565.15	2565.91	2153	5.74	3.40		Combined					
1.3323	2562.27	2562.85	2153	5.73	3.45		0.3065	2436.66	2436.62	2423	8.70	4.40
1.2985	2558.94	2559.48	2153	5.38	3.75		0.2629	2430.38	2430.40	2423	9.50	3.19
1.2650	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		0.1766	2421.55	2421.87	2423	10.45	4.37
1.1895	2545.45	2545.70	2153	5.49	2.98		0.1637	2419.93	2419.93	2423	9.91	4.35
1.1825	2543.69	2544.84	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	8.62	4.42		0.1024	2411.49	2411.44	2423	9.60	3.36
1.0780	2532.01	2532.53	2153	6.06	4.92		0.0806	2408.73	2408.73	2423	9.71	3.54
1.0266	2524.78	2524.81	2153	6.01	4.21		0.0643	2406.98	2406.98	2423	9.20	3.60
0.9794	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		0.0164	2400.03	2400.03	2423	8.33	2.98
							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 (26|25 / 35|36)
- CROSS SECTION (0.2185)
- FLOW DIVERSION (CFS) (381)
- ELEVATION REFERENCE MARK
- BASE FLOOD ELEVATIONS (2505)
- ZONE DESIGNATIONS (ZONE AE)
- CORPORATE LIMITS (Corporate Limits)
- COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY (County Boundary)

ELEVATION REFERENCE MARKS

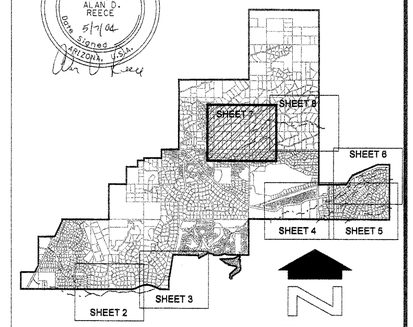
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD = -2.23 AVERAGE TO 1929 NGVD

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

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE Date Signed 6/7/02 ARIZONA, U.S.A.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GALLOWAY WASH MIDDLE BRANCH
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037

REGISTERED Professional Engineer CERTIFICATE NO. 24971 TODD A. BOK Date Signed 6/7/02 ARIZONA, U.S.A.

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

SHEET 7 OF 8

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

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

2944fid107.dlv 05-SEP-2003

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		0.9366	2513.66	2513.95	2153	5.60	3.39
0.2045	2458.98	2459.33	228	4.32	1.64		0.9152	2510.67	2511.08	2179	6.29	2.98
0.1760	2455.75	2456.37	228	4.25	1.26		0.8808	2506.43	2506.91	2179	6.75	2.98
0.1568	2453.81	2454.24	228	4.07	1.18		0.8441	2501.84	2502.32	2179	6.86	2.45
0.1295	2451.00	2451.55	228	3.60	1.52		0.8041	2496.89	2497.40	2179	5.78	1.85
0.1105	2449.20	2449.70	228	4.33	1.38		0.7560	2491.34	2491.39	2179	6.35	2.89
0.1010	2448.40	2448.69	247	4.92	1.32		0.7272	2487.63	2488.09	2179	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		0.6468	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	4.36		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	2459.60	2460.14	2210	8.33	3.83
1.5371	2587.34	2587.91	2124	3.39	5.97		0.4856	2458.26	2458.45	2210	7.57	4.59
1.5177	2584.71	2585.29	2124	3.78	5.92		0.4697	2455.57	2455.57	2210	9.58	3.72
1.4952	2581.75	2581.79	2124	5.00	5.40		0.4428	2452.44	2452.46	2210	8.92	3.63
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
1.3816	2567.77	2568.37	2153	5.58	3.62		0.3517	2442.41	2442.37	2210	6.13	4.84
1.3579	2565.16	2565.91	2153	5.74	3.40		Combined					
1.3323	2562.27	2562.85	2153	5.73	3.45		0.3065	2436.66	2436.62	2423	8.70	4.40
1.2985	2558.94	2559.48	2153	5.38	3.75		0.2629	2430.38	2430.40	2423	9.60	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		0.2060	2424.87	2424.90	2423	10.23	4.07
1.1974	2546.81	2547.33	2153	4.99	3.27		0.1766	2421.55	2421.67	2423	10.45	4.37
1.1895	2545.46	2545.70	2153	5.49	2.98		0.1637	2419.93	2419.93	2423	9.91	4.35
1.1825	2543.69	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	8.62	4.42		0.1024	2411.49	2411.44	2423	9.60	3.36
1.0780	2532.01	2532.53	2153	6.06	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		0.0164	2400.03	2400.03	2423	8.33	2.98
							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 (26|25 / 35|36)
- CROSS SECTION (0.2185)
- FLOW DIVERSION (CFS) (381)
- ELEVATION REFERENCE MARK
- 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

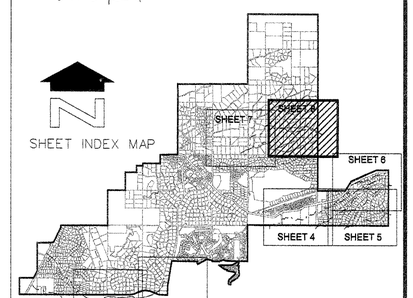
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 15	2529.97	SET ½" REBAR N: 1,030,814.22 E: 705,127.55
ERM 16	2576.35	SET CONCRETE NAIL N: 1,030,955.12 E: 706,419.30

NOTES

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

REGISTERED LAND SURVEYOR CERTIFICATE NO. 25396 ALAN D. REECE 5/7/04 DATE SIGNED ARIZONA U.S.A.

SHEET INDEX MAP



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GALLOWAY WASH MIDDLE BRANCH
CAREFREE FLOODPLAIN DELINEATION
F.C.D. CONTRACT NO. 2000 C037

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE NO. 24971 TONY A. BROK 5/7/04 DATE SIGNED ARIZONA U.S.A.

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

SHEET 8 OF 8

25,30
36,31

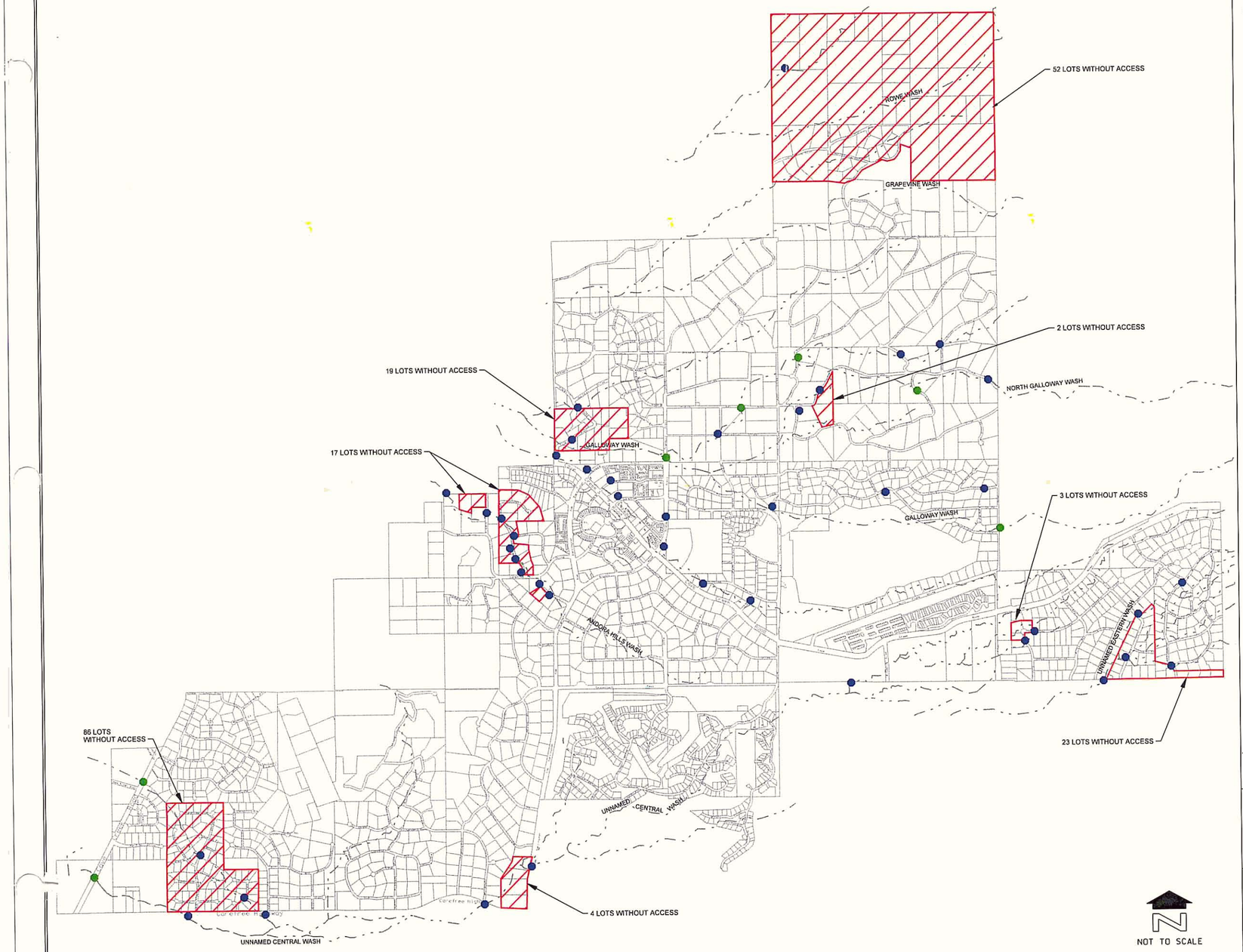
200' 0' 200' 400'
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: AUGUST 2, 2001

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

29444fip108.div 05-SEP-2003



LEGEND

- IMPASSABLE DURING 100-YR. EVENT (> 1' DEPTH OR D x V > 10)
- IMPROVEMENTS MADE TO MAKE CROSSING PASSABLE
- PARCELS INACCESIBLE DURING 100-YR. FLOOD EVENT

NOTES

ASSUMPTIONS:

1. CAVE CREEK ROAD THROUGH CAVE CREEK WILL ALLOW ACCESS TO TOM DARLINGTON.
2. IMPROVEMENTS IDENTIFIED WITH GREEN CIRCLE HAVE BEEN UPGRADED AND ARE PASSABLE.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 13 - STAGE 1 IMPROVEMENTS
100-YR. FLOOD EVENT ACCESS PLAN
90% OF PARCELS ACCESSIBLE
CAREFREE DRAINAGE MASTER PLAN

DOWNTOWN STORM DRAINAGE IMPROVEMENTS PROJECT

LEGEND

- ★ RECENT FLOODING REPORTED
- ✚ SEDIMENTATION
- ● EROSION
- ■ DAMAGED FACILITY
- ▲ FLOW OVER ROAD (PASSABLE, >15 cfs)
- ✳ EROSION SETBACK ENCROACHMENTS
- ● IMPASSABLE DURING 100-YR EVENT (>1' DEPTH OR D x V > 10)

NOTES

N

1000′ 0′ 1000′ 2000′

SCALE: 1″= 1000 FEET

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

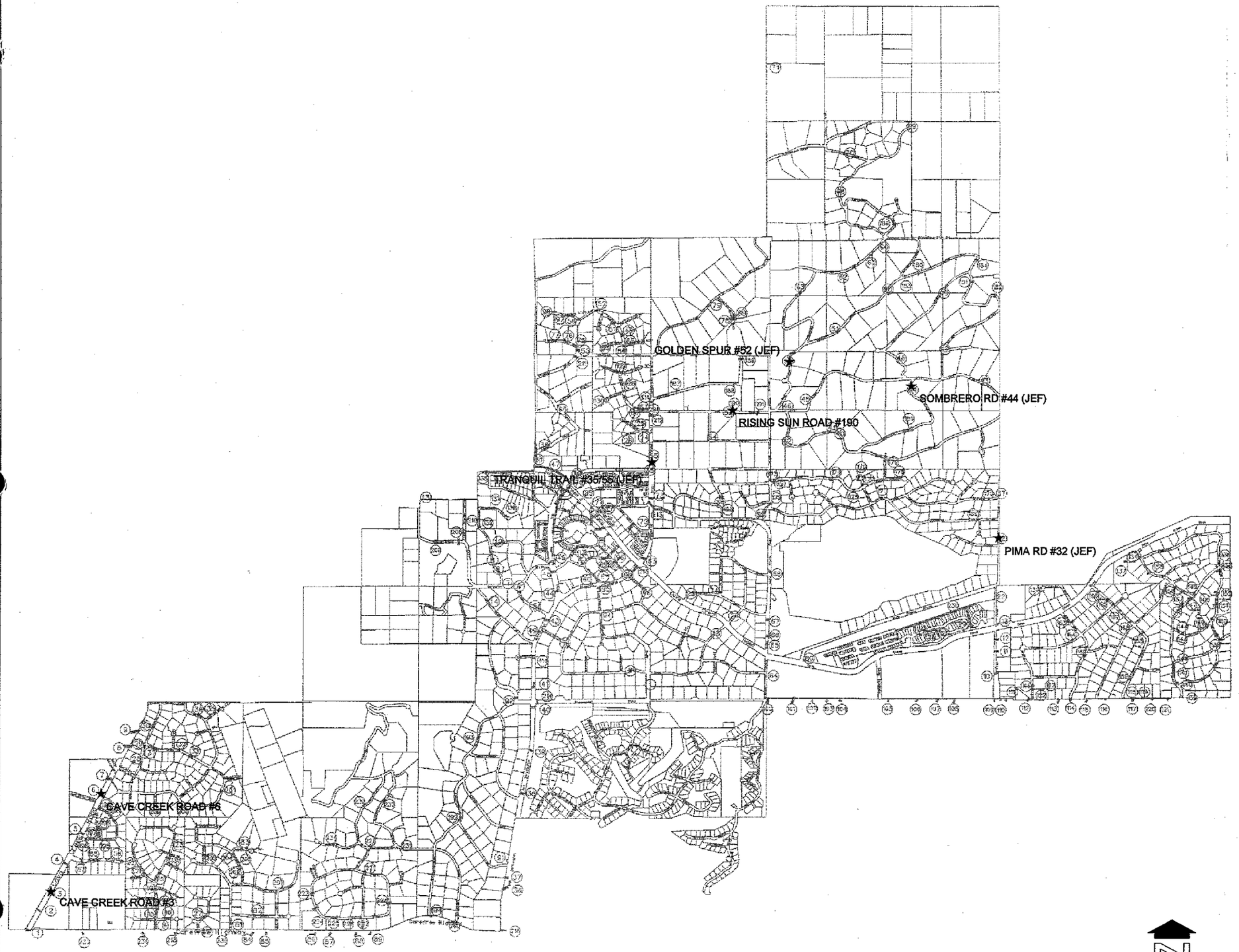
FIGURE 15

IDENTIFIED PROBLEM AREAS

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037

mtgp&c.dgn 10-APR-2003



NOT TO SCALE

LEGEND

★ ADVANCED STUDY SITES

NOTES

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

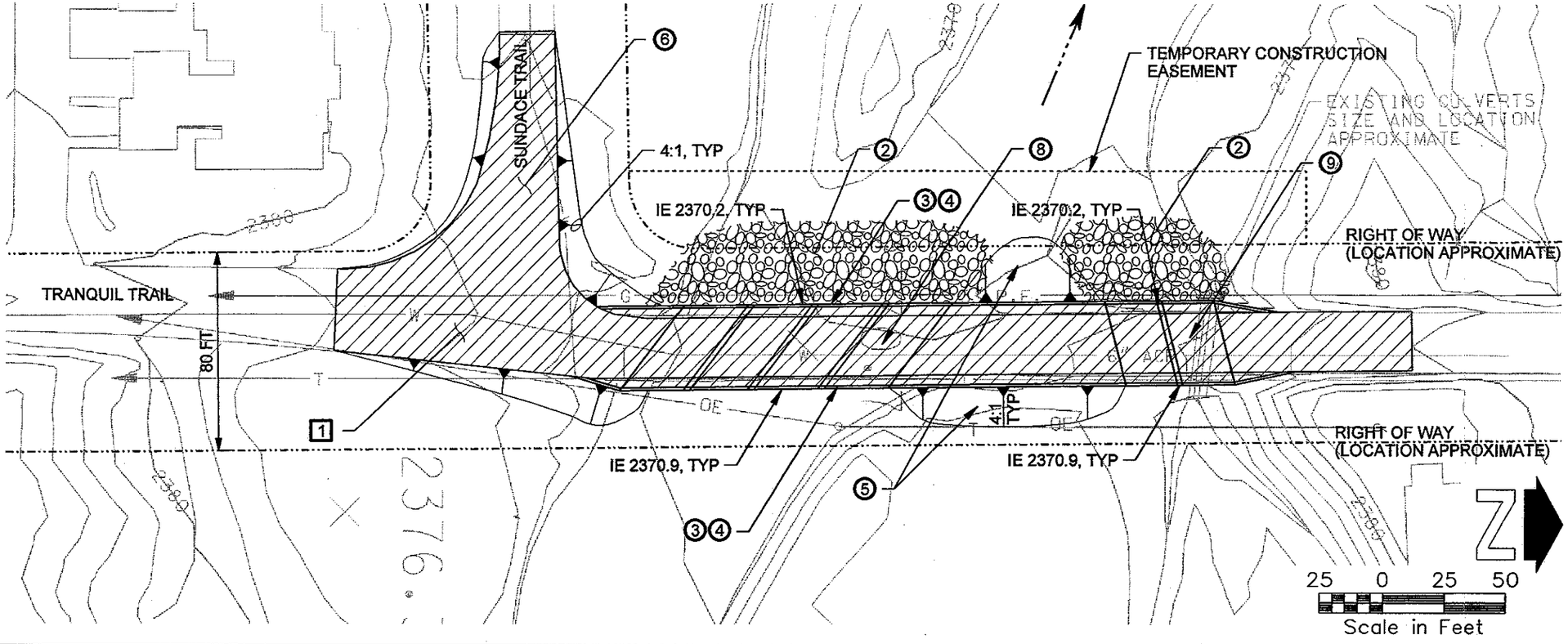
CH2MHILL

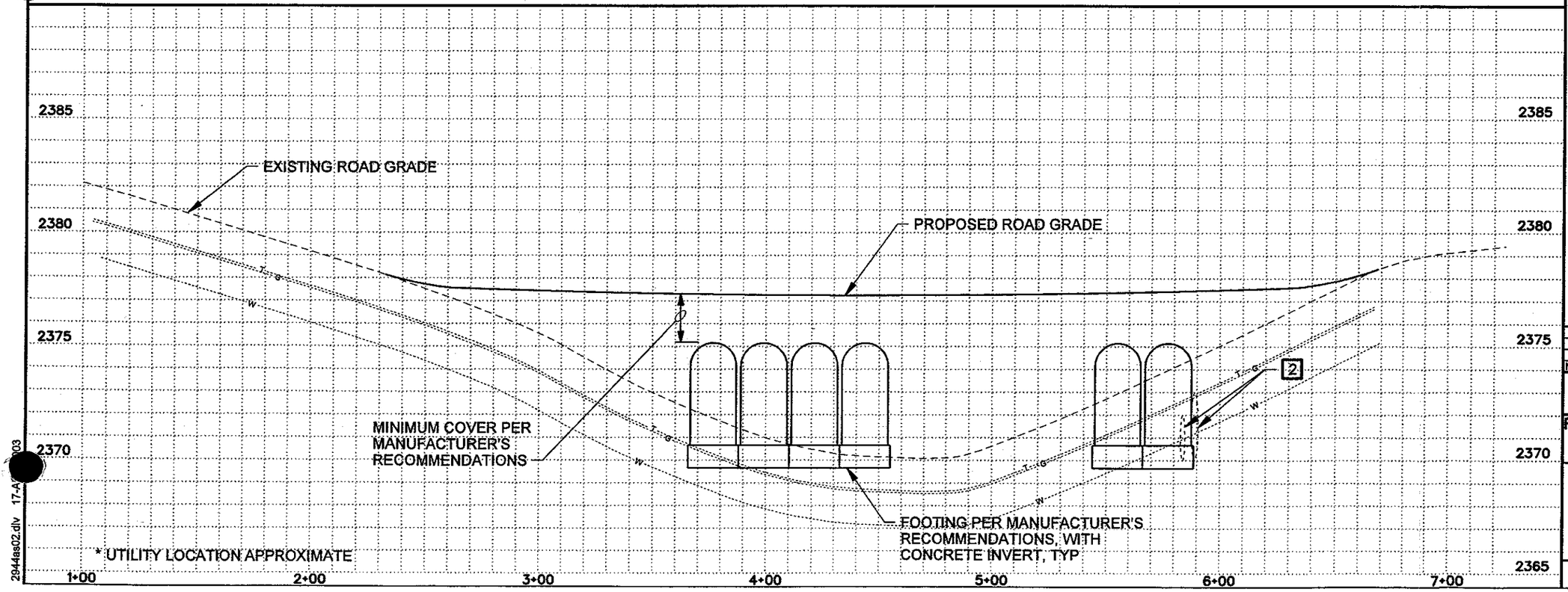
FIGURE 23

PRELIMINARY DESIGN SITES

CAREFREE DRAINAGE MASTER PLAN

F.C.D. CONTRACT NO. 2000C037





REMOVE

1. EXISTING ROADWAY
2. EXISTING CULVERTS

CONSTRUCT

2. OUTLET PROTECTION
3. HEADWALL
4. GUARD RAIL
5. EMBANKMENT FILL PROTECTION
6. ROADWAY (WITHIN SHADED LIMITS)
8. 4 - 43 LF 20'-4" X 4'-6" CMPA
9. 2 - 35 LF 20'-4" X 4'-6" CMPA

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

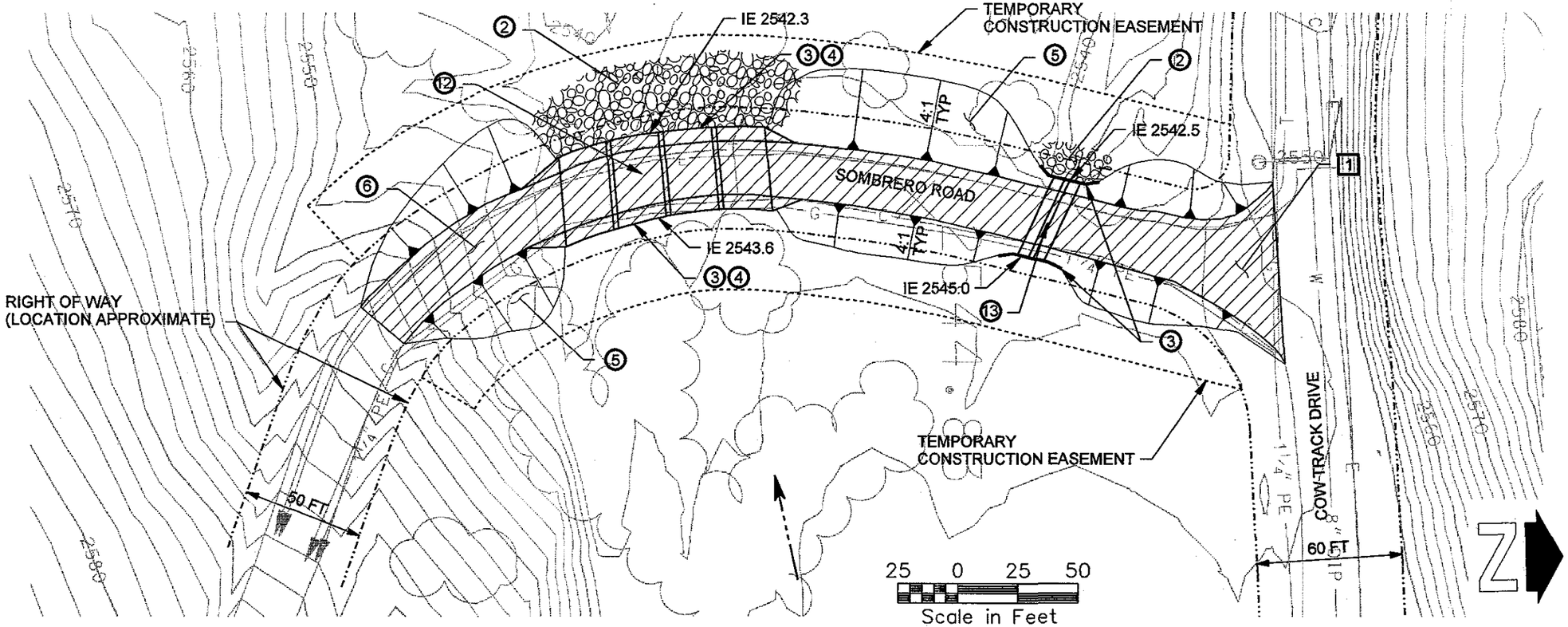
FIGURE 24 - TRANQUIL TR @35/55 (JEF)
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

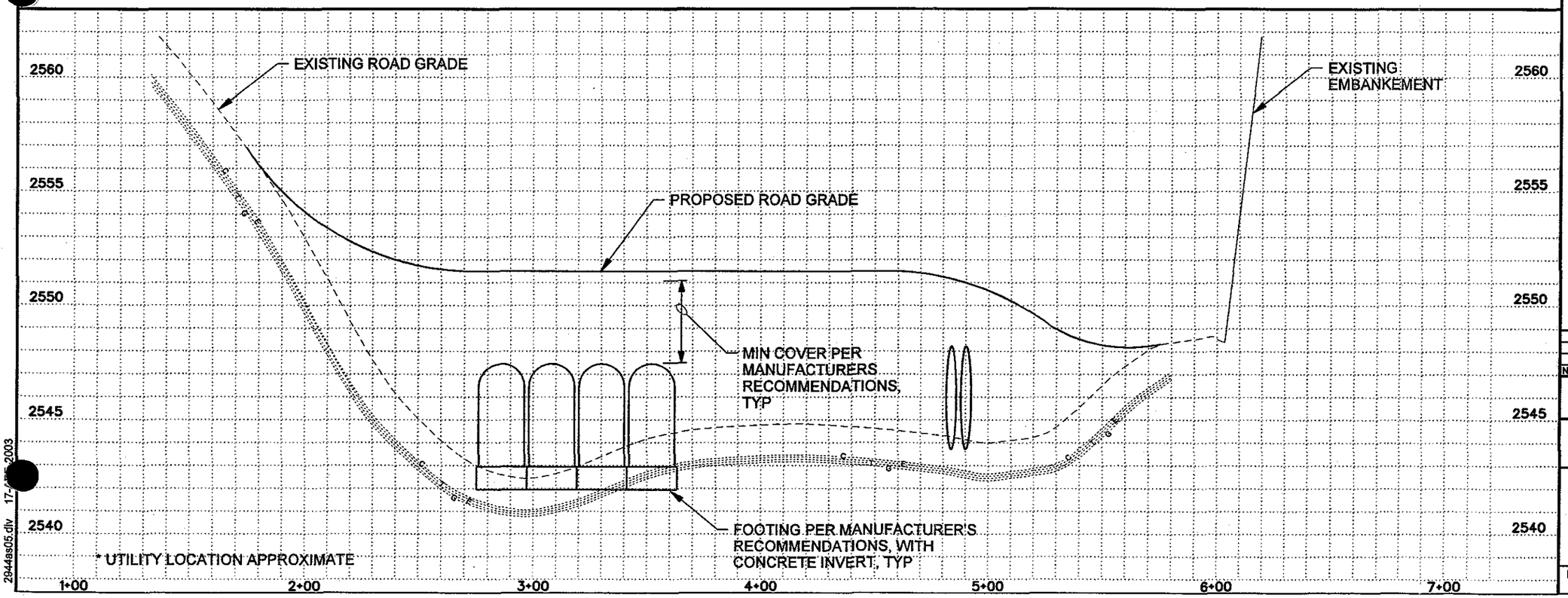
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

CH2MHILL

DRAWING NO. 02 | PLAN SHEET

2944as02.dlv 17-A[illegible]003





REMOVE

1 EXISTING ROADWAY

CONSTRUCT

2 OUTLET PROTECTION
3 HEADWALL
4 GUARD RAIL
5 EMBANKMENT FILL PROTECTION
6 ROADWAY (WITHIN SHADED LIMITS)
12 4 - 36 LF 20'-4" X 4'-6" CMPA
13 2 - 54" CMP

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FIGURE 25 - SOMBRERO RD #44 (JEF)
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

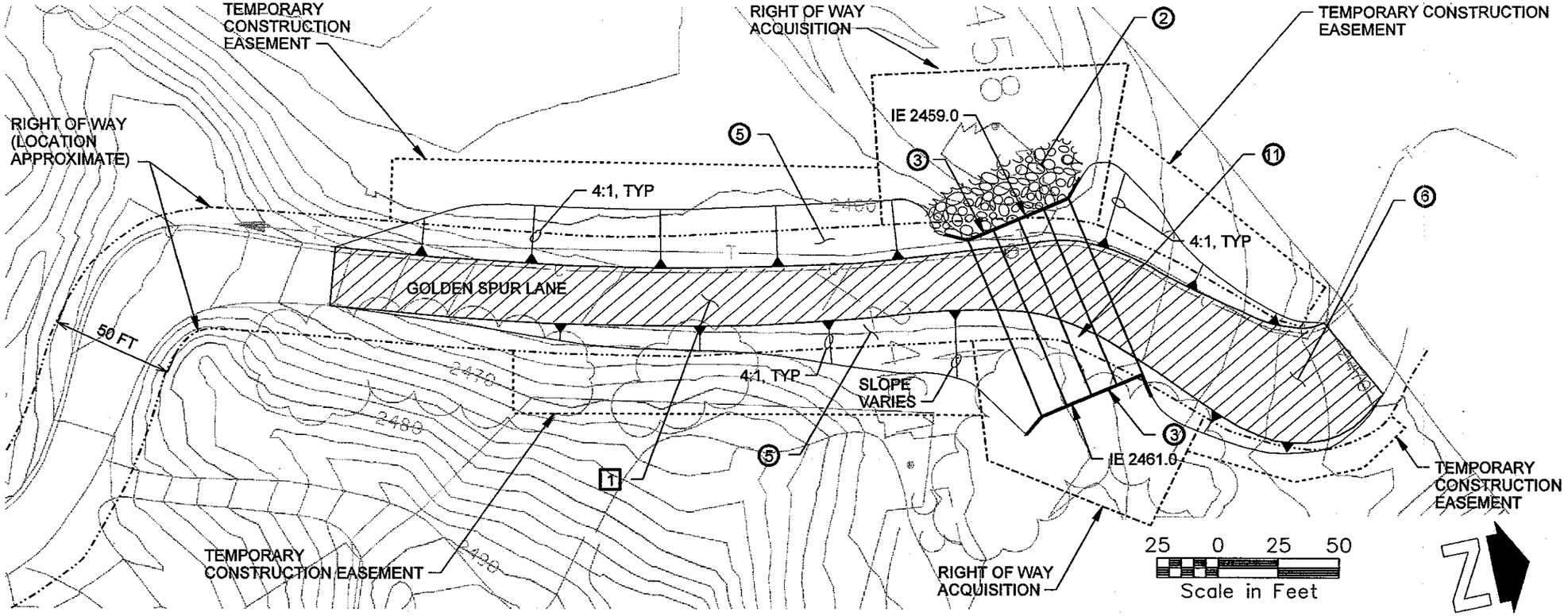
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

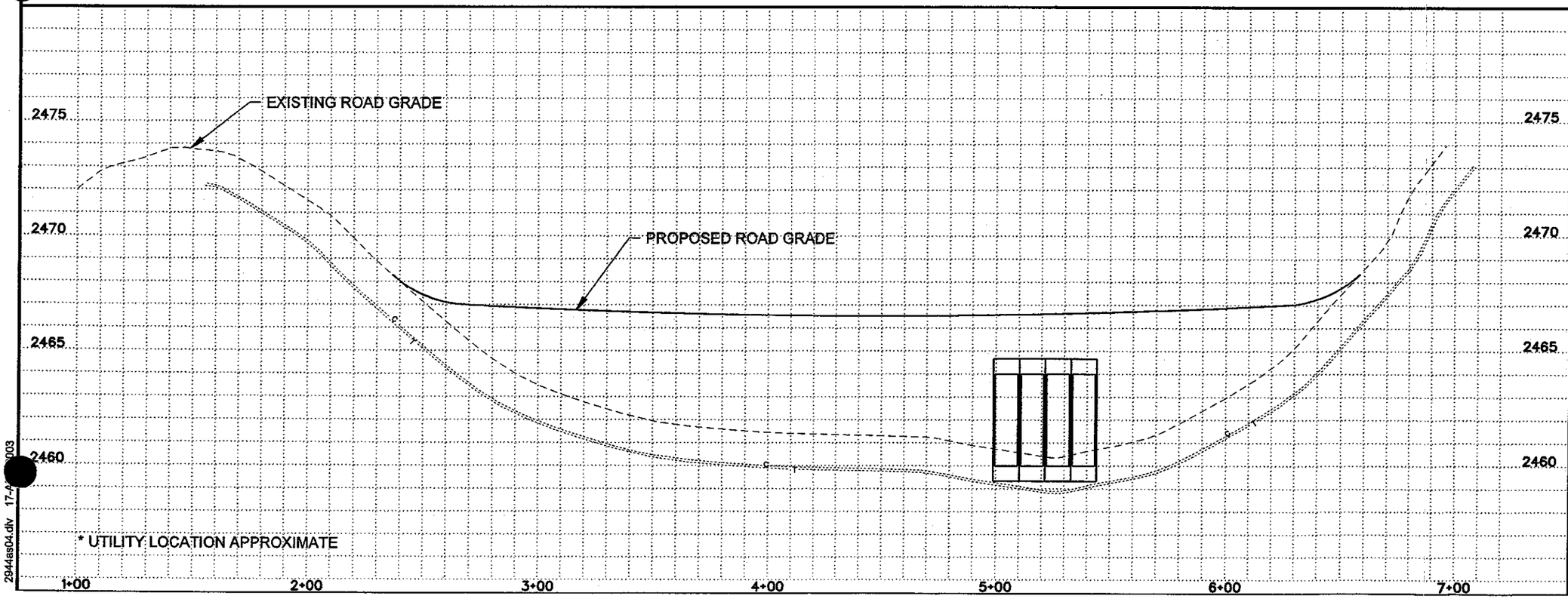
CH2MHILL

DRAWING NO. 05

PLAN SHEET

29444as05.dlv 17-APR-2003





REMOVE

1 EXISTING ROADWAY

CONSTRUCT

2 OUTLET PROTECTION
3 HEADWALL
5 EMBANKMENT FILL PROTECTION
6 ROADWAY (WITHIN SHADED LIMITS)
11 4 - 78 LF 10' X 4" CBC

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

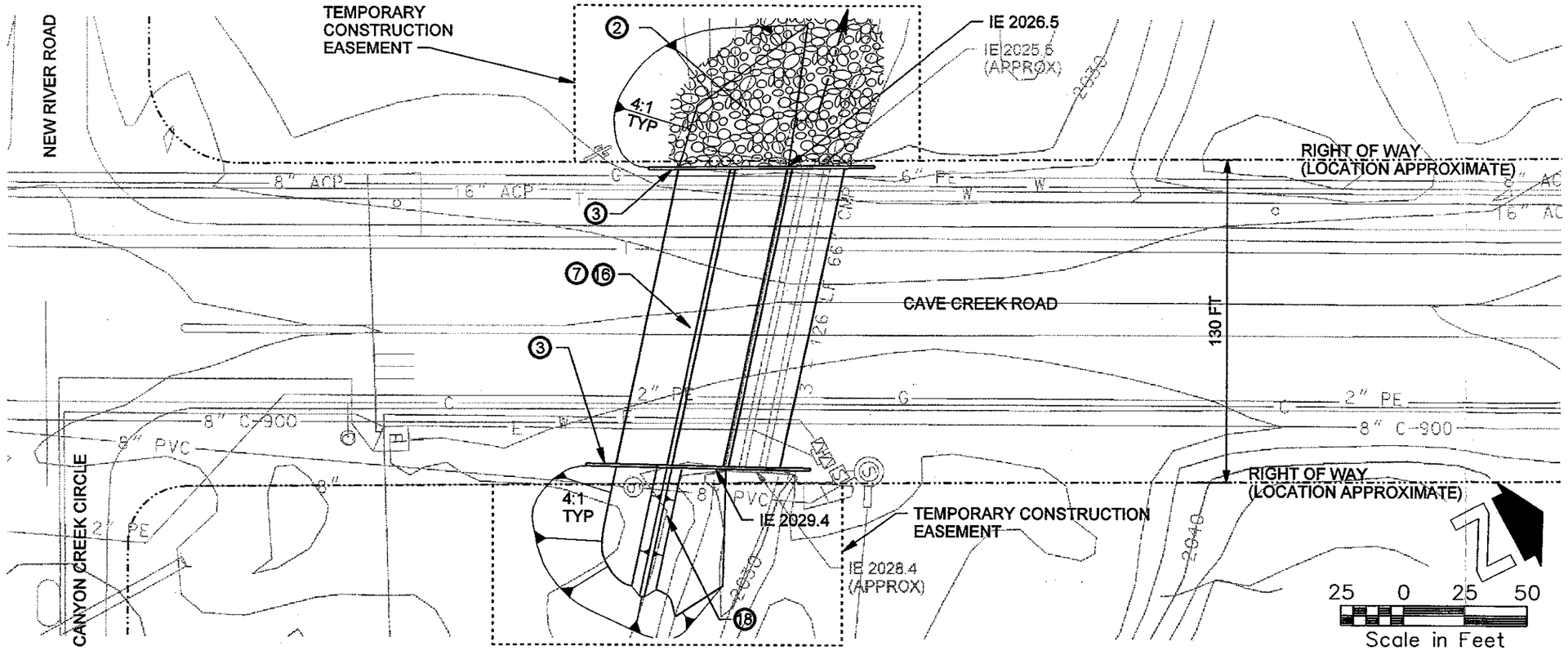
FIGURE 26 - GOLDEN SPUR #52 (JEF)
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

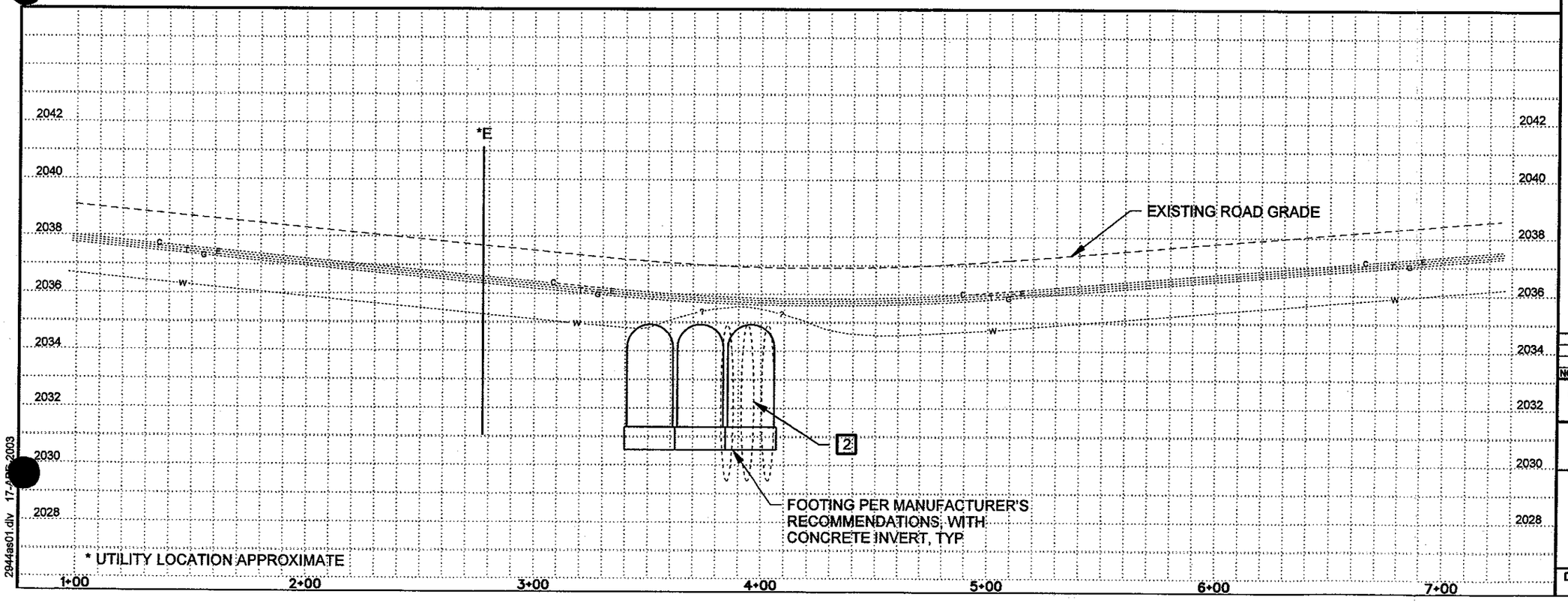
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

CH2MHILL

DRAWING NO. 04 | PLAN SHEET

2944es04.div 17-A[illegible]003





REMOVE

2 EXISTING CULVERTS

CONSTRUCT

2 OUTLET PROTECTION
3 HEADWALL
7 3 - 126 LF 20'-4" X 4'-6" CMPA
16 RESTORE PAVEMENT
18 LOW FLOW BERM

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

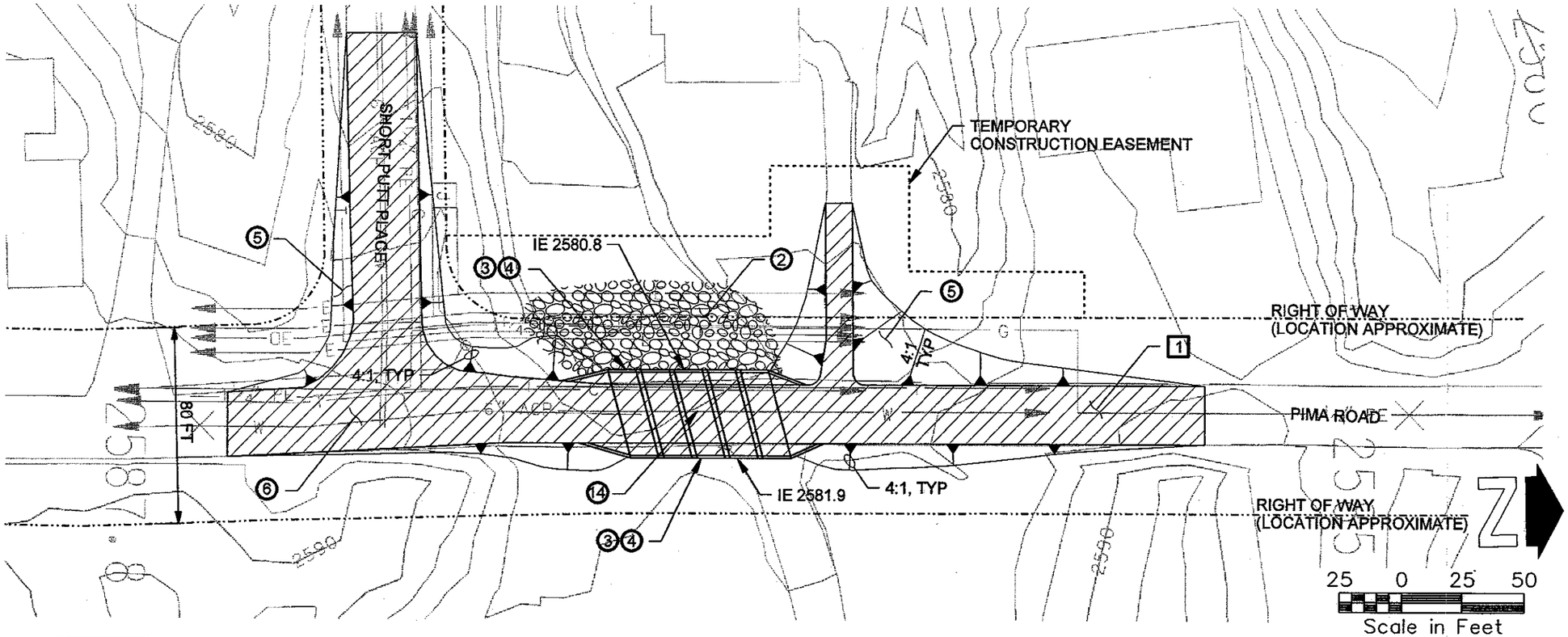
FIGURE 27 - CAVE CREEK ROAD (*6)
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

CH2MHILL

DRAWING NO. 01 | PLAN SHEET

2944as01.dlv 17-APR-2003

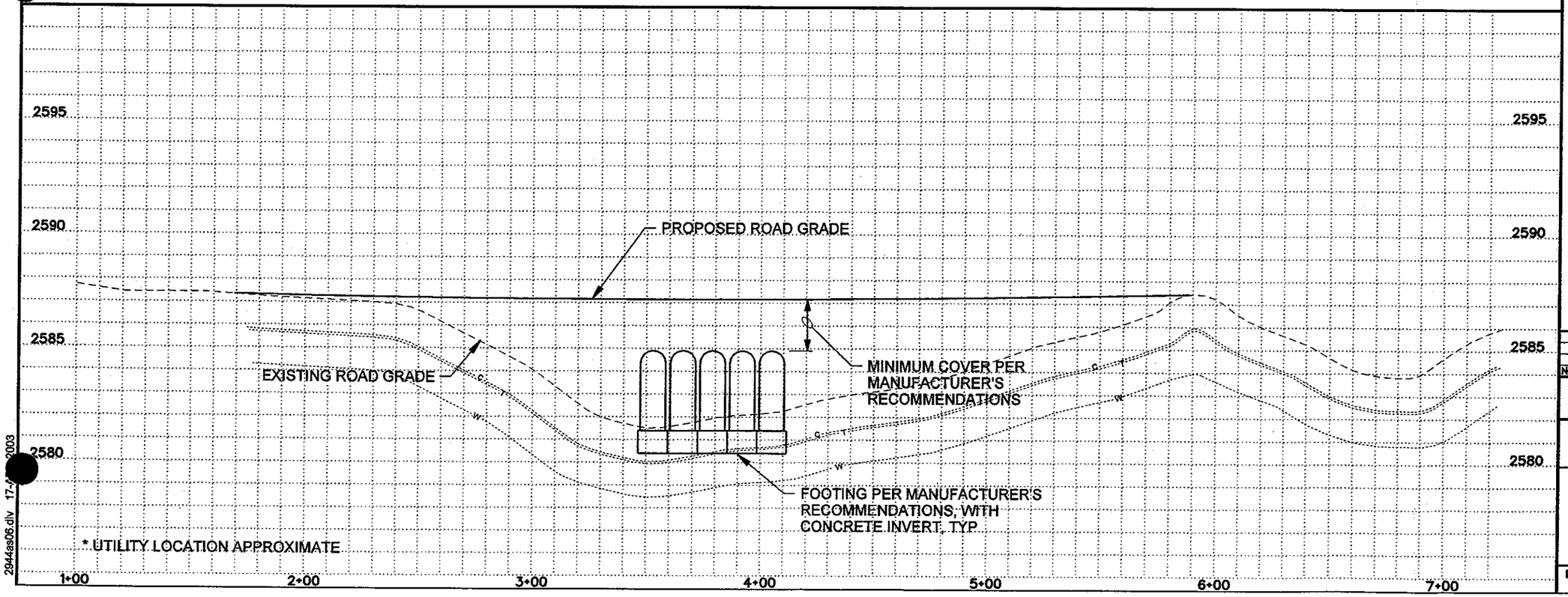


REMOVE

1 EXISTING ROADWAY

CONSTRUCT

2 OUTLET PROTECTION
3 HEADWALL
4 GUARD RAIL
5 EMBANKMENT FILL PROTECTION
6 ROADWAY (WITHIN SHADED LIMITS)
14 5 - 37 LF 11'-0" X 3'-6" CMPA



NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

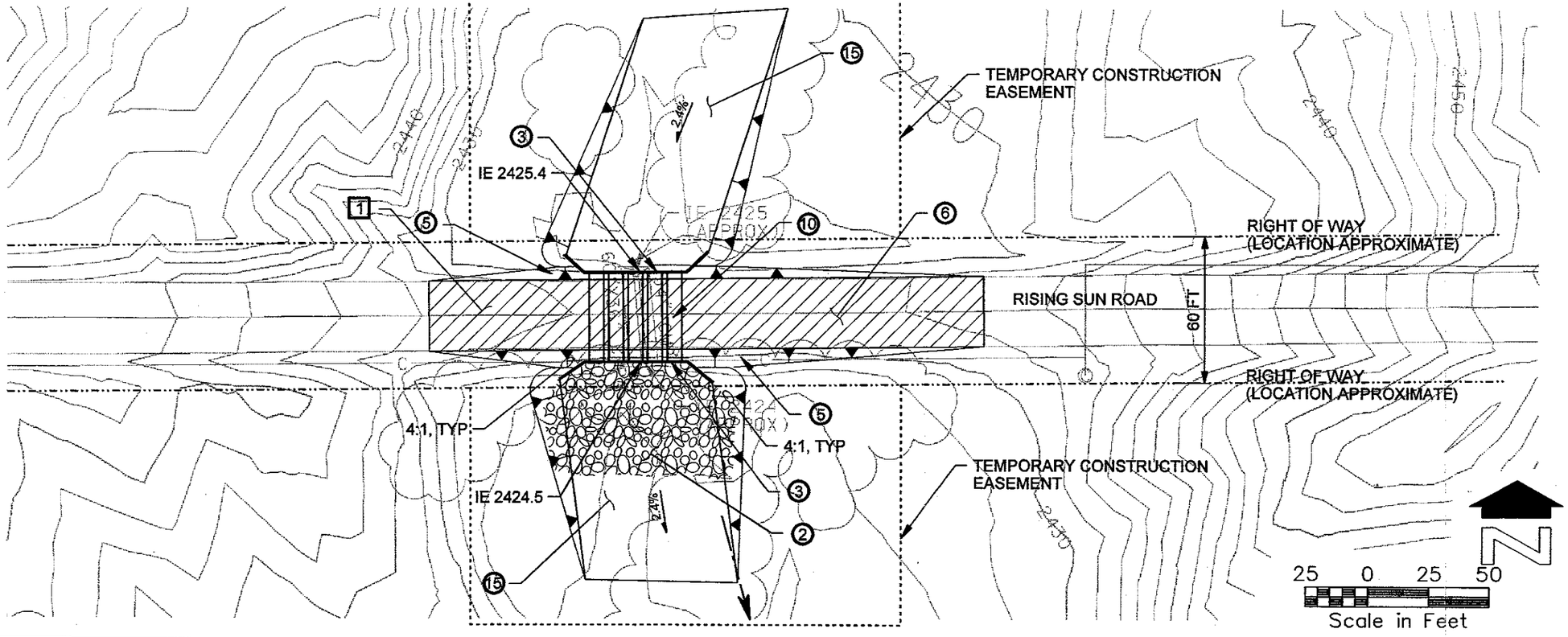
FIGURE 28 - PIMA RD #32 (JEF)
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

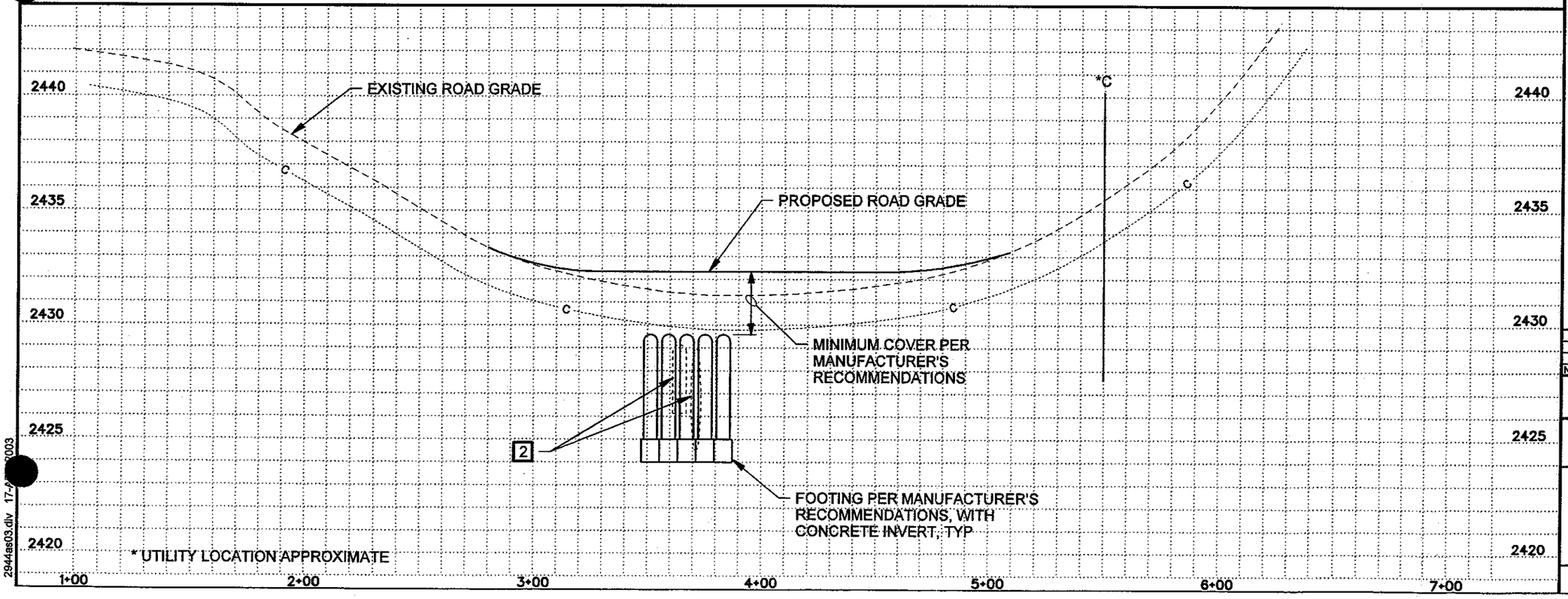
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

CH2MHILL

DRAWING NO. 06 | PLAN SHEET

2944as06.dlv 17-[illegible]-2003





REMOVE

1. EXISTING ROADWAY
2. EXISTING CULVERTS

CONSTRUCT

2. OUTLET PROTECTION
3. HEADWALL
5. EMBANKMENT FILL PROTECTION
6. ROADWAY (WITHIN SHADED LIMITS)
10. 5 - 36 LF 6'-1" X 4'-7" CMPA
15. SEDIMENT REMOVAL

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FIGURE 29 - RISING SUN RD •190
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

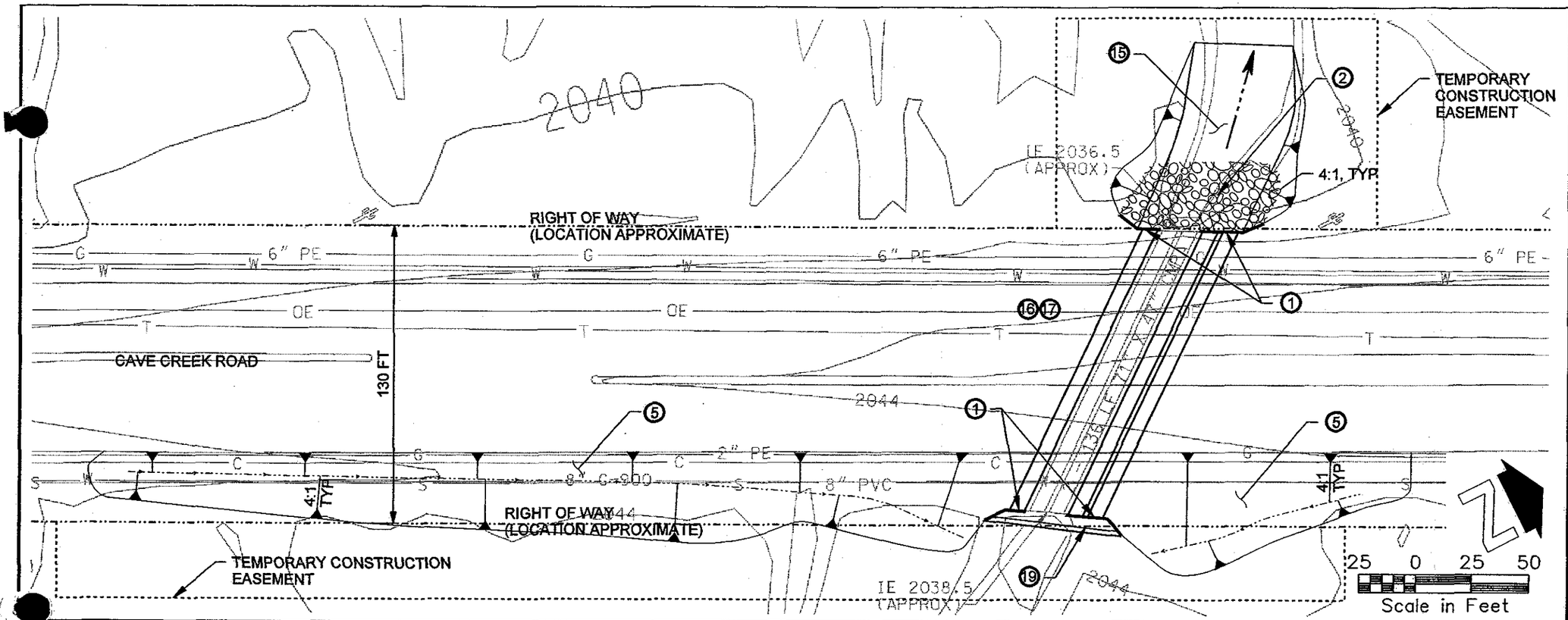
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

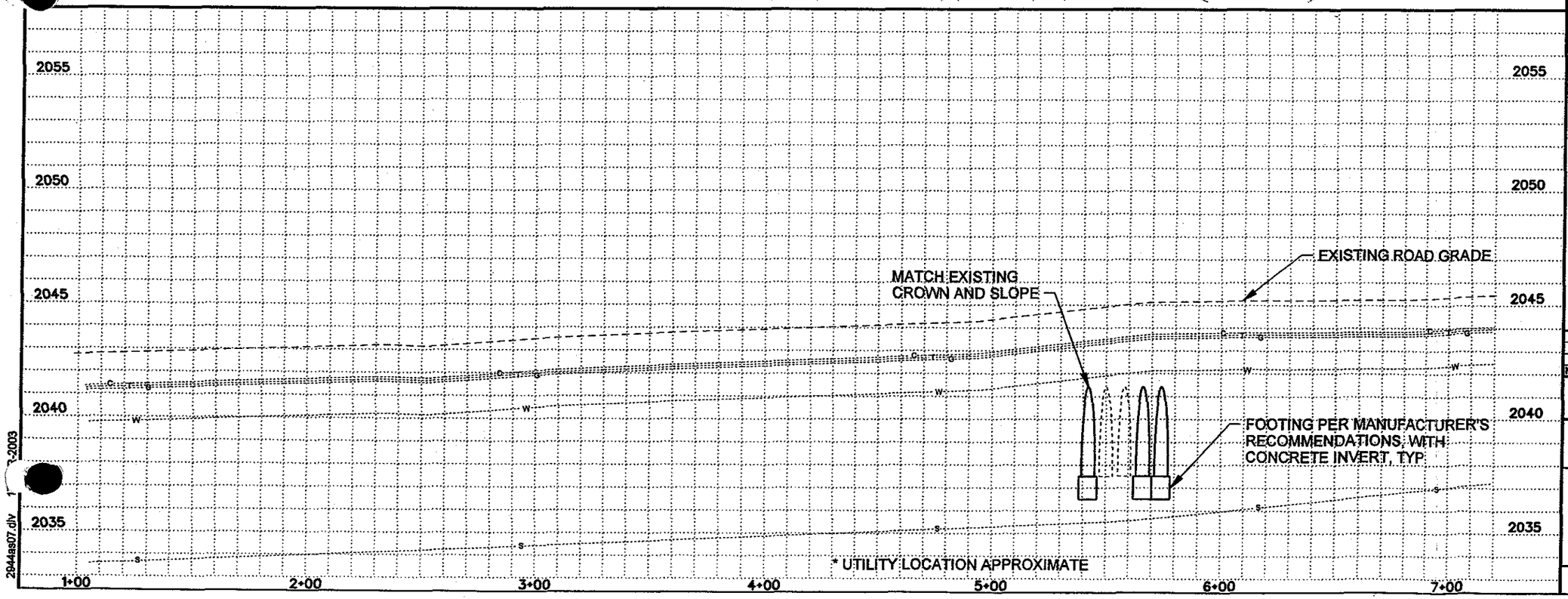
CH2MHILL

DRAWING NO. 03

PLAN SHEET

2944as03.div 17-Apr-2003





REMOVE

CONSTRUCT

1. EXTEND HEADWALL
2. OUTLET PROTECTION
5. EMBANKMENT FILL PROTECTION
15. SEDIMENT REMOVAL
16. RESTORE PAVEMENT
17. 3 - 136 LF 71" X 41" CMPA
19. CONCRETE DROP APRON

NO.	REVISION	BY	DATE

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

FIGURE 30 - CAVE CREEK RD •3
TOWN OF CAREFREE DMP
PROJECT CONTROL NO. 2000 C037

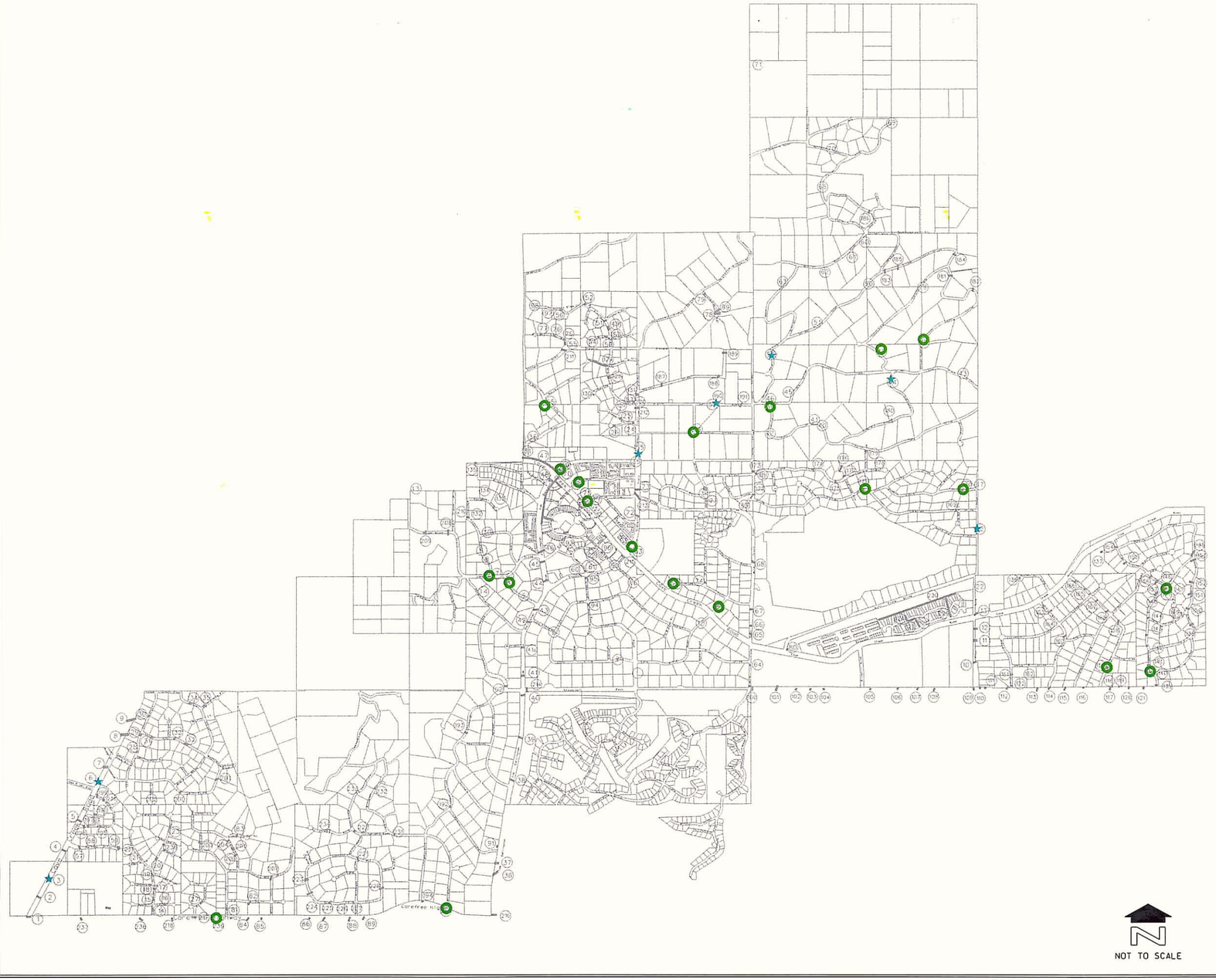
	BY	DATE
DESIGNED	ROL	
DRAWN	ROL	
CHECKED	LAJ	

CH2MHILL

DRAWING NO. 07

PLAN SHEET

2944as07.dlv 1"=2003



LEGEND

- ADVANCED STUDY SITES
- RECOMMENDED SIGNAGE LOCATIONS

NOTES

NOT TO SCALE

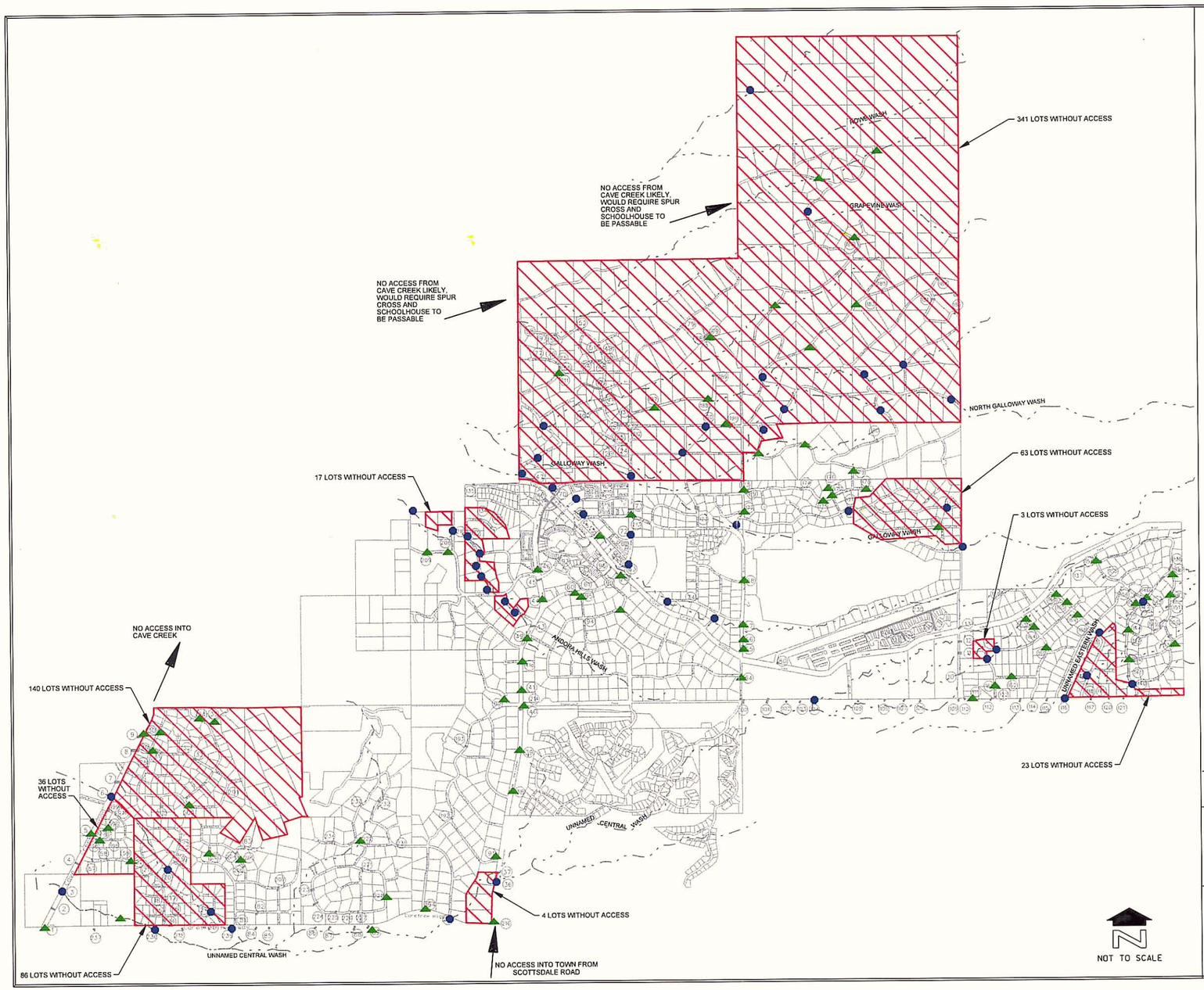
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 31

PRELIMINARY DESIGN SITES AND SIGNAGE LOCATIONS

CAREFREE DRAINAGE MASTER PLAN



LEGEND

- PARCEL INACCESSIBLE DURING 100-YR. FLOOD EVENT
- FLOW OVER ROAD (PASSABLE, > 15 CFS)
- IMPASSABLE DURING 100-YR. EVENT (> 1' DEPTH OR D x V > 10)

NOTES

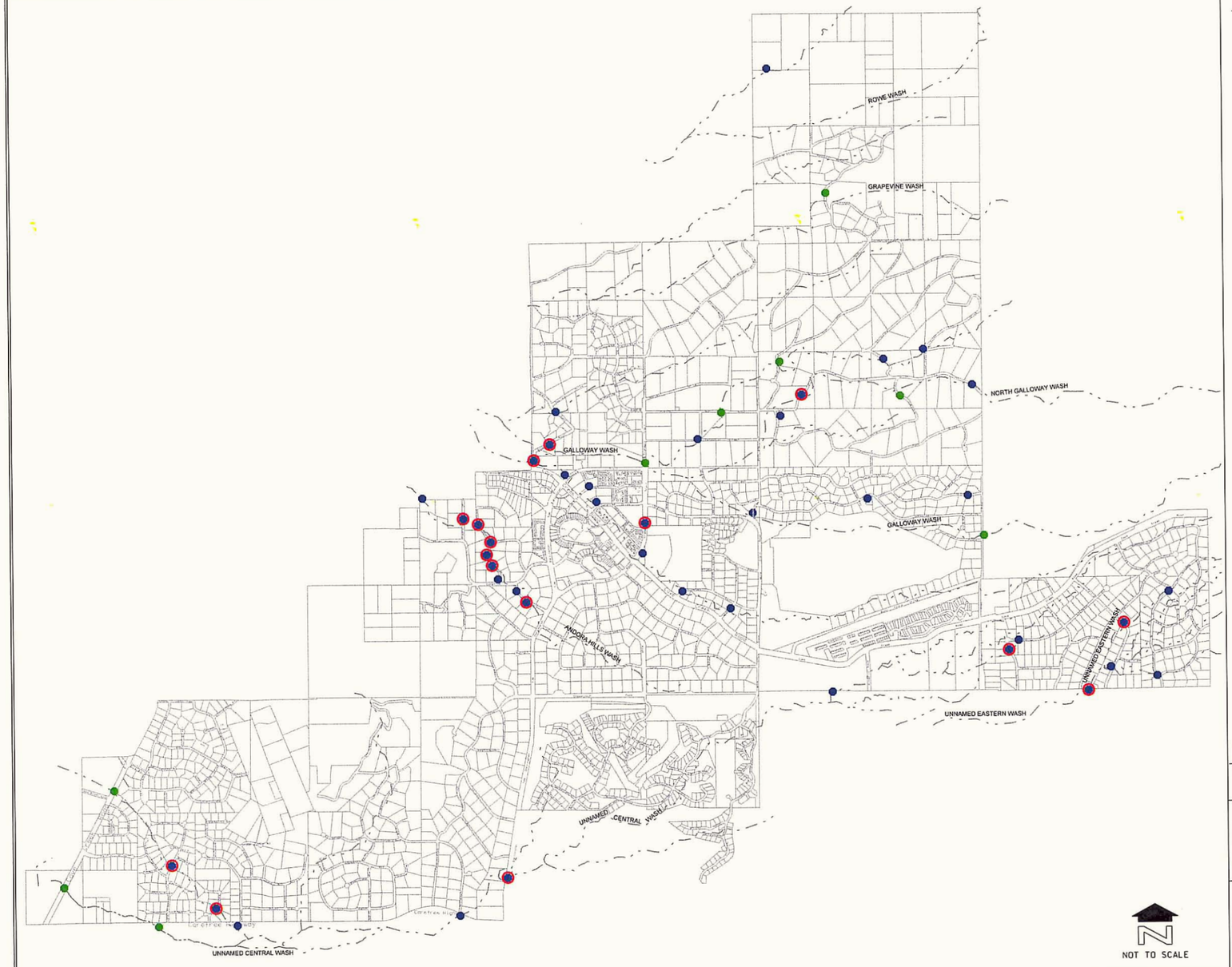
EXISTING CONDITIONS DURING 100-YR. FLOOD.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 35 - EXISTING CONDITIONS
100-YR. FLOOD EVENT ACCESS MAP
67% OF PARCELS ACCESSIBLE
CAREFREE DRAINAGE MASTER PLAN

em-access-fig-1.dgn 04-APR-2003



LEGEND

- IMPASSABLE DURING 100-YR. EVENT (> 1' DEPTH OR D x V > 10)
- IMPROVEMENTS MADE TO MAKE CROSSING PASSABLE
- IMPROVEMENTS NECCESARY FOR 100% ACCESSIBILITY, ALL PARCELS IN TOWN ACCESSIBLE

NOTES

ASSUMPTIONS:

1. CAVE CREEK ROAD THROUGH CAVE CREEK WILL ALLOW ACCESS TO TOM DARLINGTON.
2. IMPROVEMENTS IDENTIFIED WITH GREEN CIRCLE HAVE BEEN UPGRADED AND ARE PASSABLE.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

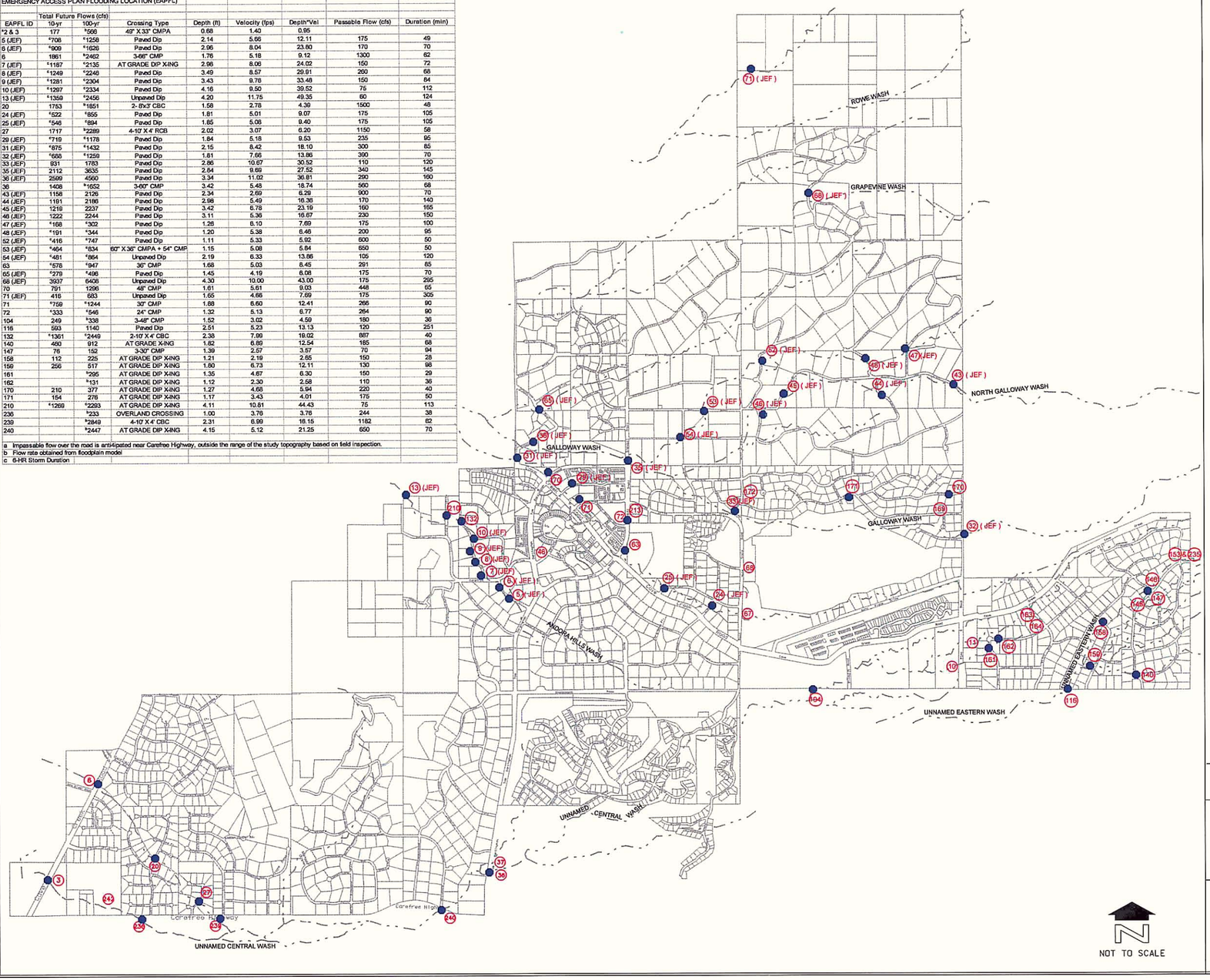
CH2MHILL

FIGURE 36 - STAGE 3 IMPROVEMENTS
100-YR. EVENT ACCESS PLAN
100% OF PARCELS ACCESSIBLE
CAREFREE DRAINAGE MASTER PLAN

em-access-fig-4.dgn 04-APR-2003

EMERGENCY ACCESS PLAN FLOODING LOCATION (EAPFL)								
	Total Future Flows (cfs)							
EAPFL ID	10-yr	100-yr	Crossing Type	Depth (ft)	Velocity (fps)	Depth*Vel	Passable Flow (cfs)	Duration (min)
*2 & 3	177	[b]566	48" X 33" CMPA	0.68	1.40	0.95		
5 (JEF)	[b]708	[c]1258	Paved Dip	2.14	5.66	12.11	175	49
6 (JEF)	[b]909	[c]1626	Paved Dip	2.96	8.04	23.80	170	70
6	1861	[b]2462	3-66" CMP	1.76	5.18	9.12	1300	62
7 (JEF)	[c]1187	[c]2135	AT GRADE DIP X-ING	2.96	8.06	24.02	150	72
8 (JEF)	[c]1249	[c]2246	Paved Dip	3.49	8.57	29.91	260	66
9 (JEF)	[c]1281	[c]2304	Paved Dip	3.43	9.78	33.48	150	84
10 (JEF)	[c]1297	[c]2334	Paved Dip	4.16	9.50	39.52	75	112
13 (JEF)	[c]1359	[c]2456	Unpaved Dip	4.20	11.75	49.35	60	124
20	1753	[b]1851	2- 8'x3' CBC	1.58	2.78	4.39	1500	48
24 (JEF)	[c]522	[c]855	Paved Dip	1.81	5.01	9.07	175	105
25 (JEF)	[b]546	[c]894	Paved Dip	1.85	5.08	9.40	175	105
27	1717	[b]2289	4-10' X 4' RCB	2.02	3.07	6.20	1150	58
29 (JEF)	[c]719	[c]1178	Paved Dip	1.84	5.18	9.53	235	95
31 (JEF)	[c]875	[c]1432	Paved Dip	2.15	8.42	18.10	300	85
32 (JEF)	[c]858	[c]1259	Paved Dip	1.81	7.66	13.86	390	70
33 (JEF)	931	1783	Paved Dip	2.86	10.67	30.52	110	120
35 (JEF)	2112	3635	Paved Dip	2.64	9.89	27.52	340	145
36 (JEF)	2599	4560	Paved Dip	3.34	11.02	36.81	290	160
36	1408	[b]1652	3-60" CMP	3.42	5.48	18.74	560	68
43 (JEF)	1158	2126	Paved Dip	2.34	2.69	6.29	900	70
44 (JEF)	1191	2186	Paved Dip	2.98	5.49	16.36	170	140
45 (JEF)	1219	2237	Paved Dip	3.42	6.78	23.19	160	165
46 (JEF)	1222	2244	Paved Dip	3.11	5.36	16.67	230	150
47 (JEF)	[c]168	[c]302	Paved Dip	1.26	6.10	7.69	175	100
48 (JEF)	[c]191	[c]344	Paved Dip	1.20	5.38	6.46	200	95
52 (JEF)	[c]416	[c]747	Paved Dip	1.11	5.33	5.92	600	50
53 (JEF)	[c]464	[c]834	60" X 36" CMPA + 54" CMP	1.15	5.08	5.84	650	50
54 (JEF)	[c]481	[c]864	Unpaved Dip	2.19	6.33	13.86	105	120
63	[c]578	[c]947	36" CMP	1.68	5.03	8.45	291	65
65 (JEF)	[c]279	[c]498	Paved Dip	1.45	4.19	6.08	175	70
68 (JEF)	3937	6408	Unpaved Dip	4.30	10.00	43.00	175	295
70	791	1296	48" CMP	1.61	5.61	9.03	448	65
71 (JEF)	416	683	Unpaved Dip	1.65	4.66	7.69	175	305
71	[c]759	[c]1244	30" CMP	1.88	6.60	12.41	266	90
72	[c]333	[c]546	24" CMP	1.32	5.13	6.77	264	90
104	249	[c]338	3-48" CMP	1.52	3.02	4.59	180	36
116	993	1140	Paved Dip	2.51	5.23	13.13	120	251
132	[c]1361	[c]2449	2-10' X 4' CBC	2.38	7.99	19.02	887	40
140	460	912	AT GRADE X-ING	1.82	6.89	12.54	185	68
147	76	152	3-30" CMP	1.39	2.67	3.67	70	94
158	112	225	AT GRADE DIP X-ING	1.21	2.19	2.65	150	28
159	256	517	AT GRADE DIP X-ING	1.80	6.73	12.11	130	98
161		[c]295	AT GRADE DIP X-ING	1.35	4.67	6.30	150	29
162		[c]131	AT GRADE DIP X-ING	1.12	2.30	2.58	110	36
170	210	377	AT GRADE DIP X-ING	1.27	4.68	5.94	220	40
171	154	276	AT GRADE DIP X-ING	1.17	3.43	4.01	175	50
210	[c]1269	[c]2293	AT GRADE DIP X-ING	4.11	10.81	44.43	75	113
236		[b]233	OVERLAND CROSSING	1.00	3.76	3.76	244	38
239		[b]2849	4-10' X 4' CBC	2.31	6.99	16.15	1182	82
240		[b]2447	AT GRADE DIP X-ING	4.15	5.12	21.25	650	70

a Impassable flow over the road is anticipated near Carefree Highway, outside the range of the study topography based on field inspection.
b Flow rate obtained from floodplain model
c 6-HR Storm Duration



LEGEND

- (71) DRAINAGE FEATURE NUMBER IDENTIFIER
- IMPASSABLE DURING 100-YR EVENT (>1' DEPTH OR D x V > 10)

NOTES

CULVERT LOCATIONS TAKEN FROM VARIOUS IMPROVEMENT PLANS, AS-BUILT PLANS, REPORTS, AND FIELD SURVEYS.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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FIGURE 4

100-YR. EVENT EXISTING CONDITIONS

IMPASSABLE ROAD CROSSINGS

CAREFREE DRAINAGE MASTER PLAN

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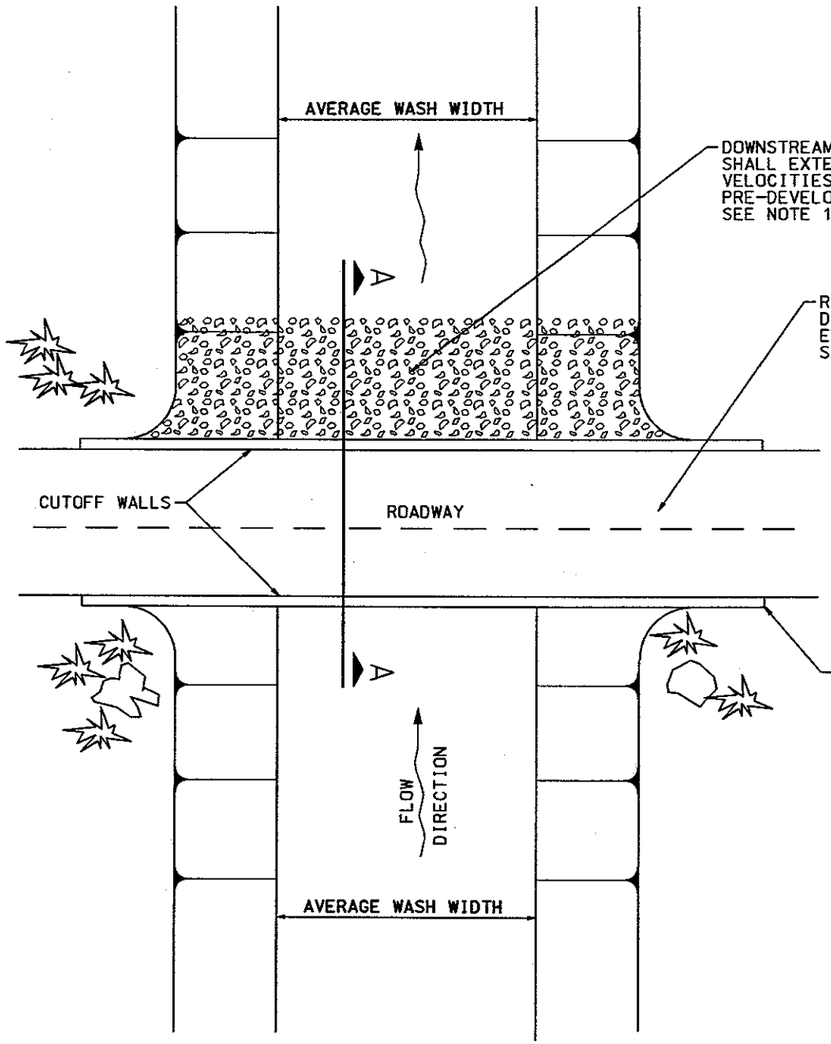
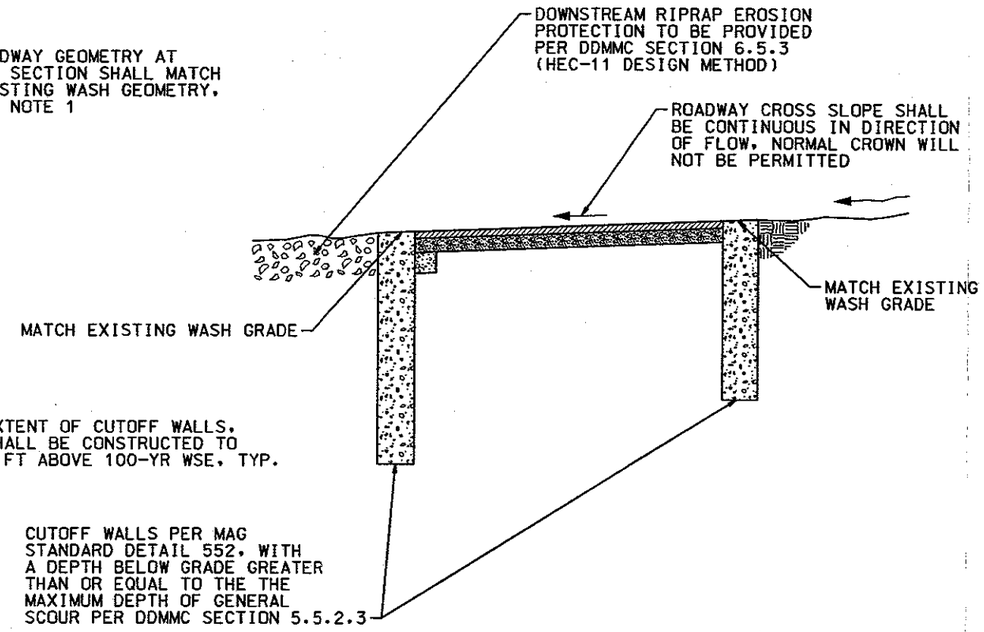


PLAN VIEW



SECTION A-A

NOT TO SCALE

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

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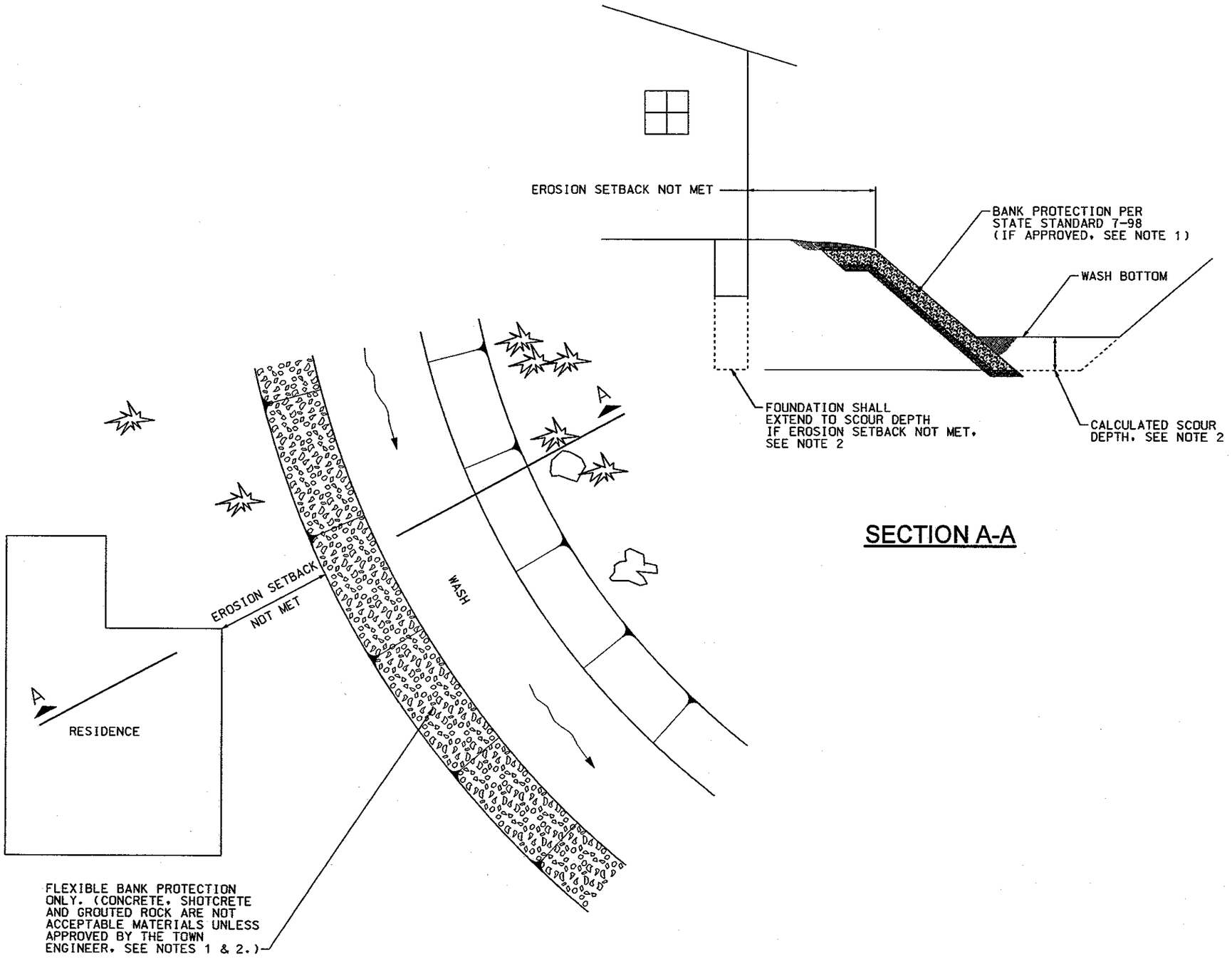
FIGURE 42
GENERIC DESIGN ELEMENT - DIP CROSSING



SECTION A-A

PLAN VIEW

NOT TO SCALE

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

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FIGURE 43
GENERIC DESIGN ELEMENT - BANK STABILIZATION

APR-2003

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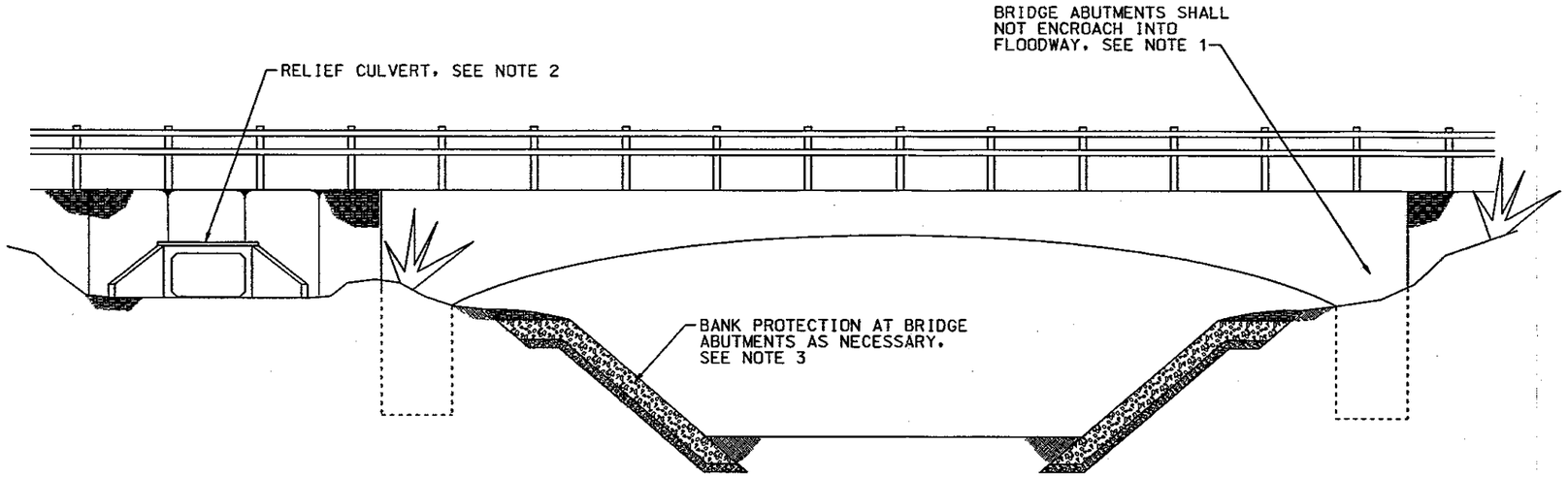
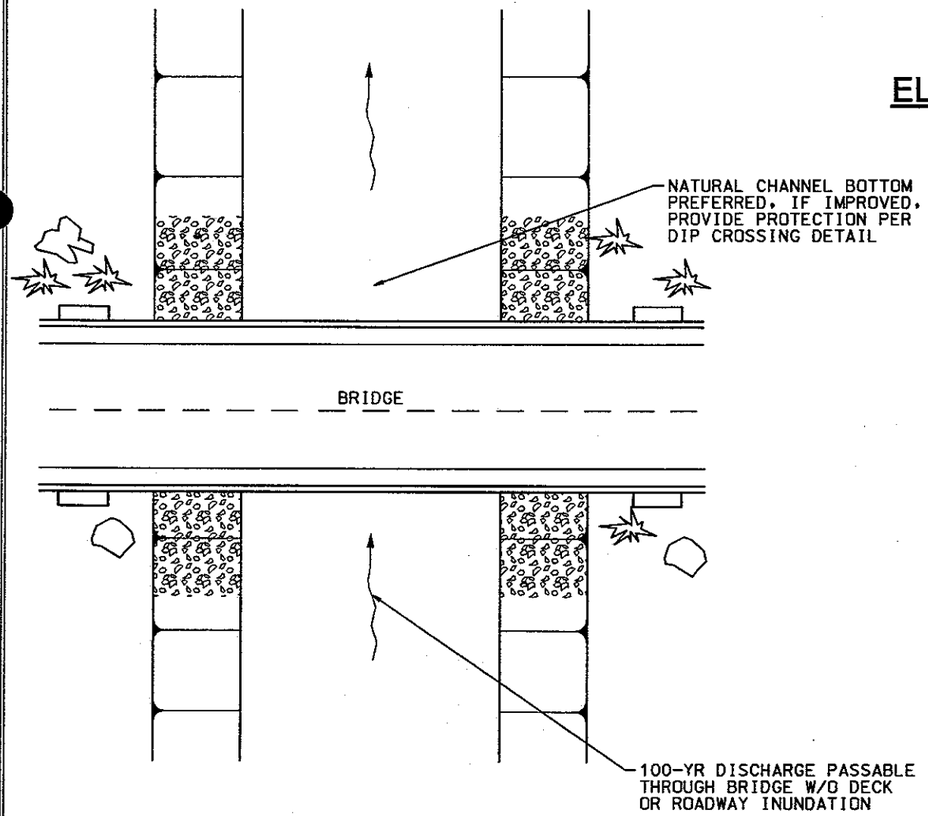


ELEVATION VIEW



PLAN VIEW

NOT TO SCALE

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

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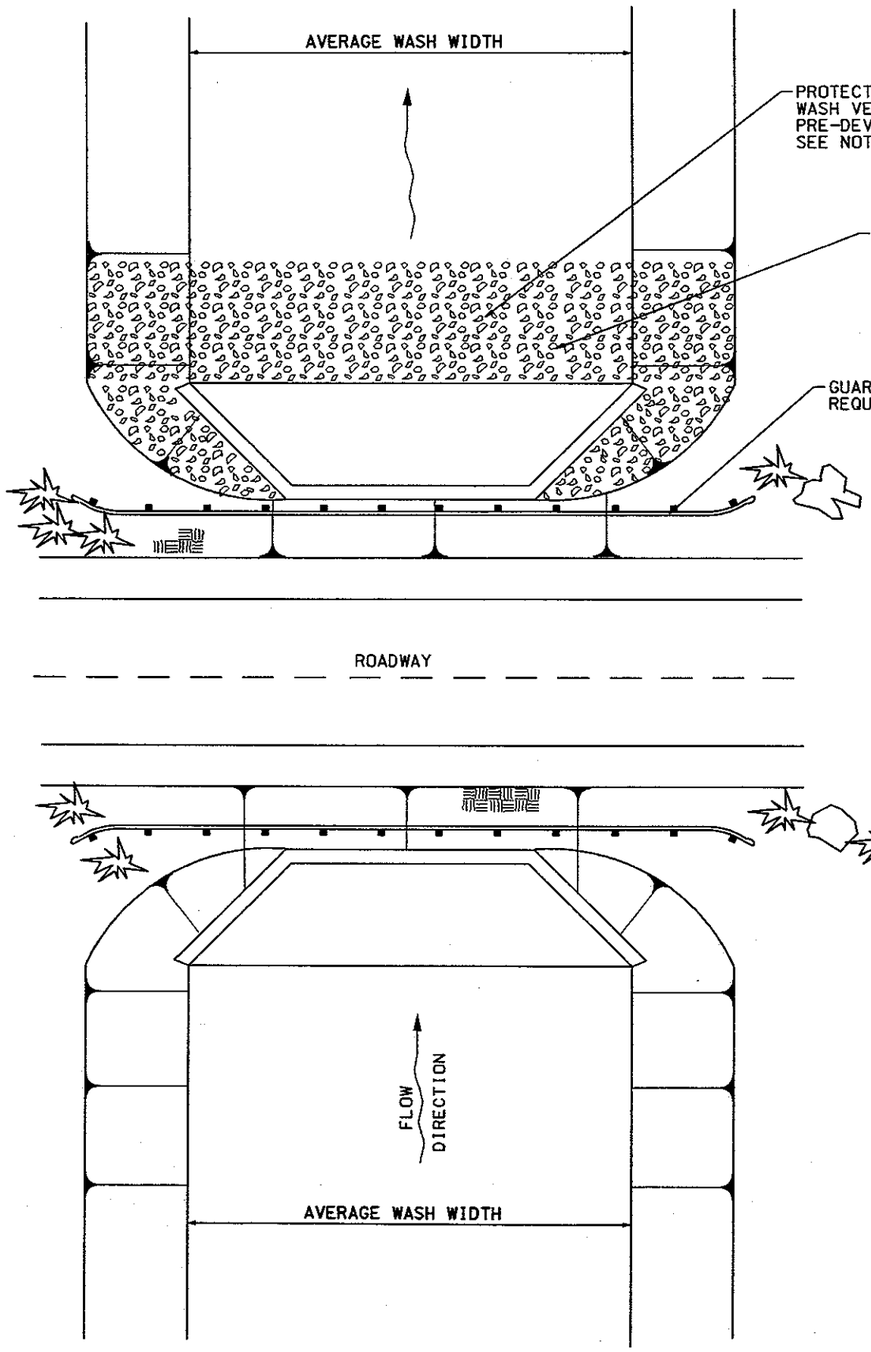
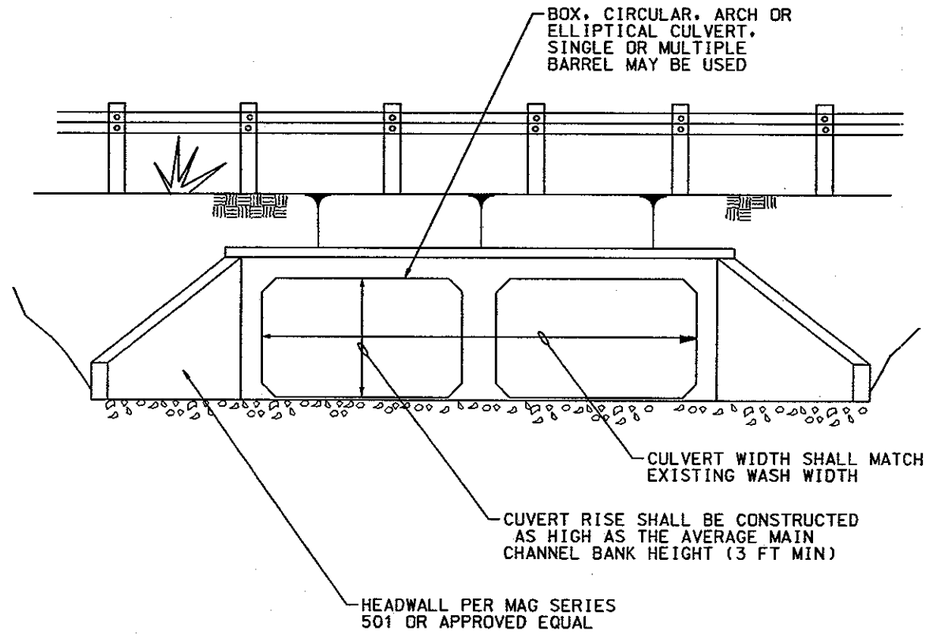
FIGURE 44
GENERIC DESIGN ELEMENT - BRIDGE CROSSING



PLAN VIEW



ELEVATION VIEW

NOT TO SCALE

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 DDMMC 100-YR PASSABLE THROUGH CULVERT PREFERRED.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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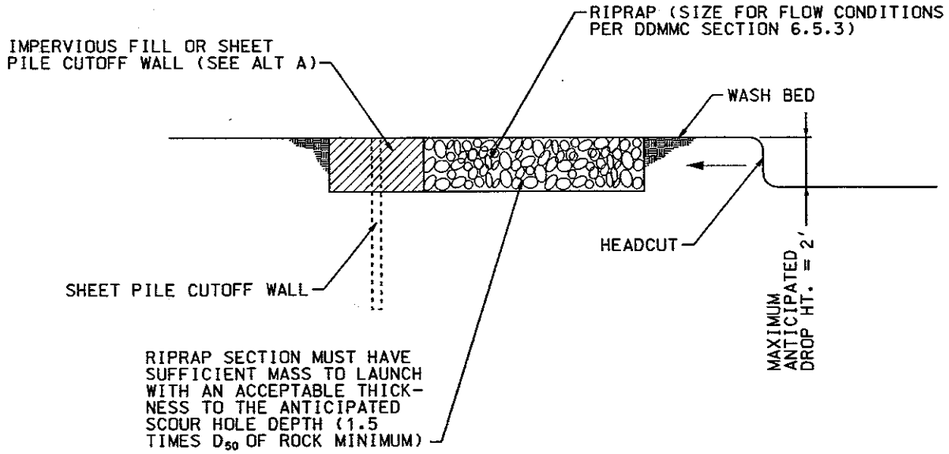
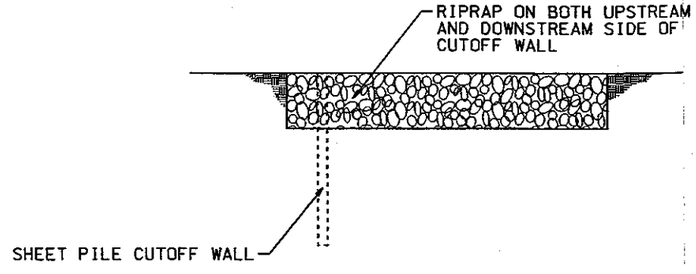
FIGURE 45
GENERIC DESIGN ELEMENT -
CULVERTS & OUTLET PROTECTION



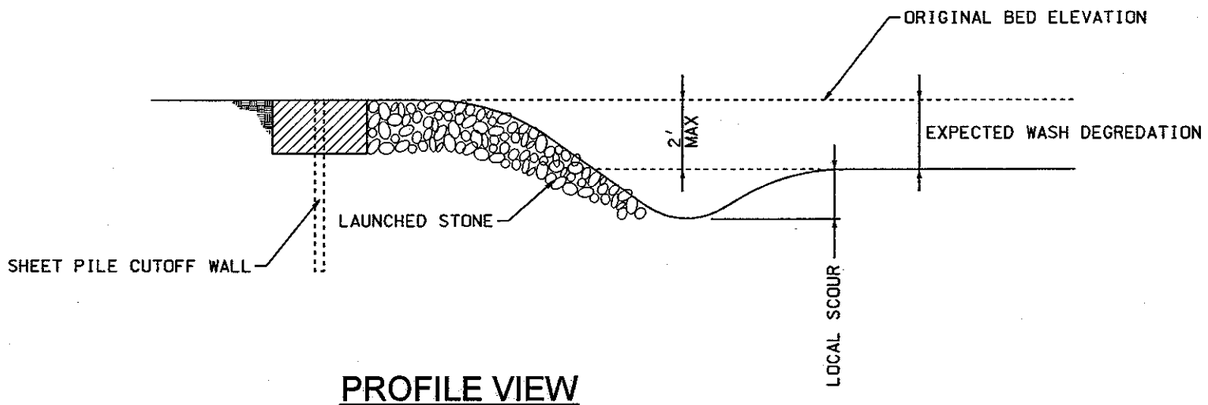
PROFILE VIEW

RIPRAP GRADE CONTROL STRUCTURE



ALTERNATIVE A

SHEET PILE CUTOFF WALL



PROFILE VIEW

RIPRAP GRADE CONTROL STRUCTURE
AFTER MIGRATION OF HEADCUT
TO STRUCTURE

NOT TO SCALE

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 APPLIC-ATIONS. 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 CON-STRUCTED OF NATURAL MATERIALS SUCH AS BOULDERS. LOOSE, GRADED RIPRAP IS NOT ALLOWED.
4. BAFFLE CHUTES ARE NOT ALLOWED.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CH2MHILL

FIGURE 46
GENERIC DESIGN ELEMENT -
GRADE CONTROL STRUCTURE

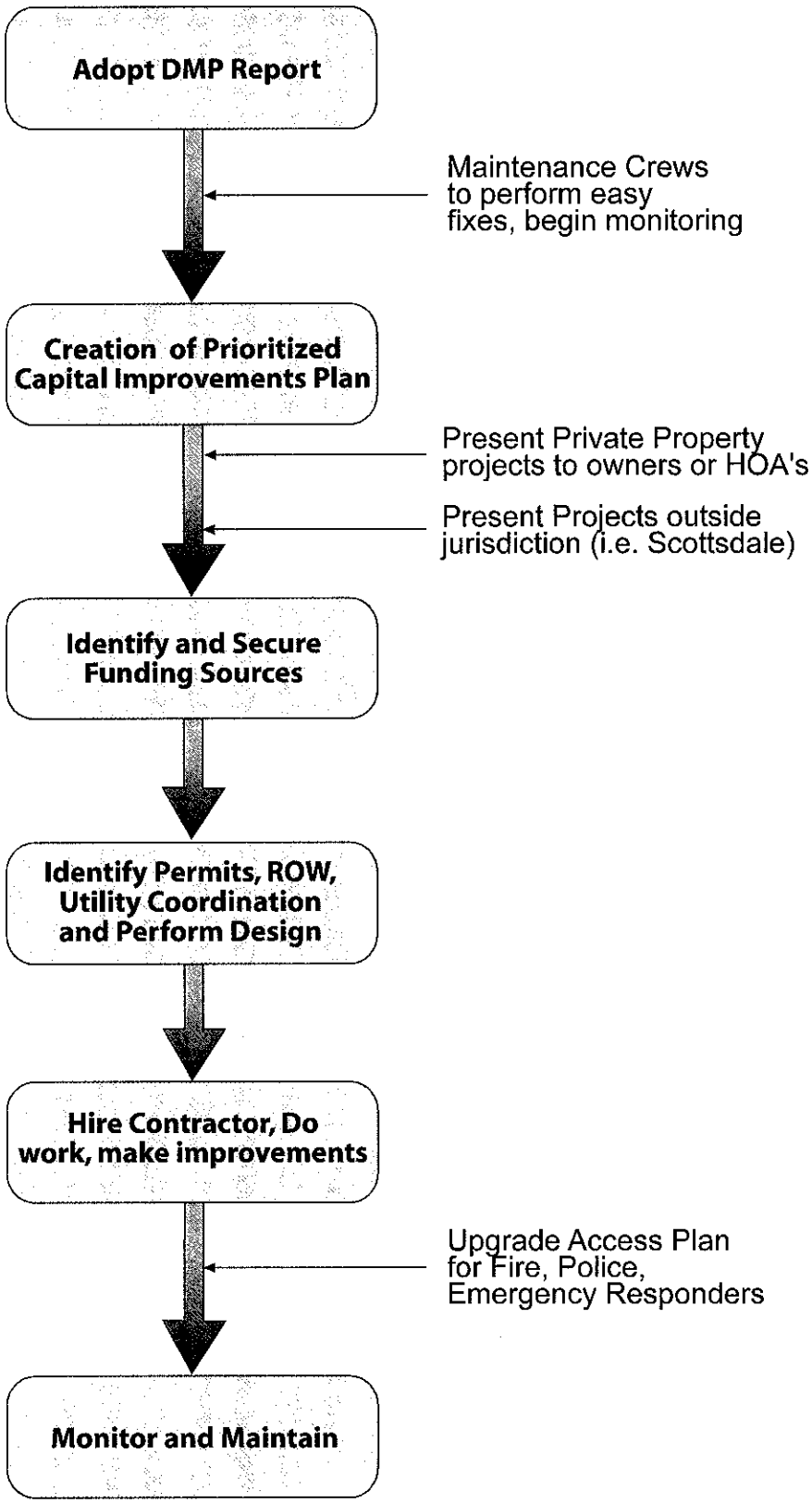


FIGURE 47
IMPLEMENTATION PLAN
TOWN OF CAREFREE