WEST CACTUS DETENTION BASIN AND CHANNELS PROJECT

CANDIDATE ASSESSMENT REPORT

Prepared For:
Flood Control District of Maricopa County
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October 2004

FCD Contract No. 2003C020
Assignment #1

SCI #16956

Stanley Consultants INC.

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West Cactus Basin and Channels – Executive Summary

The purpose of this report is to document the results of the Candidate Assessment Report (CAR). The results from this study are intended to identify the future considerations and further refine the regional basin concept introduced in the White Tanks / Agua Fria River Area Drainage Master Plan (ADMP) in the El Mirage Area. The White Tanks ADMP identified the need for the West Cactus Basin and Channels Project to reduce the flooding hazards in the City of El Mirage.

The CAR was initiated at the request of the City of El Mirage due to recent and significant development, and to verify if there was a more cost effective solution than proposed in the ADMP. The CAR was conducted in two phases. The first phase involved collection of data. This required collection of new data, reconsideration of existing conditions, and extensive surveying of the watershed to evaluate certain hydrologic and hydraulic conditions. The second phase was the performance of alternative analysis. This phase included the development and distillation of alternatives to arrive at a final preferred alternative. This project developed a number of preliminary structural alternatives to either reduce discharges or increase conveyance, as well as a "Do Nothing" alternative that evaluated existing conditions as if no structural features were built. Each preliminary alternative was evaluated for hydrologic and hydraulic benefits, costs, constructability and future multi-use opportunities. From this, the project team selected three structural alternatives and mandated the "Do Nothing" alternative.

In the study's data collection effort, the project team identified that the existing condition 100-year peak discharge, downstream from the rough graded basin south of Cactus Road, at the culvert at El Mirage Road was reduced from about 1,800 cfs to 1,326 cfs. Although this existing basin does not provide comprehensive 100-year flood protection for areas downstream (the Pueblo El Mirage Golf Course), it does provide significant attenuation for, say, a 10-year storm or less. This finding played a significant role in the study's preferred alternative.

In the final meeting with the Flood Control District of Maricopa County (District), the "Do Nothing" alternative was concluded as the preferred alternative. This was because: a) structural flood control improvements would essentially benefit only one downstream property owner; b) the existing basin already provides a significant degree of benefit; and c) the existing floodplain delineation does provide for non-structural flood protection in the form of floodplain management and flood insurance.

The study team also recommends the following items be implemented as part of the recommended plan:

1. The 100-year floodplain and floodway of Lower El Mirage Wash should be re-delineated recognizing current conditions and using newly revised ADMP hydrology.
2. A local project should be initiated that would correct the most serious of conveyance deficiencies / obstructions in the Lower El Mirage Wash immediately downstream from El Mirage Road.
3. A local project should be initiated that would correct the storm drain sump conditions that exist on 125th Avenue and Canterbury Drive adjacent to the West Cactus Basin. These conditions pose a local flood threat to existing residences.
4. The channels upstream from the West Cactus Basin should be surfaced with rock mulch, decomposed granite or at least temporarily hydroseeded to protect

bare earth banks from scour and rilling. Existing local scour problems at channel inflow points should be corrected. A comprehensive evaluation should be made regarding bed and bank protection needs at structures, bends and angle points.

5. A plan should be established to dispose of the runoff that collects in the existing West Cactus Basin below the outfall elevation associated with the existing El Mirage Road box culvert. Currently, the only means of disposal for this volume of more than 30 acre-feet is through direct percolation and evaporation.

West Cactus Detention Basin and Channels Project
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Under Separate Cover

West Cactus Detention Basin and Channels Project Survey Report

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L33PF6D.DAT	Loop 303 Corridor/White Tanks Area Drainage Master Plan Update (ADMP), Future Condition HEC-1 Model Input Based on Municipality Long-Term Planning and Zoning and with Anticipated Regional and Local Drainage Projects
L33PF6D.OH1	Loop 303 Corridor/White Tanks Area Drainage Master Plan Update (ADMP), Future Condition HEC-1 Model Output Based on Municipality Long-Term Planning and Zoning and with Anticipated Regional and Local Drainage Projects
EXSTREV1.DAT	Existing Condition HEC-1 Model Input Used for Evaluating the "Do Nothing" Alternative – Post Supplemental Hydrology Data
EXSTREV1.OUT	Existing Condition HEC-1 Model Output Used for Evaluating the "Do Nothing" Alternative – Post-Supplemental Hydrology Data
ALT2REV1.DAT	HEC-1 Model Input Used for Evaluating Preliminary Alternative No. 2 and Preliminary Alternative No. 4 (100-Yr Discharge Reduction with Off-Line Basin) – Pre-Supplemental Hydrology
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13WSHLLT.DAT	HEC-2 Model Input (West Cactus Basin Project's Base Hydraulics) Used for the Lower El Mirage Wash Channelization Application for As-Built Letter of Map Revision (LOMR), Prepared by A-N West for City of El Mirage, September 2001
13WSHLLT.DAT	HEC-2 Model Output (West Cactus Basin Project's Base Hydraulics) Used for the Lower El Mirage Wash Channelization Application for As-Built Letter of Map Revision (LOMR), Prepared by A-N West for City of El Mirage, September 2001

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13TRBLLT.DAT	HEC-2 Model Input Used for the Lower El Mirage Wash Tributary Channelization Application for As-Built Letter of Map Revision (LOMR), Prepared by A-N West for City of El Mirage, September 2001
13TRBLLT.OUT	HEC-2 Model Output Used for the Lower El Mirage Wash Tributary Channelization Application for As-Built Letter of Map Revision (LOMR), Prepared by A-N West for City of El Mirage, September 2001
13wshlt.prj	13WSHLLT.DAT HEC-2 Model Converted to HEC-RAS (version 3.1.1)
13trblt.prj	13TRBLLT.DAT HEC-2 Model Converted to HEC-RAS (version 3.1.1)
exstrev0.prj	13wshlt.prj HEC-RAS Model Modified to Reflect Existing Condition Discharges Obtained from EXSTREV1.DAT HEC-1 Model.
HEC-RAS Exst vs LOMR, rev0.xls	Excel Spreadsheet Containing HEC-RAS Comparison Between 13wshlt.prj and exstrev0.prj
Project Photos	Photographs of Various Drainage Facilities
Basin Points.dwg	AutoCAD File Containing Supplemental Survey Points of Existing On-Line Detention Basin and Local Retention
W Cactus final CAR.doc	West Cactus Detention Basin and Channels Project Candidate Assessment Repot
Drainage Facility Photos.doc	Various photographs of existing drainage facilities
Local Ersn Photos.doc	Various photographs of local erosion within the Lower El Mirage Wash and Tributary
Normal Depth Photos.doc	Photographs of Lower El Mirage Wash Channel through Pueblo El Mirage Development, downstream of Park Place

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1.0 Purpose/Introduction

The purpose of the West Cactus Basin and Channels Project is to provide drainage infrastructure within the City of El Mirage that will reduce the Lower El Mirage Wash flood potential downstream from El Mirage Road. The project could potentially provide the City of El Mirage and Maricopa County with a regional storm water detention basin that can serve as a multi-use public recreational facility. In addition, the project will locate and qualitatively assess potential erosion concerns within the Lower El Mirage Wash Channel and Lower El Mirage Wash Channel Tributary.

This Candidate Assessment Report (CAR) documents the development of conceptual plans for proposed drainage facilities associated with the West Cactus Detention Basin and Channels Project. This CAR is an extension and further development of the regional basin concept introduced in the White Tanks/Agua Fria River Area Drainage Master Plan (White Tanks ADMP). This CAR was authorized by the Flood Control District of Maricopa County (FCD) under Resolution FCD 2002R013. The primary participants in the CAR include the FCD, City of El Mirage and Stanley Consultants, Inc. (Stanley).

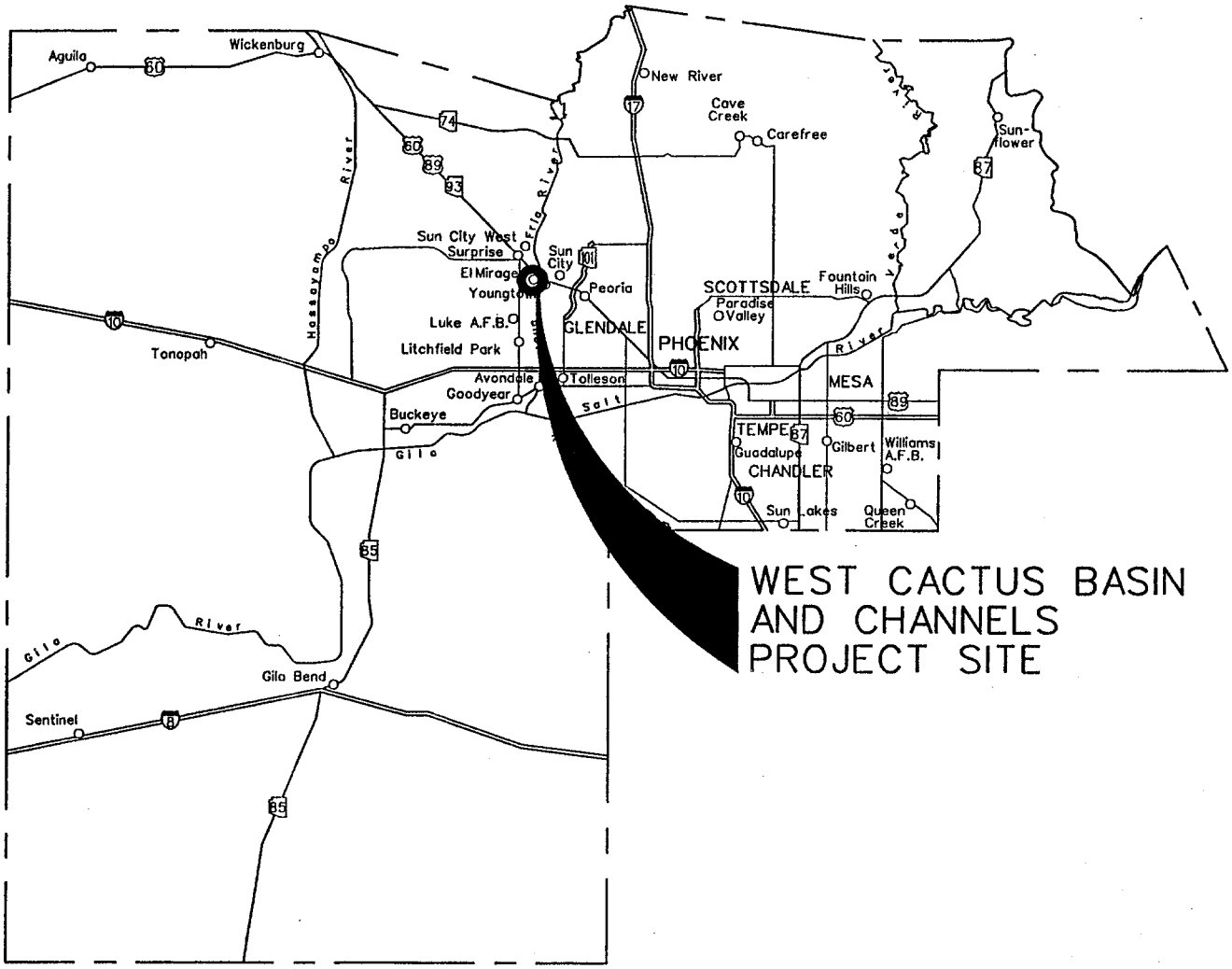
The CAR compiles available studies, plans, documents and data to outline the needs and necessity of the project. Based on the project needs and necessity, the CAR documents preliminary alternatives developed by the participants. Each preliminary alternative is compared with the other preliminary alternatives in regards to hydrologic and hydraulic benefits, costs, constructability and future land use. From the preliminary alternatives analysis, the participants select a recommended alternative that is detailed in the CAR.

The project area is located within portions of Sections 10 through 15 and 22 through 24, Township 3 North, Range 1 West of the Gila and Salt River Base and Meridian, Maricopa County, Arizona. More specifically, the project boundaries include Greenway Road to the north, Peoria Road to the south, Dysart Road to the west and the Agua Fria River to the east. The entire project area is within the City of El Mirage. Project location and vicinity maps (Figures 1 and 2, respectively) are provided on the following pages.

Development within the project area has occurred at a relatively quick pace and will be completely developed within the near future. Land use consists primarily of single-family residential homes but also includes some commercial / retail, parks and other open space, schools and some vacant land. Prior to development, land use was primarily categorized as agricultural and natural desert.

Design and construction of public drainage improvements within the project area consists primarily of channelization of the Lower El Mirage Wash and Lower El Mirage Wash Tributary downstream from Dysart Road. In addition, a number of small retention basins have been constructed ranging from less than one to several acre-feet. Although no regional detention / retention basins have been formally designed and constructed, there is currently a regional sized on-line stormwater basin located where the proposed West Cactus Basin was planned per the White Tanks ADMP.

This basin has an interim configuration and was apparently constructed by adjacent and nearby residential developers as an alternative to individual stormwater basins normally required with each subdivision. Further discussion of existing drainage facilities located within the project area is found in Section 12.0. The Lower El Mirage Wash, Lower El Mirage Wash Tributary and proposed location for the West Cactus Basin are shown on Figure 2. The West Cactus Basin and Lower El Mirage Wash downstream from the basin are also depicted on a two-sheet aerial photo exhibit (Exhibit 1) in the back pocket of this report.



LOCATION MAP

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FIGURE 1

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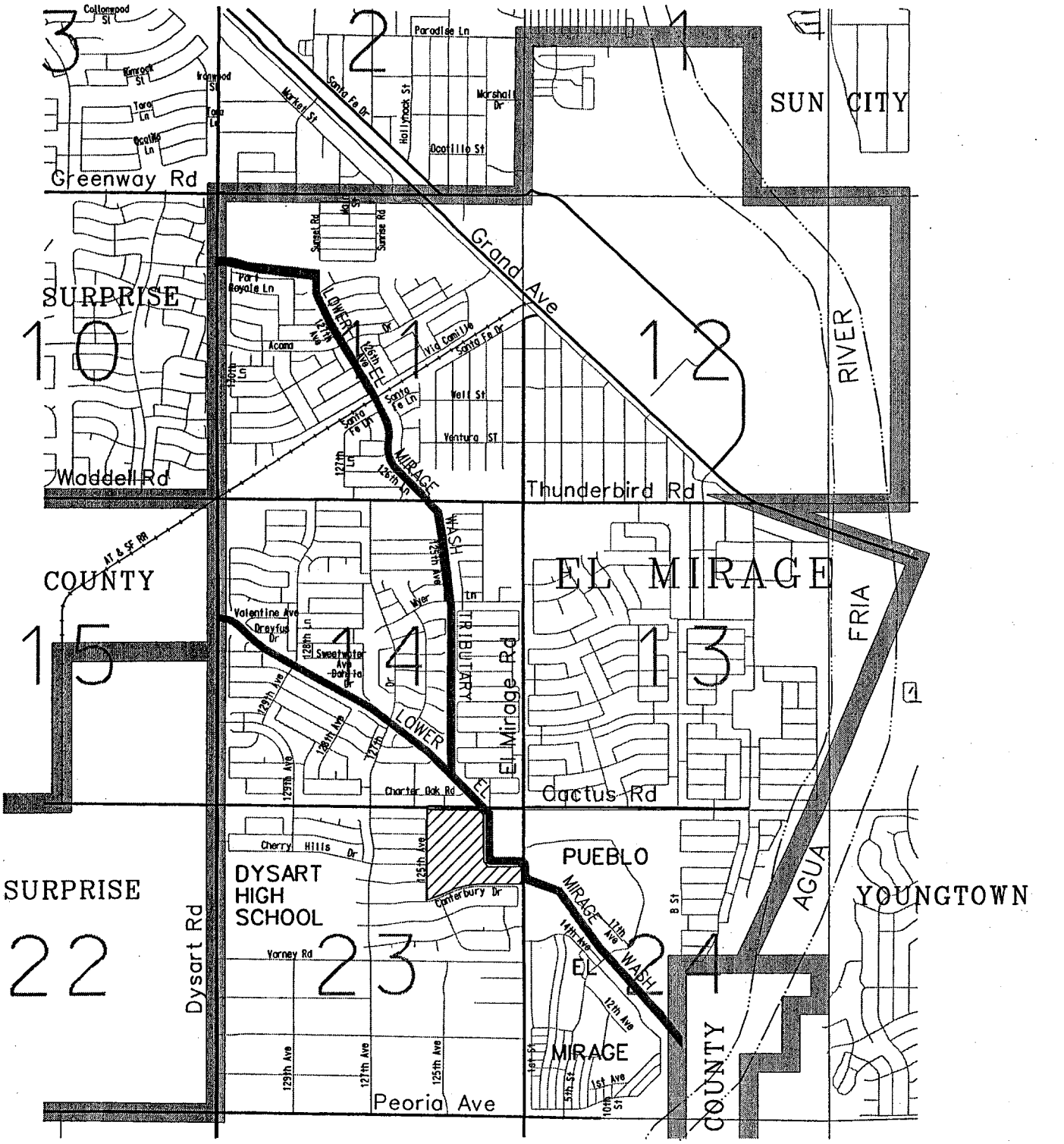

WEST CACTUS BASIN AND CHANNELS

VICINITY MAP

Not to Scale

FIGURE 2

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2.0 Project Needs and Necessity

The initial project objectives fell into two categories:

1. Reduce flooding associated with the Lower El Mirage Wash downstream from El Mirage Road; and
2. Qualitatively assess and document any local erosion found within the Lower El Mirage Wash Channel and Lower El Mirage Wash Channel Tributary.

2.1 Historic Lower El Mirage Wash Floodplain and Flooding

A brief summary of previously estimated 100-year peak discharges conveyed by the Lower El Mirage Wash downstream from El Mirage Road through the Pueblo El Mirage Golf Course is provided in Table 1.

Table1. Estimated 100-Year Peak Discharges Conveyed by the Lower El Mirage Wash Downstream from El Mirage Road

Date	Description of Study	100-Year Discharge (cfs)
1985[1]	Federal Emergency Management Agency (FEMA) Floodplain Delineation	250
1991	White Tanks / Agua Fria Area Drainage Master Study (ADMS)[2]	1,800
2001	Lower El Mirage Wash Channelization Application for Letter of Map Revision (LOMR)[3]	1,753
2004	Loop 303 Corridor / White Tanks Area Drainage Master Plan (ADMP) Update[4]	857[5]

Notes:
1. The Pueblo El Mirage Golf Course was constructed in 1985.
2. White Tanks/Agua Fria ADMS prepared by WLB Group for FCD. Discharge reported in June 30, 1999 FCD Memo, Subject: El Mirage Drainage Improvement CIP – Project Status and Summary.
3. Lower El Mirage Wash Channelization Application for LOMR prepared by A-N West for the City of El Mirage and submitted to FEMA - - reflects channelization upstream from El Mirage Road.
4. Loop 303 Corridor/White Tanks ADMP Update is currently being prepared by URS Engineering for FCD and all associated discharges are preliminary.
5. The 100-year discharge of 857 cfs reflects future developed condition based on municipality long-term planning and zoning and with anticipated regional and local drainage projects (HEC-1 Model L33PF6D.dat).

As shown in Table 1, the original FEMA 100-year discharge for the Lower El Mirage Wash through the Pueblo El Mirage development was 250 cfs. Consequently, the channel constructed through the Pueblo El Mirage Development and Golf Course may have been designed for only 250 cfs. It is uncertain what methods and assumptions were used to estimate this discharge or who originated it. The discharge presumably reflected existing conditions at the time. Prior to 1985, the contributing drainage area was mostly agricultural land use with minor components of residential and commercial development and unimproved desert.

With the completion of the original White Tanks/Agua Fria ADMS, it became very apparent that the original 100-year discharge of 250 cfs had been seriously underestimated. In the time between the original flow estimate of 250 cfs and the White Tanks/Agua Fria ADMS, there was very little change in land use and character in the drainage area contributing to the Lower El Mirage Wash.

According to the Loop 303 Corridor/White Tanks ADMP Update, the 100-year discharge routed through the golf course is 857 cfs. It should be noted that this 100-year discharge reflects current FCD methodology and future completely developed conditions in the contributing area, which consists of Unincorporated Maricopa County and the Cities of El Mirage and Surprise. It also assumes that anticipated regional and local drainage projects have been constructed to reduce flows.

The FEMA floodplains associated with the original 250 cfs, the original White Tanks/Agua Fria ADMS and the LOMR for the Lower El Mirage Wash are provided in Appendix A.

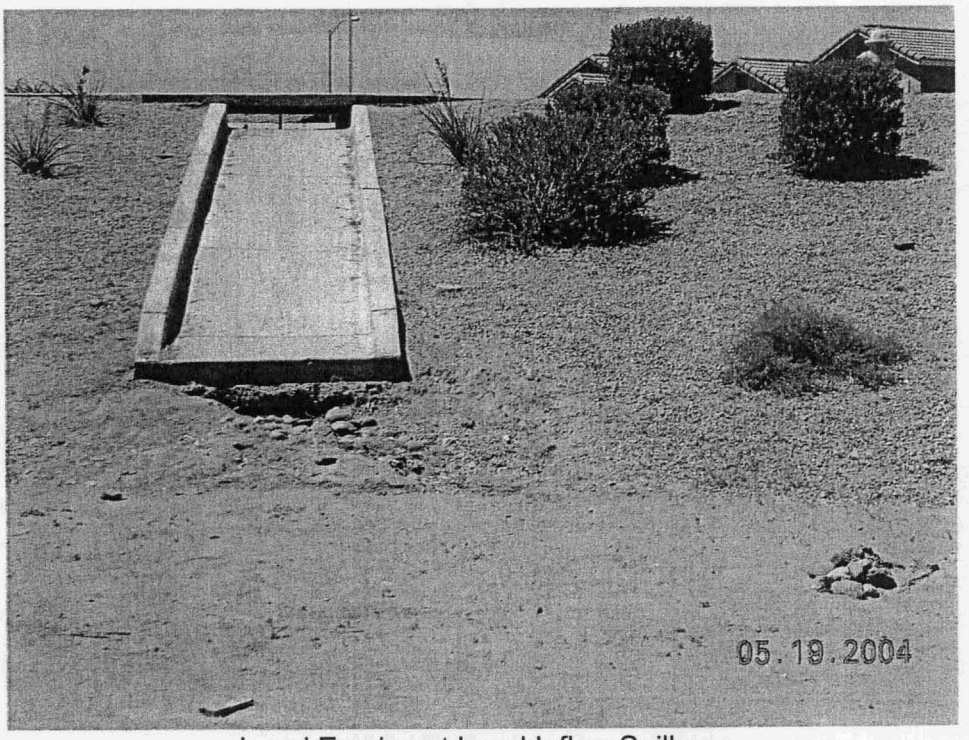
2.2 Local Erosion Problem Areas

Local erosion has been occurring at various locations along the Lower El Mirage Wash Channel and Lower El Mirage Wash Channel Tributary. Local erosion was observed during field reconnaissance at numerous locations where local drainage enters the channel. Rilling of the banks from localized inflow where there is no structure present was also noted at certain locations.

The photographs shown on the following page show erosion occurring at local inflow points located within the Lower El Mirage Wash Channel. Additional photographs of local erosion are provided in Appendix B.

Erosion at local inflow points has the potential to eventually undermine the integrity of the drainage infrastructure. Damage to drainage structures will result in reduced hydraulic efficiency, increased maintenance and increased cost of repairs.

Local Erosion Adjacent to Local Inflow Spillway
Lower El Mirage Wash Channel Between Dysart and Cactus Roads



Local Erosion at Local Inflow Spillway
Lower El Mirage Wash Channel Between Dysart and Cactus Roads

3.0 Data Collection

Data collection consisted of gathering the available information necessary to gain an understanding of the historic, present and future conditions of the project area and drainage infrastructure. Information was gathered from various sources, primarily the FCD and the City of El Mirage. Data typically fell into one of the following categories:

- FEMA and USGS maps
- GIS data
- Hydrology and hydraulic studies, design documents
- Improvement plans, as-builts
- Planning and land use
- Field survey data

A complete list of the collected data is provided in Appendix C.

4.0 Existing Hydrology

The project area is located in an area of moderately flat terrain that slopes from northwest to southeast. Because of the size and complexity of the White Tanks/Agua Fria ADMS, it's study area was broken down into smaller sub-areas referred to as "super basins". The immediate super basin around the West Cactus Detention Basin has a drainage area of approximately 2.8 square miles. However, the contributing area (or portions of it reflected through flow splits in the HEC-1 model structure) potentially extends many miles to the northwest up to the McMicken Dam and Outfall Channel. The Agua Fria River is the ultimate regional outfall for runoff from the watershed.

Approximately eighty percent of the current land use in the project area is single-family residential. The remaining land use is comprised of mobile home residential, neighborhood commercial and open space/golf course. Prior to development, land use was predominantly classified as agricultural and natural desert. Currently, there is only a small percentage of the project area that remains vacant. Future development on this vacant land is projected as primarily commercial and retail per the City of El Mirage Land Use Plan.

Development that has occurred within the project area has minimal stormwater storage capacity. Existing storage capacity is limited to approximately 20 acre-feet of local retention. Runoff is typically collected and conveyed via neighborhood streets, which eventually outfall into the Lower El Mirage Wash Channel or Lower El Mirage Wash Channel Tributary. Development that has occurred adjacent to the proposed West Cactus Basin location utilizes the existing basin for it's outfall and stormwater storage. Runoff is collected and conveyed to catch basin and storm drain systems located on 125th Avenue and Canterbury Drive. Further discussion regarding local retention, the existing basin and storm drain systems can be found in Section 12.0.

The project area is located within the Loop 303 Corridor / White Tanks Area Drainage Master Plan Update (ADMP) project boundaries. The ADMP is currently being prepared by URS Engineering for the FCD, and at the time this CAR had started, it had not been completed. However, FCD provided Stanley with four HEC-1 models that have been developed in response to the ADMP. The four models reflect the following conditions:

- Existing condition as of June 2001 (HEC-1 Model L303M1L.dat),
- Existing condition as of June 2001 with anticipated regional and local drainage projects (HEC-1 Model L33PE4H.dat),
- Future condition based on municipality long-term planning and zoning (HEC-1 Model L33F8B.dat), and
- Future condition based on municipality long-term planning and zoning and with anticipated regional and local drainage projects (HEC-1 Model L33PF6D.dat).

Stanley was directed by the District to utilize the future condition, with regional and local drainage projects, HEC-1 model (L33PF6D.dat) as the "base hydrology" for all West Cactus Basin and Channels Project drainage facility conceptual alternatives. This hydrology is provided in Appendix D as an excerpt from the base hydrology output file. The base hydrology HEC-1 model is also provided electronically on CD, which is located in the pocket folder at the end of the CAR.

The base hydrology that was provided to Stanley reflects a conceptual West Cactus Basin. According to the HEC-1 model, flow enters the basin from the Lower El Mirage Wash (between Cactus Road and El Mirage Road) via a lateral weir. The computed basin volume from that model was approximately 51 acre-feet.

The base hydrology is an updated version (URS Engineers for FCD), of the original White Tanks / Agua Fria Area Drainage Master Study (ADMS) that had been prepared by the WLB Group in 1991. Although the hydrology had been updated in an attempt to reflect current hydrologic conditions, a number of inconsistencies were noted between the base hydrology and actual existing conditions in the course of this CAR. These inconsistencies appear to underestimate the peak discharges and volumes impacting the proposed West Cactus Basin and Channels project. The following hydrologic issues were summarized at the milestone/coordination meeting held June 22, 2004:

- There is a contributing area of about 115 residential acres immediately west of the West Cactus Basin that drains directly into the basin. Based on simple rational method estimates, this area may produce up to about 400 to 450cfs and approximately 25 acre-feet of runoff volume for a 100-year 2-hour storm. Because it is assumed that this area drains directly into the basin via existing storm drain systems and overflow, some sort of low flow bypass storm drain intercept would be required to maintain an off-line concept for the basin as originally intended.

- There is another approximately 90 acres north of Cactus Road, east of Dysart Road, that drains to Cactus Road and flows east contributing to the Lower El Mirage Wash at the dip crossing in Cactus Road. The ADMP hydrology model that was provided to Stanley does not account for either the 115 acres noted above or the 90 acres as contributing to the West Cactus Basin.

- In order to evaluate a lesser storm event, Stanley performed a simple conversion of the 100-year ADMP HEC-1 model to a 10-year HEC-1 model (ALT9A.DAT) by reducing the average precipitation from 4.03 inches to 2.40 inches. The reduction in average precipitation resulted in a decrease in runoff from each sub-basin. For example, the peak runoff from Sub-Basin 157 (0.89 square miles), which is immediately upstream of the proposed West Cactus Basin location, was reduced from 649 cfs to 286 cfs. The reduction in discharge, coupled with sub-basin retention storage modeled in the base hydrology (42.4 acre-feet for Sub-Basin 157), resulted in a much less than expected 10-year flow for the Lower El Mirage Wash. Based on this 10-year model, only 86 cfs is conveyed by the Lower El Mirage Wash immediately upstream of Cactus Road (HEC-1 ID !LE3).

- The sub-basins in the local contributing area from Cactus Road to Grand Avenue and from El Mirage Road to Dysart Road in the ADMP HEC-1 model all reflect stormwater retention using a volume divert step that follows each sub-basin hydrograph step. For this area the ADMP HEC-1 model reflects approximately 112 acre-feet of retention. However, currently there is only about 20 acre-feet of retention existing in this area (see Section 12.0), although it is virtually all developed. Hence, for all the reasons stated above, the discharges and volumes per the ADMP model, which were used to

evaluate the preliminary alternatives (see Section 10.0), are probably under estimated.

Subsequent to the meeting of June 22, Stanley made a number of simple adjustments to the base hydrology HEC-1 model in an attempt to better reflect what was recently observed in the local and adjacent ADMP super basins. Adjustments included modifying the drainage areas for Sub-Basins 157 and 172 and setting aside the retention for sub-basins in the local contributing area from Cactus Road to Grand Avenue and from El Mirage Road to Dysart Road.

Relevant peak discharges according to the unaltered base hydrology (L33PF6D.dat) are provided in Table 2.

Table 2. Base Hydrology (L33PF6D.dat) Peak Discharges.

Location	Peak Discharge (cfs)
Lower El Mirage Wash Channel Above Confluence with Lower El Mirage Wash Channel Tributary (without local contributing area)	129
Lower El Mirage Wash Channel Tributary above Cactus Road	950
Lower El Mirage Wash Channel and Tributary at Cactus Road (including local contributing area)	1,384
Lower El Mirage Wash Channel at Proposed West Cactus Basin	831
Lower El Mirage Wash Channel from El Mirage Road to Agua Fria River	857
Lower El Mirage Wash Channel at the Agua Fria River outfall (including local contributing area)	880

5.0 Existing Hydraulics

The District provided Stanley with the four HEC-2 models. The models were submitted to FEMA in support of the Applications for As-Built Letter of Map Revision (LOMR) for the Lower El Mirage Wash Channelization and Lower El Mirage Wash Tributary Channelization. LOMR applications were dated September 12, 2001. The models reflected the existing conditions at the time of the submittals and the proposed as-built conditions of the channelization. The channelization all occurs upstream from El Mirage Road.

Stanley utilized the Lower El Mirage Wash Channelization proposed as-built condition HEC-2 model (13WSHLLT.dat) as the "base hydraulics" to define the existing conditions at the time of this CAR. To facilitate the hydraulic analysis for this CAR, the HEC-2 model provided by the District was imported into HEC-RAS, version 3.1.1 (HEC-RAS 13WSHLT.prj). The base hydraulic computations were then verified by comparing the calculated water surface elevations with the water surface elevations shown on the FEMA Map Panel 04013C1605H (Revised January 4, 2002) and the revised water surface elevations shown on the White Tanks/Agua Fria ADMS Floodplain Map. Both the revised FEMA Map Panel 04013C1605H and revised ADMS Floodplain Map were provided to Stanley by the District.

Output tables from the base hydraulics HEC-2 model are provided in Appendix E. In addition, the base hydraulic model is also provided electronically on the CD located in the pocket folder at the end of the CAR. The revised FEMA Map Panel 04013C1605H is provided in Appendix A.

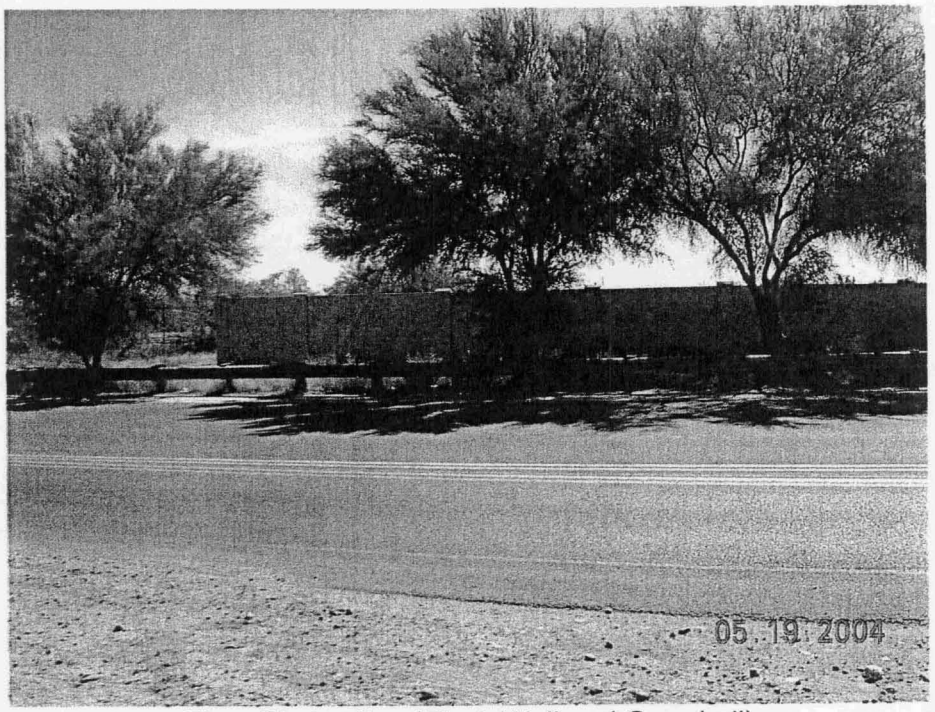
Although the base hydraulics provided to Stanley represented the best available information, various inconsistencies between the model and existing conditions were found that would considerably influence the hydraulics and Lower El Mirage Wash floodplain from El Mirage Road downstream. The inconsistencies include the following:

- The metal guardrail located on the east side of the El Mirage Road dip crossing potentially obstructs overflow but was not modeled.
- The 6 foot high masonry block wall along the east side of El Mirage Road partially extends into the effective hydraulic area of the dip crossing at El Mirage Road but is not modeled.
- The Pueblo El Mirage steel picket and concrete pilaster fencing that crosses the Lower El Mirage Wash Channel just downstream from El Mirage Road (and also near the Agua Fria River) obstructs flow but was not modeled. There is also some chain link fencing that borders Pueblo El Mirage in the floodplain on the north side of the channel just downstream from El Mirage Road that is not reflected in the model.
- The existing four-barrel, 10-foot by 3-foot (4-10'x3'), Park Place culvert crossing located within the Pueblo El Mirage development is not reflected in the model.
- There is a row of mobile home lots in Pueblo El Mirage in the floodway on the north side of the channel just downstream from the Park Place culvert. The lot nearest the culvert is occupied by a mobile home structure but no obstruction for any of these floodway lots is reflected in the model.
- The golf cart path bridge in the Pueblo El Mirage Golf Course downstream from Park Place is not reflected in the model, nor is the baseball field and associated fencing in the overbank that is near the bridge.

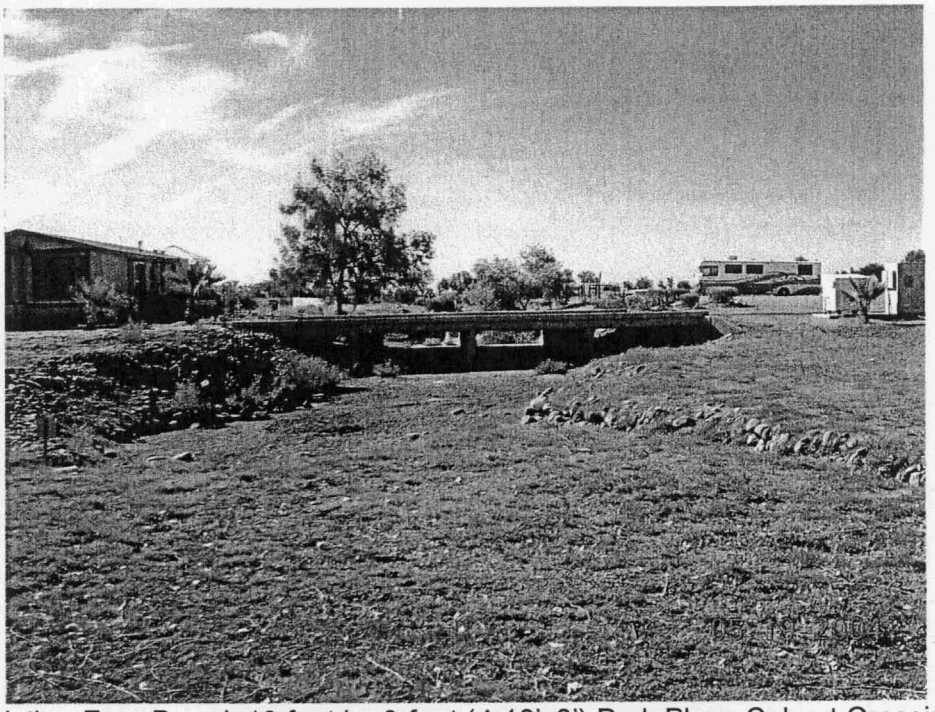
In addition, the existing 4-10'x5' culvert crossing for the Lower El Mirage Wash Channel at 129th Avenue (between Cactus and Dysart Roads) was not reflected in the base hydraulic model.

The base hydraulic model was not modified to reflect the above inconsistencies between the model and existing conditions. It is assumed that conditions limiting flow conveyance will be corrected at the time of drainage improvements associated with the West Cactus Basin and Channels Project. Further discussion regarding the Lower El Mirage Wash Channel and Lower El Mirage Wash Channel Tributary is found in Section 8.0. Photographs of various inconsistencies between the base hydraulic model and existing conditions, as discussed above, are located on the following pages.

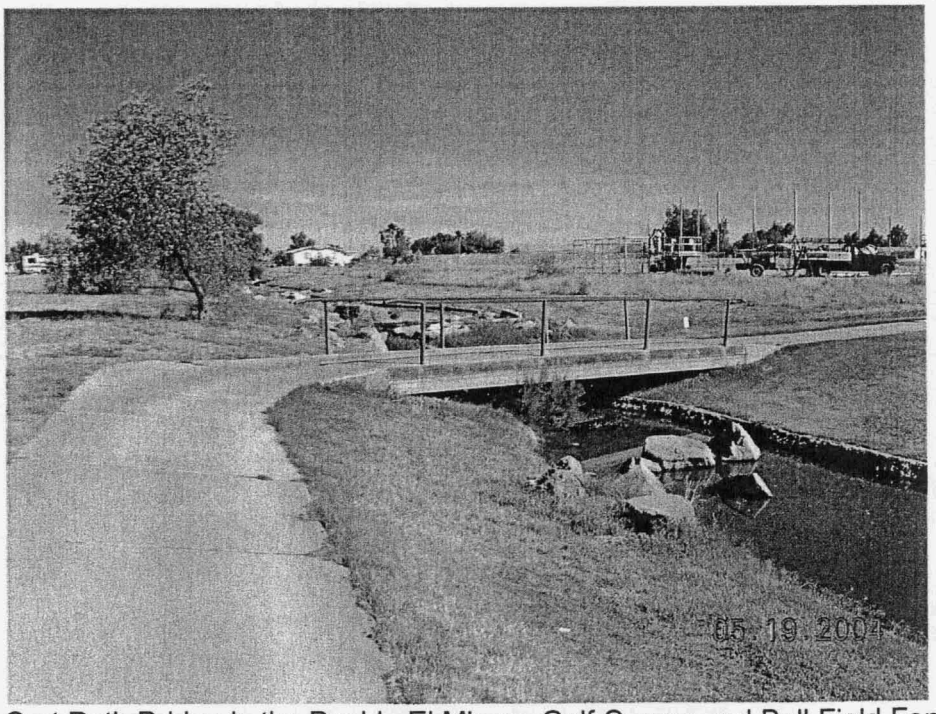
Pueblo El Mirage Steel Picket Fence Crossing the
Lower El Mirage Wash Channel Downstream from El Mirage Road



Flow Obstruction (Block Wall and Guardrail)
Located Near the El Mirage Road Dip Section



Existing Four Barrel, 10-foot by 3-foot (4-10'x3') Park Place Culvert Crossing
And Mobile Home Located Within the Pueblo El Mirage Development



Golf Cart Path Bridge in the Pueblo El Mirage Golf Course and Ball Field Fencing
Located Downstream from Park Place Culvert Crossing

6.0 Land Use

In order to determine future retention/detention storage availability within the City of El Mirage, Stanley collected existing and future land use designations for the areas within the project boundaries.

The City of El Mirage provided Stanley with existing zoning districts as of April 14, 2003. In addition, the City provided Stanley with the El Mirage Land Use Map for proposed future zoning, which was adopted by the City on December 18, 2003. The parcel dedicated for the proposed West Cactus Basin is currently listed as a Single-Family Residential Zone. However, the future zoning for this parcel is called out as Parks/Open Space. City of El Mirage existing and future zoning/land use is provided in Appendix F.

The City of El Mirage also provided Stanley with the Pueblo El Mirage North preliminary plat. The plat shows the proposed layout for the Pueblo El Mirage R.V. Resort, which is an expansion of the existing Pueblo El Mirage Country Club community. The Pueblo El Mirage North expansion is east of El Mirage Road, adjacent to a portion of the Lower El Mirage Wash Channel located within the Pueblo El Mirage Golf Course property. The Plat is provided in Appendix F. The Pueblo El Mirage Golf Course is shown on Figure 2.

7.0 Utilities

At Stanley's request, Arizona Blue Stake contacted all utility owners operating within the project area (Ticket No. 2004052000562.000). If an owner had utilities located within the project area, the owner was directed by Arizona Blue Stake to send all approximate location information. As a result, Southwest Gas Corporation and the City of El Mirage provided approximate locations for gas, water and sewer utilities. The City of El Mirage both owns and operates water and sewer utilities.

8.0 Existing Drainage Facilities Within the Project Area

Drainage facilities located within the project area include the Lower El Mirage Wash Channel (Channel), Lower El Mirage Wash Tributary Channel (Tributary), an existing basin located where the proposed West Cactus Basin is to be constructed, local retention basins and catch basin and storm drain systems. Existing drainage facilities are shown on Figure 3 on the following page. Various photographs of existing drainage facilities within the project area are provided in Appendix G.

8.1 Lower El Mirage Wash Channel

The majority of runoff from within the project boundaries, and from the overall watershed, is eventually conveyed to the Agua Fria River via the Lower El Mirage Wash Channel. The Lower El Mirage Wash Channel is considered a regional drainage facility. However, it is classified by the U.S. Army Corps of Engineers as a non-jurisdictional "waters of the U.S." under Section 404 of the Clean Water Act. As stated in Section 1.0, improvements to the Lower El Mirage Wash occurred in conjunction with development taking place within the historic floodplain. The Lower El Mirage Wash Channel is shown on Figure 3.

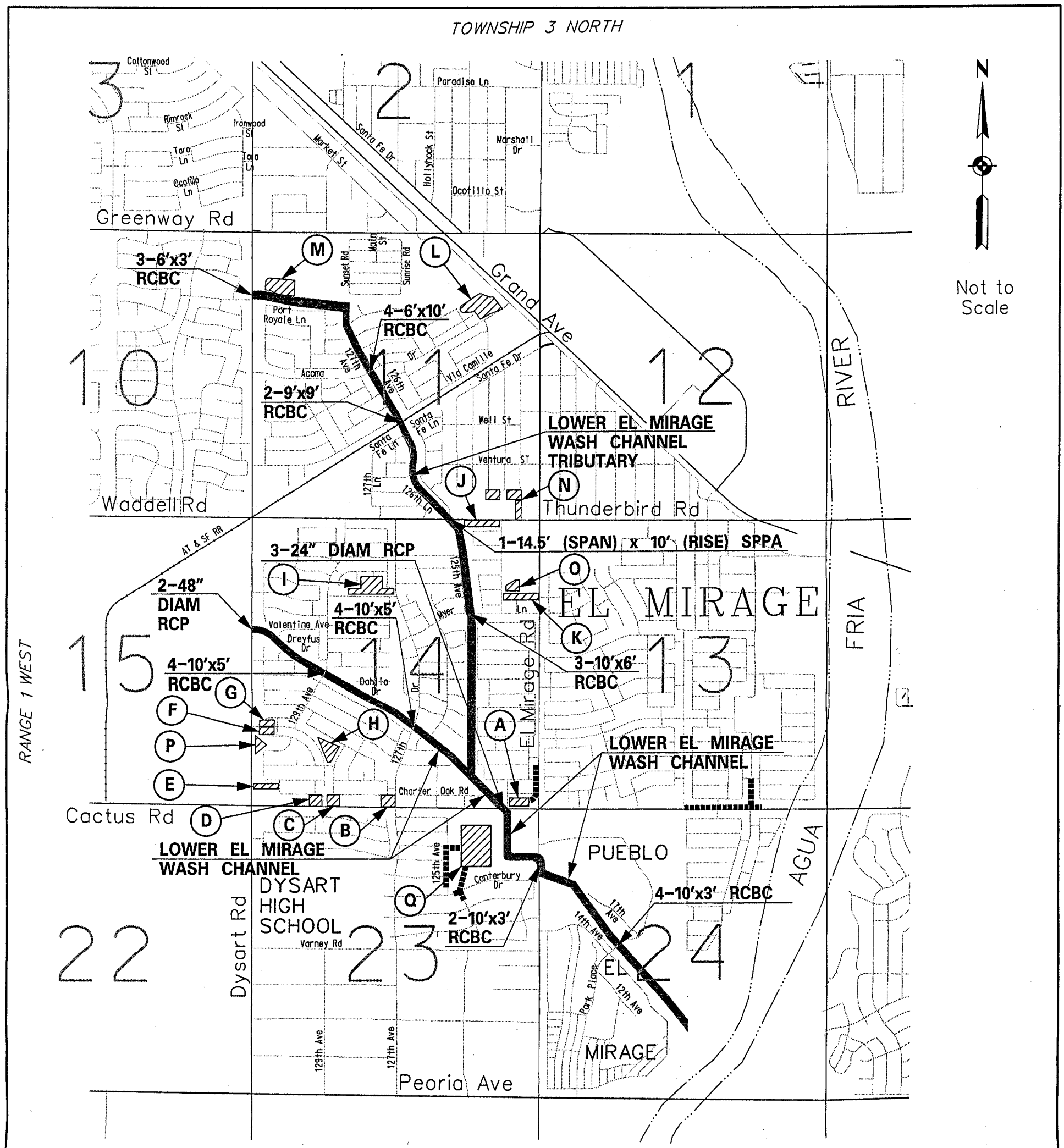
8.1.1 Lower El Mirage Wash Channel Lower Reach

The lower reach of the Lower El Mirage Wash Channel extends upstream from the Agua Fria River, through the Pueblo El Mirage Golf Course, to El Mirage Road. The cross-section for the lower reach varies from trapezoidal to shallow, wide sections with significant storage within the floodplain. As mentioned in Section 2.1, the lower reach was designed for a 100-year discharge of 250 cfs, which was the FEMA accepted 100-year discharge at Cactus Road at the time of golf course construction in 1985.

In September of 2001 the discharge used for the Lower El Mirage Wash Channelization LOMR (HEC-2 Model 13WSHLLT.dat), at Cactus Road, was 1,771 cfs. The LOMR HEC-2 model routed a discharge of 1,753 cfs through the Pueblo El Mirage Golf Course. Stanley was not able to find any explanation for the difference between the above two discharges.

Normal depth calculations for a cross-section taken at the most restricted section in the lower reach shows the capacity of the channel to be approximately 400 cfs at the top-of-bank and about 250 cfs with 1-foot of freeboard. This section is located downstream of the Park Place culvert crossing, adjacent to the softball field currently under construction. Normal depth calculations and photographs of the section are provided in Appendix H.

According to the Base Hydrology (HEC-1 L33PF6D.dat), the peak discharge conveyed through the lower reach (HEC-1 I.D. RLE4) is approximately 860 cfs. Photographs of the Lower El Mirage Wash Channel lower reach are provided on the following pages.

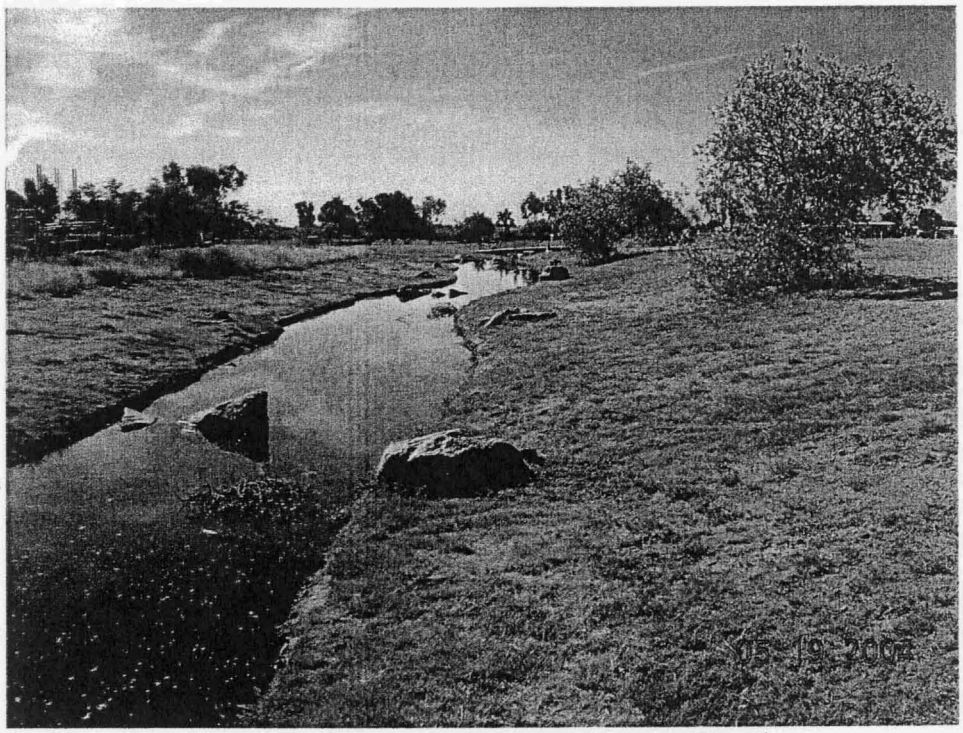


WEST CACTUS BASIN AND CHANNELS

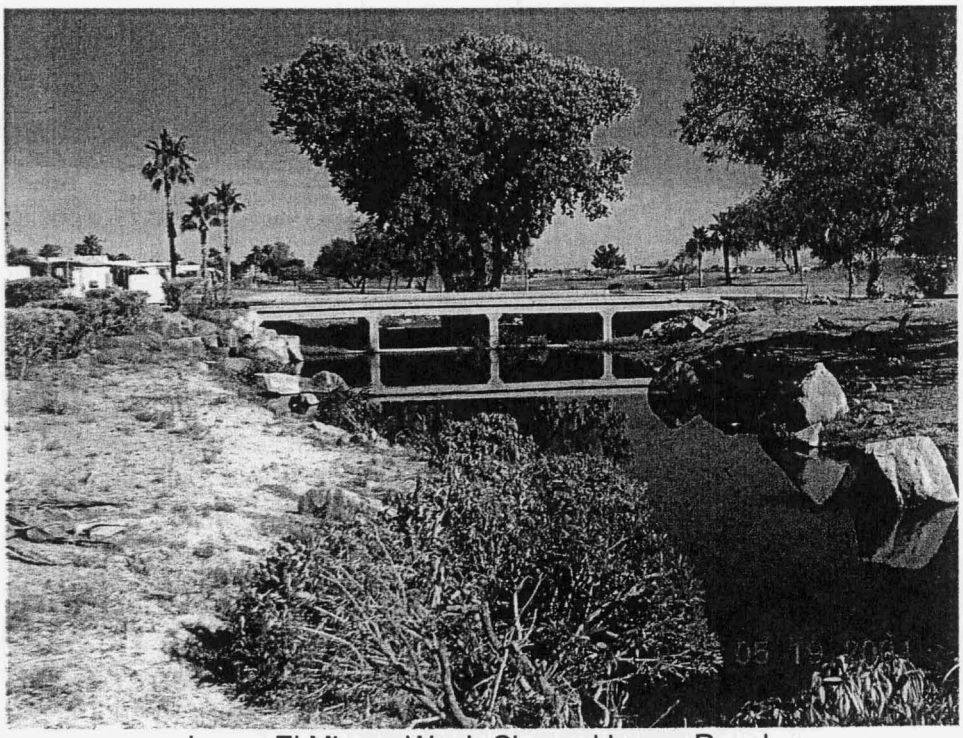
EXISTING DRAINAGE FACILITIES

FIGURE 3

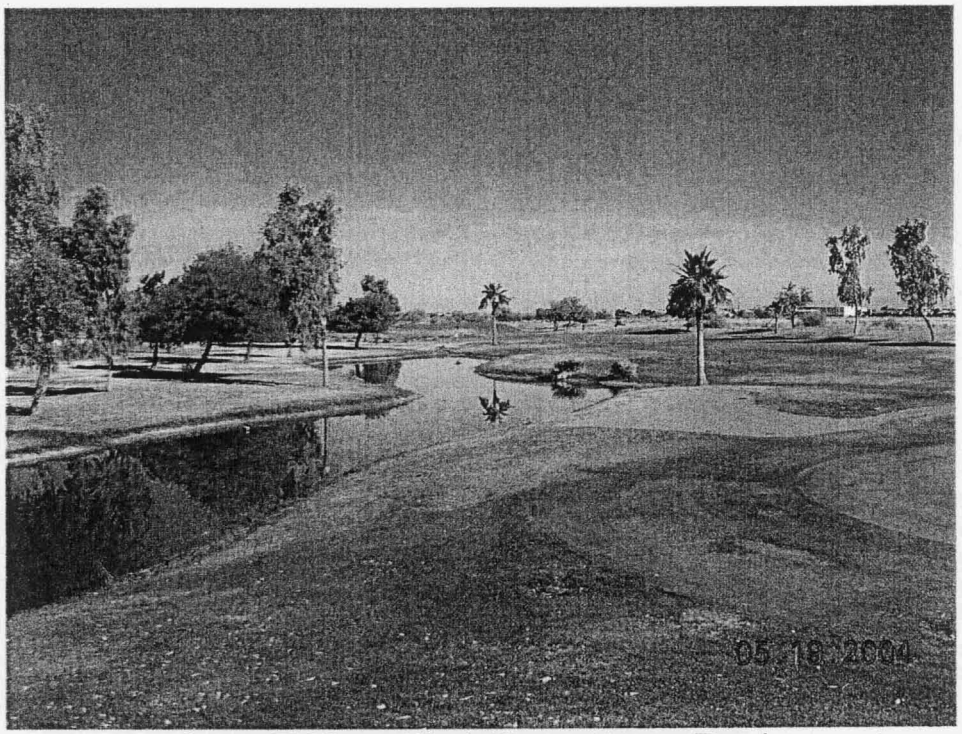
11/3/2004 q:\16956\03-Assign 1 CADD\DGN\VICINITY-11X17-FIG3.dgn



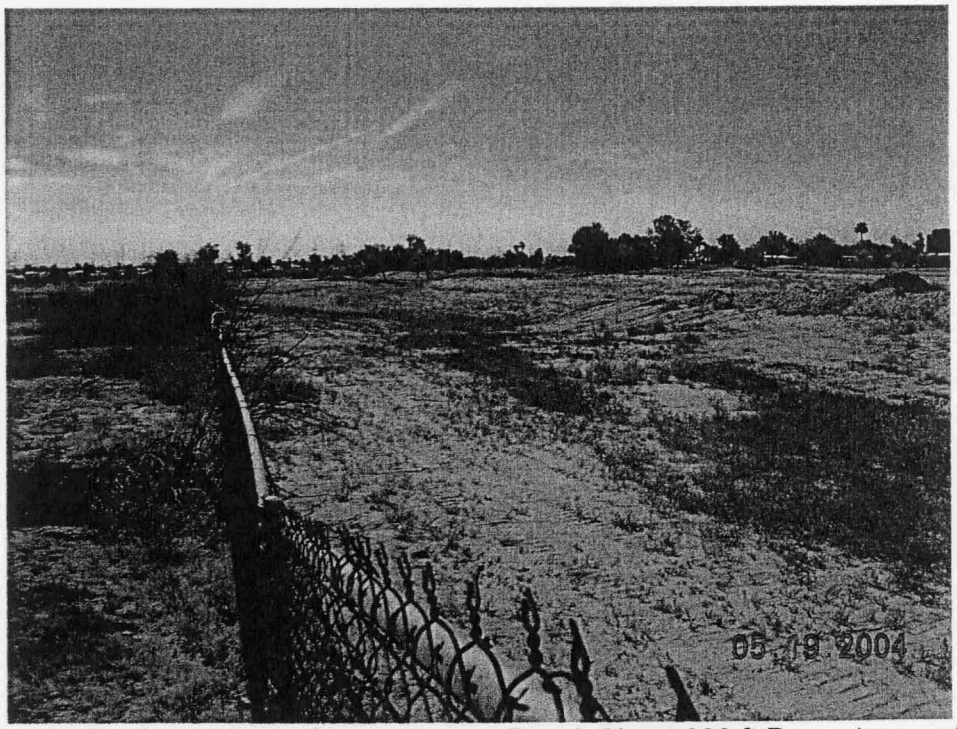
Lower El Mirage Wash Channel Lower Reach
Downstream from Park Place Culvert
Looking Downstream



Lower El Mirage Wash Channel Lower Reach
Park Place Culvert
Looking Upstream



Lower El Mirage Wash Channel Lower Reach
Upstream of Park Place Culvert
Looking Upstream



Lower El Mirage Wash Channel Lower Reach About 200 ft Downstream of
El Mirage Road. Chain Link Fencing Adjacent to Channel
View Looking Downstream (Southeast)

8.1.2 Lower El Mirage Wash Channel Upper Reach

The upper reach of the Lower El Mirage Wash Channel extends upstream from El Mirage Road, through the proposed West Cactus Basin parcel, crosses Cactus Road, and ends at Dysart Road approximately 2,000 feet south of Thunderbird Road. The upper reach channel geometry is a constructed trapezoidal section with varying bottom width, sideslopes and depth. Approximations of the upper reach plan and cross-section are shown in the As-Built LOMR Exhibits for the Lower El Mirage Wash Channelization, A Portion of the El Mirage Wash Master Drainage Plan that is provided in Appendix I.

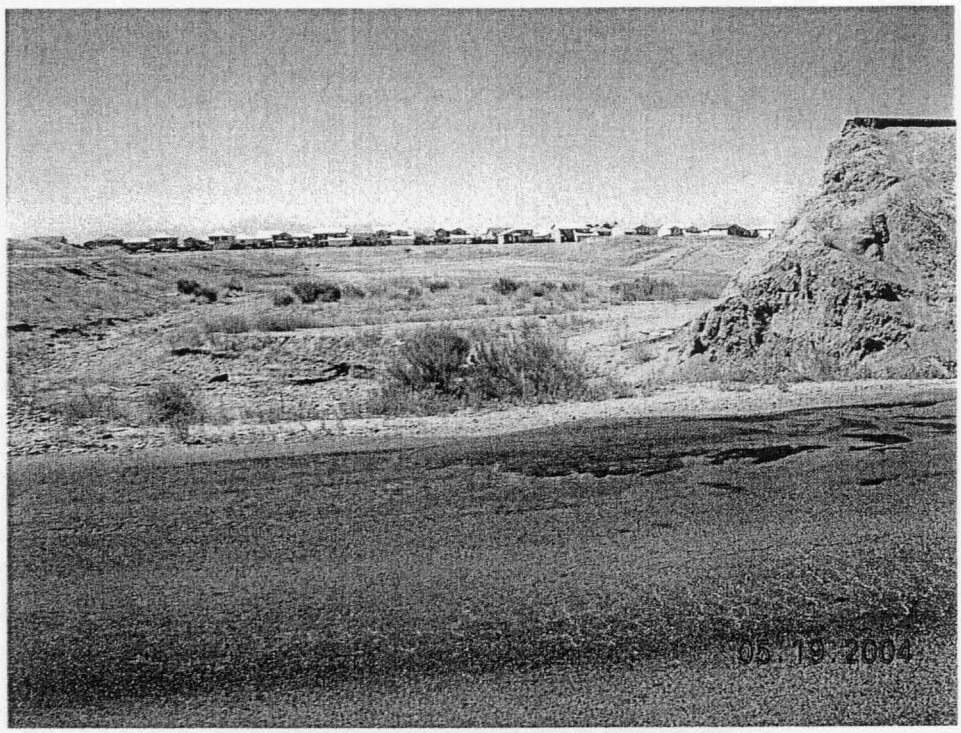
The Lower El Mirage Wash Channel upper reach is subject to local inflow that is typically conveyed from the streets to the channel by scuppers or small diameter pipes. In addition, the upper reach contains three grade control structures and four culvert crossings. The culvert crossings are listed in Table 3.

Table 3. Lower El Mirage Wash Channel, Upper Reach, Culvert Crossings.

Location	Culvert Type
129th Avenue	4-10'x5' RCBC
127th Avenue	4-10'x5' RCBC
Cactus Road	3-24" Daimeter RCP
El Mirage Road	2-10'x3' RCBC

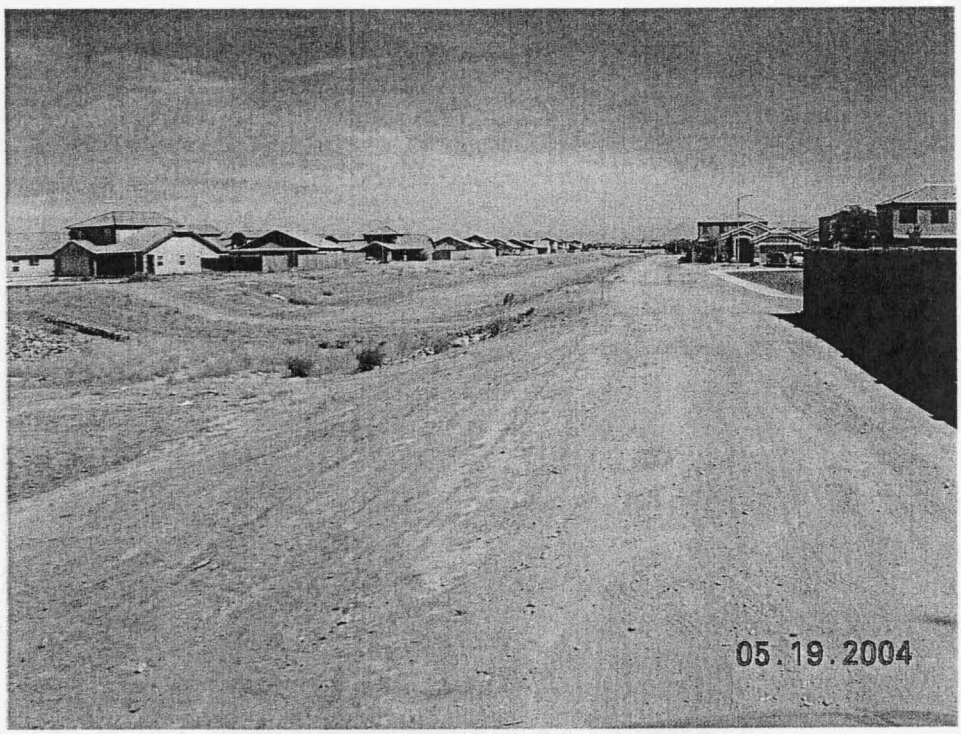
RCBC – Reinforced Concrete Box Culvert
RCP- Reinforced Concrete Pipe

According to the Base Hydrology (HEC-1 L33PF6D.dat), the peak discharge conveyed through the upper reach, upstream of the confluence with the Lower El Mirage Wash Channel Tributary, is approximately 130 cfs (HEC-1 I.D. RLLE1). The computed peak discharge conveyed by the upper reach from the confluence with the Tributary to Cactus Road is approximately 1,380 cfs (HEC-1 I.D. !LE3). Finally, the computed peak discharge conveyed by the upper reach from Cactus Road to El Mirage Road is approximately 1,390 cfs (HEC-1 I.D. !LE4). Photographs of the Lower El Mirage Wash Channel upper reach are provided on the following pages.

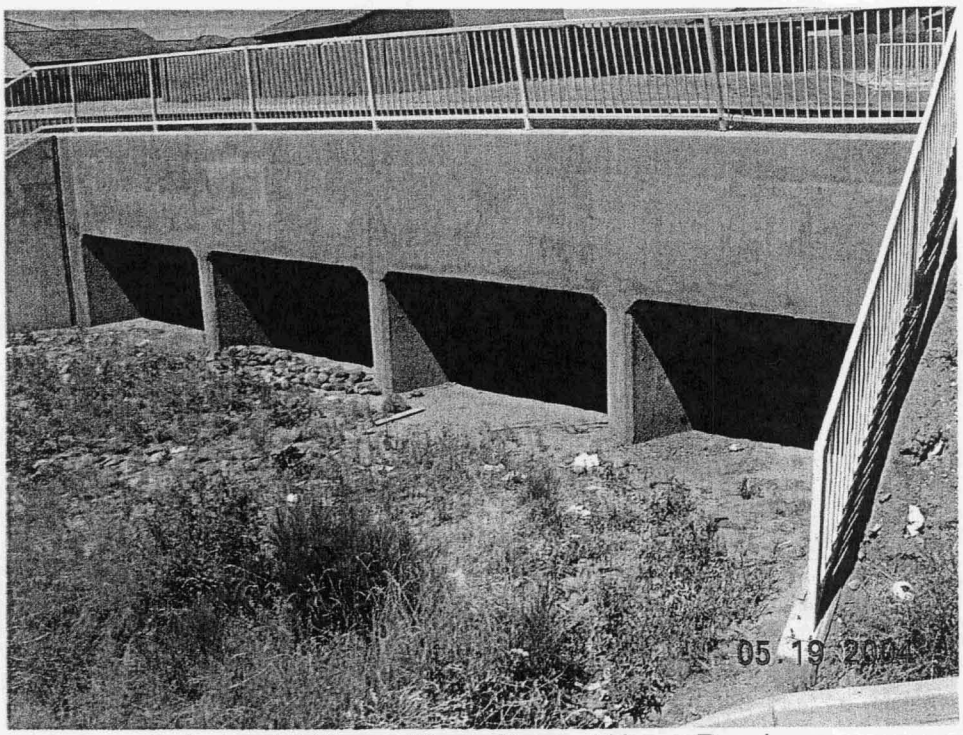


Lower El Mirage Wash Channel Upper Reach
Cactus Road Dip Crossing
Looking Downstream

Lower El Mirage Wash Channel Upper Reach
Confluence with Lower El Mirage Wash Channel Tributary
Looking Upstream



Lower El Mirage Wash Channel Upper Reach
Upstream of Confluence with Lower El Mirage Wash Channel Tributary
Looking Upstream



Lower El Mirage Wash Channel Upper Reach
127th Avenue Culvert Crossing
Looking Upstream

8.2 Lower El Mirage Wash Channel Tributary

The Lower El Mirage Wash Channel Tributary extends upstream from the confluence with the Lower El Mirage Wash Channel, crosses Thunderbird Road and ends at Dysart Road approximately 900 feet south of Greenway Road. The Tributary is considered a regional drainage facility. However, it is classified by the U.S. Army Corps of Engineers as a non-jurisdictional water of the U.S. under Section 404 of the Clean Water Act. As stated in Section 1.0, improvements to the Tributary occurred in conjunction with development taking place within the historic floodplain. The Tributary is shown on Figure 3.

The Tributary channel geometry is a constructed trapezoidal section with varying bottom width, sideslopes and depth. Approximations of the Tributary plan and cross-section are shown in the As-Built LOMR Exhibits for the Lower El Mirage Wash Tributary Channelization, A Portion of the El Mirage Wash Master Drainage Plan that is provided in Appendix I.

The Tributary contains four grade control structures and four culvert crossings. The culvert crossings are listed in Table 4.

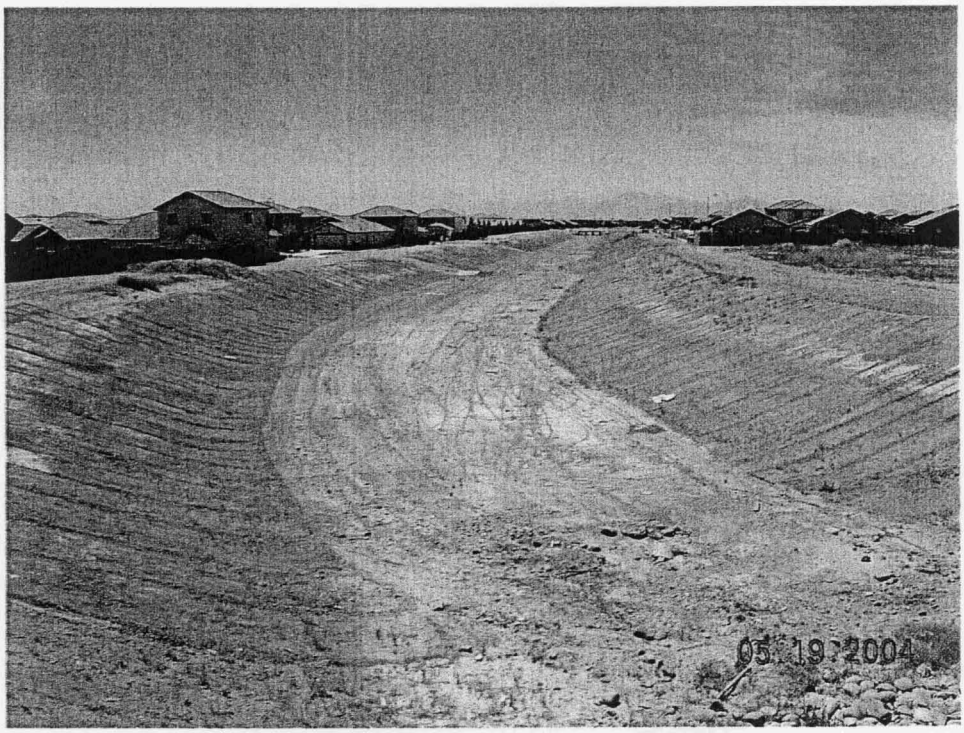
Table 4. Lower El Mirage Wash Channel Tributary Culvert Crossings.

Location	Culvert Type
Myer Lane	3-10'x6' RCBC
Thunderbird Road	1-14.5' (span) x 10' (rise) SPPA
Burlington Norhthern Santa Fe Railroad	2-9'x9' RCBC
Acoma Drive	4-6'x10' RCBC

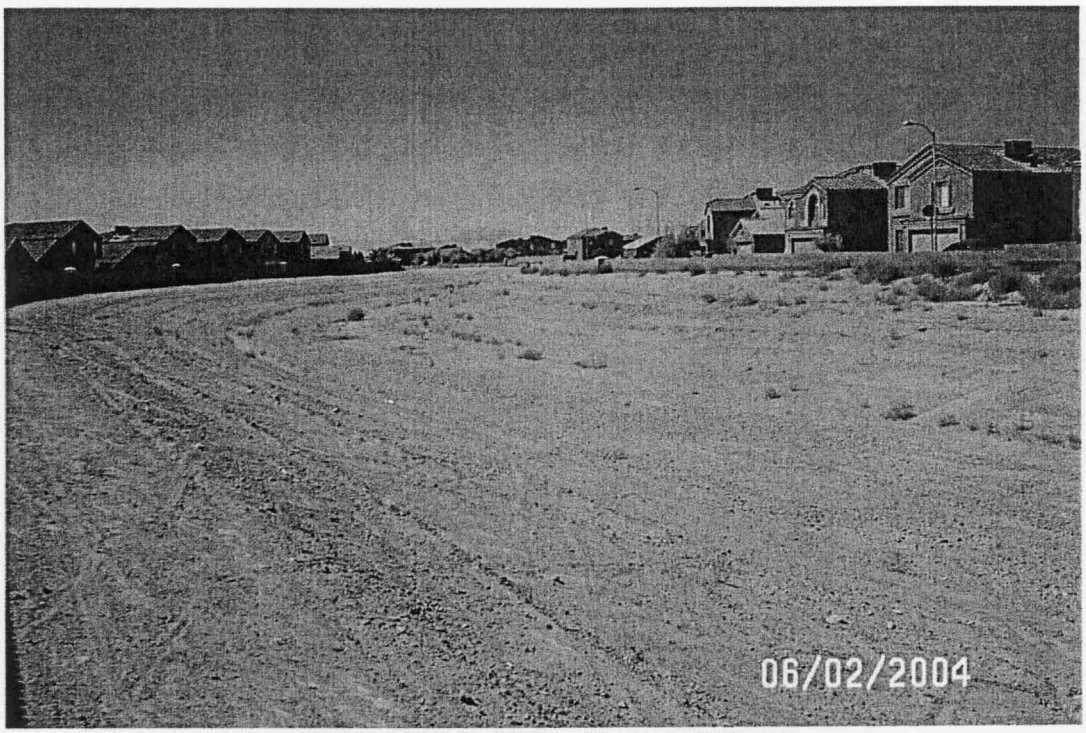
RCBC – Reinforced Concrete Box Culvert
SPPA – Structural Plate Pipe Arch

According to the Base Hydrology (HEC-1 L33PF6D.dat), the peak discharge conveyed through the Tributary is approximately 950 cfs (HEC-1 I.D. RLE2). Photographs of the Tributary are provided on the following pages.

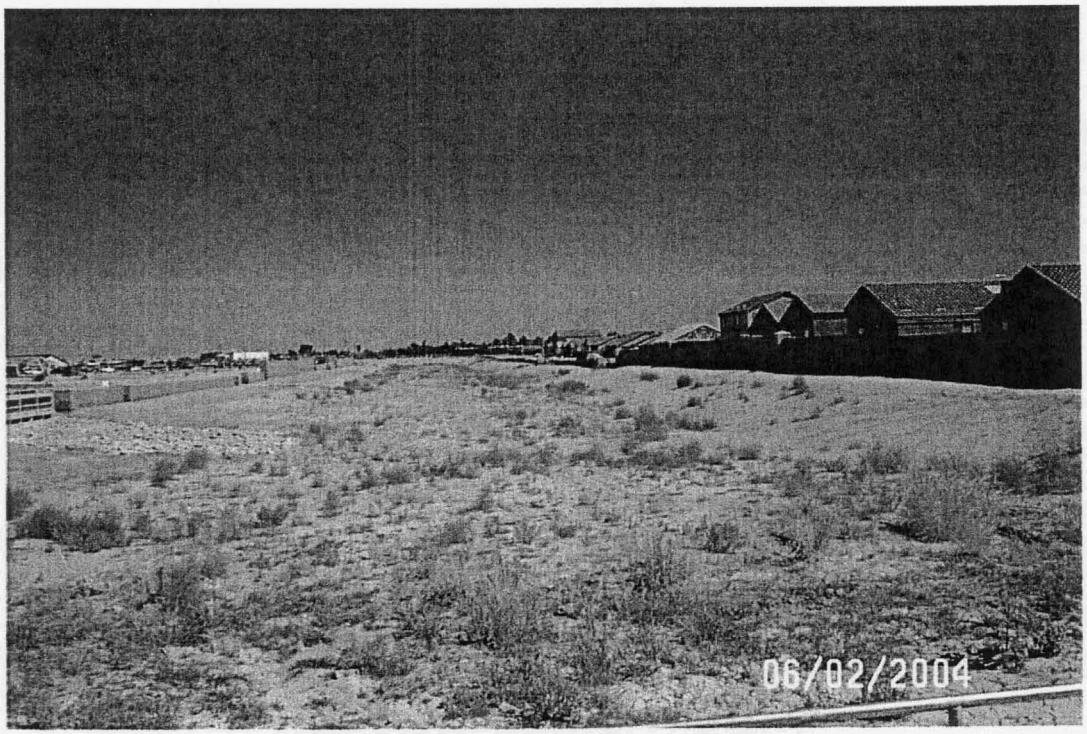
Lower El Mirage Wash Channel Tributary Just Upstream
From Confluence with Lower El Mirage Wash Channel
Looking Upstream



Lower El Mirage Wash Channel Tributary
Just Downstream From Thunderbird Road
Looking Downstream



Lower El Mirage Wash Channel Tributary
Just Downstream From Burlington Northern Santa Fe Railroad
Looking Downstream



Lower El Mirage Wash Channel Tributary
Looking Upstream from Acoma Drive

8.3 Existing On-Line Detention Basin

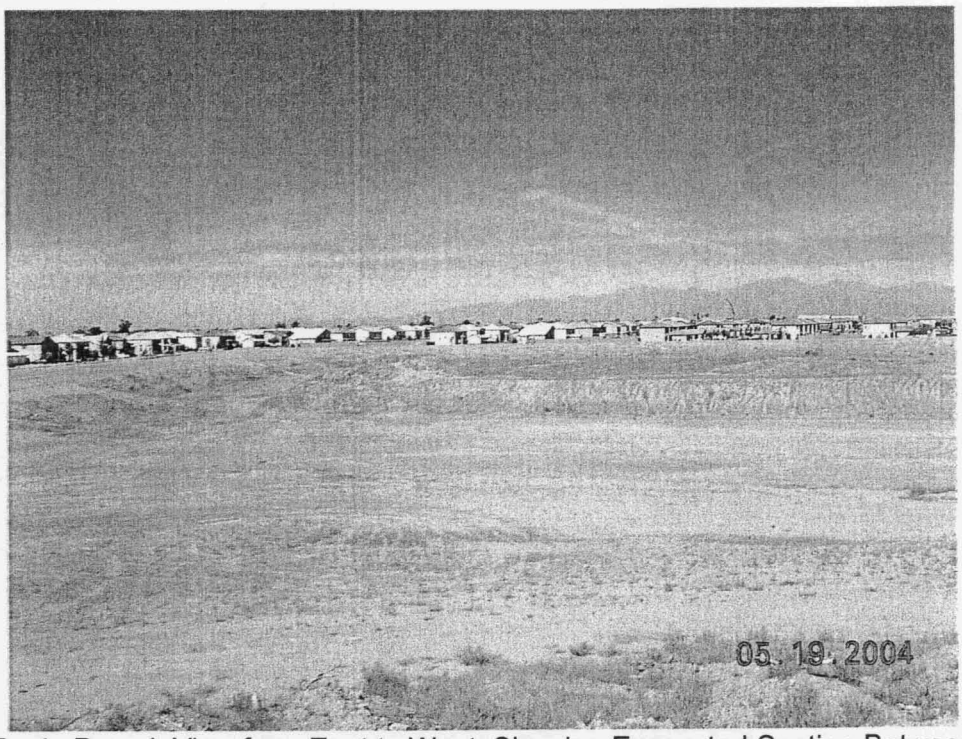
An existing on-line detention basin is located on the southwest corner of Cactus Road and El Mirage Road. The basin was constructed as development occurred within the project area and was intended to serve as a regional facility in lieu of retention for each of the new subdivision units recently constructed in the project area. No engineering plans or supporting documentation for the basin have been found. The basin occupies the area in which the proposed West Cactus Basin was to be constructed. This basin will henceforth be referred to as the "existing" West Cactus Basin.

The existing basin is hydraulically connected to the Lower El Mirage Wash Channel just upstream of El Mirage Road. Flow from the channel is able to enter the basin via an excavated section of earth. This results in an "on-line" configuration for the existing basin. Based on field survey, the existing basin volume is approximately 93 acre-feet, which includes that portion of the Lower El Mirage Wash channel upstream (north) of Cactus Road below the elevation corresponding to the lowest point in the El Mirage Road dip crossing near the existing double 10'x3' concrete box culvert (see Section 12.0).

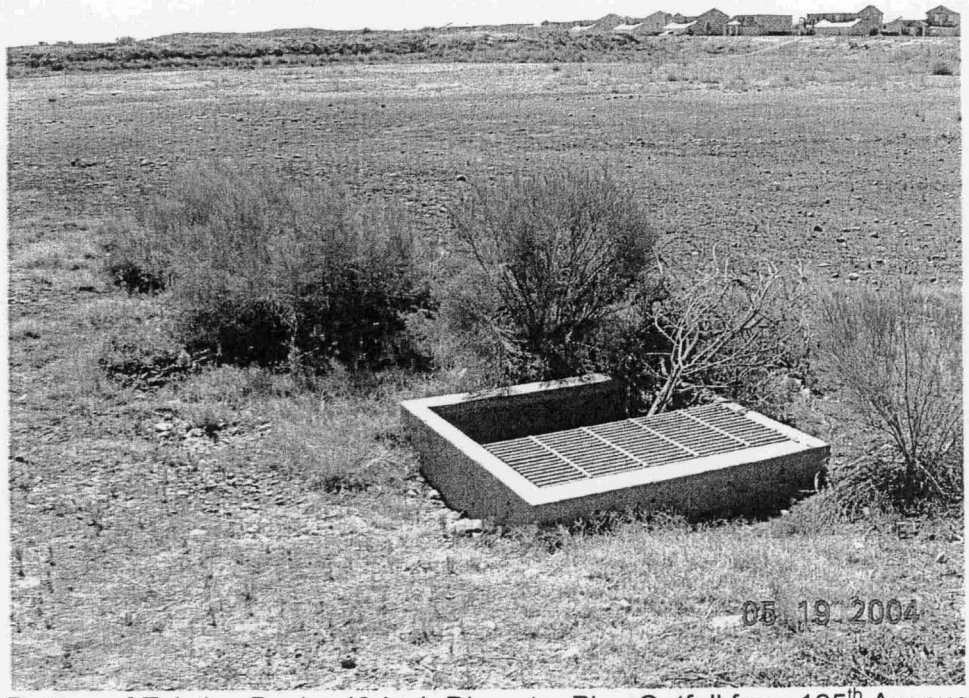
The basin boundaries include Cactus Road to the north, El Mirage Road to the east, Canterbury Drive to the south and 125th Avenue to the west. At the southeast corner of the basin parcel, the existing ground elevation is approximately 1,113 feet (NVGD 1929). The existing grade along the southern boundary of the parcel gradually increases to approximately 1,117 feet at the southwest corner. The basin bottom elevation varies between 1,103 feet at its lowest elevation and 1,107.5 feet at the inlet invert of the 2-10' x 3' concrete box outlet culvert at El Mirage Road. Overflow of the basin outlet occurs at the El Mirage Road sag (approximate elevation 1,111.4 feet), located just south of the culvert (see Section 12.0).

Runoff from adjacent residential developments, primarily located west of the basin, currently drains directly into the existing basin. Runoff from that area is conveyed east through the streets where it is collected and conveyed to the basin via two independent storm drain systems. During a large event, it is likely that the storm drain systems will not be sufficient to convey all the runoff and water will begin to pond in Canterbury Drive, Berry Lane and 125th Avenue. Water will continue to pond until it overtops the break-over in Berry Lane, just south of Sierra Street. As water overtops the break-over elevation, the flow will be to the south, out of the project area. Further discussion regarding the existing condition of the basin and storm drain system capacity is provided in Section 12.0.

Photographs of the existing basin are provided on the following page.



Basin Parcel, View from East to West, Showing Excavated Section Between Existing Basin and Lower El Mirage Wash Channel

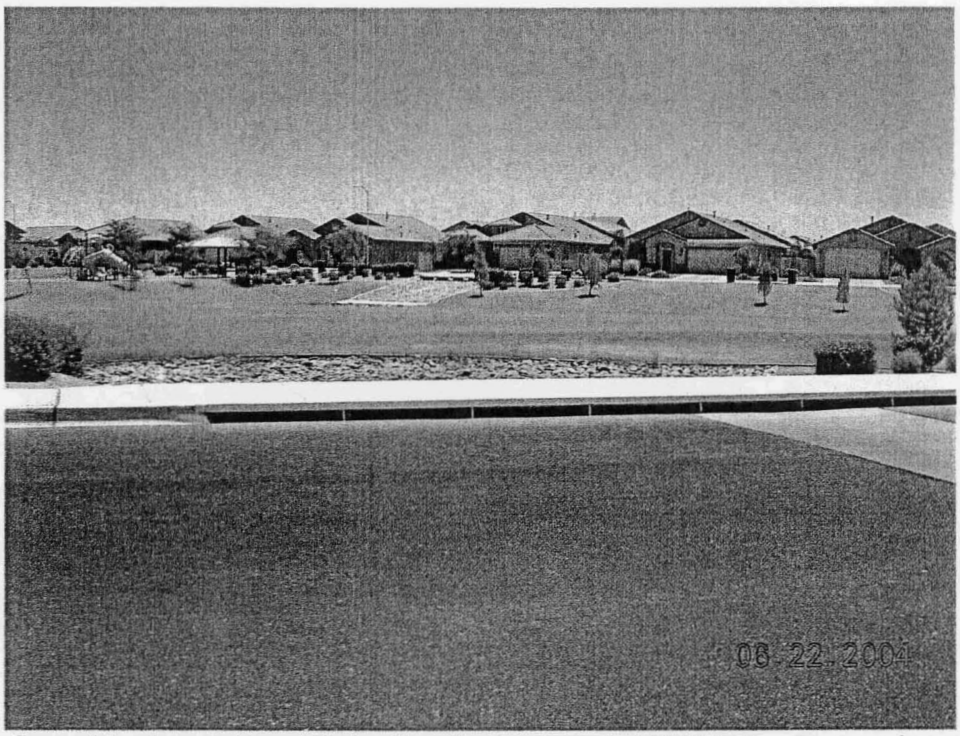


Bottom of Existing Basin, 48-inch Diameter Pipe Outfall from 125th Avenue Storm Drain. Location is Near West Side of Basin

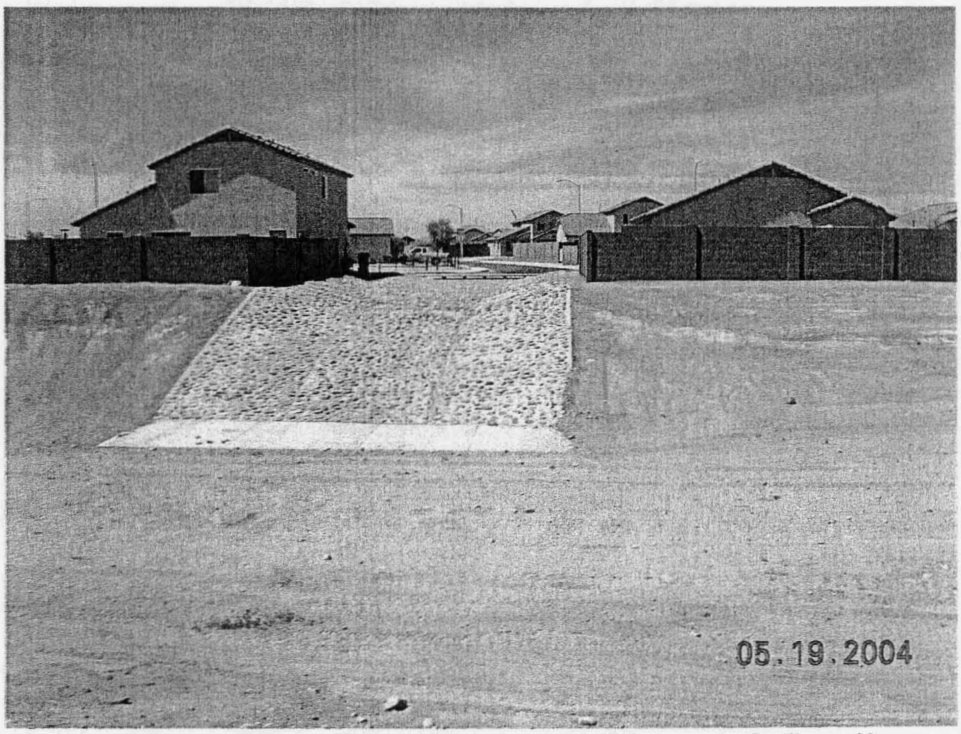
8.4 Local Retention, Catch Basins, Storm Drains and Scuppers

Residential developments within the project area have constructed a number of small retention basins. Retention basins were not constructed for every subdivision unit, but rather as small basins scattered throughout the project area. The accumulative retention volume existing within the project limits is not known. However, based on survey information, the existing retention volume located within the contributing area of the proposed West Cactus Basin is approximately 20 acre-feet. A photograph of a local retention basin is provided on the following page. Further discussion regarding local retention is provided in Section 12.0.

Catch basins, storm drains and scuppers are typically used to convey local runoff to a larger conveyance or basin. Outfall locations for local runoff are typically protected by a concrete spillway or apron. As discussed in Section 2.2, local erosion has been occurring at some locations where drainage infrastructure has been constructed within the Lower El Mirage Wash Channel and Tributary. A photograph of a scupper and apron located within the Lower El Mirage Wash Channel is provided on the following page.



One of the larger Local Retention Basins Located Within the Project Area



Lower El Mirage Wash Channel Scupper and Concrete Spillway/Apron

9.0 Lower El Mirage Wash and Tributary Channels Sediment Transport

Sediment transport is the movement of bed and bank material by flowing water. Understanding the sediment transport potential of a stream or channel is required to protect against general scour and channel degradation. For the purposes of this report, sediment transport issues deal with flow in the channel as opposed to the local scour issues discussed in Section 2.2 that deal mainly with local flow entering the channel.

9.1 Channel General Scour

General scour is the enlargement of a flow section by the removal of boundary material through the action of fluid motion during a single discharge event. Results of scouring action may or may not be evident after the passing of the flood event. Although numerous hydraulic factors control the extent of scour, of primary importance are the channel bed and bank material, channel flow velocity and type of armoring.

9.1.1 Lower El Mirage Wash Channel Scour Potential

The bed and bank material of the Lower El Mirage Wash Channel (from Dysart Road to El Mirage Road) is primarily composed of native earth. This earth consists primarily of sandy silts. Coarse sand and light gravel is present in places but few naturally occurring cobbles and no boulders are present. In addition, the channel bed and bank is typically void of vegetation that would provide protection from scour. According to the FCD Hydraulics Manual, Table 6.1, the maximum permissible velocity for this type of channel is approximately 5 ft/s.

According to the Lower El Mirage Wash Channel LOMR HEC-2 model (13WSHLLT.DAT), the typical flow velocity for the overall channel is below 5 ft/s. Drop structures have been constructed in the channel to flatten its slope and help reduce flow velocities. However, the flow velocity in this channel approaches 9 ft/s at a location approximately midway between the 129th Avenue and 127th Avenue culverts. Given the channel bed and bank characteristics and flow velocities, it is probable that certain sections of the Lower El Mirage Wash Channel may be subject to general scour during a large event, but the overall channel general scour potential appears minimal. In addition, based on site reconnaissance, there is no evidence of general scour. The HEC-2 model 13WSHLLT.DAT and output 13WSHLLT.OUT are provided on a CD that is located in a pocket folder at the end of the CAR.

Although the potential for general scour in the Lower El Mirage Wash Channel appears minimal, as discussed in Section 2.2, local erosion has occurred at some of the local inflow structures and other locations.

9.1.2 Lower El Mirage Wash Tributary Channel Scour Potential

The Lower El Mirage Wash Tributary Channel (from Dysart Road to the confluence with the Lower El Mirage Wash Channel) is very similar to the main channel in terms of its physical characteristics, hydraulics and soils. The channel bed and banks are also typically void of vegetation that would provide protection from scour. The potential for general scour is similar to the main channel. And like the main channel, based on site reconnaissance, there is no evidence of general scour.

9.2 Channel Degradation

Channel degradation is the removal of bed material by flowing water over an extended period of time. Factors such as channel slope, sediment size and availability and discharge determine the potential for channel degradation. As discussed in the previous

section, the Lower El Mirage Wash and Tributary Channels included installation of grade control and drop structures, which will deter channel degradation. Grade control structures include the various box culverts mentioned previously because they have hardened bottoms with turndowns. Drop structures are constructed from gabion baskets with additional scour protection immediately downstream of the structure, as seen in the photograph below.

Lower El Mirage Wash Channel Grade Control Structure
Downstream of the 129th Avenue Culvert, View Upstream

9.3 Sediment Transport and Local Scour Recommendations

It is recommended that further evaluation of local scour be considered for both the main channel and the tributary channel. Existing local scour (discussed briefly in Section 2.2) is relatively minor but is found at many, many locations. Completion of the channel landscaping will help reduce rilling of the banks. Gravel mulch or decomposed granite would help. Hydroseeding might also be considered as an interim solution until final landscaping is completed. It is also recommended that the need for bed and bank armoring be reviewed at locations like channel bends, angle points, downstream from culverts and drop structures and at the confluence of the main and tributary channels.

10.0 Preliminary Alternatives

Preliminary alternatives were formulated on the basis of problem locations and flood-prone areas, potential regional and local drainage and floodplain benefits, engineering judgment and available property and existing and future land use. Alternative formulation involved input from FCD, the City of El Mirage and Stanley. The following nine preliminary structural alternatives were developed for the West Cactus Basin and Channels Project:

- **Preliminary Alternative No. 1:** A 100-year discharge reduction at West Cactus Basin per the Loop 303 Corridor/White Tanks ADMP Update off-line basin approach.
- **Preliminary Alternative No. 2:** A 100-year discharge reduction at West Cactus Basin using an optimized version of the Loop 303 Corridor/White Tanks ADMP Update off-line basin.
- **Preliminary Alternative No. 3:** A 100-year discharge reduction at West Cactus Basin using on-line basin approach or combination on/off-line basin approach.
- **Preliminary Alternative No. 4:** A 100-year discharge reduction at West Cactus Basin, as in Preliminary Alternatives 2 and 3. However, place an emphasis on aesthetics and multi-use.
- **Preliminary Alternative No. 5:** A 100-year discharge reduction at West Cactus Basin as in Alternatives 1 through 4 and provide additional 100-year discharge reduction by constructing a new basin on vacant land located south of Thunderbird Road, between the Lower El Mirage Wash Channel Tributary and 127th Avenue.
- **Preliminary Alternative No. 6:** A 100-year discharge reduction at West Cactus Basin as in Alternatives 1 through 5 and add conveyance in the Lower El Mirage Wash Channel corridor through the Pueblo El Mirage development to further reduce any remaining floodplain impacts.
- **Preliminary Alternative No. 7:** A 100-year discharge reduction at West Cactus Basin as in Alternatives 1 through 5 and add conveyance to further reduce any remaining Pueblo El Mirage development floodplain impact by constructing a new storm drain intercept that would take flow south in El Mirage Road to Peoria Avenue, then east to the Agua Fria River.
- **Preliminary Alternative No. 8:** A 100-year discharge reduction at West Cactus Basin as in Alternatives 1 through 5 and add conveyance to further reduce any remaining Pueblo El Mirage development floodplain impact by constructing a new storm drain intercept that would take flow east in Cactus Road to the Agua Fria River.
- **Preliminary Alternative No. 9:** Select Alternative 6, 7 or 8 and use a 10-year design storm standard.

10.1 Evaluation of Preliminary Alternatives

The above preliminary alternatives were reviewed at the coordination and milestone meeting held June 22, 2004 along with the results of preliminary hydrology, hydraulics and cost estimates. One of the objectives of the June 22 meeting was to select the three structural alternatives that would be promoted to the next step in the evaluation. The conclusions of the project team were as follows:

- Preliminary Alternative 1 is the off-line basin concept from the ADMP and simply serves as the benchmark with which we will modify, improve and optimize through Preliminary Alternatives 2 and 4.

- Preliminary Alternative 3 used an on-line basin concept at Cactus and El Mirage instead of an off-line basin. A much greater volume was required with this alternative compared to Preliminary Alternatives 2 and 4 to achieve the same discharge reduction downstream. Therefore, this alternative was dropped from further consideration.

- Preliminary Alternative 5 involved constructing a new off-line retention basin along the west side of the Lower El Mirage Wash channel on a vacant parcel of land on the south side of Thunderbird Road. The cost of this alternative was very high with only a slight reduction in discharge. Therefore, this alternative was dropped.

- Preliminary Alternatives 7 and 8 involved constructing a new storm drain that would intercept flow and divert it directly to the Aqua Fria River south along El Mirage Road turning east on Peoria (Alterative 7) or west along Cactus Road (Alternative 8). These alternatives were both very expensive and did not eliminate the need for discharge reduction on the West Cactus basin parcel. Preliminary Alternative 7 was dropped because it was the more expensive of the two. Alternative 8 was still in contention because it was less expensive than Alternative 7 and would potentially provide another conveyance alternative to Preliminary Alternative 6 (increasing conveyance through the Pueblo El Mirage Golf Course).

- Preliminary Alternative 9 involved a 10-year design storm. This alternative was dropped from further consideration for the following reasons: a) Stanley's simple attempt to produce a 10-year hydrograph that could be used as the basis for this alternative did not yield reasonable results, as discussed in Section 4.0. b) The design storm criteria originally envisioned and desired by the project team was 100-year and it appeared that, based on the ADMP 100-year model, we could arrive at a 100-year solution. c) Stanley's scope of work did not include any modification of the ADMP HEC-1 model to create a model with a different return frequency and FCD hydrology staff did not have time to produce an appropriate 10-year model.

- Preliminary Alternatives 2 and 4 both looked like the most promising, cost effective alternatives. Neither by itself, however, would eliminate the need for at least minimal conveyance improvements to the channel downstream in the Pueblo El Mirage development. The consensus of the project team was to promote off-line basin Alternatives 2 and 4, each combined with the appropriate

conveyance improvements of Alternative 6 to the next level of analysis. The third structural alternative that would move to the next step of analysis was Alternative 8 combined with either Alternative 2 or Alternative 4.

It should be noted that the formulation and evaluation of the preliminary alternatives was based on the known hydrology at that time. Supplemental hydrology was obtained after the formulation and evaluation process in order to gain a better understanding of the current and future hydrologic conditions within the City of El Mirage. Further discussion regarding the supplemental hydrology can be found in Section 12.0.

11.0 Selected Alternatives

After review of the preliminary alternatives at the Coordination and Milestone Meeting held June 22, 2004, three structural alternatives were selected for further development, along with the "Do Nothing" Alternative. The three structural alternatives are: Preliminary Alternative No. 2; Preliminary Alternative No. 4; and Preliminary Alternative No. 2 or No. 4 in combination with Preliminary Alternative No. 8.

At the July 21, 2004 Coordination and Milestone Meeting, a review of the selected alternatives, based on the hydrology as of that date, took place. All preliminary alternatives including the "Do Nothing" Alternative reflect the closest representation of known hydrologic and hydraulic conditions within the project area as of the July 21, 2004 Coordination and Milestone Meeting. Exhibits depicting the selected alternatives discussed below are provided in Appendix J. In addition, a site plan for the El Mirage Regional Park (West Cactus Basin), which was prepared by A-N West Consulting Engineers for the City of El Mirage in August 1999, is provided in Appendix J. HEC-1 models used for the alternative selection process are provided on the CD that is located in the pocket folder at the end of the CAR.

11.1 "Do Nothing" Alternative

As mentioned above, the "Do Nothing" Alternative reflected hydrologic and hydraulic conditions within the project area as of the July 21, 2004 Coordination and Milestone Meeting. In addition, the basin description, peak discharges and runoff volumes discussed below reflect pre-supplemental hydrology information (see Section 12.0).

The existing basin has been partly excavated and performs as an on-line detention basin. The basin can be broken into two distinct areas. Area 1 is approximately 8.5 acres in area and has an average bottom elevation of about 1104 feet and a volume of about 59.5 acre-feet. Area 2, which includes a portion of the Lower El Mirage Wash Channel, is approximately 6.7 acres in area and has an average bottom elevation of about 1,106 feet and a volume of about 33.5 acre-feet. These estimated storage volumes assume vertical sides and a top elevation of 1,111 feet, which is the top-of-roadway at the El Mirage Road dip crossing just south of the existing 2–10'x3' box culvert. The total estimated volume is approximately 93 acre-feet.

Table 5 lists peak discharges and runoff volumes computed for the "Do Nothing" Alternative hydrology (EXSTREV0.DAT).

Table 5. "Do Nothing" Alternative Hydrology Peak Discharges and Runoff Volumes

Location	Peak Discharge (cfs)	Runoff Volume (ac-ft)
@ Cactus Road	1,560	368
Total Basin Inflow	1,808	408
@ El Mirage Road	1,532	- -
Thru Golf Course Channel	1,487	- -

Because the "Do Nothing" Alternative does not entail any construction, no preliminary cost estimate for this alternative has been developed. However, it should be recognized that costs such as flood damage to existing structures and to the Pueblo El Mirage Golf Course, the cost of flood insurance, etc. are associated with the "Do Nothing" Alternative.

The following benefits are associated with the "Do Nothing" Alternative:

- No cost to construct or maintain,
- Slight reduction in discharge compared to the previously estimated ADMP existing condition 100-year discharge,
- Existing basin probably effectively controls lesser storm events, like perhaps the 5-year event, and
- Existing first flush capabilities.

The following constraints are associated with the "Do Nothing" Alternative:

- Potential threat of residential flooding by local runoff ponding during large events in the vicinity of 125th Avenue and Canterbury Drive. Increased water surface profile in the vicinity of the El Mirage Road culvert crossing due to flow obstructions.
- Only slight reduction in 100-year floodplain downstream in Pueblo El Mirage.
- Very limited opportunity for multi-use parks and recreation with current on-line basin configuration.
- Current basin aesthetics visually un-appealing.
- Disposal of retained runoff is currently through percolation into the bottom of the basin and could take longer than 36 hours and pose vector control, attractive nuisance and public safety issues.

The existing basin grades along the south and west perimeter are higher than the adjacent grades in Canterbury Drive and 125th Avenue, which are drained by catch basins in sump. If the capacity of the catch basins and storm drain system in these two adjacent streets is exceeded, ponded runoff could back up into the adjacent residential properties.

11.2 Preliminary Alternative No. 2

This alternative entails construction of an off-line detention basin with a storage capacity of approximately 195 acre-feet. Flow would enter the basin via lateral weir (length and elevation to be estimated at a level of design beyond that associated with this CAR). The basin will have 4H : 1V side slopes and an average bottom elevation of 1,104 feet. The top-of-basin storage elevation was assumed to be 1,111 feet. It may be necessary to add another culvert barrel to the existing box culvert at El Mirage Road to create the necessary low-flow bypass at lower head associated with elevation of the lateral weir into the basin.

Low flows entering the proposed detention basin from the adjacent residential area to the west would collect in a local depression around the storm drain outfall and be disposed of via dry wells and percolation. A single 48-inch diameter pipe, set at invert elevations of 1,106 feet, would be used to bleed-off the basin. The bleed-off pipe would outfall approximately 350 feet downstream of the basin, into the Lower El Mirage Wash Channel at an elevation of 1,105 feet. Remaining runoff stored within the basin below 1,106 feet could potentially be drained from the basin by drywells, percolation, a stormwater pump, or a combination thereof. A short reach of the Lower El Mirage Wash channel just downstream from the existing 2–10'x3' box culvert would need to be improved. The rest of the channel through Pueblo El Mirage appears capable of conveying the basin outflow. This preliminary option did not consider a concrete low

flow channel to carry flows from the 48-inch diameter pipe outfall to the El Mirage Road culvert.

Table 6 lists peak discharges and runoff volumes computed by the Preliminary Alternative No. 2 hydrology (ALT2REV1.DAT).

Table 6. Preliminary Alternative No. 2 Hydrology Peak Discharges and Runoff Volumes

Location	Peak Discharge (cfs)	Runoff Volume (ac-ft)
@ Cactus Road	1560	368
Basin Inflow	1210	190
@ El Mirage Rd	350	- -
Thru Golf Course Channel	420	- -

Estimated construction costs associated with Preliminary Alternative No. 2 are provided in Table 7.

Table 7. Preliminary Alternative No. 2 Estimated Construction Costs

Description	Quantity,	Unit Price	Cost
Basin excavation	181,200 CY	$5/CY	$906,000
Erosion protection @ Cactus Road	140 CY	$300/CY	$42,000
Side weir	720 CY	$350/CY	$252,000
Improved El Mirage Rd. box culvert	130 CY	$350/CY	$45,500
48" bleedoff pipe	350 LF	$95/LF	$33,250
Drywells	8 EA	$5,000/EA	$40,000
Stormwater Pump	1 LS	$250,000	$250,000
Right-of-Way Acquisition	474,804 SF	$8/SF	$3,798,400
Channel Improvements D/S of El Mirage Rd	200 LF	$65/LF	$13,000
Channel Improvements Between Cactus and El Mirage Roads	1,500 LF	$65/LF	$97,500
Landscaping	265,000 SF	$2/SF	$530,000
		Total	**$6,007,650**
Contingency @ 35% of total			$2,102,680
		Total	**$8,110,330**

The following benefits are associated with Preliminary Alternative No. 2:

- Basin configuration minimizes excavation, maximizes basin bottom area and keeps the average basin bottom higher than Alternative 4,
- Basin configuration has a slightly smaller cost associated with it than the more aesthetically pleasing basin in Alternative 4,
- The existing 3-24" low flow pipes and dip at Cactus Road could essentially remain as-is, and
- The average basin bottom of 1104 approximates the existing basin bottom at the west end of the basin parcel.

The following constraint is associated with Preliminary Alternative No. 2:

- An average basin bottom lower than about elevation 1106 may require a pump to dispose of stormwater in less than 36 hours.

11.3 Preliminary Alternative No. 4

This alternative is essentially the same as Alternative No. 2 except it employs a more aesthetically pleasing side slope of 10H:1V instead of 4H:1V. The storage capacity is about the same as with Alternative No. 2 except the average basin bottom must drop to an elevation of 1103 to make up for the loss of volume due to the flatter side slopes. Use of the flatter side slopes is intended to account for not only a flatter but a more curvilinear basin perimeter side slope. In design, the actual side slopes could vary from, say, 4H : 1V to 8H : 1V. All other features of Alternative No. 4 are essentially the same as Alternative No. 2.

Both Preliminary Alternatives 2 and 4 utilized the same HEC-1 model for hydrologic computations (ALT2REV1.DAT). Table 8 lists peak discharges and runoff volumes computed by the Preliminary Alternative No. 4 hydrology.

Table 8. Preliminary Alternative No. 4 Hydrology Peak Discharges and Runoff Volumes

Location	Peak Discharge (cfs)	Runoff Volume (ac-ft)
Cactus Road	1560	368
Basin Inflow	1210	190
El Mirage Rd	350	222
Thru Golf Course Channel	415	221

Estimated construction costs associated with Preliminary Alternative No. 4 are provided in Table 9.

Table 9. Preliminary Alternative No. 4 Estimated Construction Costs

Description	Quantity	Unit Price	Cost
Basin excavation	189,300 CY	$5/CY	$946,500
Erosion protection @ Cactus Road	140 CY	$300/CY	$42,000
Side weir	1,600 CY	$350/CY	$560,000
Improved El Mirage Rd. box culvert	130 CY	$350/CY	$45,500
48" bleedoff pipe	350 LF	$95/LF	$33,250
Drywells	8 EA	$5,000/EA	$40,000
Stormwater Pump	1 LS	$250,000	$250,000
Right-of-Way Acquisition	474,804 SF	$8/SF	$3,798,400
Channel Improvements D/S of El Mirage Rd	200 LF	$65/LF	$13,000
Channel Improvements Between Cactus and El Mirage Roads	1,500 LF	$65/LF	$97,500
Landscaping	530,000 SF	$2/SF	$1,060,000
		Total	**$6,886,150**
Contingency @ 35% of total			$2,410,150
		Total	**$9,296,300**

The following benefit is associated with Preliminary Alternative No. 4:

- Compared to Alternative No. 2, has a more aesthetically pleasing and the visual interest potential is greater.

The following constraints are associated with Preliminary Alternative No. 4:

- Compared to Alternative No. 2, has a deeper smaller bottom that potentially decreases the opportunity for multi-use and recreation facilities, and
- Average basin bottom lower than about elevation 1106 increases the potential need for a pump to dispose of stormwater in less than 36 hours.

11.4 Preliminary Alternative No. 2 Plus 8

This alternative entails construction of essentially the same off-line detention basin as in Alternative No. 2 except with a higher average basin bottom and smaller storage volume. The basin bottom would be the highest of all the structural alternatives at elevation 1106 feet. The storage capacity would be approximately 140 acre-feet. To make up for the loss in storage, a portion of the flow would need to be diverted before entering the basin and conveyed directly to the Agua Fria River in a 72-inch diameter storm drain located in Cactus Road. The basin uses essentially the same footprint as Alternative No. 2 but the side slopes have been adjusted to 5.6H:1V.

Table 10 lists peak discharges and runoff volumes computed by the Preliminary Alternative No. 2 plus 8 hydrology (ALT2+8.DAT).

Table 10. Preliminary Alternative No. 2 Plus 8 Hydrology Peak Discharges and Runoff Volumes

Location	Peak Discharge (cfs)	Runoff Volume (ac-ft)
@ Cactus Road	1560	368
Storm Drain	200	177
Basin Inflow	1010	145
@ El Mirage Rd	350	- -
Thru Golf Course Channel	420	- -

Estimated construction costs associated with Preliminary Alternative No. 2 plus 8 are provided in Tale 11.

Table 11. Preliminary Alternative No. 2 Plus 8 Estimated Construction Costs

Description	Quantity	Unit Price	Cost
Basin excavation	92,500 CY	$5/CY	$462,500
Erosion protection @ Cactus Road	140 CY	$300/CY	$42,000
Side weir	720 CY	$350	$252,000
Improved El Mirage Rd. box culvert	130 CY	$350/CY	$45,500
72" Storm drain	5,300 LF	$190/LF	$1,007,000
New culvert @ Cactus Road	360 CY	$350/CY	$126,000
36" bleedoff pipe	350 LF	$65/LF	$22,750
Drywells	6 EA	$5,000/EA	$30,000
Right-of-Way Acquisition	474,804 SF	$8/SF	$3,798,400
Channel Improvements D/S of El Mirage Rd	200 LF	$65/LF	$13,000
Channel Improvements Between Cactus and El Mirage Roads	1,500 LF	$65/LF	$97,500
Landscaping	265,000 SF	$2/SF	$530,000
		Total	**$6,426,650**
Contingency @ 35% of total			$2,249,330
		Total	**$8,675,980**

The following benefits are associated with Preliminary Alternative No. 2 plus 8:

- Basin configuration minimizes excavation, maximizes basin bottom area and keeps the average basin bottom as high as possible,
- Smallest basin cost, and
- Has best chance of eliminating need for pump station for disposal.

The following constraints are associated with Preliminary Alternative No. 2 plus 8:

- Requires new culvert and roadway improvements at Cactus Road, and
- Requires new 72 inch diameter storm drain.

12.2 Existing On-Line Detention Basin Supplemental Hydrology

Supplemental hydrologic information for the existing on-line detention basin (discussed in Section 8.3) included the following:

- Basin perimeter top and bottom elevation shots, which includes that portion of the Lower El Mirage Wash Channel between Cactus Road and El Mirage Road;
- Additional bottom-of-basin and surrounding grade elevation shots. These shots include the 2-10'x3' culvert under El Mirage Road, the El Mirage Road dip section just south of the 2-10'x3' culvert crossing, the 3-24" diameter pipes under Cactus Road and the Cactus Road dip section at the 3-24" diameter pipes.
- Channel top and bottom elevation shots for the Lower El Mirage Wash Channel upstream from Cactus Road below the El Mirage Road dip elevation.

Based on the field survey, the on-line basin has approximately 93.1 acre-feet of on-line storage capacity in its current "interim" configuration. Most of this volume is found within the basin parcel(s) at the southwest corner of Cactus and El Mirage Roads. However, because this is an on-line basin, the total volume also includes that portion of the Lower El Mirage Wash Channel upstream from Cactus Road below elevation of 1,111.4 feet. This elevation corresponds to the low point in the El Mirage Road dip section near the existing double 10' x 3' concrete box culvert.

Approximately 32.0 ac-ft of the total existing volume surveyed in the basin occurs below elevation 1,107.5 feet, corresponding to the invert of the existing double 10' x 3' concrete box culvert under El Mirage Road. This volume is in the form of retention since it has no apparent outfall and will only dissipate through evaporation and percolation. The remaining volume (61.1 acre-feet) above elevation 1,107.5 feet is in the form of detention since it has a positive outfall downstream in the Lower El Mirage Wash Channel to the Agua Fria River. The existing on-line detention basin storage estimate is provided in Appendix K as part of the storage estimate for the local basins.

The existing basin configuration, with a total volume of 93.1 acre-feet corresponding to elevation 1,111.4 feet, was reflected in a revised HEC-1 model for the "Do Nothing" Alternative. Results of the revised HEC-1 model are discussed in Section 13.1.

12.3 Existing Local Retention Supplemental Hydrology

Based on the field survey, Stanley estimated that existing local stormwater retention within the City of El Mirage portion of the West Cactus Basin contributing area provides a combined total of approximately 20.1 acre-feet of storage. Local retention estimates are provided in Appendix K.

The local retention volume associated with the appropriate sub-basins was reflected in a revised HEC-1 model for the "Do Nothing" Alternative. Results of the revised HEC-1 model are discussed in Section 13.1.

12.4 Future 100-Year, 2-Hour Retention Supplemental Hydrology

The future 100-year, 2-hour retention storage capacity for remaining undeveloped parcels that contribute runoff to the existing West Cactus Basin has a total estimated volume of 11.0 ac-ft. This is the post-development estimated storage. Most of the currently undeveloped parcels will have commercial/retail developments in the future.

12.0 Supplemental Hydrology

After review of the selected alternatives at the July 21, 2004 Coordinating and Milestone Meeting (see Section 11.0), the project team decided that supplemental hydrology was necessary to accurately reflect the hydrologic conditions for the existing basin and surrounding vicinity. On August 17, 2004 Stanley was notified to proceed with the West Cactus Detention Basin and Channels Project (CAR) – Additional Hydrology and Hydraulics Task. The Scope of Work for collecting the supplemental hydrology is provided in Appendix K.

Tasks for collecting the additional hydrology included the following:

- Field survey (using a combination of GPS and conventional level) the existing on-line detention basin, storm drain systems that outfall to the basin, finish floor elevation for homes in vicinity of the basin, existing grades and facilities in the vicinity of the basin and existing stormwater retention/detention basins located within the Loop 303/White Tanks ADMP Sub-Basins 127, 139, 140, 156, 157, 171 (portions) and 172.
- Reduce the field collected survey data to determine the volumes of stormwater retention/detention within that portion of the area tributary to the proposed West Cactus Basin that is within the City of El Mirage.
- Perform hydrologic and hydraulic analysis for the existing storm drains in 125th Avenue and Canterbury Drive to determine the capacities and associated hydraulic grade line in relation to the finished floors of residences adjacent to the storm drain system.
- Identify undeveloped parcels within the existing on-line detention basin contributing area that have potential future retention storage and estimate this retention based on a 100-year, 2-hour storm event.
- Modify the ADMP HEC-1 model with the new data produced from the above tasks.
- Investigate ownership of properties within the Pueblo El Mirage Golf Resort adjacent to the Lower El Mirage Wash floodplain.
- Document the results of the supplemental hydrology in the final CAR.

12.1 Supplemental Hydrology Field Survey Data

Survey data was collected using a combination of GPS and conventional level. The GPS was used to collect survey data for retention / detention storage, street grades and drainage facilities. The conventional level was used to collect survey data for finish floor elevations and storm drain systems (including catch basins, manholes and pipe inverts). A schematic showing the surveyed storm drain systems, finish floor elevations and street grade breaks in the vicinity of the basin are provided in Appendix K. Copies of the survey notebooks are provided in the Survey Report, provided under separate cover.

Stanley confirmed that the City of El Mirage will continue to enforce it's drainage ordinance and require stormwater retention for future development on these parcels. The location of undeveloped parcels and associated future storage estimates are provided in Appendix K. It should be noted that the existing parcel at the southeast corner of Cactus and El Mirage Road, which will be developed as commercial – retail, is assumed to have future 100-year, 2-hour retention on it even though it is immediately adjacent to the West Cactus Basin.

Future commercial/retail retention volume, associated with the appropriate sub-basins, was reflected in a revised HEC-1 model for the "Do Nothing" Alternative (see Section 11.1). Anticipating future retention in this way is consistent with future condition assumptions in the base hydrology HEC-1 model (L33PF6D.dat). Results of the revised HEC-1 model are discussed in Section 13.

12.5 ADMP HEC-1 Sub-Basins 157 and 172 Supplemental Hydrology

Based on the field survey, Stanley confirmed that the contributing area to the existing West Cactus Basin includes the upper portion of ADMP HEC-1 Sub-Basin 171. Sub-Basin 171 consists of residential development to the west and northwest of the existing basin. A total of 205 acres from Sub-Basin 171 were then added to Sub-Basins 157 (90 acres) and 172 (115 acres) and the length and area data associated with these two sub-basins was adjusted in the HEC-1 model. An exhibit illustrating the revised contributing areas in question is provided in Appendix K.

Because the original ADMP Sub-Basin 171 is outside the project boundaries and does not contribute to the West Cactus Basin or Lower El Mirage Wash, no adjustments were made to its area or length to account for the revised boundary. Sub-basin adjustments were reflected in a revised HEC-1 model for the "Do Nothing" Alternative. Results of the revised HEC-1 model are discussed in Section 13.1.

12.6 Existing Storm Drain Systems Supplemental Hydrology

Two separate storm drain systems outfall to the existing on-line detention basin. One system is located along 125th Avenue and consists of three on-grade catch basins and four in-sump catch basins split between two sumps. The second system is located in Canterbury Drive and Berry Lane and consists of three on-grade catch basins and two in-sump catch basins, with a single sump located in Canterbury Drive. Field survey data was collected for catch basin grate elevations, manhole rim and sump elevations and storm drain pipe invert elevations. A schematic of the storm drain systems is provided in Appendix K.

The storm drain systems have a combined capacity that will convey about a 5-year frequency storm (approximately 150 cfs) before the water backs up and ponds in the street. The contributing area adjacent to the on-line detention basin generates a 100-year discharge of 410 cfs. This discharge is the summation of estimated 100-year flows for contributing areas associated with each catch basin collecting flow. These estimates are based on FCD rational equation methodology. Supporting documentation for the 100-year runoff estimate is provided in Appendix K.

As mentioned above, there are a total of three sump conditions associated with the existing storm drain systems. Two of the sumps are located on 125th Avenue and the third is on Canterbury Drive. One of the two sumps on 125th Avenue is contained within the other larger, higher sump. When storm flows back up and begin to pond in the street

at these sumps, the water surface can reach a height equal to the confining adjacent grade break in the street. When the water surface rises above the top of curb at the sumps, water cannot overflow into the basin because existing grades on the basin parcel are higher than the street by as much as three to four feet.

The two combined sumps on 125th Avenue are higher in elevation than the sump on Canterbury Drive. Storm flows that exceed the sump(s) on 125th Avenue will overflow south to the Canterbury Drive sump. Flows overtopping the sump on Canterbury Drive will overflow to the south, out of the project area once the water surface elevation exceeds the grade break on Berry Lane immediately south of Sierra Street. The existing storm drain systems, sump and grade break locations, and adjacent finished floor elevations are shown on the storm drain schematic provided in Appendix K.

13.0 Supplemental Hydrology Results

Based on the collected supplemental hydrologic data, Stanley re-assessed the existing conditions within the project area, particularly in the vicinity of the West Cactus Basin. The assessment included updating the "Do Nothing" Alternative HEC-1 model and comparing estimated water surface elevations associated with the storm drain systems that outfall to the basin against finish floor elevations within the vicinity of the sumps. The updated hydrology was not re-applied to any of the preliminary structural alternatives covered in Section 11.

13.1 Updated "Do Nothing" Alternative HEC-1 Results

The Loop 303 Corridor/White Tanks ADMP HEC-1 model used for the "Do Nothing" Alternative (see Section 11.1, HEC-1 EXSTREV0.dat) was updated to reflect existing West Cactus Basin configuration (Section 12.2), existing local retention (Section 12.3), likely future retention (Section 12.4) and the revised boundary areas for Sub-Basins 157 and 172. The updated HEC-1 model (EXSTREV1.dat) is provided on CD, which is located in the pocket folder at the end of the CAR. In addition, excerpts from the updated HEC-1 model output are provided in Appendix K.

Hydraulic analysis for the storm drain systems in 125th Avenue and Canterbury Drive (see Section 12.6) would indicate that some of the contributing runoff might overflow to the south and leave the project area. However, this conclusion is based on rational method hydrology that typically yields much larger discharges than the regional hydrograph methods used in the ADMP HEC-1 model. The updated "Do Nothing" HEC-1 model disregards the potential overflow that might leave the project area (all flow enters the existing West Cactus Basin). The updated HEC-1 model also disregards any ponding or storage attenuation for the runoff contributing to the storm drain systems.

Based on the updated HEC-1 model, the runoff peak discharge and volume approaching Cactus Road from the north is approximately 1,560 cfs and 343 acre-feet, respectively. This flow, combined with stormwater from Sub-Basin 172 generates 1,808 cfs, which is modeled as the total flow entering the basin. The attenuation created by the existing West Cactus Basin results in a discharge of 1,326 cfs conveyed through the Pueblo El Mirage Golf Course. In comparison, according to the 1991 White Tanks/Agua Fria ADMP, the peak discharge routed through the golf course is 1,800 cfs (see Section 2.1). Additional hydrologic comparatison of peak discharges and runoff volumes for existing and proposed conditions is provided in Table 12, located on the following page and in Appendix K.

Table 12. West Cactus Basin Hydrologic Comparative

	1985 FEMA Floodplain Delineation[1]	1992 ADMP[2]	September 2001 LOMR[3]	January 2004 ADMP Existing Condition[4]	January 2004 Base Hydrology, ADMP Future Condition with Project[5]		Alternative 1 "Do Nothing" (July 2004)[6]		Alternative 2 (July 2004)[7]		Alternative 4 (July 2004)[8]		Alternative 2 + 8 (July 2004)[9]		Alternative 1 "Do Nothing" (October 2004)[10]	
Location of Peak Q	**Peak Q (cfs)**	**Peak Q (cfs)**	**Peak Q (cfs)**	**Peak Q (cfs)**	**Peak Q (cfs)**	**Runoff (ac-ft)**	**Peak Q (cfs)**	**Runoff (ac-ft)**	**Peak Q (cfs)**	**Runoff (ac-ft)**	**Peak Q (cfs)**	**Runoff (ac-ft)**	**Peak Q (cfs)**	**Runoff (ac-ft)**	**Peak Q (cfs)**	**Runoff (ac-ft)**
Cactus Rd.	250	-	1771	1487	1384	261	1560	368	1560	368	1560	368	1560	368	1560	343
Subbasin 172	-	-	-	111	135	19	252	41	252	41	41	41	252	41	252	41
Entering Basin	-	-	-	-	1343	51*	1808	121*	1462	188*	1462	188*	1262	145*	1808	118*
Thru Basin Parcel Channel	250	-	-	1510	45	-	-	-	350	-	350	-	350	-	-	-
Thru Golf Course Channel	250	1800	1753	1462	857	-	1487	-	400	-	400	-	400	-	1326	-

Notes:

1. As reported in the FEMA Flood Insurance Study, Revised December 3, 1993.
2. White Tanks/Agua Fria ADMP Prepared by WLB Group for FCD. Discharge reported in June 30th, 1999 FCD Memo, Subject: El Mirage Drainage Improvement CIP – Project Status and Summary.
3. Lower El Mirage Wash Channelization, Application for As-Built Letter of Map Revision; Post-Project Conditions Model; Prepared by A-N West, Inc. for City of El Mirage.
4. White Tanks ADMP Update, Existing Condition, Without Projects in Place; Prepared by URS, 01-14-04. HEC-1 File L303M1L.DAT. Reflects development in City of El Mirage, including retention for each subbasin.
5. White Tanks ADMP Update, Future Condition, With Project – Level III, Prepared by URS, 01-14-04. HEC-1 File: L33PF6D.DAT. Reflects concept level off-line basin at proposed West Cactus Basin location. Given to Stanley by the FCD at beginning of the project to use as the base hydrology when developing structural alternatives.
6. Future condition and existing basin configuration. Developed prior to collection of supplemental hydrologic data. HEC-1 File: EXSTREV0.DAT. The retention divert steps for subbasins located within El Mirage contributing area are set aside.
7. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach. Developed prior to collection of supplemental hydrologic data. HEC-1 File: EXSTREV1.DAT. The retention diversion steps for subbasins located within El Mirage contributing area are set aside.
8. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach, emphasis on aesthetics and multi-use. Developed prior to collection of supplemental hydrologic data. HEC-1 File: EXSTREV1.DAT. The retention diversion steps for subbasins located within El Mirage contributing area are set aside.
9. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach, with a proposed storm drain in Cactus Rd. Developed prior to collection of supplemental hydrologic data. HEC-1 File: ALT2+8.DAT. The retention diversion steps for subbasins located within El Mirage contributing area are set aside.
10. Future condition and existing basin configuration. HEC-1 File: EXSTREV1.DAT. The retention divert steps for subbasins located within El Mirage contributing area, and West Cactus Basin level pool routing, are based on supplemental hydrology gathered in September and October of 2004.

*Portion of hydrograph stored at peak discharge.

13.1.1 Updated Hydrology and Hydraulic Computational Results

The updated HEC-1 model computed discharge through the Pueblo El Mirage Golf Course was used to revise the Lower El Mirage Wash Channelization LOMR HEC-RAS model (see Section 5.0). For the revised model (HEC-RAS exstrev0.prj) the discharge was reduced from 1,753 to 1,326 cfs. In general, the decrease in water surface elevation and top-width for the golf course reach is about 0.25 feet and 40 feet, respectively. However, at HEC-RAS River Station No. 0.696, the decrease in water surface elevation and top-width is 1.32 ft and 244 ft, respectively. The relatively large change in flow depth and top-width at station 0.696 is attributed to the elimination of overbank flow with the reduced discharge. River Station No. 0.696 is located approximately 950 ft downstream from the El Mirage Rd box culvert. The revised HEC-RAS model is provided on a CD that is located in the pocket folder at the end of the CAR.

13.2 Storm Drain System Capacities and Finish Floor Elevation Comparison

Based on the rational method discharges discussed above (see Section 12.6), the 100-year water surface elevation at each of the three sumps was estimated and compared to the lowest adjacent finished floor elevations located within their vicinity. The high water elevation associated with the combined sumps on 125th Avenue is about 0.1 feet higher than the lowest adjacent finished floor elevation. The high water elevation associated with the sump on Canterbury Drive is about 0.2 feet below the lowest adjacent finished floor.

Based on this analysis, there is concern that some residences near the sumps may be exposed to local flooding. Wakes caused by passing vehicles and potential obstruction of the storm drain pipe and inlets beyond what was assumed in the hydraulic analysis may add to this concern. A comparison of 100-year water surface elevations and finish floor elevations for areas in the vicinity of sumps located in 125th Avenue and Canterbury Drive is provided in Appendix K.

To address the potential of residential flooding within the vicinity of the sumps, it might be desirable to consider excavating a temporary breach in the high ground within the basin parcel adjacent to the sumps in 125th Avenue and Canterbury.

14.0 Candidate Assessment Report Conclusions and Recommendations

The hydrologic and hydraulic results based on the supplemental hydrology (see Sections 12.0 and 13.0) were discussed at the October 14, 2004 meeting held between the District and Stanley Consultants. The current configuration of the West Cactus Basin reduces the 100-year peak discharge through the Pueblo El Mirage Golf Course to 1,326 cfs. This is less than the pre-developed condition discharge that was used to delineate the Lower El Mirage Wash floodplain depicted on the Flood Insurance Rate Map (Map No. 04013C1605 H, Revised July 19, 2001).

The West Cactus Basin in its current configuration reduces the risk of flooding downstream. It does not eliminate the floodplain downstream or reduce the 100-year discharge to a point where existing facilities are able to convey all of it. The objective of the CAR alternatives has been to convey the 100-year flow. Conveyance of lesser events has generally not been considered. However, the West Cactus Basin in its current configuration does provide significant attenuation for, say, a 10-year storm or less. The existing basin does provide a flood control benefit downstream - - just not a comprehensive 100-year benefit.

Research of the property ownership downstream from El Mirage Road indicates there are basically only three underlying property owners that are impacted by the existing 100-year floodplain. Two of these properties, LR Contreras Contractor, Inc. and CP Holdings, Inc., have no improvements on them other than perhaps some fencing. They are essentially vacant parcels. The other property is the Pueblo El Mirage Development and Golf Course. Although this property is subdivided into separate lots, all the lots currently in the floodplain are owned, in fee, by the Pueblo El Mirage Development. Pueblo El Mirage Development also owns the golf course and various utility and roadway infrastructure also located in the floodplain. An exhibit depicting the property ownership in the vicinity of the West Cactus Basin is found in Appendix M.

At the end of the CAR project, it was concluded that it would not be appropriate to expend funds for structural flood control improvements that would benefit the area downstream from El Mirage Road for the following reasons:

1. Structural flood control improvements would essentially benefit only one underlying fee title property owner.
2. The existing West Cactus Basin already provides a benefit in the form of discharge reduction.
3. The existing floodplain delineation, although in need of updating, does provide for non-structural flood protection in the form of floodplain management and flood insurance.

Therefore, the "Do Nothing" Alternative was selected as the preferred alternative for this CAR.

The following recommendations are concluded from this CAR. These recommendations are not necessarily presented in any order of preference or priority.

1. The 100-year floodplain and floodway of Lower El Mirage Wash should be re-delineated. This re-delineation should, at a minimum, cover the reach from El Mirage Road to the Agua Fria River and should recognize the various culvert, channelization, fencing, structures and other improvements mentioned in Section

5.0 of this CAR. Re-delineation could also consider the reach upstream from El Mirage Road. The current configuration of the West Cactus Basin is not completely reflected in the recent CLOMR / LOMR and the existing culvert at 129th Avenue is also not reflected as mentioned in Section 5.0. Any re-delineation should reflect the newly revised ADMP hydrology and reduction in discharge provided by the existing West Cactus Basin.

2. A local project should be initiated that would correct the most serious of conveyance deficiencies / obstructions in the Lower El Mirage Wash. This would be immediately downstream from El Mirage Road. At this location, there are fence and guardrail obstructions that could seriously raise the flood profile upstream as well as pose a risk of sudden failure under increased head. The channel immediately downstream from El Mirage Road takes two very sharp bends and also has an adverse grade and significant weed and brush that obstruct flow. If the existing adverse conditions raised the 100-year water surface profile enough, it may be possible for flow to exceed the confining elevation of the El Mirage Road dip section and break out to the south down El Mirage Road. Solutions at this location could include such things as extending the existing El Mirage Road box culvert downstream, eliminating the guard rail, re-aligning the channel to remove the sharp bends, re-grading the channel profile, removing fencing or replacing it with break away fencing and removal of brush.
3. A local project should be initiated that would correct the storm drain sump conditions that exist on 125th Avenue and Canterbury Drive adjacent to the West Cactus Basin. Temporary breaches could be considered that would provide overflow relief directly into the West Cactus Basin. The earth excavated from these breaches could be temporarily stockpiled on the West Cactus Basin parcel above the 100-year water surface or it should be removed from the property. These breaches could be incorporated into the final grading and reconfiguration of the West Cactus Basin if and when it is improved in the future as a park.
4. The channels upstream from the West Cactus Basin should be landscaped or surfaced with rock mulch, decomposed granite or at least temporarily hydroseeded to protect bare earth banks from scour and rilling. Existing locations where local scour has undermined or otherwise compromised existing drainage improvements should be corrected. A comprehensive evaluation should be done regarding bed and bank protection needs at structures, bends, angle points and confluences. These channels are relatively new and have apparently not experienced any significant or damaging flows. Bed and bank material that is lost to erosion and scour will be deposited in the existing West Cactus Basin. The loss of storage that would result from this deposition will potentially reduce its current benefit downstream.
5. A plan should be established to dispose of the runoff that collects in the existing West Cactus Basin below the outfall elevation associated with the existing El Mirage Road box culvert. Because the basin has an on-line configuration, it has the capacity to store 30+ acre-feet of stormwater as retention with no means of disposal except evaporation and percolation. This poses a potential health risk and reduces the basin's effectiveness downstream if it already has stormwater in it when a subsequent storm occurs. Solutions for this could take the form of drywells, shallow disposal trenches or portable pumps.

APPENDIX A

FEMA Floodplain Exhibits

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1605 OF 4350

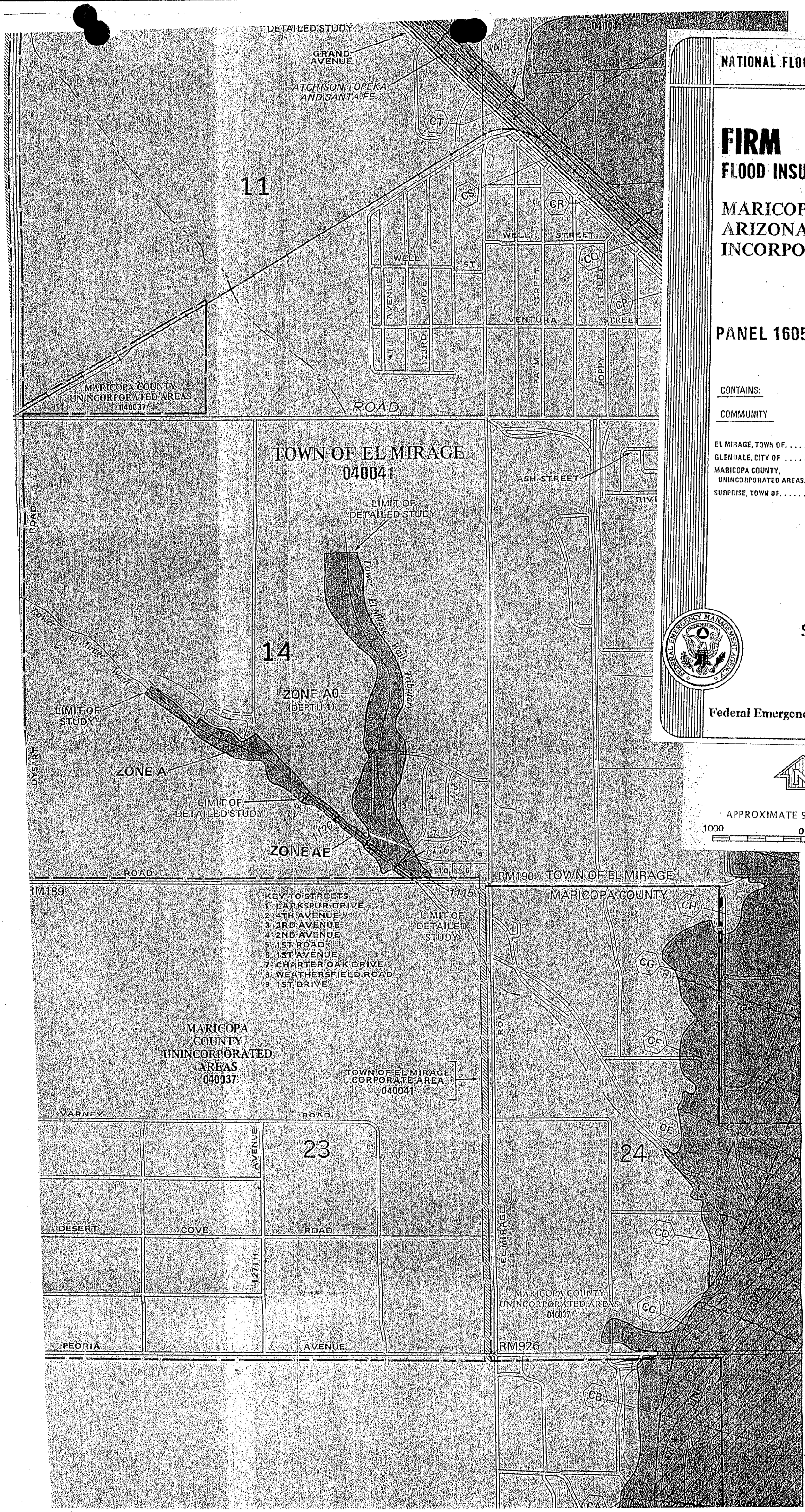
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL MIRAGE, TOWN OF	040041	1605	E
GLENDALE, CITY OF	040045	1605	E
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1605	E
SURPRISE, TOWN OF	040053	1605	E

MAP NUMBER
04013C1605 E

MAP REVISED:
SEPTEMBER 4, 1991

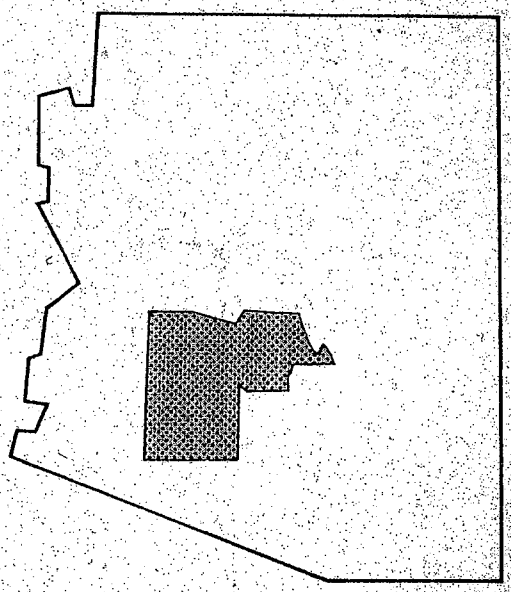
Federal Emergency Management Agency



MAP NO. 04013C1605 E
SEPT 4, 1991

FLOOD INSURANCE STUDY

MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS
VOLUME 1 OF 9



COMMUNITY NAME	COMMUNITY NUMBER
AVONDALE, CITY OF	040038
BUCKEYE, TOWN OF	040039
CAREFREE, TOWN OF	040126
CAVE CREEK, TOWN OF	040129
CHANDLER, CITY OF	040040
EL MIRAGE, TOWN OF	040041
GILA BEND, TOWN OF	040043
GILBERT, TOWN OF	040044
GLENDALE, CITY OF	040045
GOODYEAR, TOWN OF	040046
GUADALUPE, TOWN OF	040111
LITCHFIELD PARK, CITY OF	040128
MARICOPA COUNTY UNINCORPORATED AREAS	040037
MESA, CITY OF	040048
PARADISE VALLEY, TOWN OF	040049
PEORIA, CITY OF	040050
PHOENIX, CITY OF	040051
QUEEN CREEK, TOWN OF	040132
SCOTTSDALE, CITY OF	045012
SURPRISE, TOWN OF	045053
TEMPE, CITY OF	040054
TOLLESON, CITY OF	040055
WICKENBURG, TOWN OF	040056
YOUNGSTOWN, TOWN OF	040057

REVISED: DECEMBER 3, 1993

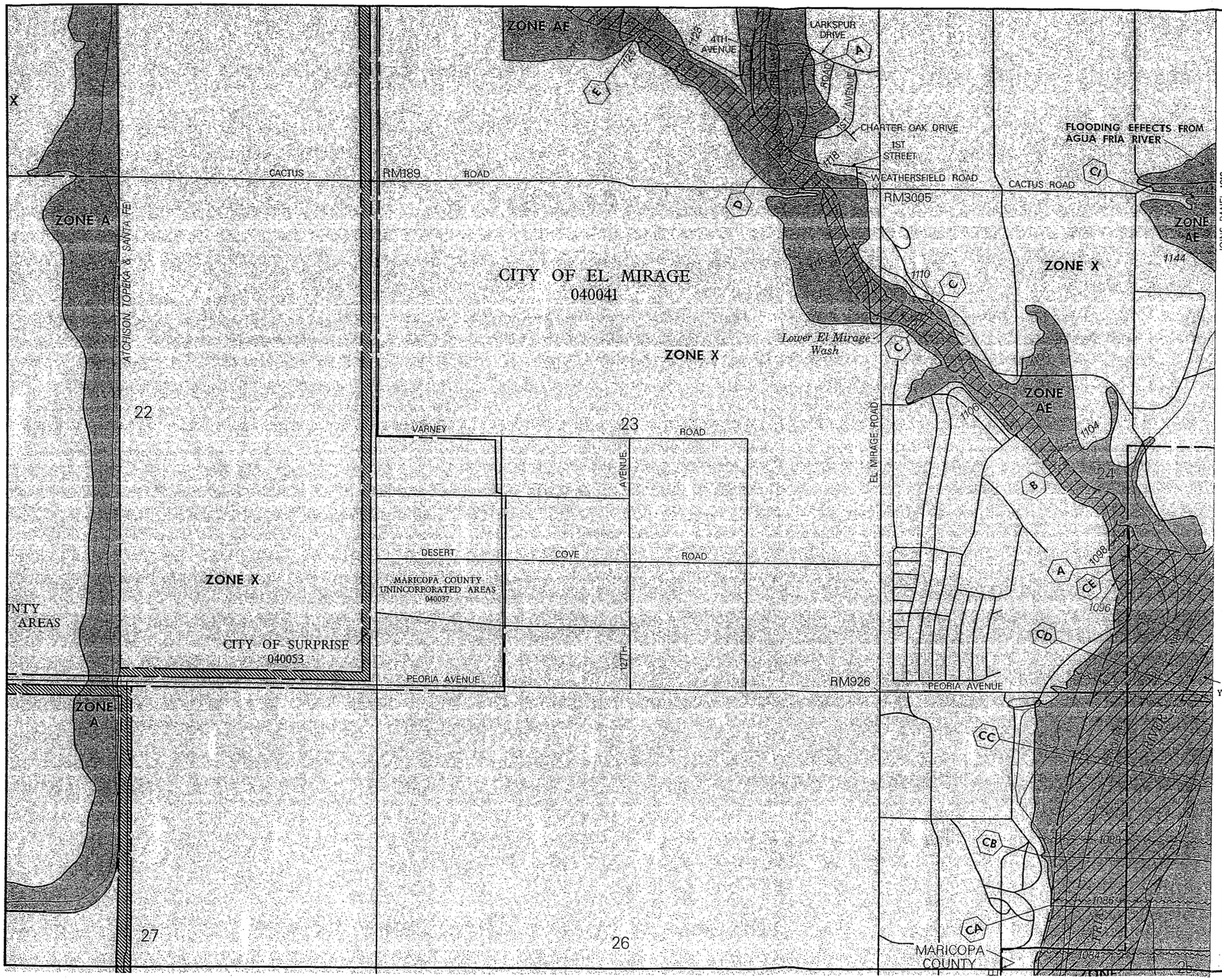
Federal Emergency Management Agency

Table 3. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Powder House Wash					
At Jack Burden Road	1.9	300	1,300	1,900	4,400
Martinez Wash					
At Mouth	103.0	9,220	27,400	32,000	45,000
Mockingbird Wash					
At U.S. Highways 60, 70, and 89	6.9	2,750	4,040	5,060	7,400
Little San Domingo Wash					
At U.S. Highways 60, 70, and 89	6.2	1,690	2,620	3,090	4,250
Wittmann Drainage					
At Atchison, Topeka & Santa Fe Railway	8.6	1,760	2,770	3,060	4,350
Lower El Mirage Wash					
At Cactus Road	1.9	90	200	250	--[1]
Lower El Mirage Wash Tributary					
At Mouth	1.3	53	110	150	--[1]

[1]Not Computed

Table 3. Summa[illegible] Discharges (Cont'd)



APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1605 OF 4350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

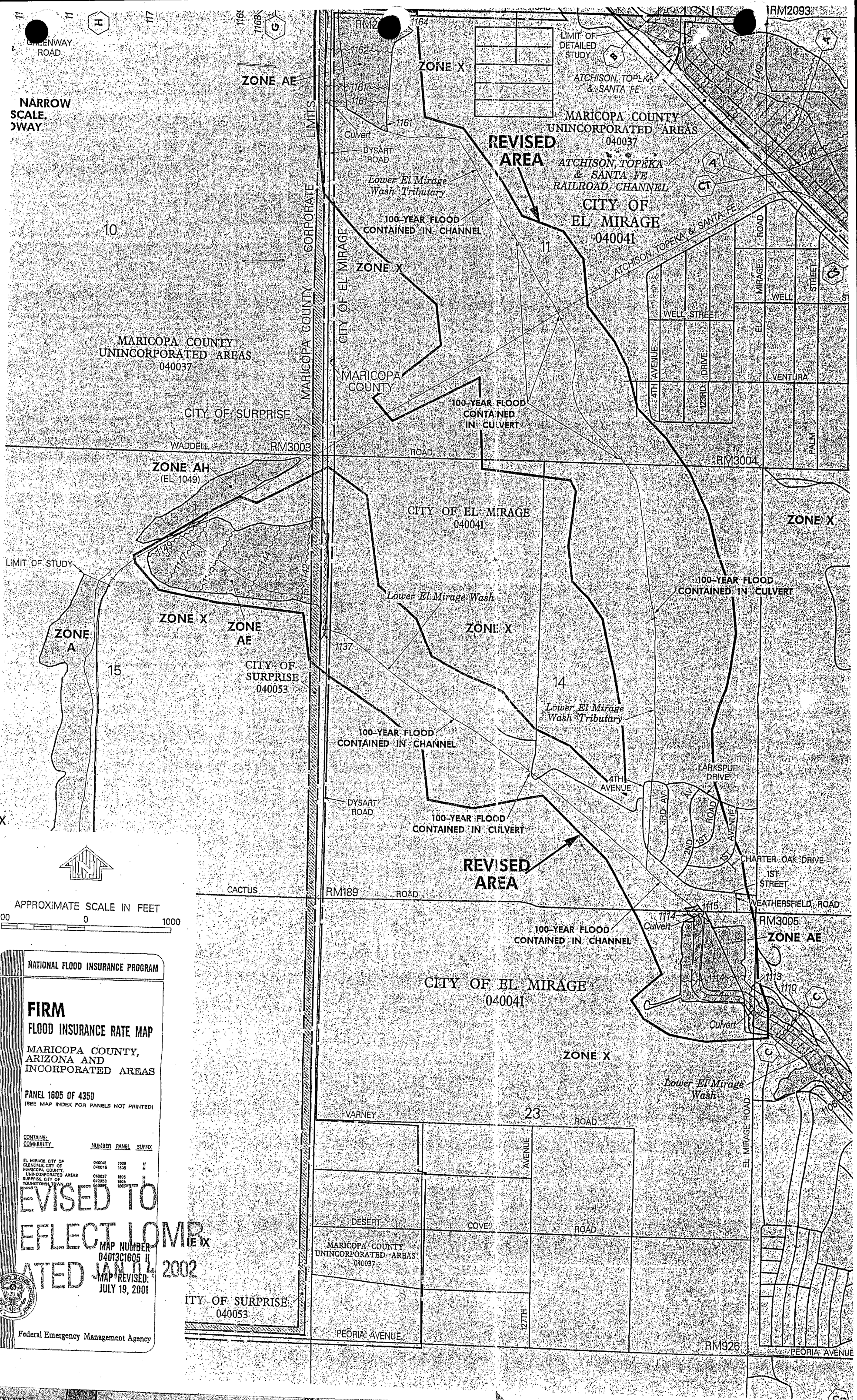
COMMUNITY	NUMBER	PANEL	SUFFIX
EL MIRAGE, CITY OF	040041	1605	H
GLENDALE, CITY OF	040045	1605	H
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1605	H
SURPRISE, CITY OF	040053	1605	H
YOUNGTOWN, TOWN OF	040057	1605	H

MAP NUMBER 04013C1605 H

MAP REVISED: JULY 19, 2001

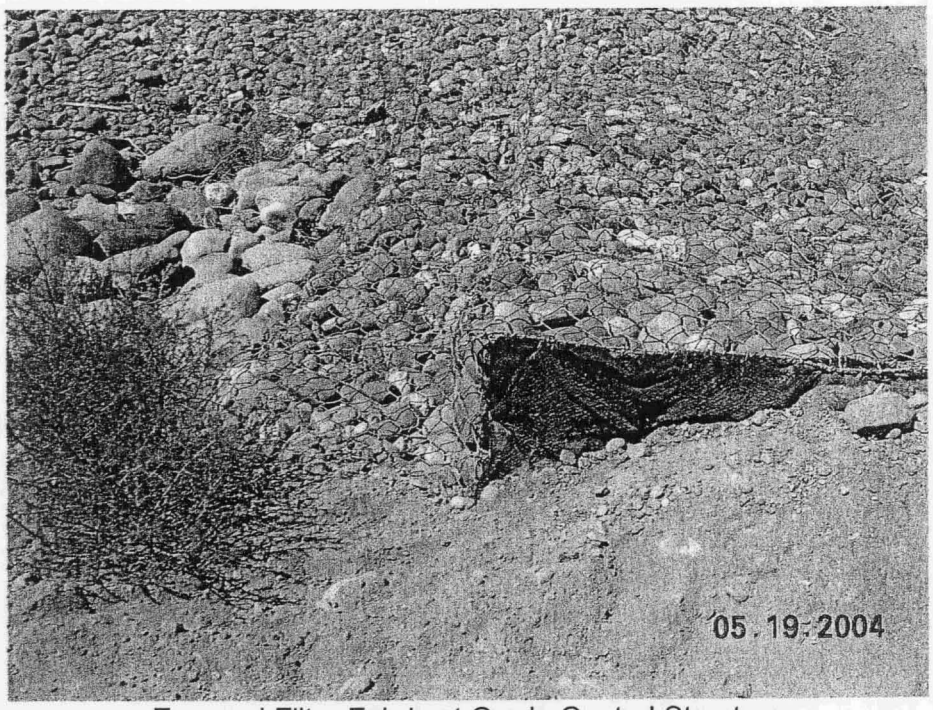
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

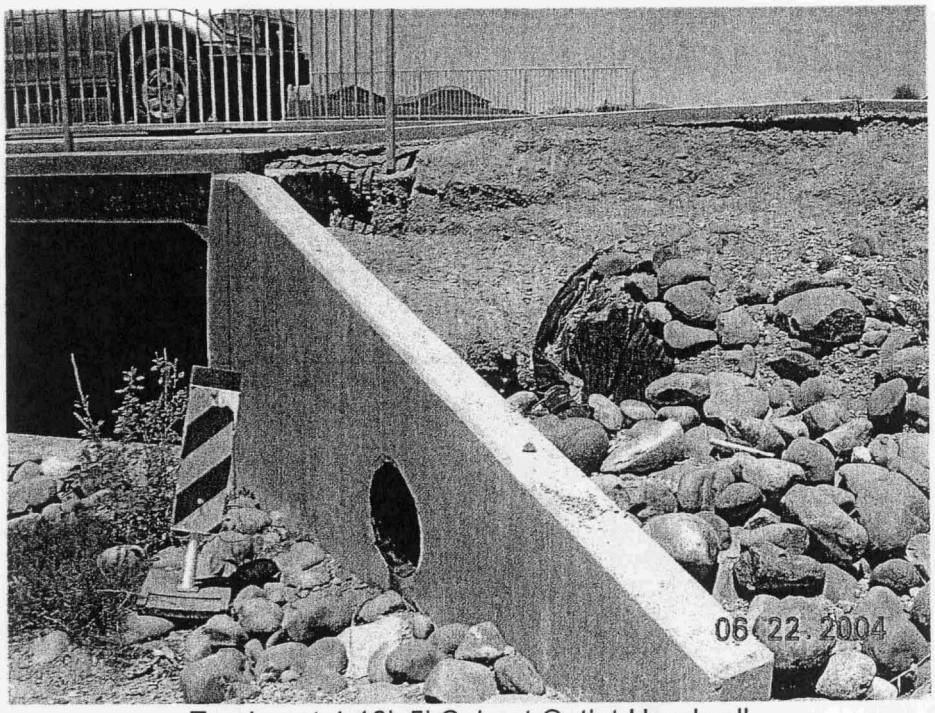

GREENWAY ROAD
ZONE AE
ZONE X
LIMIT OF DETAILED STUDY
ATCHISON, TOPEKA & SANTA FE
MARICOPA COUNTY UNINCORPORATED AREAS 040037
REVISED AREA
ATCHISON, TOPEKA & SANTA FE RAILROAD CHANNEL
CITY OF EL MIRAGE 040041
Culvert
DYSART ROAD
Lower El Mirage Wash Tributary
100-YEAR FLOOD CONTAINED IN CHANNEL
MARICOPA COUNTY CORPORATE LIMITS
CITY OF EL MIRAGE
ZONE X
MARICOPA COUNTY UNINCORPORATED AREAS 040037
MARICOPA COUNTY
CITY OF SURPRISE
100-YEAR FLOOD CONTAINED IN CULVERT
WELL STREET
4TH AVENUE
123RD DRIVE
EL MIRAGE ROAD
VENTURA STREET
PALM
WADDELL ROAD
RM3003
RM3004
ZONE AH (EL 1049)
CITY OF EL MIRAGE 040041
ZONE X
LIMIT OF STUDY
ZONE A
ZONE AE
CITY OF SURPRISE 040053
Lower El Mirage Wash
100-YEAR FLOOD CONTAINED IN CULVERT
Lower El Mirage Wash Tributary
LARKSPUR DRIVE
3RD AV.
2ND AV.
1ST ROAD
1ST AVENUE
CHARTER OAK DRIVE
1ST STREET
WEATHERSFIELD ROAD
CACTUS ROAD
RM189
RM3005
ZONE AE
CITY OF EL MIRAGE 040041
ZONE X
Lower El Mirage Wash
VARNEY ROAD
DESERT COVE ROAD
MARICOPA COUNTY UNINCORPORATED AREAS 040037
CITY OF SURPRISE 040053
PEORIA AVENUE
127TH AVENUE
EL MIRAGE ROAD
RM926
PEORIA AVENUE
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS
PANEL 1605 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL MIRAGE, CITY OF 040041 1605 H
GLENDALE, CITY OF 040045 1605 H
MARICOPA COUNTY, UNINCORPORATED AREAS 040037 1605 H
SURPRISE, CITY OF 040053 1605 H
YOUNGTOWN, TOWN OF 040057 1605 H
MAP NUMBER 04013C1605 H
MAP REVISED: JULY 19, 2001
Federal Emergency Management Agency
REVISED TO REFLECT LOMR EFFECTIVE DATED JAN. 11, 2002

APPENDIX B

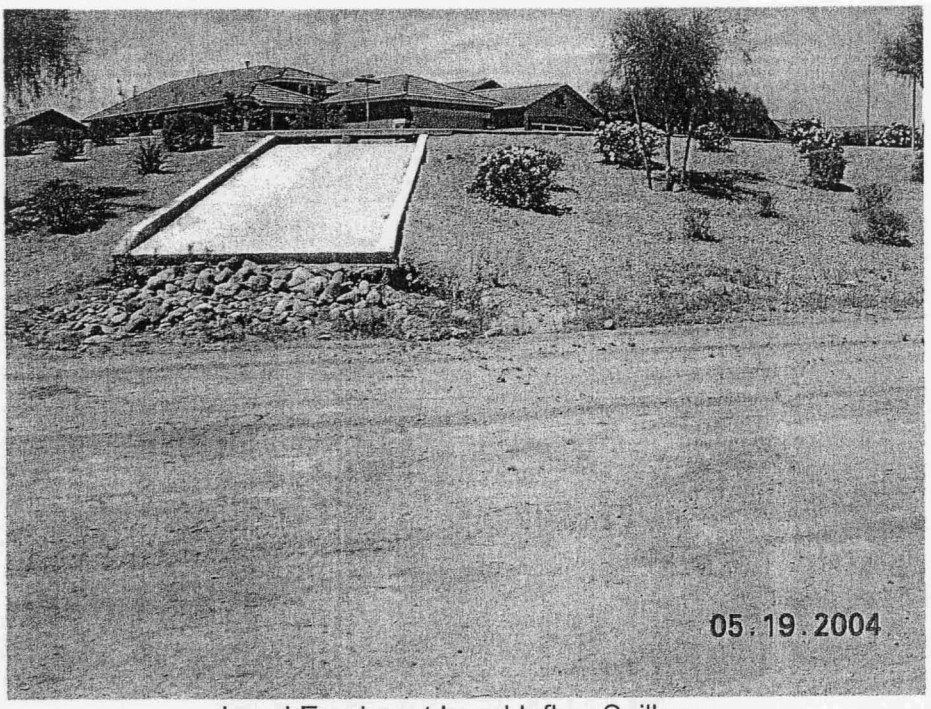
Local Erosion Photographs



Exposed Filter Fabric at Grade Control Structure
Lower El Mirage Wash Channel
Between Confluence with Tributary and Dysart Road



Erosion at 4-10'x5' Culvert Outlet Headwall
Lower El Mirage Wash Channel
Culvert Located at 129th Avenue



Local Erosion at Local Inflow Spillway
Lower El Mirage Wash Channel
Between Confluence with Tributary and Dysart Road

Erosion Taking Place at Local Inflow Location
Lower El Mirage Wash Tributary Channel
Upper Reach, Immediately Downstream of Dysart Road
LDS Church Property in Background

APPENDIX C

Data Collection List

West Cactus Detention Basin & Channels Project (CAR)
FCD No. 2003C020
SCI No. 16956.01.00

Data Collection List

1. HEC-1 Model L33PF6D.DAT; Future Condition Hydrology Model With Projects – Level III; White Tanks Area Drainage Master Study Update; Revised by URS, 14 January 2004.

2. West Cactus Basin and Channel Data CD (GIS Data, HEC-1 Schematic); From Flood Control District of Maricopa County (Bill Haas), 5 May 2004.

3. West Cactus Basin and Channel Data CD (Topography, Aerial Photographs, Floodplains, Roads, etc...); From Flood Control District of Maricopa County (Greg Jones), 5 May 2004.

4. Hydrologic Analysis for Lower El Mirage Wash at El Mirage Road Under Future Developed Conditions; Flood Control District of Maricopa County Engineering Division; September 14, 1999.

5. HEC-2 Model 13.dat, Lower El Mirage Wash Channelization, Application for As-Built Letter of Map Revision (LOMR); Effective Model; Prepared by A-N West, Inc. for City of El Mirage; September 12, 2001.

6. HEC-2 Model 13WSHLLT.dat, Lower El Mirage Wash Channelization, Application for As-Built Letter of Map Revision (LOMR); Post-Project Conditions Model; Prepared by A-N West, Inc. for City of El Mirage; September 12, 2001.

7. HEC-2 Model T004LOMR.HC2, Lower El Mirage Wash Tributary Channelization, Application for As-Built Letter of Map Revision (LOMR); Effective Model; Prepared by A-N West, Inc. for City of El Mirage; September 12, 2001.

8. HEC-2 Model 13TRBLLT.dat, Lower El Mirage Wash Tributary Channelization, Application for As-Built Letter of Map Revision (LOMR); Post-Project Conditions Model; Prepared by A-N West, Inc. for City of El Mirage; September 12, 2001.

9. White Tanks/Agua Fria Area Drainage Master Study – Revision of Original Floodplain Map Reflecting the Lower El Mirage Wash Channelization, Work Map Sheet 18 of 64.

10. White Tanks/Agua Fria Area Drainage Master Study – Revision of Original Floodplain Map Reflecting the Lower El Mirage Wash Tributary Channelization – Work Map, Sheet 11 of 64.

11. As-Built LOMR Exhibit for the Lower El Mirage Wash Channelization; Prepared by A-N West for Flood Control District of Maricopa County; August 29. 2001.

12. As-Built LOMR Exhibit for the Lower El Mirage Wash Tributary Channelization; Prepared by A-N West for Flood Control District of Maricopa County; August 29. 2001.

13. Annotated Flood Insurance Rate Map Revised to Reflect the Proposed Lower El Mirage Wash Channelization, Dated August 5, 1997; Map Number 04013C1605 G.

14. LOMR Attachment (11" x 17"), Flood Insurance Rate Map Revised to Reflect LOMR Dated January 4, 2002; Map Number 04013C1605 H.

15. County Parcel Data CD; Provided by Flood Control District of Maricopa County to Stanley Consultants on May 19, 2004.

16. 2003 Orthophotography 1-Foot Pixels, Date of Photographs May 12, 2002; Provided by Flood Control District of Maricopa County to Stanley Consultants on May 21, 2004.

17. Level III Preferred Alternative Map, July 2003; Prepared by URS for Flood Control District of Maricopa County.

18. Preliminary/Draft, Level III, Phase III Alternatives Analysis Report, Loop 303 Corridor/White Tanks ADMP Update; Prepared for Flood Control District of Maricopa County, Prepared by URS; June 2004.

19. Site Plan for El Mirage Regional Park; Prepared by A-N West Consulting Engineers; Revised July 17, 2001.

20. City of El Mirage General Plan; December 18, 2003.

21. Zoning Map of El Mirage, Arizona, Draft Copy; April 14, 2003.

22. Preliminary Plat for Pueblo El Mirage North; Prepared by SKG Enterprises, Inc.

23. Pueblo El Mirage Drainage Report; Prepared by SKG Enterprises for NCR Development; May 2004.

24. Thunderbird Road Improvements; Prepared by A-N West Inc. for City of El Mirage; April, 25, 2001.

25. City of El Mirage Sewer Map Book; June 2004.

26. City of El Mirage Water Map Book; June 2004.

27. Rancho Mirage Unit II, Parcel II – Phase 3 Paving Plan; Prepared by Sage Engineering for Hancock Communities; February 2000.

28. Rancho Mirage Unit II, Parcel II – Phase 3 Grading Plan; Prepared by Sage Engineering for Hancock Communities; February 2000.

29. Rancho Mirage Unit II, Parcel II – Phase 3 Sewer Plan; Prepared by Sage Engineering for Hancock Communities; November 1999.

30. Rancho Mirage Unit II, Parcel II – Phase 2 Water Plan; Prepared by Sage Engineering for Hancock Communities; November 1999.

31. Rancho Mirage Unit II, Parcel II – Phase 2 Sewer Plan; Prepared by Sage Engineering for Hancock Communities; November 1999.

32. Rancho Mirage Unit II, Parcel II – Phase 2 Paving Plan; Prepared by Sage Engineering for Hancock Communities; February 2000.

33. Rancho Mirage Unit II, Parcel II – Phase 2 Grading Plan; Prepared by Sage Engineering for Hancock Communities; February 2000.

34. Rancho Mirage Unit II, Parcel II – Phase 1 Grading Plan; Prepared by Sage Engineering for Hancock Communities; December 1999.

35. Rancho Mirage Unit II, Parcel II – Phase 1 Paving Plan; Prepared by Sage Engineering for Hancock Communities; December 1999.

36. Rancho Mirage Unit II, Parcel II – Phase 1 Sewer Plan; Prepared by Sage Engineering for Hancock Communities; November 1999.

37. Rancho Mirage Unit II, Parcel II – Phase 1 Water Plan; Prepared by Sage Engineering for Hancock Communities; November 1999.

38. Parque Verde Unit 2 Sewer Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; May 2000.

39. Parque Verde Unit 3 Sewer Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; November 2000.

40. Parque Verde Unit 4 Sewer Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; June 2001.

41. Parque Verde Unit 4 Grading Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; September 2001.

42. Parque Verde Unit 4 Storm Water Management Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; September 2001.

43. Parque Verde Unit 4 Paving Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; September 2001.

44. Parque Verde Unit 1 Sewer Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; August 1999.

45. Parque Verde Unit 1 Grading Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; January 2000.

46. Parque Verde Unit 1 Paving Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; March 2000.

47. Parque Verde Unit 1 Water Plan; Prepared by Sage Engineering for Sivage-Thomas Homes; August 1999.

48. Sundial IV – Unit 2 Grading Plans; Prepared by RBF Consulting for Hancock Communities; November 2001.

49. Sundial IV – Unit 2 Sewer Plans; Prepared by RBF Consulting for Hancock Communities; October 2001.

50. Sundial IV – Unit 1 Water Plans; Prepared by RBF Consulting for Hancock Communities; August 2001.

51. Sundial IV – Unit 1 Grading Plans; Prepared by RBF Consulting for Hancock Communities; November 2001.

52. Sundial IV – Unit 1 Paving Plans; Prepared by RBF Consulting for Hancock Communities; July 2001.

53. Sundial IV – Unit 1 Sewer Plans; Prepared by RBF Consulting for Hancock Communities; August 2001.

54. El Mirage Road Improvements, Olive Avenue to Cactus Road; Prepared by A-N West for City of El Mirage; November 1999.

55. El Mirage Road Improvements and City Hall Offsite Improvements; Prepared by A-N West for City of El Mirage; January 2000.

56. Dysart School District No. 89 Offsite Sewer System; Prepared by Gookin Engineers; December 1989.

57. Construction Plans for Western El Mirage Sanitary Sewer; Prepared by A-N West for City of El Mirage; February 1999.

58. Report and Recommendations for El Mirage Drainage Improvement Project; Prepared by Flood Control District of Maricopa County; October 4, 1999.

59. Preliminary Basin Drawings on CD; Prepared by A-N West for City of El Mirage; August, 1999.

60. Cactus Road Detention Basin Design Concept Overview; Prepared by A-N West for Flood Control District of Maricopa County; July 2004.

APPENDIX D

HEC-1 Model L33PF6D.dat Excerpts

Loop 303 Corridor / White Tanks ADMP
Future Condition HEC-1 Model.
"Base Hydrology" Used for West Cactus Basin Project.

```
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 *            VERSION 4.1               *
 *                                      *
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*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID         FUTURE CONDITION HDYROLOGY MODEL WITH PROJECTS - LEVEL III
  2           ID
  3           ID         WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
  4           ID         Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
  5           ID         TANKS/AGUA FRIA ADMS, Date: October 1991
  6           ID
  7           ID         ***REMOVED RETENTION AT SUPER BASIN #5 SUB BASINS 297, 315, ***
  8           ID         ***334, 335A, 335, 316 TO REFLECT RELAXED RETENTION REQUIRE-***
  9           ID         ***MENTS ADJACENT TO THE BULLARD CHANNEL S. OF I-10.        ***
 10           ID
 11           ID        * URS REVISED RTIMP PERCENT IMPERVIOUS VALUES *
 12           ID        * AS PER FCDMC GIS DATA - 6-27-01 *
 13           ID
 14           ID         REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
 15           ID         100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
 16           ID
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 17          ID         FUTURE CASE WITH RETENTION VOLUME DIVERTS
 18          ID
 19          ID                                          REVISED BY URS     DATE: 01-14-04
 20          ID                                                             FILE: L33PF6D.DAT
 21          ID
 22          ID        NOTES:
 23          ID        1. THIS HEC-1 MODEL CONTAINS THE FOLLOWING SUPER BASINS: WHITE TANKS 3,
 24          ID           2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2 & 3, 4 THRU 26.
 25          ID        2. REVISED TO REFLECT UPDATED SOILS MAPS AND NEW DEVELOPMENT.
 26          ID        3. AVERAGE XKSAT VALUES FOR EACH SUBBASIN WAS RECEIVED FROM FCDMC
 27          ID           GIS DATA AND THEN ADJUSTED FOR VEGETATION, OR LEFT AS ORIGINALLY IN
 28          ID           THE WLB MODEL.
 29          ID        4. FOR NEW DEVELOPMENTS ONLY 80% OF REPORTED PROVIDED RETENTION
 30          ID           WAS INCLUDED IN THIS MODEL (AS A CONSERVATIVE ESTIMATE). RETENTION
 31          ID           CAPACITIES WERE ESTIMATED BY EEC FOR DEVELOPMENTS WITH NO
 32          ID           DRAINAGE REPORTS.
 33          ID        5. REVISED DRAINAGE BOUNDARIES BASED UPON FIELD INSPECTION OF SUN CITY.
 34          ID           GRAND.  COMBINED SEVERAL BASINS TOGETHER TO MAKE NEW BASINS 114 &115.
 35          ID           ALSO REROUTED SUBBASINS 100A, 101, 102A AND 106 TO THE SOUTH TO 113A.
 36          ID        6. CHANNEL ROUTE ALONG REEMS ROAD UPDATED TO REFLECT NEW CONSTRUCTION.
 37          ID        7. REVISED SCS TYPE II RAINFALL DISTRIBUTION FOR THE 24-HOUR GENERAL
 38          ID           STORM.
 39          ID        8. REVISED RAINFALL DEPTH-AREA REDUCTION FACTORS.
 40          ID        9. PSIF WERE ADJUSTED BASED ON THE VALUES OF XKSAT AND WERE EDITED INTO
 41          ID           THE DATA FILE BY THE FCDMC.
 42          ID       10. AVERAGE XKSAT VALUES FOR SUBBASINS WITH BORROW PITS (WHITE TANKS
 43          ID           AREAS #3 & #4) WERE ESTIMATED BY EEC.
 44          ID
             *DIAGRAM
 45          IT       5                    1000
 46          IO       5
 47          IN      15
 48          JD    4.03    .001
 49          PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
 50          PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
 51          PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
 52          PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
 53          PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
 54          PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 55          PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
 56          PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
 57          PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
 58          PC    .983    .986    .989    .992    .995    .998    1.00   1.000   1.000   1.000
 59          JD    3.79      10
 60          JD    3.51      50
 61          JD    3.39     100
 62          JD    3.29     200
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1696          KK  CP138A
1697          KM        ADD HYDROGRAPHS AT CP138A
1698          HC       2   23.68
              *
              * ALT-1 RJS 5-25-01
              *
              *
              * TURN DIVERT OFF PER LEVEL III
              *

1699          KK   D138A
1700          KM        DIVERT TO CP154 FROM CP138A
1701          DT   DI154
1702          DI       0      44     392    1366    3326    6347   10546   16046
1703          DQ       0       0       0       0       0       0       0       0

1704          KK   R138A
1705          KM        ROUTE REMAINDER FROM CP138A TO CP157
1706          RS      15              -1       0
1707          RC    .075     .04    .075    6708   .0051
1708          RX    1000    1001    1580    2290    2450    2710    2799    2800
1709          RY    1140    1140    1138    1136    1136    1138    1140    1140

1710          KK   D138A
1711          KM        RETURN DIVERT AT CP138A
1712          DR   DI154
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY

1713          KK    RLLE
1714          KM        ROUTE REMAINDER FROM CP138A TO CP157
1715          RS      15              -1       0
1716          RC    0.03    0.03    0.03    2020   0.004
1717          RX       0      20      25      30      35    41.5    51.1    82.3
1718          RY      10       0       0       0       0       0     4.8      10
              * KK R138A
              * KM      ROUTE FLOW FROM CP138A TO CP154
              * RS    15              -1       0
              * RC   .08     .08     .08    2640   .0026
              * RX  1000    1001    1002    1025    1160    1840    2099    2100
              * RY  1145    1145    1145    1144    1144    1146    1148    1148
              *

1719          KK     154
1720          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 154
1721          BA     .17
1722          LG     .50     .00    5.88     .30      78
1723          UI     12.     12.     36.     53.     64.     74.     87.    106.    146.    142.
1724          UI    114.     98.     82.     69.     58.     43.     27.     21.     19.     12.
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1725          UI     12.      5.      4.      4.      4.      4.      4.      4.      0.      0.
```

```
1726          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1727          KK  154OUT
1728          KM        DIVERSION-RETENTION
1729          DT  154RET    16.8
1730          DI       0   10000
1731          DQ       0   10000
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY
              * KK CP154

1732          KK    LLE1
1733          KM        ADD HYDROGRAPHS AT CP154
1734          HC       2    0.33
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY

1735          KK   RLLE1
1736          KM        ROUTE FLOW FROM CP154 TO CP157
1737          RS      19              -1       0
1738          RC    0.03    0.03    0.03    4950  0.0039
1739          RX       0      30      38      54    76.5     104     139     154
1740          RY      10       4       4       0       0       0       7      10
              * KK  R154
              * KM      ROUTE FLOW FROM CP154 TO CP157
              * RS    19              -1       0
              * RC   .07     .06     .07    5800   .0048
              * RX  1000    1001    1580    2290    2450    2710    3199    3200
              * RY  1140    1140    1138    1136    1136    1138    1140    1140
              *

1741          KK     157
1742          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 157
1743          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1744          KM    L=      1.3  Lca=       .6   S=   26.8  Kn= .084  LAG=  59.9
1745          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1746          BA     .89
1747          LG     .40     .25    5.20     .36    22.7
1748          UI     50.     50.     78.    175.    219.    257.    289.    326.    373.    435.
1749          UI    560.    646.    535.    458.    407.    359.    312.    272.    238.    189.
1750          UI    133.     89.     84.     82.     51.     50.     43.     15.     15.     15.
1751          UI     15.     15.     15.     15.     15.      0.      0.      0.      0.      0.
1752          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1753          KK  157OUT
1754          KM        DIVERSION-RETENTION
1755          DT  157RET    42.4
1756          DI       0   10000
1757          DQ       0   10000

1758          KK   1I157
1759          KM        ADD HYDROGRAPHS AT 1I157
1760          HC       2   25.08
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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KK   2I157
KM        ADD HYDROGRAPHS AT 2I157
HC       2   25.08
*

KK     127
KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 127
BA     .22
LG     .12     .18    7.00     .14   20.00
UI     90.    276.    510.    430.    243.     91.     37.     15.      0.      0.
UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

KK    R127
KM        ROUTE FLOW FROM CP127 TO CP139
RS      29              -1       0
RC     .08     .08     .08    3744   .0032
RX    1000    1001    1002    1410    1820    2410    2860    3000
RY    1155    1155    1155    1154    1154    1156    1158    1159
*

KK     139
KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 139
KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
KM    L=      1.0  Lca=       .5   S=   17.0  Kn= .039  LAG=  24.5
KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
BA     .47
LG     .27     .24    6.20     .19    63.1
UI     65.    224.    357.    488.    760.    602.    440.    311.    158.    100.
UI     63.     20.     20.     20.      0.      0.      0.      0.      0.      0.
UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

KK  139OUT
KM        DIVERSION-RETENTION
DT  139RET    40.8
DI       0   10000
DQ       0   10000

KK   1I139
KM        ADD HYDROGRAPHS AT 1I139
HC       2     .69

KK    D126
KM        RETURN DIVERT AT CP126
DR   DI139
* PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY

KK     RLE
KM        ROUTE FLOW FROM CP126 TO CP139
RS     1.6            -1.0     0.0
RC   0.030   0.030   0.030    4062  0.0031
RX     0.0    37.2    47.2    57.2    67.2    77.2    87.2   124.4
RY  1160.5  1151.2  1151.2  1151.2  1151.2  1151.2  1151.2  1160.5
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                  * KK  R126
                  * KM ROUTE FLOW TO LE1 (CP126 TO CP139)
                  * DUMMY ROUTE
                  * RS     1              -1       0
                  * RC  0.03   0.028    0.03    2640   .0021
                  * RX  1000    1030    1035    1070    1200    1300    1330    1360
                  * RY  1100    1090    1090    1090    1090    1090    1090    1100

LINE              ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1803              KK   2I139
1804              KM        ADD HYDROGRAPHS AT 2I139
1805              HC       2    7.04
                  *

1806              KK     140
1807              KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 140
1808              BA     .18
1809              LG     .50     .00    5.64     .34    78.6
1810              UI     13.     13.     35.     53.     65.     75.     88.    104.    142.    155.
1811              UI    123.    105.     90.     76.     64.     52.     33.     22.     21.     16.
1812              UI     13.      9.      4.      4.      4.      4.      4.      4.      0.      0.
1813              UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1814              KK  140OUT
1815              KM        DIVERSION-RETENTION
1816              DT  140RET   16.56
1817              DI       0   10000
1818              DQ       0   10000
                  *
                  * MODIFY PER LEVEL III
                  *
                  * KK CP139

1819              KK    !LE1
1820              KM        ADD HYDROGRAPHS AT CP139
1821              HC       2    0.88
                  *
                  * REMOVE PONDING AT RAILROAD WITH PROPOSED CHANNEL
                  *
                  * KK SR139
                  * KM       STOAGE ROUTE BEHIND RAILROAD.
                  * RS      1    STOR       0       0
                  * SV      0    1.14    3.12    6.43   29.35
                  * SQ      0       0     170    1037    5977
                  * SE1046.2  1047.2  1047.5    1048    1049
                  *
                  * KK  R139

1822              KK    RLE1
1823              KM        ROUTE FLOW FROM CP139 TO CP156
1824              RS     1.6            -1.0     0.0
```

```
1825          RC   0.030   0.030   0.030    1980  0.0023
1826          RX     0.0    19.2    29.2    39.2    49.2    59.2    69.2    88.4
1827          RY  1137.5  1132.7  1132.7  1132.7  1132.7  1132.7  1132.7  1137.5
              *

1828          KK     156
1829          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 156
1830          BA     .30
1831          LG     .35     .09    5.00     .41    54.8
1832          UI     18.     18.     33.     64.     82.     94.    106.    121.    139.    173.
1833          UI    223.    206.    171.    149.    132.    113.     99.     85.     69.     47.
1834          UI     31.     30.     28.     18.     18.     12.      5.      5.      5.      5.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1835          UI      5.      5.      5.      5.      0.      0.      0.      0.      0.      0.
1836          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1837          KK  156OUT
1838          KM        DIVERSION-RETENTION
1839          DT  156RET    12.0
1840          DI       0   10000
1841          DQ       0   10000
              *
              * MODIFY PER LEVEL III
              *
              * KK CP156

1842          KK    !LE2
1843          KM   ADD HYDROGRAPHS AT LE2
1844          HC       2    1.18
              *
              * MODIFY PER LEVEL III
              *
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY

1845          KK    RLE2
1846          KM        ROUTE FLOW FROM CP156 TO CP157
1847          RS     3.4            -1.0     0.0
1848          RC   0.030   0.030   0.030    4888  0.0020
1849          RX     0.0    24.4    34.4    44.4    54.4    64.4    74.4    98.8
1850          RY  1128.5  1122.4  1122.4  1122.4  1122.4  1122.4  1122.4  1128.5
              *
              * MODIFY PER LEVEL III
              *
              * KK CP157

1851          KK    !LE3
1852          KM   ADD HYDROGRAPHS AT LE3 (CP157)
1853          HC       2    1.65
              * KK  R157
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY
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```
1854          KK    RLE3
1855          KM   ROUTE LE3 TO LE4
1856          RS     1.5                -1.0      0.0
1857          RC   0.030   0.030   0.030    2282  0.0020
1858          RX     0.0    25.2    35.2    45.2    55.2    65.2    75.2   100.4
1859          RY  1113.6  1107.3  1107.3  1107.3  1107.3  1107.3  1107.3  1113.6
              *

1860          KK     172
1861          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 172
1862          BA     .12
1863          LG     .50     .00    4.58     .55    62.2
1864          UI      9.      9.     28.     39.     47.     55.     66.     82.    112.     96.
1865          UI     79.     68.     56.     47.     39.     26.     16.     15.     11.      9.
1866          UI      6.      3.      3.      3.      3.      3.      3.      0.      0.      0.
1867          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```



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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1868          KK  172OUT
1869          KM        DIVERSION-RETENTION
1870          DT  172RET     7.8
1871          DI       0   10000
1872          DQ       0   10000
              *
              * MODIFY PER LEVEL III
              *
              * KK CP172

1873          KK    !LE4
              * KO     1                                  21
1874          KM   ADD HYDROGRAPHS AT LE4 (CP172)
1875          HC       2    1.77

1876          KK  SRLECH
              * KO     1                                  21
1877          KM   STORAGE ROUTE THROUGH PONDED AREA BEHIND EXISTING 10'X3'X115' DOUBLE RCBS
1878          RS       1    STOR       0       0
1879          SV       0     0.5     1.8     3.4     5.1     7.0     9.2    11.5
1880          SQ       0       5      15      25     509    1387    2519    3860
1881          SE  1107.6    1108    1109    1110    1111    1112    1113    1114

1882          KK    DLE4
              * KO     1                                  21
1883          KM
1884          DT  EM-CLV
1885          DI       0       5      15      25     509    1387    2519    3860
1886          DQ       0       5      15      25      35      45      54      64
              * STORAGE ROUTE THROUGH PROPOSED BASIN AT EL MIRAGE ROAD & CACTUS

1887          KK   SRLE4
              * KO     1                                  21
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```
1888          KM   STORAGE ROUTE
1889          RS       1    STOR       0       0
1890          SV       0     8.3    16.5    24.8    70.1      80
1891          SQ       0       0       0     528    1056    1231
1892          SE  1104.5  1105.5  1106.5  1107.5    1113    1114

1893          KK   DILE4
              * KO     1                                 21
1894          KM   RETURN DISCHARGE DIVERTED TO EXISTING 10'X3'X115' RCB'S
1895          DR  EM-CLV
              * KK  R172

1896          KK    2LE4
1897          KM   COMBINE ROUTED FLOW FROM OFFLINE BASIN WITH MAIN-CHANNEL FLOW AT LE4
1898          HC       2    1.77
              * DUMMY ROUTE - ELEV'S FROM MAP
              * KK  R172
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


1899          KK    RLE4
1900          RS     1.6            -1.0     0.0
1901          RC   0.030   0.030   0.030  4875.3  0.0038
1902          RX     0.0      36      39      42      45      48      51      87
1903          RY  1102.8  1096.8  1096.8  1096.8  1096.8  1096.8  1096.8  1096.8
              *

1904          KK     173
1905          KM         RUNOFF HYDROGRAPH FROM SUB-BASIN 173
1906          BA     .31
1907          LG     .50     .00    4.00     .74     8.4
1908          UI     15.     15.     15.     43.     57.     71.     79.     87.     96.    109.
1909          UI    121.    146.    184.    191.    160.    139.    125.    114.    100.     90.
1910          UI     79.     71.     57.     43.     27.     26.     25.     22.     15.     15.
1911          UI     14.      5.      5.      5.      5.      5.      5.      5.      5.      5.
1912          UI      5.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1913          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
              *
              * MODIFY PER LEVEL III
              *
              * KK CP173

1914          KK    !LE5
1915          KM   ADD HYDROGRAPHS AT LE5 (CP173)
1916          HC       2    2.08
              *
              * ***************************************************************************
              * ***THE FOLLOWING SECTION TAKEN FROM NEW SUPER BASIN 2E WITH NEW SOILS*****
              * ***************************************************************************
              *

1917          KK    156A
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```
1918          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 156A
1919          BA     .31
1920          LG     .12      .25     4.38      .46    20.00
1921          UI     82.     276.     434.     664.     443.     275.     114.      65.      18.      18.
1922          UI      0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
1923          UI      0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

1924          KK   R156A
1925          KM        ROUTE FLOW FROM CP156A TO CP158
1926          RS      34                -1       0
1927          RC     .07      .07      .07     5400    .0030
1928          RX    1000     1001     1002     1380     2200     2838     2839     2840
1929          RY    1117     1117     1117     1116     1116     1118     1118     1118
              *

1930          KK     158
1931          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 158
1932          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1933          KM    L=       1.4  Lca=        .7   S=   20.7  Kn= .034  LAG=  27.3
1934          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1935          BA     .97
1936          LG     .27      .26     4.20      .48    25.00
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1937          UI    120.     350.     615.     802.    1158.    1393.    1004.     753.     547.     280.
1938          UI    196.     120.      54.      37.      37.      37.       0.       0.       0.       0.
1939          UI      0.       0.       0.       0.       0.       0.       0.       0.       0.       0.

1940          KK  158OUT
1941          KM        DIVERSION-RETENTION
1942          DT  158RET   61.74
1943          DI       0   10000
1944          DQ       0   10000

1945          KK   CP158
1946          KM        ADD HYDROGRAPHS AT CP158
1947          HC       2    1.28

1948          KK    R158
1949          KM        ROUTE FLOW FROM CP158 TO CP173B
1950          RS       6                -1       0
1951          RC     .07      .04      .07     4524    .0035
1952          RX    1000     1001     1240     1360     1440     1500     1650     1750
1953          RY    1113     1113     1112     1110     1110     1112     1114     1115
              *

1954          KK    173B
1955          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 173B
1956          BA     .20
1957          LG     .46      .11     3.50     0.89     12.2
1958          UI     12.      12.      21.      42.      53.      61.      69.      78.      90.     109.
1959          UI    143.     141.     116.     101.      89.      77.      67.      58.      49.      35.
```

```
UI     22.     20.     19.     13.     12.     11.      4.      4.      4.      4.
UI      4.      4.      4.      4.      0.      0.      0.      0.      0.      0.
UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

KK  173BOT
KM        DIVERSION-RETENTION
DT  173BRT    4.54
DI       0   10000
DQ       0   10000

KK  CP173B
KM        ADD HYDROGRAPHS AT CP173B
HC       2    1.48
* KKRC173B
* KM      ADD HYDROGRAPHS AT RCP173B
* HC     2    3.44

KK   AFR2E
KM        ADD HYDROGRAPHS AT RCP173
HC       2   30.12

KK   RR173
KM        RIVER ROUTE FLOW FROM RCP173 TO RCP173A
RS       1              -1       0
RC    .035    .035    .035    1650   .0050
RX    1000    1001    1002    1042    2042    2082    2083    2084
RY    1101    1101    1101    1091    1091    1101    1101    1101
*
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1696          .      .           .
              .  CP138A...........
              .      .
              .      .
1701          .      .-------> DI154
1699          .  D138A
              .      V
              .      V
1704          .  R138A
              .      .
              .      .
1712          .      .           .<-------   DI154
1710          .      .      D138A
              .      .          V
              .      .          V
1713          .      .       RLLE
              .      .          .
              .      .          .
1719          .      .          .         154
              .      .          .           .
              .      .          .           .
1729          .      .          .           .-------> 154RET
1727          .      .          .      154OUT
              .      .          .           .
              .      .          .           .
1732          .      .       LLE1...........
              .      .          V
              .      .          V
1735          .      .      RLLE1
              .      .          .
              .      .          .
1741          .      .          .         157
              .      .          .           .
              .      .          .           .
1755          .      .          .           .-------> 157RET
1753          .      .          .      157OUT
              .      .          .           .
              .      .          .           .
1758          .      .      1I157...........
              .      .          .
              .      .          .
1761          .  2I157...........
              .      .
              .      .
1764          .      .        127
              .      .          V
              .      .          V
1770          .      .       R127
              .      .          .
              .      .          .
1776          .      .          .         139
              .      .          .           .
              .      .          .           .
1788          .      .          .           .-------> 139RET
```

```
1786          .           .           .      139OUT
              .           .           .           .
              .           .           .           .
1791          .           .       1I139............
              .           .           .
              .           .           .
1796          .           .           .           .<-------   DI139
1794          .           .           .        D126
              .           .           .           V
              .           .           .           V
1797          .           .           .         RLE
              .           .           .           .
              .           .           .           .
1803          .           .       2I139............
              .           .           .
              .           .           .
1806          .           .           .         140
              .           .           .           .
              .           .           .           .
1816          .           .           .           .------->  140RET
1814          .           .           .      140OUT
              .           .           .           .
              .           .           .           .
1819          .           .        !LE1............
              .           .           V
              .           .           V
1822          .           .        RLE1
              .           .           .
              .           .           .
1828          .           .           .         156
              .           .           .           .
              .           .           .           .
1839          .           .           .           .------->  156RET
1837          .           .           .      156OUT
              .           .           .           .
              .           .           .           .
1842          .           .        !LE2............
              .           .           V
              .           .           V
1845          .           .        RLE2
              .           .           .
              .           .           .
1851          .        !LE3............
              .           V
              .           V
1854          .        RLE3
              .           .
              .           .
1860          .           .         172
              .           .           .
              .           .           .
1870          .           .           .------->  172RET
1868          .           .      172OUT
              .           .           .
```

```
1873          .        .          .
              .      !LE4...........
              .         V
              .         V
1876          .     SRLECH
              .         .
              .         .
1884          .         .-------> EM-CLV
1882          .      DLE4
              .         V
              .         V
1887          .     SRLE4
              .         .
              .         .
1895          .         .          .<-------  EM-CLV
1893          .         .      DILE4
              .         .          .
              .         .          .
1896          .      2LE4...........
              .         V
              .         V
1899          .      RLE4
              .         .
              .         .
1904          .         .        173
              .         .          .
              .         .          .
1914          .      !LE5...........
              .         .
              .         .
1917          .         .       156A
              .         .          V
              .         .          V
1924          .         .      R156A
              .         .          .
              .         .          .
1930          .         .          .        158
              .         .          .          .
              .         .          .          .
1942          .         .          .          .-------> 158RET
1940          .         .          .     158OUT
              .         .          .          .
              .         .          .          .
1945          .         .      CP158...........
              .         .          V
              .         .          V
1948          .         .       R158
              .         .          .
              .         .          .
1954          .         .          .       173B
              .         .          .          .
              .         .          .          .
1965          .         .          .          .-------> 173BRT
1963          .         .          .     173BOT
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                .          .          .          .
                .          .          .          .
1968            .          .      CP173B.........
                .          .          .
                .          .          .
1971            .      AFR2E..........
                .          V
                .          V
1974            .      RR173
                .          .
```

+	2 COMBINED AT	CP138A	115.	12.50	15.	5.	2.	23.68
+	DIVERSION TO	DI154	0.	.00	0.	0.	0.	23.68
+	HYDROGRAPH AT	D138A	115.	12.50	15.	5.	2.	23.68
+	ROUTED TO	R138A	25.	15.08	14.	5.	2.	23.68
+	HYDROGRAPH AT	D138A	0.	.00	0.	0.	0.	23.68
+	ROUTED TO	RLLE	0.	.00	0.	0.	0.	23.68
+	HYDROGRAPH AT	154	199.	12.58	45.	15.	5.	.17
+	DIVERSION TO	154RET	199.	12.58	29.	8.	3.	.17
+	HYDROGRAPH AT	154OUT	159.	12.83	23.	7.	2.	.17
+	2 COMBINED AT	LLE1	158.	12.83	23.	7.	2.	.33
+	ROUTED TO	RLLE1	129.	13.33	23.	7.	2.	.33
+	HYDROGRAPH AT	157	649.	12.83	135.	40.	13.	.89
+	DIVERSION TO	157RET	630.	12.75	79.	21.	7.	.89
+	HYDROGRAPH AT	157OUT	533.	13.00	67.	18.	6.	.89
+	2 COMBINED AT	1I157	437.	13.08	74.	21.	7.	25.08
+	2 COMBINED AT	2I157	437.	13.08	87.	26.	9.	25.08
+	HYDROGRAPH AT	127	456.	12.08	41.	12.	4.	.22
+	ROUTED TO	R127	248.	13.42	41.	12.	4.	.22

+	HYDROGRAPH AT	139	772.	12.25	111.	37.	12.	.47
+	DIVERSION TO	139RET	772.	12.25	72.	21.	7.	.47
+	HYDROGRAPH AT	139OUT	577.	12.42	55.	16.	5.	.47
+	2 COMBINED AT	1I139	580.	12.42	95.	28.	9.	.69
+	HYDROGRAPH AT	D126	849.	12.67	162.	49.	16.	4.75
+	ROUTED TO	RLE	525.	12.92	157.	49.	16.	4.75
+	2 COMBINED AT	2I139	638.	13.33	245.	75.	25.	7.04
+	HYDROGRAPH AT	140	208.	12.67	48.	16.	5.	.18
+	DIVERSION TO	140RET	205.	12.58	29.	8.	3.	.18
+	HYDROGRAPH AT	140OUT	175.	12.75	27.	8.	3.	.18
+	2 COMBINED AT	!LE1	815.	12.83	282.	86.	29.	.88
+	ROUTED TO	RLE1	779.	13.00	279.	86.	29.	.88
+	HYDROGRAPH AT	156	280.	12.75	66.	21.	7.	.30
+	DIVERSION TO	156RET	148.	12.25	19.	6.	2.	.30
+	HYDROGRAPH AT	156OUT	280.	12.75	55.	15.	5.	.30
+	2 COMBINED AT	!LE2	1007.	12.92	332.	101.	34.	1.18
+	ROUTED TO	RLE2	950.	13.17	326.	101.	34.	1.18
+	2 COMBINED AT	!LE3	1384.	13.08	430.	132.	44.	1.65

+	ROUTED TO	RLE3	1354.	13.33	427.	132.	44.	1.65
+	HYDROGRAPH AT	172	135.	12.58	28.	9.	3.	.12
+	DIVERSION TO	172RET	114.	12.42	13.	4.	1.	.12
+	HYDROGRAPH AT	172OUT	135.	12.58	19.	5.	2.	.12
+	2 COMBINED AT	!LE4	1387.	13.25	441.	137.	46.	1.77
+	ROUTED TO	SRLECH	1388.	13.33	438.	137.	46.	1.77
+	DIVERSION TO	EM-CLV	45.	13.33	32.	21.	7.	1.77
+	HYDROGRAPH AT	DLE4	1343.	13.33	406.	116.	39.	1.77
+	ROUTED TO	SRLE4	831.	14.00	375.	108.	36.	1.77
+	HYDROGRAPH AT	DILE4	45.	13.33	32.	21.	7.	1.77
+	2 COMBINED AT	2LE4	870.	14.00	407.	128.	43.	1.77
+	ROUTED TO	RLE4	857.	14.17	401.	128.	43.	1.77
+	HYDROGRAPH AT	173	195.	13.00	41.	11.	4.	.31
+	2 COMBINED AT	!LE5	880.	14.17	420.	138.	46.	2.08
+	HYDROGRAPH AT	156A	501.	12.17	46.	13.	4.	.31
+	ROUTED TO	R156A	178.	14.17	45.	13.	4.	.31
+	HYDROGRAPH AT	158	1195.	12.33	147.	44.	15.	.97
+	DIVERSION TO	158RET	1195.	12.33	116.	31.	10.	.97

+	HYDROGRAPH AT	158OUT	534.	12.58	44.	13.	4.	.97
+	2 COMBINED AT	CP158	534.	12.58	85.	26.	9.	1.28
+	ROUTED TO	R158	198.	13.25	81.	26.	9.	1.28
+	HYDROGRAPH AT	173B	123.	12.83	23.	7.	2.	.20
+	DIVERSION TO	173BRT	83.	12.50	8.	2.	1.	.20
+	HYDROGRAPH AT	173BOT	123.	12.83	16.	4.	1.	.20
+	2 COMBINED AT	CP173B	267.	13.17	96.	30.	10.	1.48
+	2 COMBINED AT	AFR2E	879.	14.08	469.	156.	52.	30.12
+	ROUTED TO	RR173	779.	14.83	412.	141.	47.	30.12

APPENDIX E

HEC-2 Model 13WSHLLT.dat Output Tables

```
1*******************************************
 *  HEC-2 WATER SURFACE PROFILES           *
 *                                         *
 *  Version   4.6.2;  May 1991             *
 *                                         *
 *  RUN DATE    12SEP01    TIME   13:40:27 *
 *******************************************
```

```
****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
```

```
X     X  XXXXXXX  XXXXX            XXXXX
X     X  X       X    X          X     X
X     X  X       X                     X
XXXXXXX  XXXX    X         XXXXX   XXXXX
X     X  X       X                X
X     X  X       X    X           X
X     X  XXXXXXX  XXXXX            XXXXXXX
```

1

12SEP01 13:40:27 PAGE 1

THIS RUN EXECUTED 12SEP01 13:40:27

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
```

```
   ****************************NOTES****REVISIONS****************************
T1      WHITE TANKS / AQUA FRIA AREA DRAINAGE MASTER STUDY
T2      100 - YEAR STORM EVENT      FLOODPLAIN RUN        FILE: 13WSHLLT.DAT
T3      LOWER EL MIRAGE WASH. FROM AGUA FRIA RIVER TO THE TOPEKA AND SANTA FE
T4      RAILROAD AT WADDELL RD.
T5      DISCHARGES ARE AS DERIVED FROM THE 24-HOUR STORM HEC1 MODEL.
T6
T7      THIS STUDY HAS BEEN EDITED TO INCLUDE THE PROPOSED MAIN EL MIRAGE
T8      CHANNEL AND PROPOSED DYSART ROAD CROSS SECTION FOR USE IN THE
T9      APPLICATION FOR A LETTER OF MAP REVISION
```

Lower El Mirage Wash
LOMR HEC-2 Model (2001)
Prepared By A-N West
Prepared for City of El Mirage
Used As "Base Hydraulics"
for West Cactus Basin
Project.

THIS RUN EXECUTED 12SEP01 13:40:28

```
*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.2;  May 1991
*************************************
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

LOWER EL MIRAGE WASH. FR

SUMMARY PRINTOUT

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
	.000	1753.00	1092.94	9844.49	9990.00	10015.00	11020.48	.00	490.46	2.44	1090.50	75.77	4.56
	.000	1753.00	1092.94	9845.00	9990.00	10015.00	11020.00	.00	489.74	2.44	1090.50	75.50	4.56
*	.076	1753.00	1094.96	9972.29	9935.00	10070.00	10648.38	2.02	661.81	3.96	1091.00	35.19	1.80
*	.076	1753.00	1094.96	9973.00	9935.00	10070.00	10648.00	2.02	660.08	3.96	1091.00	35.26	1.81
*	.153	1753.00	1095.84	9934.17	9930.00	10165.00	10332.42	.89	398.25	4.24	1091.60	13.86	2.08
*	.153	1753.00	1095.84	9935.00	9930.00	10165.00	10332.00	.89	397.00	4.24	1091.60	13.83	2.09
*	.186	1753.00	1096.12	9847.50	9870.00	10150.00	10156.88	.28	309.38	1.62	1094.50	50.70	4.44
*	.186	1753.00	1096.12	9848.00	9870.00	10150.00	10156.00	.28	308.00	1.62	1094.50	50.82	4.44
	.259	1753.00	1097.69	9896.08	9960.00	10025.00	10146.00	1.57	249.91	2.89	1094.80	35.41	5.85
	.259	1753.00	1097.69	9897.00	9960.00	10025.00	10145.96	1.57	248.96	2.89	1094.80	35.39	5.85
*	.386	1753.00	1103.72	9638.24	9980.00	10025.00	10048.89	6.03	410.66	3.52	1100.20	59.62	7.25
*	.386	1753.00	1104.00	9850.00	9980.00	10025.00	10048.00	6.31	198.00	3.80	1100.20	65.18	8.12
*	.485	1753.00	1105.23	9343.36	9960.00	10025.00	10058.33	1.51	714.97	4.03	1101.20	10.77	3.44
*	.485	1753.00	1105.82	9810.00	9960.00	10025.00	10058.00	1.82	248.00	4.62	1101.20	12.21	4.10
	.581	1753.00	1105.65	9797.57	9965.00	10040.00	10128.98	.42	331.41	4.05	1101.60	6.79	3.17
*	.581	1753.00	1106.29	9930.00	9965.00	10040.00	10080.00	.47	150.00	4.69	1101.60	5.92	3.28
*	.696	1753.00	1108.61	9919.30	9970.00	10015.00	10213.33	2.96	294.03	5.01	1103.60	34.16	7.57
*	.696	1753.00	1108.56	9921.75	9970.00	10015.00	10165.00	2.28	243.25	4.96	1103.60	36.89	7.81
*	.791	1753.00	1110.12	9777.98	9970.00	10020.00	10173.61	1.51	395.63	4.72	1105.40	10.81	4.39
*	.791	1753.00	1110.21	9950.00	9970.00	10020.00	10110.00	1.64	160.00	4.81	1105.40	14.24	5.10
*	683.000	1768.00	1111.97	9847.52	9989.50	10010.50	10222.80	1.85	375.29	4.77	1107.20	49.48	8.22
*	683.000	1768.00	1112.16	9910.00	9989.50	10010.50	10110.00	1.96	200.00	4.96	1107.20	55.89	8.97

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	798.000	1768.00	1113.19	9879.66	9989.50	10010.50	10254.03	1.22	374.36	5.59	1107.60	15.41	7.28
*	798.000	1768.00	1113.41	9900.00	9989.50	10010.50	10105.00	1.24	205.00	5.81	1107.60	16.98	7.83
*	931.000	1768.00	1113.69	9685.78	9925.00	10105.00	10101.40	.50	200.02	6.09	1107.60	3.76	2.46
*	931.000	1768.00	1114.08	9925.00	9925.00	10105.00	10100.00	.67	175.00	6.48	1107.60	3.54	2.27
	1207.000	1768.00	1113.80	9461.64	9925.00	10105.00	10103.83	.11	226.30	6.20	1107.60	2.34	2.12
	1207.000	1768.00	1114.16	9951.67	9925.00	10105.00	10075.00	.08	123.32	6.56	1107.60	2.69	2.36
*	1403.000	1768.00	1113.87	9352.67	9925.00	10258.00	10249.11	.08	363.73	6.27	1107.60	.51	1.04
	1403.000	1768.00	1114.21	9954.52	9925.00	10258.00	10075.00	.05	120.48	6.61	1107.60	2.86	2.43
	1543.000	1768.00	1113.88	9318.26	9925.00	10205.00	10197.16	.00	410.22	6.28	1107.60	.75	1.25
	1543.000	1768.00	1114.25	9952.36	9925.00	10205.00	10075.00	.04	122.64	6.65	1107.60	2.68	2.36
	1859.000	1768.00	1113.90	9391.74	9925.00	10208.00	10199.92	.02	419.77	6.30	1107.60	.78	1.26
	1859.000	1768.00	1114.34	9952.70	9925.00	10208.00	10075.00	.08	122.30	6.74	1107.60	2.59	2.34
	2053.000	1771.00	1113.92	9484.69	9925.00	10208.00	10199.61	.02	423.72	6.32	1107.60	.77	1.25
	2053.000	1771.00	1114.39	9952.34	9925.00	10208.00	10075.00	.05	122.66	6.79	1107.60	2.73	2.38
*	2188.000	1771.00	1113.93	9850.94	9925.00	10085.00	10193.55	.01	240.59	6.33	1107.60	2.65	2.07
	2188.000	1771.00	1114.42	9954.59	9925.00	10085.00	10075.00	.04	120.41	6.82	1107.60	4.17	2.75
*	2270.000	1771.00	1113.93	25.85	.00	140.00	138.00	.00	112.15	6.33	1107.60	12.60	3.96
	2270.000	1771.00	1114.46	26.00	.00	140.00	138.00	.03	112.00	6.86	1107.60	8.48	3.51
*	2378.000	1771.00	1114.96	20.89	.00	237.00	219.78	1.02	198.89	7.36	1107.60	2.06	2.49
*	2378.000	1771.00	1114.98	20.36	.00	237.00	219.91	.52	199.55	7.38	1107.60	2.02	2.47
	2402.000	1771.00	1114.96	10.49	22.00	127.00	139.03	.01	128.54	7.36	1107.60	2.44	2.48
	2402.000	1771.00	1114.99	10.40	22.00	127.00	139.13	.01	128.73	7.39	1107.60	2.41	2.47
	2403.000	1771.00	1114.96	10.53	22.00	127.00	139.00	.00	128.47	7.36	1107.60	2.61	2.53
	2403.000	1771.00	1114.99	10.42	22.00	127.00	139.11	.00	128.69	7.39	1107.60	2.57	2.52
	2445.000	1771.00	1114.97	9.38	22.00	145.00	137.39	.01	128.02	7.37	1107.60	2.93	2.53
	2445.000	1771.00	1115.00	8.82	22.00	145.00	137.47	.01	128.65	7.40	1107.60	2.89	2.52
	2533.000	1771.00	1115.00	18.95	15.00	141.00	134.04	.03	115.08	7.60	1107.40	3.29	2.62
	2533.000	1771.00	1115.03	18.87	15.00	141.00	134.11	.03	115.24	7.63	1107.40	3.25	2.61
	2624.000	1771.00	1115.03	20.78	12.00	141.00	133.84	.03	113.06	7.33	1107.70	3.49	2.69
	2624.000	1771.00	1115.05	20.70	12.00	141.00	133.91	.03	113.21	7.35	1107.70	3.45	2.68
	2831.000	1771.00	1115.09	18.88	14.00	138.00	128.78	.06	109.90	6.19	1108.90	6.28	3.25
	2831.000	1771.00	1115.11	18.79	14.00	138.00	128.85	.06	110.05	6.21	1108.90	6.20	3.23

3044.000	1771.00	1115.21	23.03	18.00	135.00	127.10	.13	104.08	5.71	1109.50	8.20	3.59
3044.000	1771.00	1115.23	22.95	18.00	135.00	127.16	.12	104.21	5.73	1109.50	8.09	3.58

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
	3237.000	1258.00	1115.40	16.25	19.00	110.00	104.16	.19	87.91	5.80	1109.60	7.17	3.26
	3237.000	1258.00	1115.42	15.72	19.00	110.00	104.21	.19	88.49	5.82	1109.60	7.07	3.24
	3463.000	1258.00	1115.56	21.69	16.00	113.00	105.22	.16	83.53	5.46	1110.10	8.38	3.44
	3463.000	1258.00	1115.58	21.64	16.00	113.00	105.26	.16	83.63	5.48	1110.10	8.28	3.42
	3598.000	1258.00	1115.66	24.18	17.00	113.00	104.28	.10	80.10	5.06	1110.60	11.47	3.84
	3598.000	1258.00	1115.68	24.13	17.00	113.00	104.32	.10	80.19	5.08	1110.60	11.34	3.83
*	3836.000	1258.00	1115.91	25.11	18.00	103.00	92.35	.25	67.24	4.51	1111.40	28.32	5.41
*	3836.000	1258.00	1115.93	25.07	18.00	103.00	92.39	.25	67.32	4.53	1111.40	28.02	5.39
	3962.000	1258.00	1116.33	25.20	18.00	111.00	100.31	.42	75.11	4.53	1111.80	22.04	4.81
	3962.000	1258.00	1116.34	25.17	18.00	111.00	100.33	.41	75.16	4.54	1111.80	21.89	4.79
	4226.000	1258.00	1116.93	26.60	18.00	115.00	102.73	.60	76.13	4.13	1112.80	24.79	4.95
	4226.000	1258.00	1116.94	26.59	18.00	115.00	102.74	.60	76.16	4.14	1112.80	24.69	4.94
	4361.000	1258.00	1117.29	26.67	19.00	114.00	103.37	.36	76.71	4.39	1112.90	17.38	4.43
	4361.000	1258.00	1117.30	26.66	19.00	114.00	103.38	.36	76.72	4.40	1112.90	17.34	4.43
*	4482.000	1258.00	1117.53	.00	.00	43.00	43.00	.23	43.00	4.13	1113.40	47.05	7.08
*	4482.000	1258.00	1117.53	.00	.00	43.00	43.00	.23	43.00	4.13	1113.40	46.97	7.07
	4545.000	1258.00	1117.92	.00	.00	43.00	43.00	.39	43.00	4.32	1113.60	41.13	6.78
	4545.000	1258.00	1117.92	.00	.00	43.00	43.00	.39	43.00	4.32	1113.60	41.13	6.78
*	4644.000	1258.00	1118.88	19.47	6.00	118.00	102.37	.97	82.90	4.98	1113.90	13.06	3.95
*	4644.000	1258.00	1118.88	19.47	6.00	118.00	102.37	.96	82.90	4.98	1113.90	13.05	3.95
	4918.000	1258.00	1119.25	18.95	.00	125.00	106.05	.37	87.10	4.65	1114.60	13.85	3.95
	4918.000	1258.00	1119.25	18.95	.00	125.00	106.05	.37	87.11	4.65	1114.60	13.85	3.95
*	4924.000	1258.00	1121.48	19.32	.00	125.00	105.68	2.23	86.36	2.38	1119.10	129.31	7.77
*	4924.000	1258.00	1121.48	19.32	.00	125.00	105.68	2.23	86.36	2.38	1119.10	129.31	7.77
	4986.000	1258.00	1122.18	33.19	24.00	125.00	99.80	.70	66.61	3.18	1119.00	80.84	7.46
	4986.000	1258.00	1122.18	33.19	24.00	125.00	99.80	.70	66.61	3.18	1119.00	80.84	7.46
*	5164.000	1258.00	1123.51	23.91	5.00	125.00	105.54	1.33	81.64	4.11	1119.40	30.29	5.13
*	5164.000	1258.00	1123.51	23.91	5.00	125.00	105.54	1.33	81.64	4.11	1119.40	30.29	5.13
	5440.000	1258.00	1124.30	20.64	5.00	125.00	106.23	.78	85.59	4.30	1120.00	20.00	4.44
	5440.000	1258.00	1124.30	20.64	5.00	125.00	106.23	.78	85.59	4.30	1120.00	20.00	4.44

5641.000	1258.00	1124.72	18.44	1.00	125.00	105.46	.42	87.02	3.82	1120.90	26.56	4.81
5641.000	1258.00	1124.72	18.44	1.00	125.00	105.46	.42	87.02	3.82	1120.90	26.56	4.81
5833.000	1258.00	1125.22	20.18	2.00	125.00	106.11	.50	85.92	4.22	1121.00	21.28	4.52
5833.000	1258.00	1125.22	20.18	2.00	125.00	106.11	.50	85.92	4.22	1121.00	21.28	4.52

	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
	6024.000	1258.00	1125.63	20.01	3.00	125.00	106.79	.41	86.78	4.53	1121.10	17.32	4.23
	6024.000	1258.00	1125.63	20.01	3.00	125.00	106.79	.41	86.78	4.53	1121.10	17.32	4.23
	6315.000	1258.00	1126.18	19.18	.00	124.00	103.04	.55	83.87	3.98	1122.20	26.86	4.89
	6315.000	1258.00	1126.18	19.18	.00	124.00	103.04	.55	83.87	3.98	1122.20	26.86	4.89
	6500.000	1258.00	1126.62	27.83	20.00	96.00	94.12	.44	66.29	4.32	1122.30	22.02	5.01
	6500.000	1258.00	1126.62	27.83	20.00	96.00	94.12	.44	66.29	4.32	1122.30	22.02	5.01
*	6503.000	1258.00	1127.87	29.73	20.00	96.00	93.08	1.25	63.35	2.57	1125.30	124.93	8.65
*	6503.000	1258.00	1127.87	29.73	20.00	96.00	93.08	1.25	63.35	2.57	1125.30	124.93	8.65
	6506.000	1258.00	1128.32	27.89	20.00	96.00	93.63	.45	65.74	3.02	1125.30	70.94	7.18
	6506.000	1258.00	1128.32	27.89	20.00	96.00	93.63	.45	65.74	3.02	1125.30	70.94	7.18
*	6781.000	1258.00	1129.82	30.19	15.00	125.00	115.10	1.50	84.91	4.42	1125.40	20.99	4.52
*	6781.000	1258.00	1129.82	30.19	15.00	125.00	115.10	1.50	84.91	4.42	1125.40	20.99	4.52
	7008.000	1258.00	1130.36	13.41	.00	122.00	106.12	.54	91.11	3.66	1126.70	35.57	5.15
	7008.000	1258.00	1130.36	13.41	.00	122.00	106.12	.54	91.11	3.66	1126.70	35.57	5.15
	7200.000	1258.00	1131.04	12.48	.00	125.00	106.17	.67	93.69	3.84	1127.20	28.42	4.76
	7200.000	1258.00	1131.04	12.48	.00	125.00	106.17	.67	93.69	3.84	1127.20	28.42	4.76
	7397.000	1258.00	1131.58	11.92	3.00	125.00	104.22	.54	92.30	4.18	1127.40	22.37	4.46
	7397.000	1258.00	1131.58	11.92	3.00	125.00	104.22	.54	92.30	4.18	1127.40	22.37	4.46
	7580.700	1258.00	1131.98	14.27	.00	125.00	103.13	.40	88.86	4.48	1127.50	21.68	4.48
	7580.700	1258.00	1131.98	14.27	.00	125.00	103.13	.40	88.86	4.48	1127.50	21.68	4.48
	7750.000	1258.00	1132.36	12.17	3.00	125.00	106.05	.38	93.88	4.36	1128.00	21.29	4.36
	7750.000	1258.00	1132.36	12.17	3.00	125.00	106.05	.38	93.88	4.36	1128.00	21.29	4.36
*	7942.000	1258.00	1136.59	38.80	134.00	144.00	209.48	4.22	170.68	7.79	1128.80	24.91	8.83
*	7942.000	1258.00	1136.59	38.80	134.00	144.00	209.48	4.22	170.68	7.79	1128.80	24.91	8.83
*	8014.000	845.00	1137.78	9733.34	9995.00	10005.00	10102.58	1.19	366.24	7.38	1130.40	25.10	6.37
*	8014.000	845.00	1137.78	9733.34	9995.00	10005.00	10102.58	1.19	366.24	7.38	1130.40	25.10	6.37
*	8274.000	845.00	1139.42	9903.64	9980.00	10008.00	10012.23	1.64	108.59	3.77	1135.65	94.17	4.79
*	8274.000	845.00	1139.42	9903.64	9980.00	10008.00	10012.23	1.64	108.59	3.77	1135.65	94.17	4.79

*	8504.000	845.00	1141.15	9724.88	9932.00	10040.00	10063.76	1.72	293.30	4.86	1136.29	37.88	1.29
*	8504.000	845.00	1141.15	9724.88	9932.00	10040.00	10063.76	1.72	293.30	4.86	1136.29	37.88	1.29
	8769.000	845.00	1142.31	9151.70	9910.00	10075.00	10124.49	1.16	952.11	1.01	1141.30	26.54	1.88
	8769.000	845.00	1142.31	9151.70	9910.00	10075.00	10124.49	1.16	952.11	1.01	1141.30	26.54	1.88
	9269.000	845.00	1143.50	9229.55	9710.00	10220.00	10264.54	1.20	1034.99	.90	1142.60	25.19	1.76
	9269.000	845.00	1143.50	9229.55	9710.00	10220.00	10264.54	1.20	1034.99	.90	1142.60	25.19	1.76

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	SECNO	Q	CWSEL	SSTA	STCHL	STCHR	ENDST	DIFWSX	TOPWID	DEPTH	ELMIN	10*KS	VCH
*	9774.000	845.00	1145.41	9581.72	9875.00	10200.00	10561.07	1.90	979.34	.71	1144.70	59.94	1.97
*	9774.000	845.00	1145.41	9581.72	9875.00	10200.00	10561.07	1.90	979.34	.71	1144.70	59.94	1.97
	10109.000	845.00	1147.09	9554.59	9822.00	10235.00	10573.09	1.68	1018.51	.84	1146.25	41.73	1.89
	10109.000	845.00	1147.09	9554.59	9822.00	10235.00	10573.09	1.68	1018.51	.84	1146.25	41.73	1.89
*	10279.000	845.00	1148.37	9772.45	9795.00	10303.00	10269.10	1.28	496.65	.67	1147.70	231.32	3.86
*	10279.000	845.00	1148.37	9772.45	9795.00	10303.00	10269.10	1.28	496.65	.67	1147.70	231.32	3.86

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LOWER EL MIRAGE WASH. FR

SUMMARY PRINTOUT TABLE 101

	SECNO	EGOC	ELLC	EGIC	ELTRD	QCULV	QWEIR	CLASS	H4	DEPTH	CWSEL	VCH	EG
*	798.000	1133.53	1110.60	1136.82	1111.80	617.56	1138.76	16.00	.74	5.59	1113.19	7.28	1113.66
*	798.000	1133.72	1110.60	1136.82	1111.80	617.56	1138.76	16.00	.35	5.81	1113.41	7.83	1114.02
*	2378.000	2326.29	1108.40	2167.17	1112.10	53.84	1705.14	17.00	.88	7.36	1114.96	2.49	1115.05
*	2378.000	2326.81	1108.40	2167.17	1112.10	40.03	1733.97	17.00	.43	7.38	1114.98	2.47	1115.08
	4545.000	1118.63	1118.60	1118.53	1122.80	1258.00	.00	7.00	.33	4.32	1117.92	6.78	1118.63
	4545.000	1118.63	1118.60	1118.53	1122.80	1258.00	.00	7.00	.32	4.32	1117.92	6.78	1118.63
*	8014.000	1161.20	1134.40	1167.23	1135.45	306.58	536.33	16.00	.46	7.38	1137.78	6.37	1138.15
*	8014.000	1161.20	1134.40	1167.23	1135.45	306.58	536.33	16.00	.46	7.38	1137.78	6.37	1138.15

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LOWER EL MIRAGE WASH. FR

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	.000	1092.94	-.06	1093.16	490.46	322.34	124.17	1306.49	.00	.00	9990.00	10015.00	.00
	.000	1092.94	.00	1093.16	489.74	322.78	124.19	1306.03	1175.00	9845.00	9990.00	10015.00	11020.00
*	.076	1094.96	.00	1095.07	661.81	.00	84.31	1668.69	.00	.00	9935.00	10070.00	.00
*	.076	1094.96	.00	1095.07	660.08	.00	84.34	1668.66	675.00	9973.00	9935.00	10070.00	10648.00
*	.153	1095.84	.00	1095.93	398.25	.00	577.92	1175.08	.00	.00	9930.00	10165.00	.00
*	.153	1095.84	.00	1095.93	397.00	.00	578.45	1174.55	397.00	9935.00	9930.00	10165.00	10332.00
*	.186	1096.12	.00	1096.43	309.38	.67	1752.13	.20	.00	.00	9870.00	10150.00	.00
*	.186	1096.12	.00	1096.43	308.00	.66	1752.12	.21	308.00	9848.00	9870.00	10150.00	10156.00
	.259	1097.69	.00	1098.08	249.91	346.12	1063.08	343.79	.00	.00	9960.00	10025.00	.00
	.259	1097.69	.00	1098.08	248.96	346.94	1062.55	343.51	249.00	9897.00	9960.00	10025.00	10146.00
*	.386	1103.72	.00	1104.19	410.66	836.78	855.39	60.83	.00	.00	9980.00	10025.00	.00
*	.386	1104.00	.28	1104.71	198.00	591.16	1060.07	101.76	198.00	9850.00	9980.00	10025.00	10048.00
*	.485	1105.23	.00	1105.33	714.97	1039.38	692.74	20.87	.00	.00	9960.00	10025.00	.00
*	.485	1105.82	.58	1106.00	248.00	705.67	981.34	65.99	248.00	9810.00	9960.00	10025.00	10058.00
	.581	1105.65	.00	1105.76	331.41	473.26	918.20	361.54	.00	.00	9965.00	10040.00	.00
*	.581	1106.29	.63	1106.42	150.00	313.30	1103.42	336.27	150.00	9930.00	9965.00	10040.00	10080.00
*	.696	1108.61	.00	1109.37	294.03	120.50	1458.87	173.63	.00	.00	9970.00	10015.00	.00
*	.696	1108.56	-.05	1109.38	243.25	117.29	1487.18	148.53	245.00	9920.00	9970.00	10015.00	10165.00
*	.791	1110.12	.00	1110.31	395.63	455.50	969.46	328.03	.00	.00	9970.00	10020.00	.00
*	.791	1110.21	.08	1110.51	160.00	207.49	1147.81	397.70	160.00	9950.00	9970.00	10020.00	10110.00
*	683.000	1111.97	.00	1112.53	375.29	280.35	815.88	671.77	.00	.00	9989.50	10010.50	.00
*	683.000	1112.16	.19	1112.92	200.00	347.93	926.52	493.55	200.00	9910.00	9989.50	10010.50	10110.00
*	798.000	1113.19	.00	1113.66	374.36	186.58	854.88	726.54	.00	.00	9989.50	10010.50	.00
*	798.000	1113.41	.21	1114.02	205.00	282.74	955.46	529.80	205.00	9900.00	9989.50	10010.50	10105.00
*	931.000	1113.69	.00	1113.78	200.02	2.64	1765.36	.00	.00	.00	9925.00	10105.00	.00
*	931.000	1114.08	.39	1114.16	175.00	.00	1768.00	.00	175.00	9925.00	9925.00	10105.00	10100.00
	1207.000	1113.80	.00	1113.87	226.30	12.33	1755.67	.00	.00	.00	9925.00	10105.00	.00
	1207.000	1114.16	.36	1114.24	123.32	.00	1768.00	.00	150.00	9925.00	9925.00	10105.00	10075.00
*	1403.000	1113.87	.00	1113.89	363.73	6.10	1761.90	.00	.00	.00	9925.00	10258.00	.00
	1403.000	1114.21	.33	1114.30	120.48	.00	1768.00	.00	150.00	9925.00	9925.00	10258.00	10075.00
	1543.000	1113.88	.00	1113.90	410.22	14.75	1753.24	.00	.00	.00	9925.00	10205.00	.00
	1543.000	1114.25	.37	1114.34	122.64	.00	1768.00	.00	150.00	9925.00	9925.00	10205.00	10075.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	1859.000	1113.90	.00	1113.93	419.77	5.50	1762.50	.00	.00	.00	9925.00	10208.00	.00
	1859.000	1114.34	.43	1114.42	122.30	.00	1768.00	.00	150.00	9925.00	9925.00	10208.00	10075.00
	2053.000	1113.92	.00	1113.94	423.72	9.02	1761.98	.00	.00	.00	9925.00	10208.00	.00
	2053.000	1114.39	.47	1114.47	122.66	.00	1771.00	.00	150.00	9925.00	9925.00	10208.00	10075.00
*	2188.000	1113.93	.00	1113.98	240.59	.80	1260.72	509.48	.00	.00	9925.00	10085.00	.00
	2188.000	1114.42	.50	1114.54	120.41	.00	1771.00	.00	150.00	9925.00	9925.00	10085.00	10075.00
*	2270.000	1113.93	.00	1114.17	112.15	.00	1771.00	.00	.00	.00	.00	140.00	.00
	2270.000	1114.46	.53	1114.65	112.00	.00	1771.00	.00	112.00	26.00	.00	140.00	138.00
*	2378.000	1114.96	.00	1115.05	198.89	.00	1771.00	.00	.00	.00	.00	237.00	.00
*	2378.000	1114.98	.03	1115.08	199.55	.00	1771.00	.00	.00	.00	.00	237.00	.00
	2402.000	1114.96	.00	1115.06	128.54	13.69	1742.98	14.33	.00	.00	22.00	127.00	.00
	2402.000	1114.99	.03	1115.08	128.73	13.89	1742.56	14.55	.00	.00	22.00	127.00	.00
	2403.000	1114.96	.00	1115.06	128.47	14.04	1742.25	14.70	.00	.00	22.00	127.00	.00
	2403.000	1114.99	.03	1115.09	128.69	14.29	1741.74	14.97	.00	.00	22.00	127.00	.00
	2445.000	1114.97	.00	1115.07	128.02	1.21	1769.79	.00	.00	.00	22.00	145.00	.00
	2445.000	1115.00	.03	1115.10	128.65	1.35	1769.65	.00	.00	.00	22.00	145.00	.00
	2533.000	1115.00	.00	1115.11	115.08	.00	1771.00	.00	.00	.00	15.00	141.00	.00
	2533.000	1115.03	.03	1115.13	115.24	.00	1771.00	.00	.00	.00	15.00	141.00	.00
	2624.000	1115.03	.00	1115.14	113.06	.00	1771.00	.00	.00	.00	12.00	141.00	.00
	2624.000	1115.05	.02	1115.16	113.21	.00	1771.00	.00	.00	.00	12.00	141.00	.00
	2831.000	1115.09	.00	1115.25	109.90	.00	1771.00	.00	.00	.00	14.00	138.00	.00
	2831.000	1115.11	.02	1115.27	110.05	.00	1771.00	.00	.00	.00	14.00	138.00	.00
	3044.000	1115.21	.00	1115.41	104.08	.00	1771.00	.00	.00	.00	18.00	135.00	.00
	3044.000	1115.23	.02	1115.43	104.21	.00	1771.00	.00	.00	.00	18.00	135.00	.00
	3237.000	1115.40	.00	1115.57	87.91	.02	1257.98	.00	.00	.00	19.00	110.00	.00
	3237.000	1115.42	.02	1115.58	88.49	.04	1257.96	.00	.00	.00	19.00	110.00	.00
	3463.000	1115.56	.00	1115.75	83.53	.00	1258.00	.00	.00	.00	16.00	113.00	.00
	3463.000	1115.58	.02	1115.76	83.63	.00	1258.00	.00	.00	.00	16.00	113.00	.00
	3598.000	1115.66	.00	1115.89	80.10	.00	1258.00	.00	.00	.00	17.00	113.00	.00
	3598.000	1115.68	.02	1115.91	80.19	.00	1258.00	.00	.00	.00	17.00	113.00	.00
*	3836.000	1115.91	.00	1116.37	67.24	.00	1258.00	.00	.00	.00	18.00	103.00	.00
*	3836.000	1115.93	.01	1116.38	67.32	.00	1258.00	.00	.00	.00	18.00	103.00	.00
	3962.000	1116.33	.00	1116.69	75.11	.00	1258.00	.00	.00	.00	18.00	111.00	.00
	3962.000	1116.34	.01	1116.70	75.16	.00	1258.00	.00	.00	.00	18.00	111.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	4226.000	1116.93	.00	1117.31	76.13	.00	1258.00	.00	.00	.00	18.00	115.00	.00
	4226.000	1116.94	.00	1117.32	76.16	.00	1258.00	.00	.00	.00	18.00	115.00	.00
	4361.000	1117.29	.00	1117.60	76.71	.00	1258.00	.00	.00	.00	19.00	114.00	.00
	4361.000	1117.30	.00	1117.60	76.72	.00	1258.00	.00	.00	.00	19.00	114.00	.00
*	4482.000	1117.53	.00	1118.30	43.00	.00	1258.00	.00	.00	.00	.00	43.00	.00
*	4482.000	1117.53	.00	1118.30	43.00	.00	1258.00	.00	.00	.00	.00	43.00	.00
	4545.000	1117.92	.00	1118.63	43.00	.00	1258.00	.00	.00	.00	.00	43.00	.00
	4545.000	1117.92	.00	1118.63	43.00	.00	1258.00	.00	.00	.00	.00	43.00	.00
*	4644.000	1118.88	.00	1119.12	82.90	.00	1258.00	.00	.00	.00	6.00	118.00	.00
*	4644.000	1118.88	.00	1119.12	82.90	.00	1258.00	.00	.00	.00	6.00	118.00	.00
	4918.000	1119.25	.00	1119.49	87.10	.00	1258.00	.00	.00	.00	.00	125.00	.00
	4918.000	1119.25	.00	1119.49	87.11	.00	1258.00	.00	.00	.00	.00	125.00	.00
*	4924.000	1121.48	.00	1122.41	86.36	.00	1258.00	.00	.00	.00	.00	125.00	.00
*	4924.000	1121.48	.00	1122.41	86.36	.00	1258.00	.00	.00	.00	.00	125.00	.00
	4986.000	1122.18	.00	1123.04	66.61	.00	1258.00	.00	.00	.00	24.00	125.00	.00
	4986.000	1122.18	.00	1123.04	66.61	.00	1258.00	.00	.00	.00	24.00	125.00	.00
*	5164.000	1123.51	.00	1123.92	81.64	.00	1258.00	.00	.00	.00	5.00	125.00	.00
*	5164.000	1123.51	.00	1123.92	81.64	.00	1258.00	.00	.00	.00	5.00	125.00	.00
	5440.000	1124.30	.00	1124.60	85.59	.00	1258.00	.00	.00	.00	5.00	125.00	.00
	5440.000	1124.30	.00	1124.60	85.59	.00	1258.00	.00	.00	.00	5.00	125.00	.00
	5641.000	1124.72	.00	1125.08	87.02	.00	1258.00	.00	.00	.00	1.00	125.00	.00
	5641.000	1124.72	.00	1125.08	87.02	.00	1258.00	.00	.00	.00	1.00	125.00	.00
	5833.000	1125.22	.00	1125.54	85.92	.00	1258.00	.00	.00	.00	2.00	125.00	.00
	5833.000	1125.22	.00	1125.54	85.92	.00	1258.00	.00	.00	.00	2.00	125.00	.00
	6024.000	1125.63	.00	1125.91	86.78	.00	1258.00	.00	.00	.00	3.00	125.00	.00
	6024.000	1125.63	.00	1125.91	86.78	.00	1258.00	.00	.00	.00	3.00	125.00	.00
	6315.000	1126.18	.00	1126.56	83.87	.00	1258.00	.00	.00	.00	.00	124.00	.00
	6315.000	1126.18	.00	1126.56	83.87	.00	1258.00	.00	.00	.00	.00	124.00	.00
	6500.000	1126.62	.00	1127.01	66.29	.00	1258.00	.00	.00	.00	20.00	96.00	.00
	6500.000	1126.62	.00	1127.01	66.29	.00	1258.00	.00	.00	.00	20.00	96.00	.00
*	6503.000	1127.87	.00	1129.03	63.35	.00	1258.00	.00	.00	.00	20.00	96.00	.00
*	6503.000	1127.87	.00	1129.03	63.35	.00	1258.00	.00	.00	.00	20.00	96.00	.00

6506.000	1128.32	.00	1129.12	65.74	.00	1258.00	.00	.00	.00	20.00	96.00	.00
6506.000	1128.32	.00	1129.12	65.74	.00	1258.00	.00	.00	.00	20.00	96.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	6781.000	1129.82	.00	1130.14	84.91	.00	1258.00	.00	.00	.00	15.00	125.00	.00
*	6781.000	1129.82	.00	1130.14	84.91	.00	1258.00	.00	.00	.00	15.00	125.00	.00
	7008.000	1130.36	.00	1130.77	91.11	.00	1258.00	.00	.00	.00	.00	122.00	.00
	7008.000	1130.36	.00	1130.77	91.11	.00	1258.00	.00	.00	.00	.00	122.00	.00
	7200.000	1131.04	.00	1131.39	93.69	.00	1258.00	.00	.00	.00	.00	125.00	.00
	7200.000	1131.04	.00	1131.39	93.69	.00	1258.00	.00	.00	.00	.00	125.00	.00
	7397.000	1131.58	.00	1131.89	92.30	.00	1258.00	.00	.00	.00	3.00	125.00	.00
	7397.000	1131.58	.00	1131.89	92.30	.00	1258.00	.00	.00	.00	3.00	125.00	.00
	7580.700	1131.98	.00	1132.29	88.86	.00	1258.00	.00	.00	.00	.00	125.00	.00
	7580.700	1131.98	.00	1132.29	88.86	.00	1258.00	.00	.00	.00	.00	125.00	.00
	7750.000	1132.36	.00	1132.66	93.88	.00	1258.00	.00	.00	.00	3.00	125.00	.00
	7750.000	1132.36	.00	1132.66	93.88	.00	1258.00	.00	.00	.00	3.00	125.00	.00
*	7942.000	1136.59	.00	1137.32	170.68	479.01	687.85	91.14	.00	.00	134.00	144.00	.00
*	7942.000	1136.59	.00	1137.32	170.68	479.01	687.85	91.14	.00	.00	134.00	144.00	.00
*	8014.000	1137.78	.00	1138.15	366.24	288.01	469.92	87.07	.00	.00	9995.00	10005.00	.00
*	8014.000	1137.78	.00	1138.15	366.24	288.01	469.92	87.07	.00	.00	9995.00	10005.00	.00
*	8274.000	1139.42	.00	1140.08	108.59	741.82	101.80	1.38	.00	.00	9980.00	10008.00	.00
*	8274.000	1139.42	.00	1140.08	108.59	741.82	101.80	1.38	.00	.00	9980.00	10008.00	.00
*	8504.000	1141.15	.00	1141.40	293.30	796.02	48.18	.79	.00	.00	9932.00	10040.00	.00
*	8504.000	1141.15	.00	1141.40	293.30	796.02	48.18	.79	.00	.00	9932.00	10040.00	.00
	8769.000	1142.31	.00	1142.35	952.11	593.84	246.46	4.70	.00	.00	9910.00	10075.00	.00
	8769.000	1142.31	.00	1142.35	952.11	593.84	246.46	4.70	.00	.00	9910.00	10075.00	.00
	9269.000	1143.50	.00	1143.54	1034.99	162.54	673.01	9.45	.00	.00	9710.00	10220.00	.00
	9269.000	1143.50	.00	1143.54	1034.99	162.54	673.01	9.45	.00	.00	9710.00	10220.00	.00
*	9774.000	1145.41	.00	1145.47	979.34	178.67	297.91	368.42	.00	.00	9875.00	10200.00	.00
*	9774.000	1145.41	.00	1145.47	979.34	178.67	297.91	368.42	.00	.00	9875.00	10200.00	.00
	10109.000	1147.09	.00	1147.14	1018.51	290.47	445.28	109.25	.00	.00	9822.00	10235.00	.00
	10109.000	1147.09	.00	1147.14	1018.51	290.47	445.28	109.25	.00	.00	9822.00	10235.00	.00
*	10279.000	1148.37	.00	1148.60	496.65	.49	844.51	.00	.00	.00	9795.00	10303.00	.00
*	10279.000	1148.37	.00	1148.60	496.65	.49	844.51	.00	.00	.00	9795.00	10303.00	.00

SUMMARY OF ERRORS AND SPECIAL NOTES

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WARNING SECNO=       .076  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=       .076  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=       .153  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=       .153  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=       .186  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=       .186  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=       .386  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=       .386  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=       .386  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=       .386  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=       .386  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=       .386  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=       .485  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=       .485  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=       .581  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=       .696  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=       .696  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=       .696  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=       .696  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=       .696  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=       .696  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=       .791  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=       .791  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=    683.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    683.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    683.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=    683.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    683.000  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    683.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=    798.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=    798.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=    798.000  PROFILE=  2  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=    798.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=    931.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=    931.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   1403.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   2188.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   2270.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO=   2378.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   2378.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   3836.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   3836.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4482.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   4482.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   4644.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   4644.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   4924.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   4924.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   4924.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   4924.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   4924.000  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   4924.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=   5164.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   5164.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   6503.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   6503.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   6503.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   6503.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   6503.000  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   6503.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=   6781.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   6781.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=   7942.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   7942.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   7942.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   7942.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   7942.000  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   7942.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   8014.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   8014.000  PROFILE=  1  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   8014.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
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CAUTION SECNO=   8014.000  PROFILE=  2  WSEL ASSUMED BASED ON MIN DIFF
CAUTION SECNO=   8014.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   8274.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   8274.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   8274.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=   8274.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   8274.000  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   8274.000  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL
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WARNING SECNO=   8504.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   8504.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=   9774.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=   9774.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=  10279.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=  10279.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY
CAUTION SECNO=  10279.000  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=  10279.000  PROFILE=  2  MINIMUM SPECIFIC ENERGY

1
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FLOODWAY DATA,   LOWER EL MIRAGE WASH. FR
PROFILE NO.  2
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STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
.000	1175.	485.	3.6	1092.9	1092.9	.0
.076	675.	646.	2.7	1095.0	1095.0	.0
.153	397.	734.	2.4	1095.8	1095.8	.0
.186	308.	397.	4.4	1096.1	1096.1	.0
.259	249.	399.	4.4	1097.7	1097.7	.0
.386	198.	312.	5.6	1104.0	1103.7	.3
.485	248.	579.	3.0	1105.8	1105.2	.6
.581	150.	614.	2.9	1106.3	1105.7	.6
.696	243.	308.	5.7	1108.6	1108.6	.0
.791	160.	452.	3.9	1110.2	1110.1	.1
683.000	200.	330.	5.4	1112.2	1112.0	.2
798.000	205.	350.	5.0	1113.4	1113.2	.2
931.000	175.	777.	2.3	1114.1	1113.7	.4
1207.000	123.	749.	2.4	1114.2	1113.8	.4

1403.000	120.	729.	2.4	1114.2	1113.9	.3
1543.000	123.	748.	2.4	1114.3	1113.9	.4
1859.000	122.	755.	2.3	1114.3	1113.9	.4
2053.000	123.	745.	2.4	1114.4	1113.9	.5
2188.000	120.	645.	2.7	1114.4	1113.9	.5
2270.000	112.	505.	3.5	1114.4	1113.9	.5
2378.000	200.	718.	2.5	1115.0	1115.0	.0
2402.000	129.	739.	2.4	1115.0	1115.0	.0
2403.000	129.	724.	2.4	1115.0	1115.0	.0
2445.000	129.	707.	2.5	1115.0	1115.0	.0
2533.000	115.	678.	2.6	1115.0	1115.0	.0
2624.000	113.	662.	2.7	1115.0	1115.0	.0
2831.000	110.	548.	3.2	1115.1	1115.1	.0
3044.000	104.	495.	3.6	1115.2	1115.2	.0
3237.000	88.	388.	3.2	1115.4	1115.4	.0
3463.000	84.	367.	3.4	1115.6	1115.6	.0
3598.000	80.	329.	3.8	1115.7	1115.7	.0
3836.000	67.	234.	5.4	1115.9	1115.9	.0
3962.000	75.	262.	4.8	1116.3	1116.3	.0
4226.000	76.	254.	4.9	1116.9	1116.9	.0
4361.000	77.	284.	4.4	1117.3	1117.3	.0
4482.000	43.	178.	7.1	1117.5	1117.5	.0
4545.000	43.	186.	6.8	1117.9	1117.9	.0
4644.000	83.	318.	4.0	1118.9	1118.9	.0
4918.000	87.	319.	3.9	1119.2	1119.2	.0
4924.000	86.	162.	7.8	1121.5	1121.5	.0
4986.000	67.	169.	7.5	1122.2	1122.2	.0
5164.000	82.	245.	5.1	1123.5	1123.5	.0

1

FLOODWAY DATA, LOWER EL MIRAGE WASH. FR
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
5440.000	86.	283.	4.4	1124.3	1124.3	.0
5641.000	87.	262.	4.8	1124.7	1124.7	.0
5833.000	86.	278.	4.5	1125.2	1125.2	.0
6024.000	87.	297.	4.2	1125.6	1125.6	.0
6315.000	84.	257.	4.9	1126.2	1126.2	.0
6500.000	66.	251.	5.0	1126.6	1126.6	.0
6503.000	63.	145.	8.6	1127.9	1127.9	.0
6506.000	66.	175.	7.2	1128.3	1128.3	.0
6781.000	85.	278.	4.5	1129.8	1129.8	.0
7008.000	93.	244.	5.2	1130.4	1130.4	.0
7200.000	94.	264.	4.8	1131.0	1131.0	.0
7397.000	92.	282.	4.5	1131.6	1131.6	.0

7580.700	89.	281.	4.5	1132.0	1132.0	.0
7750.000	94.	289.	4.4	1132.4	1132.4	.0
7942.000	171.	274.	4.6	1136.6	1136.6	.0
8014.000	369.	283.	3.0	1137.8	1137.8	.0
8274.000	109.	132.	6.4	1139.4	1139.4	.0
8504.000	339.	231.	3.7	1141.1	1141.1	.0
8769.000	973.	534.	1.6	1142.3	1142.3	.0
9269.000	1035.	549.	1.5	1143.5	1143.5	.0
9774.000	979.	429.	2.0	1145.4	1145.4	.0
10109.000	1019.	480.	1.8	1147.1	1147.1	.0
10279.000	497.	220.	3.8	1148.4	1148.4	.0

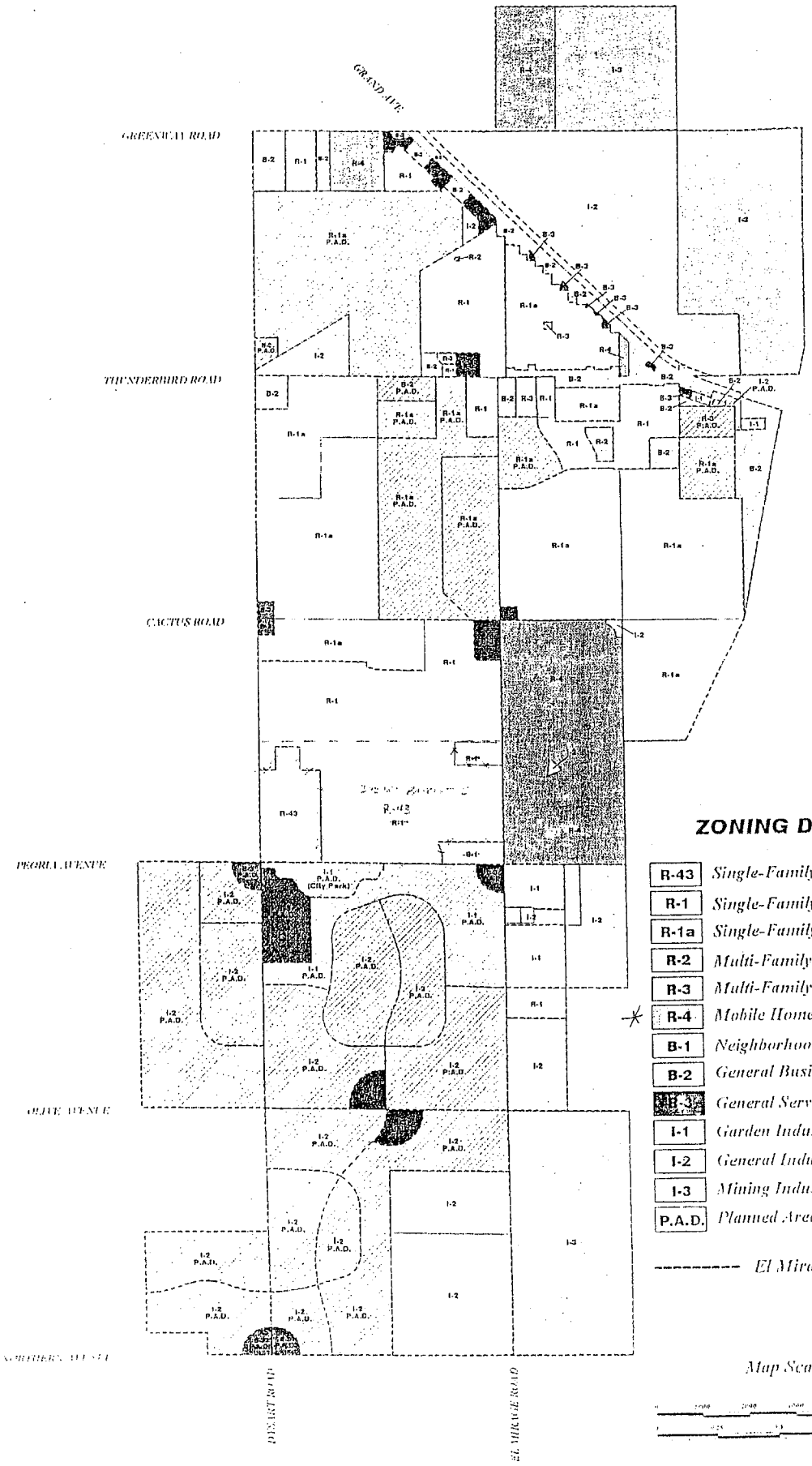
APPENDIX F

City of El Mirage Existing and Future Zoning/Land Use and
Pueblo El Mirage North Preliminary Plat

EXISTING

Zoning Map of El Mirage, Arizona

— NOT OFFICIAL —



N
W E
S

April 14, 2003

DRAFT COPY

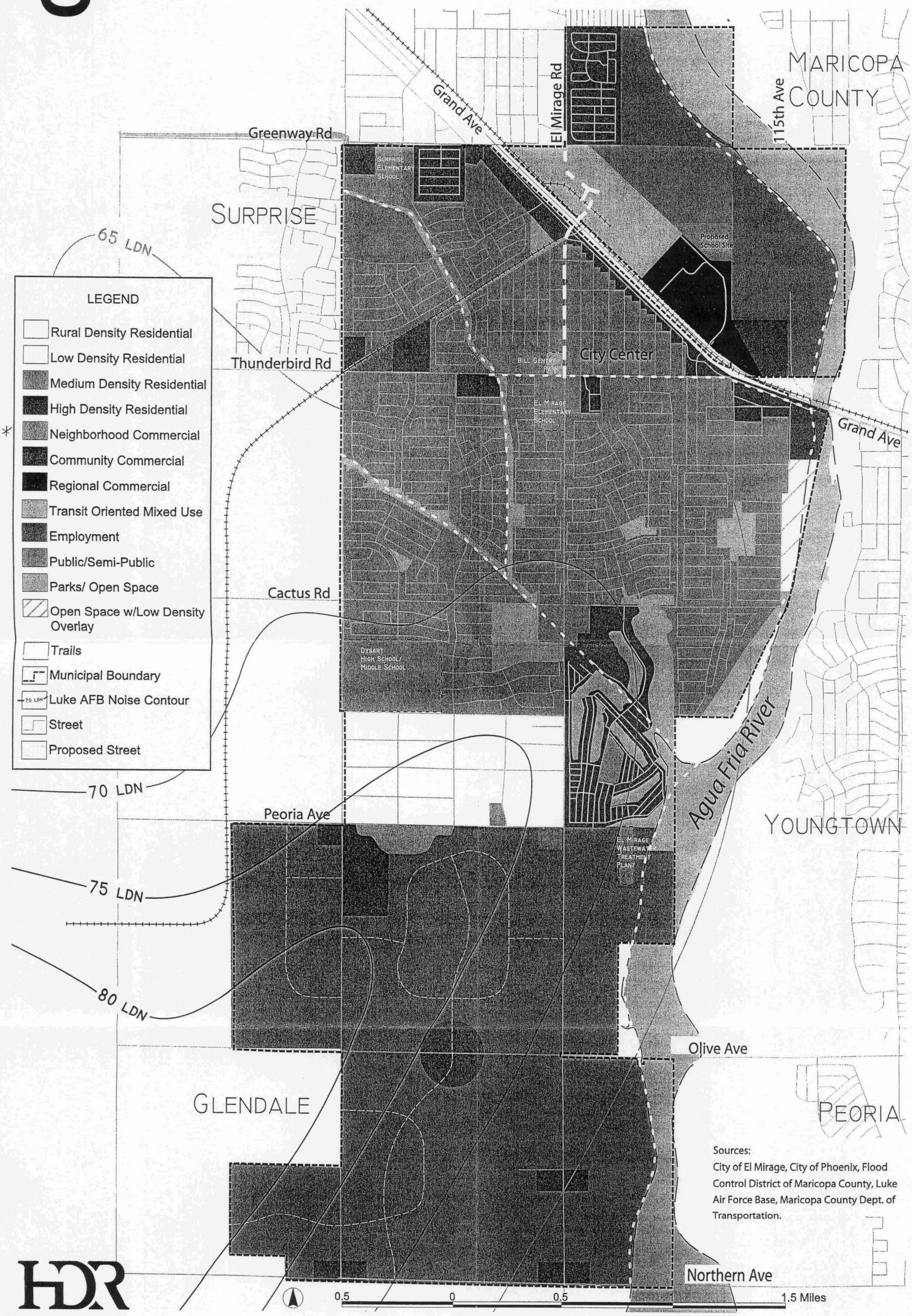
ZONING DISTRICTS

R-43	*Single-Family Residential (R-43)*
R-1	*Single-Family Residential Zone (R-1)*
R-1a	*Single-Family Residential Zone (R-1a)*
R-2	*Multi-Family Residential Zone (R-2)*
R-3	*Multi-Family Residential Zone (R-3)*
R-4	*Mobile Home Residential Zone (R-4)*
B-1	*Neighborhood Business Zone (B-1)*
B-2	*General Business Zone (B-2)*
B-3	*General Services Zone (B-3)*
I-1	*Garden Industrial Zone (I-1)*
I-2	*General Industrial Zone (I-2)*
I-3	*Mining Industrial Zone (I-3)*
P.A.D.	*Planned Area Development Zone (P.A.D.)*

---------- *El Mirage City Limits*

Map Scale: 1" = 1000'

City of El Mirage Land Use Map



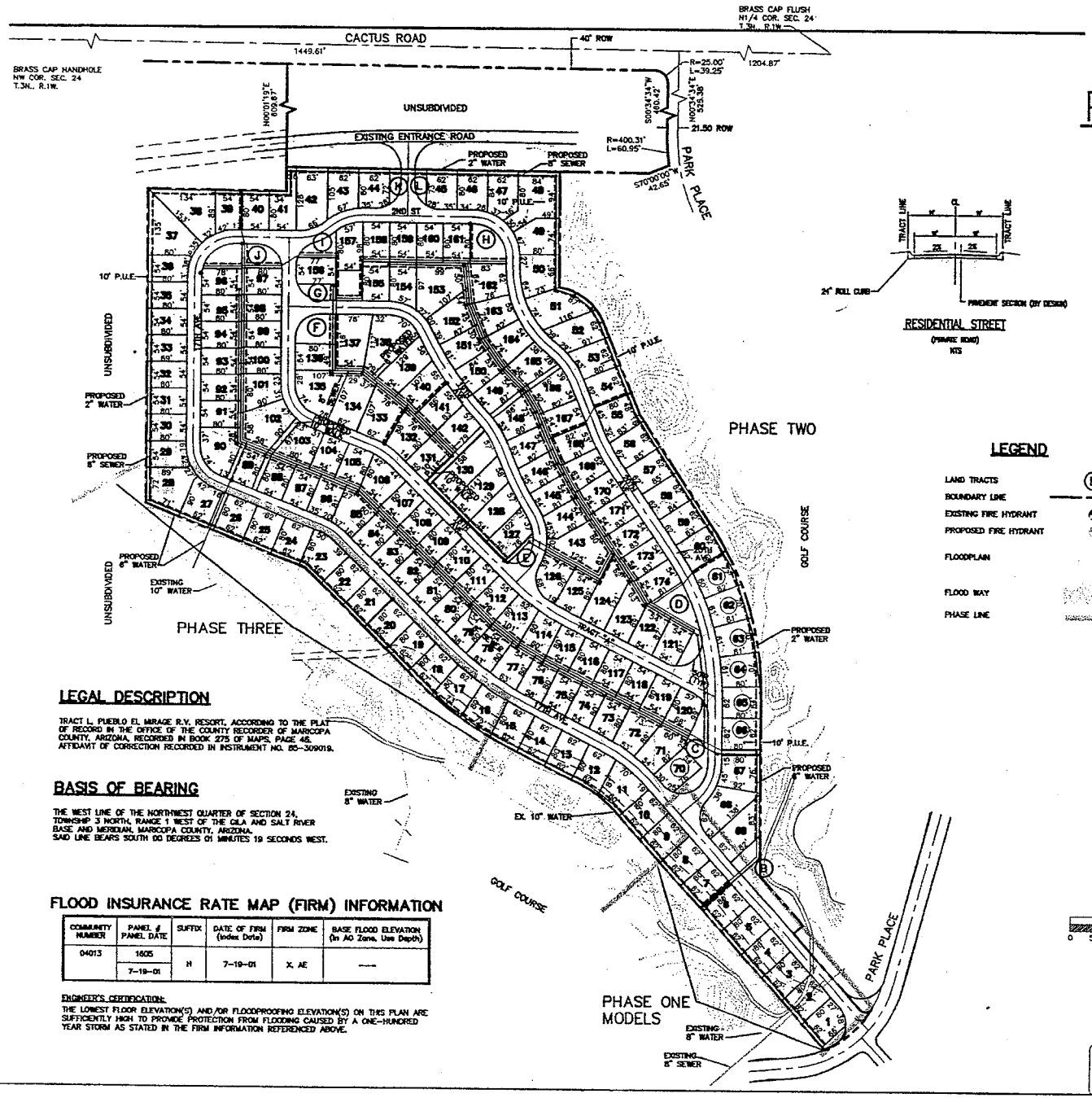
HDR

ADOPTED BY THE EL MIRAGE CITY COUNCIL ON DECEMBER 18, 2003

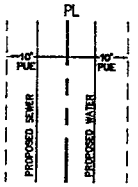
LAND USE MAP

PRELIMINARY PLAT FOR PUEBLO EL MIRAGE NORTH

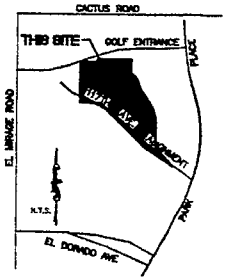
A PORTION OF THE NORTHWEST QUARTER OF SECTION 24 T.3N., R.1W. G&S.R.B.&M.



RESIDENTIAL STREET
(PRIVATE ROAD)
NTS



TYPICAL REAR YARD EASEMENT
NTS



N.T.S.
VICINITY MAP

LEGEND

LAND TRACTS	(D)
BOUNDARY LINE	
EXISTING FIRE HYDRANT	
PROPOSED FIRE HYDRANT	
FLOODPLAIN	
FLOOD WAY	
PHASE LINE	

ENGINEER

SKG ENTERPRISES INC.
ATTN.: JIM ROBERTSON
9260 EAST RAINTREE DRIVE
SUITE 140
SCOTTSDALE, AZ. 85260
(480) 996-5600

OWNER/DEVELOPER

NCR DEVELOPMENT
11201 N. EL MIRAGE ROAD
EL MIRAGE, ARIZONA 85335
PHONE: (623) 583-0484
CONTACT: CHUCK BUTTRUM

HYDROLOGY

SKG ENTERPRISES INC.
ATTN.: SHAKIR GUSHGARI
9260 EAST RAINTREE DRIVE
SUITE 140
SCOTTSDALE, AZ. 85260
(480) 996-5600

BENCHMARK

A BRASS CAP IN A HANDHOLE AT THE INTERSECTION OF PEORIA AVENUE AND EL MIRAGE ROAD.

ELEVATION 1105.83

SITE DATA

GROSS AREA: 26.218 Acres
NET AREA: 22.105 Acres

NUMBER OF LOTS: 174

ZONING: CURRENT R-4
PROPOSED PAD

SETBACKS: F 15'
S 5'
R-GOLFCOURSE 5'
OTHERS 10'

NOTE:

ALL PROPOSED STREETS = TRACT "A"
TRACTS: "B" THRU "K" ARE DEDICATED AS PUE'S AND DRAINAGE EASEMENT

TRACTS: "L" AND "K" ARE DEDICATED AS DRAINAGE EASEMENTS

PHASE I LOTS 1-8
PHASE II LOTS 11-15, 29-174
PHASE III LOTS 16-28

LEGAL DESCRIPTION

TRACT L, PUEBLO EL MIRAGE R.V. RESORT, ACCORDING TO THE PLAT OF RECORD IN THE OFFICE OF THE COUNTY RECORDER OF MARICOPA COUNTY, ARIZONA, RECORDED IN BOOK 275 OF MAPS, PAGE 45. AFFIDAVIT OF CORRECTION RECORDED IN INSTRUMENT NO. 85-309019.

BASIS OF BEARING

THE WEST LINE OF THE NORTHWEST QUARTER OF SECTION 24, TOWNSHIP 3 NORTH, RANGE 1 WEST OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA.
SAID LINE BEARS SOUTH 00 DEGREES 01 MINUTES 19 SECONDS WEST.

FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

COMMUNITY NUMBER	PANEL # / PANEL DATE	SUFFIX	DATE OF FIRM (Index Date)	FIRM ZONE	BASE FLOOD ELEVATION (In AO Zone, Use Depth)
04013	1605	H	7-19-01	X, AE	—
	7-19-01				

ENGINEER'S CERTIFICATION:
THE LOWEST FLOOR ELEVATION(S) AND/OR FLOODPROOFING ELEVATION(S) ON THIS PLAN ARE SUFFICIENTLY HIGH TO PROVIDE PROTECTION FROM FLOODING CAUSED BY A ONE-HUNDRED YEAR STORM AS STATED IN THE FIRM INFORMATION REFERENCED ABOVE.

0 50' 100' 200' 300'
1" = 100' HORIZ.

DATE	REVISION	BY

SKG ENTERPRISES, INC.
CONSULTING CIVIL ENGINEERS
9260 E. Raintree Drive • Suite 140 • Scottsdale, Az. • 85260 • (480) 996-5600

CALL FOR THE BLUE STAKES
602-263-1100
1-800-STAKE-IT
OUTSIDE MARICOPA COUNTY

DSN: JIM
CKD: JIM
SCALE
HORIZ: 1"=100'
VERT: N/A

PUEBLO EL MIRAGE NORTH
PRELIMINARY PLAT

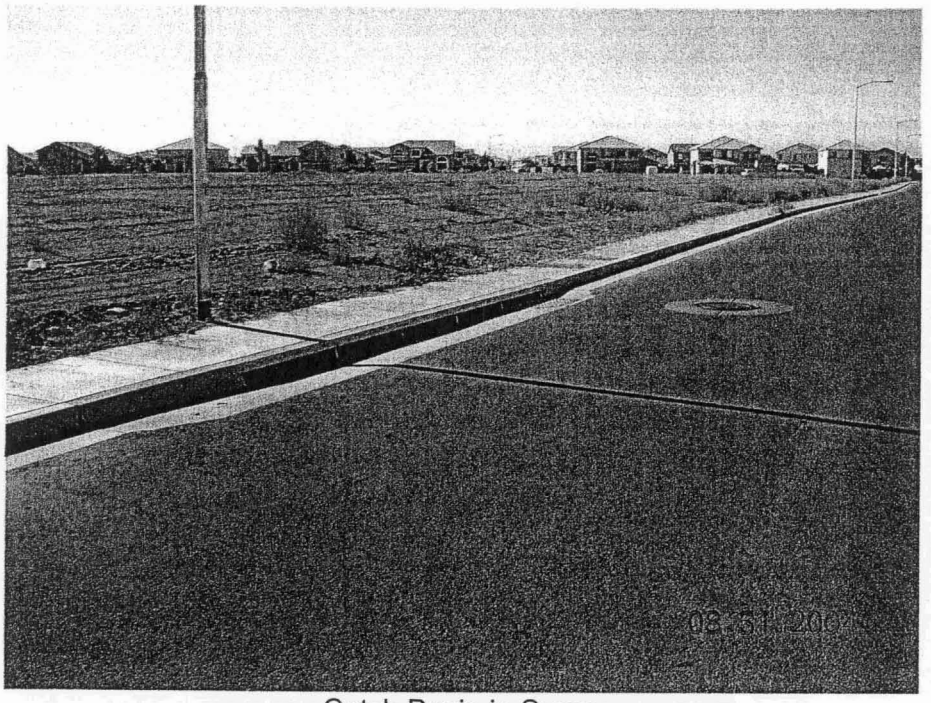
JOB# 127-1
SHEET 1 of 1

Pueblo El Mirage North Preliminary Plat

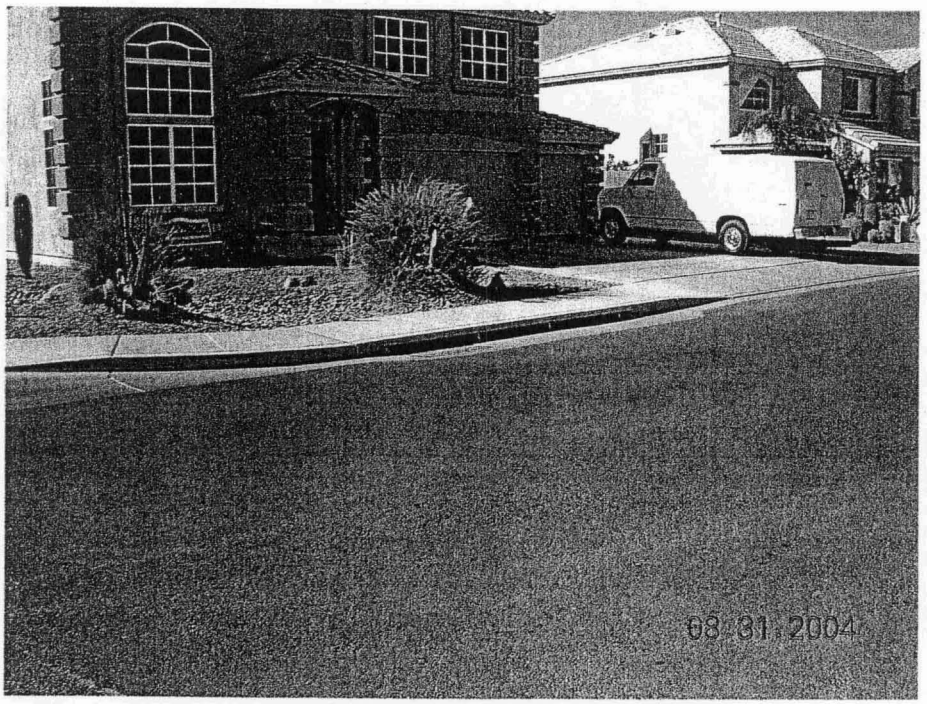
West Cactus Detention Basin and Channels Project
Preliminary Candidate Assessment Report

APPENDIX G

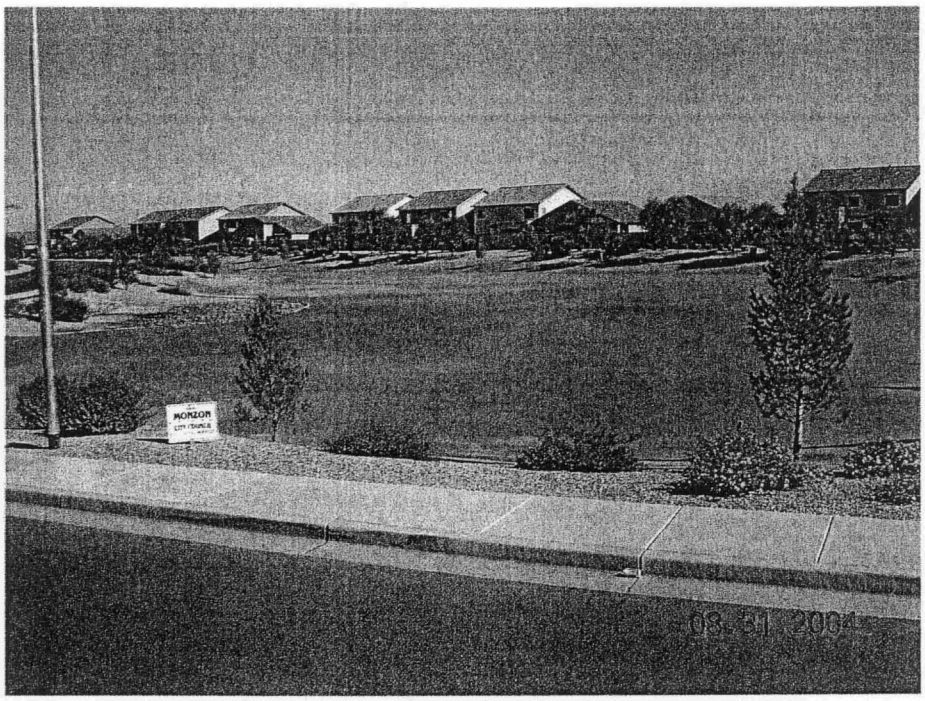
Representative Photographs of Existing Drainage Facilities



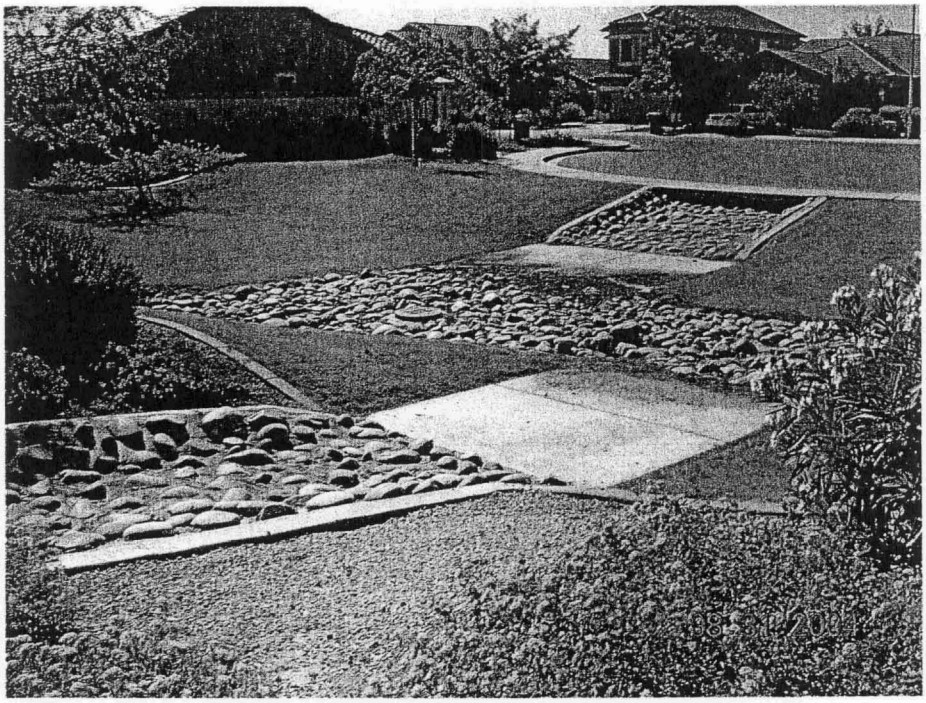
Catch Basin in Sump
125th Avenue, Immediately South of Cherry Hills Drive



Catch Basin in Sump
Canterbury Drive, Immediately West of 125th Avenue

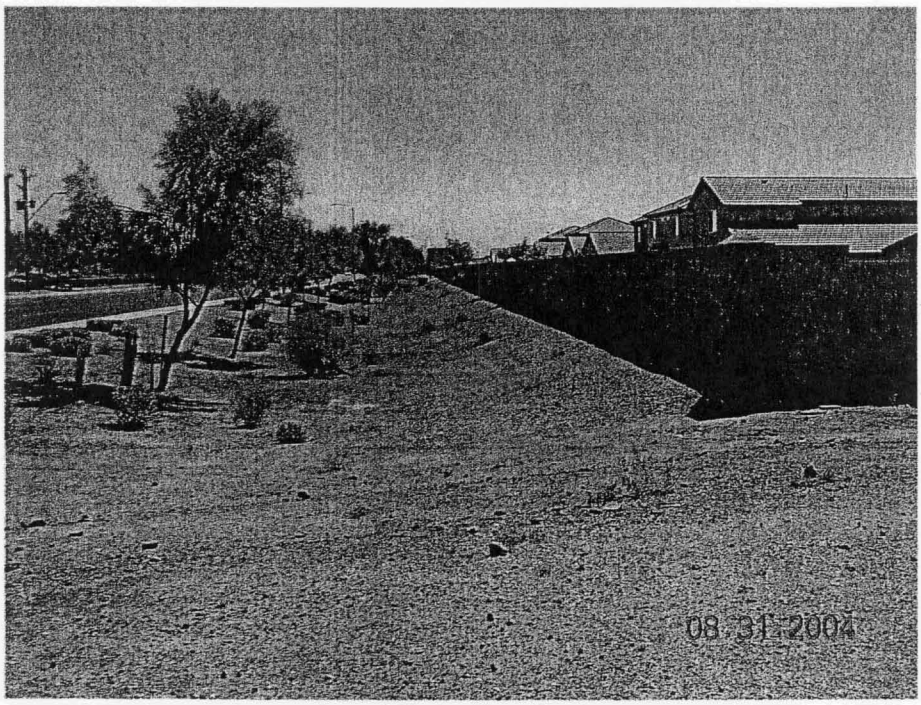


Local Retention Basin
Located North of Columbine Drive, Between 128th Drive and 129th Avenue



Local Retention Basin
Located at the Southeast Corner of Dysart Road and Parque Del Sol Boulevard

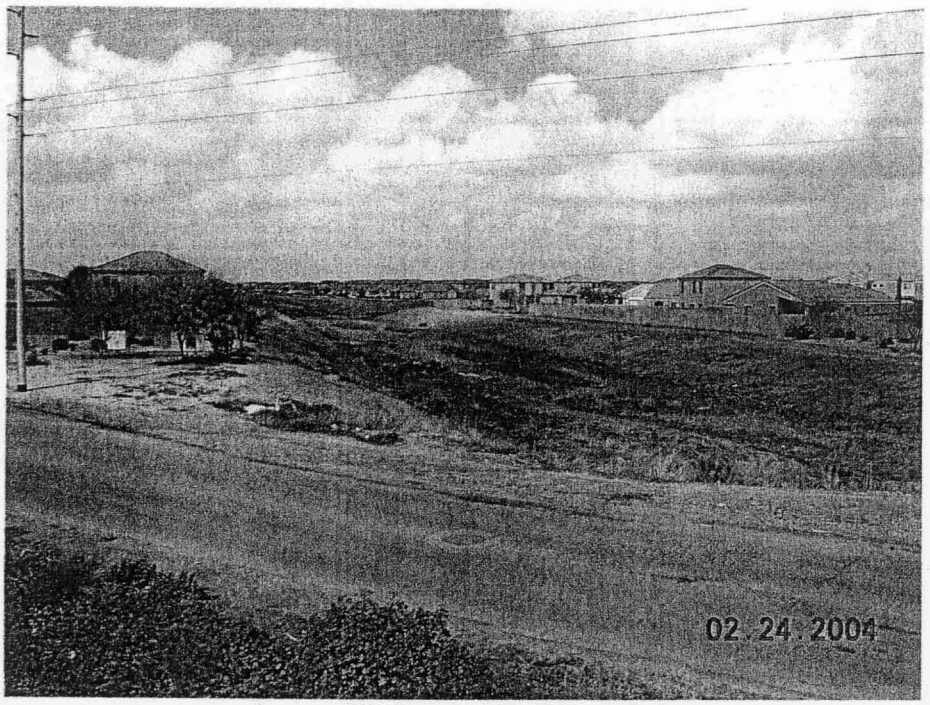
Local Retention Basin
Located at the Southwest Corner of 127th Avenue and Ash Street



Local Retention Basin
Located Between Lower El Mirage Wash Tributary and Elementary School
South Side of Thunderbird Road

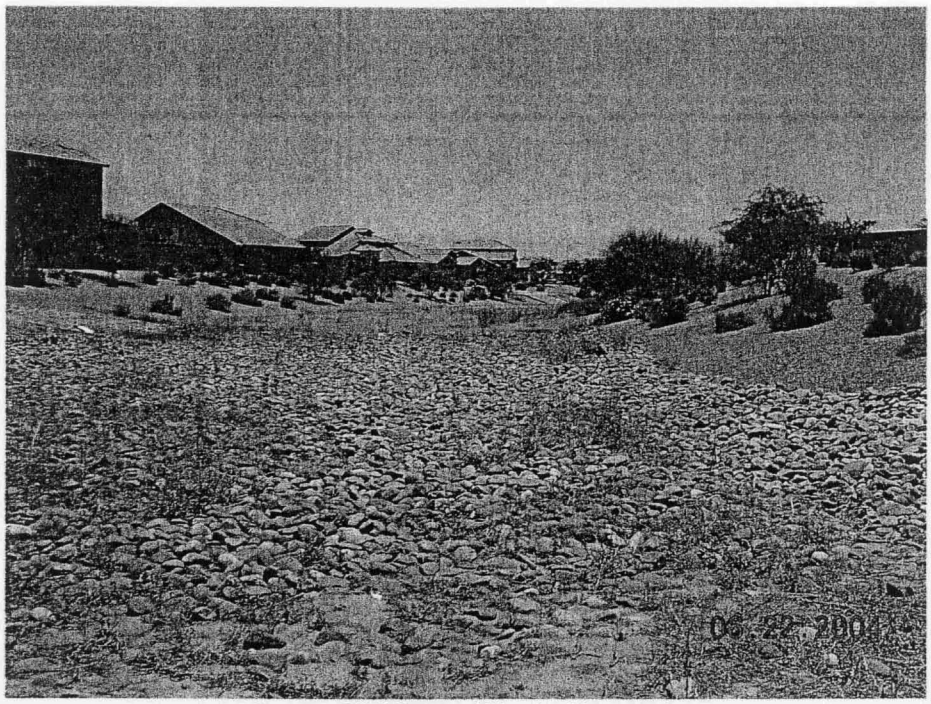
Lower El Mirage Wash Channel
Reach Through Basin Parcel, Immediately South of Cactus Road
View to the South from Cactus Road Dip Section

Outlet of Triple Barrel, 24-Inch Diameter Pipes
Located at the Cactus Road Dip Section
Lower El Mirage Wash Culvert Crossing

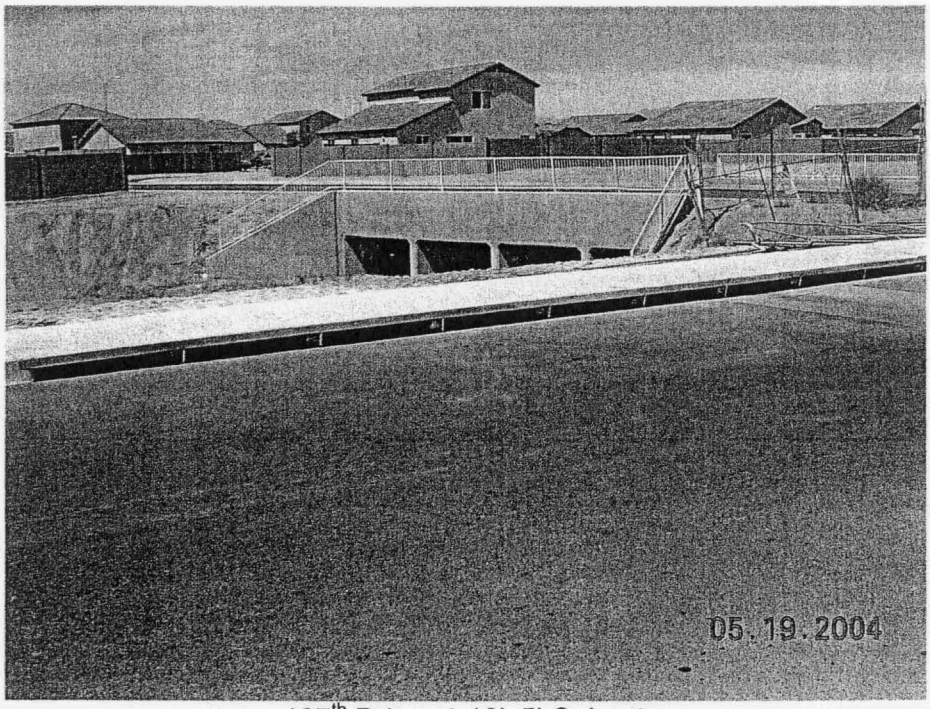


Lower El Mirage Wash Channel
Upstream View from Cactus Road Dip Section

Lower El Mirage Wash Channel
Upstream View, Below the 129th Avenue Culvert

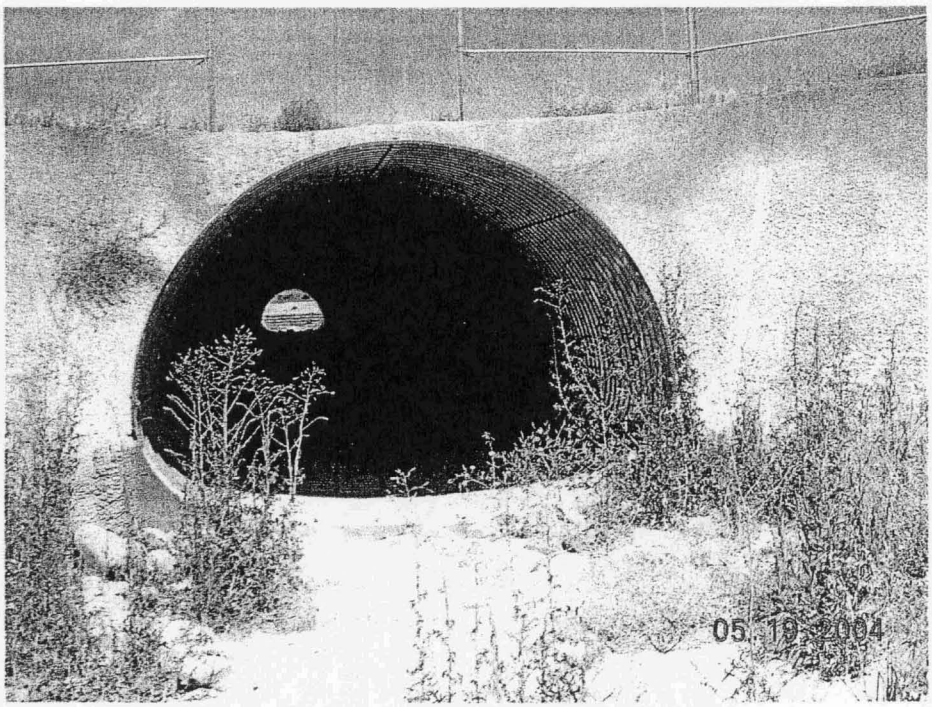


Lower El Mirage Wash Channel
Downstream View, Immediately Below Dysart Road

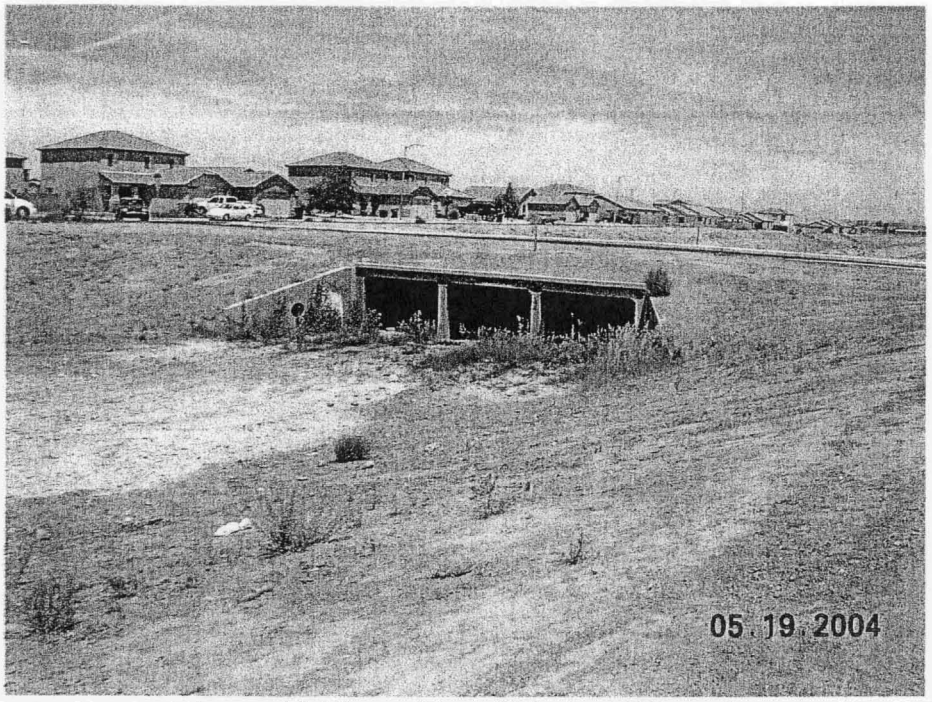


127th Drive, 4-10'x5' Culvert
and Scuppers Outfalling to Lower El Mirage Wash Channel

Lower El Mirage Wash Tributary Channel
Upstream Side of 2-9'x9' Culvert Under AT & SF Railroad

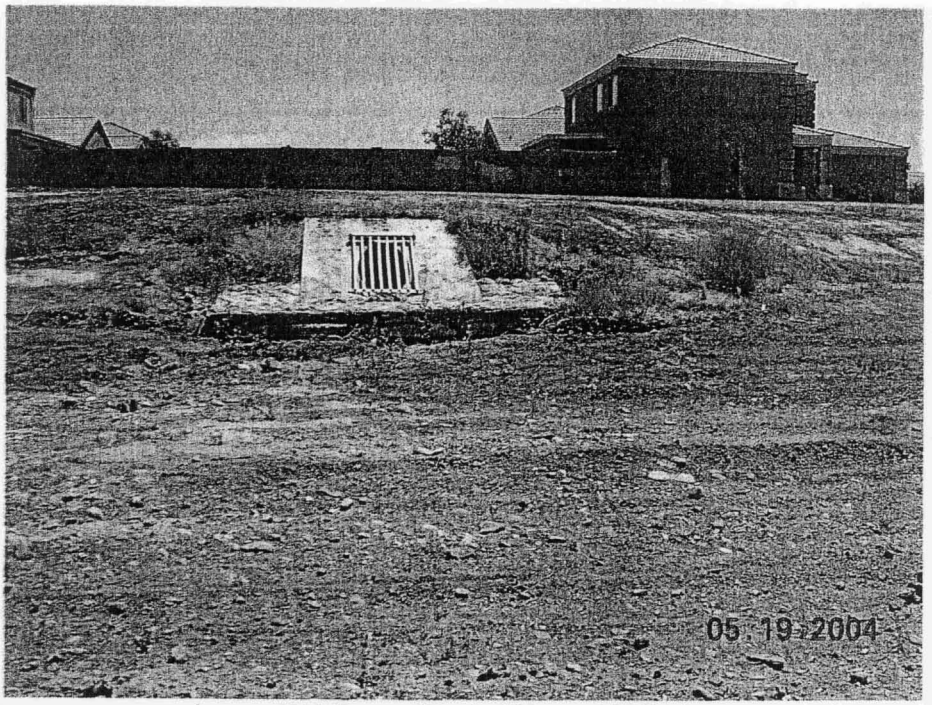


Lower El Mirage Wash Tributary Channel
Outlet of 1-14.5'x10' Structural Plate Pipe Arch
Under Thunderbird Road



Lower El Mirage Wash Tributary Channel
Outlet End of 3-10'x6' Culvert Located at Myer Lane

Lower El Mirage Wash Channel
Inlet End of 2-10'x3' Culvert Located at El Mirage Road



Lower El Mirage Wash Channel Tributary
Local Inflow Point
Approximate Location Between Myer Lane and Thunderbird Road

Lower El Mirage Wash Channel Tributary
Downstream View from Dysart Road

APPENDIX H

Lower El Mirage Wash Channel
Lower Reach (Through Pueblo El Mirage Golf Course)
Normal Depth Calculations and Photographs

Golf Course Lower Reach, Below Drop and Above Cart Path Bridge
Worksheet for Irregular Channel

Project Description	
Worksheet	Golf Course Lower Reach, Below Drop and Above Gol
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data	
Channel Slope	.002000 ft/ft
Water Surface Elev	1,104.00 ft

Q = 408 cfs @
WSEL = 1,104 ft

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.029	
Elevation Range	0.10 to 1,104.50	
Discharge	408.14	cfs
Flow Area	120.4	ft²
Wetted Perimeter	67.02	ft
Top Width	66.30	ft
Actual Depth	3.90	ft
Critical Elevation	1,102.96	ft
Critical Slope	0.011280	ft/ft
Velocity	3.39	ft/s
Velocity Head	0.18	ft
Specific Energy	1,104.18	ft
Froude Number	0.44	
Flow Type	Subcritical	

Lower El Mirage Wash Reach With Least Conveyance Capacity. Reach is Located Below Drop Structure and Above Golf Cart Path Bridge. Reach is Adjacent to Softball Field.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+26.30	0.030
0+26.30	0+40.00	0.025
0+40.00	0+71.00	0.030

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	1,104.00
0+26.30	1,101.30
0+28.70	1,100.30
0+33.30	1,100.10
0+38.00	1,100.30
0+40.00	1,101.30
0+66.30	1,104.00
0+71.00	1,104.50

1/3

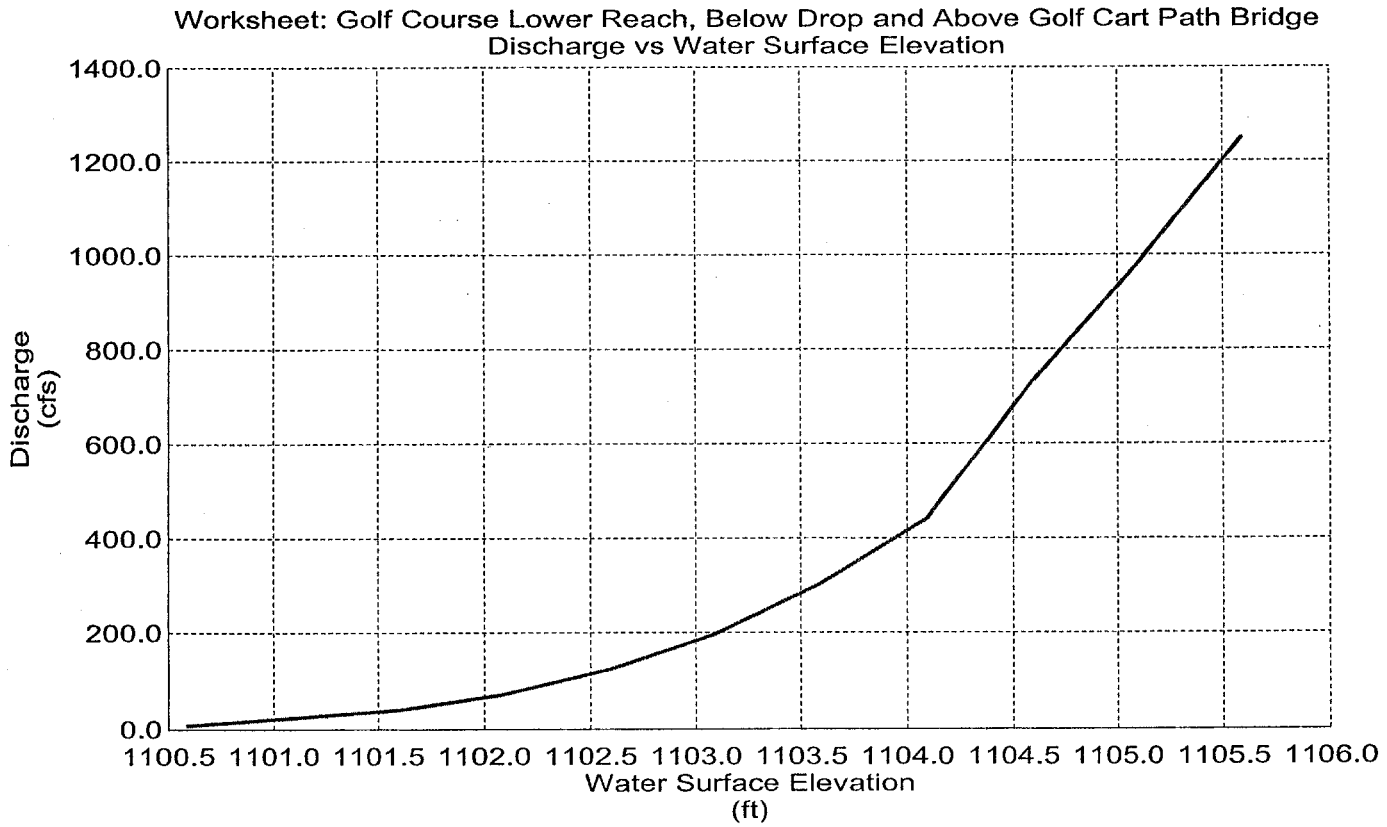
Curve
Plotted Curves for Irregular Channel

Project Description	
Worksheet	Golf Course Lower Reach, Below Drop and Above Gol
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

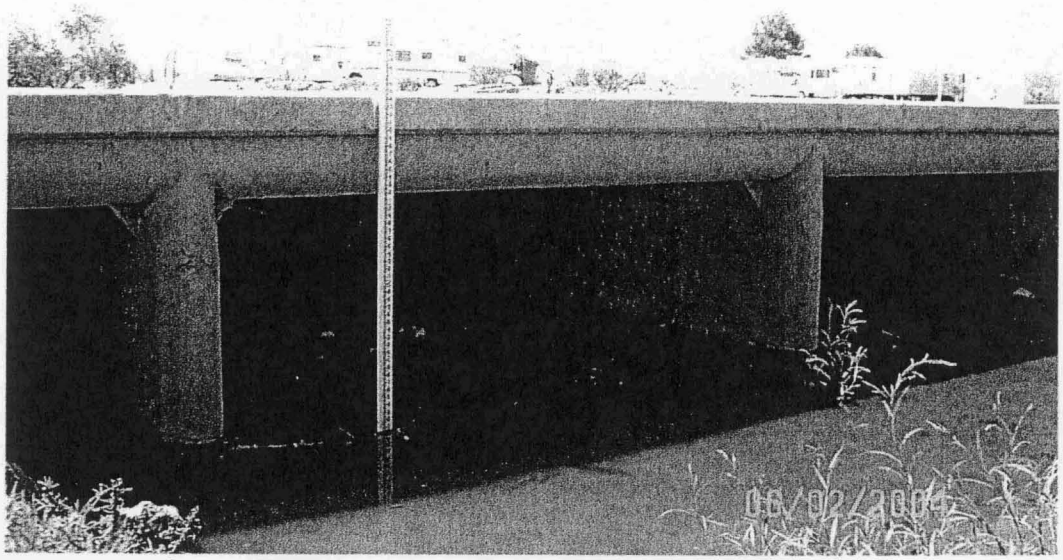
Input Data	
Channel Sl	002000 ft/ft

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

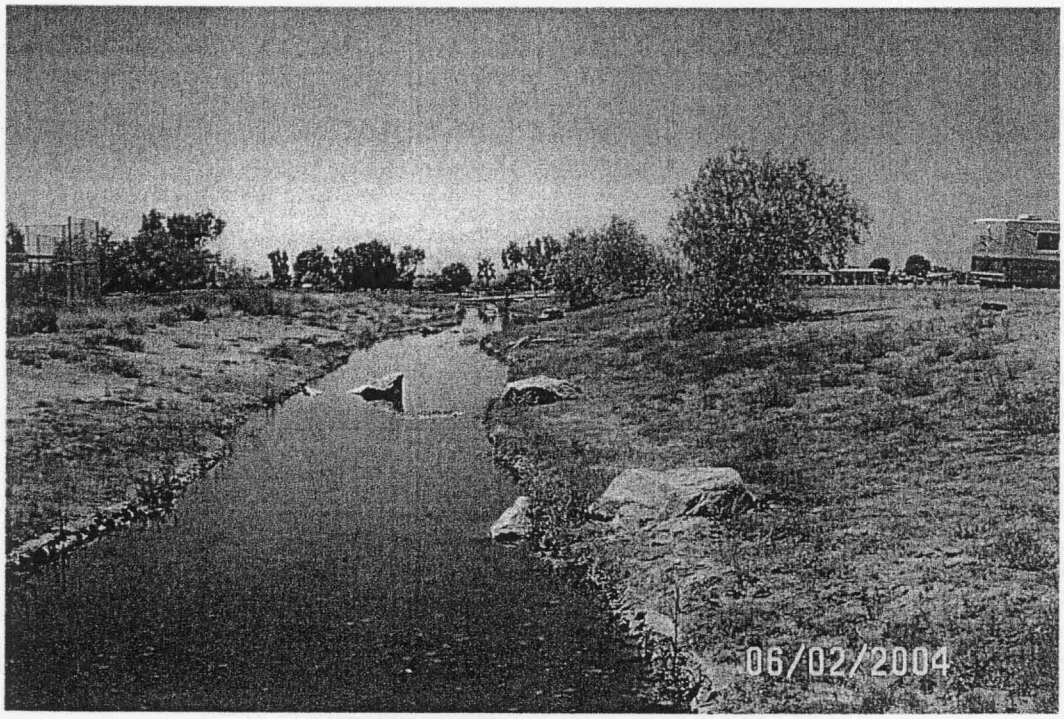
Attribute	Minimum	Maximum	Increment
Water Surface Elevat	1,100.10	1,105.60	0.50



2/3



Lower El Mirage Wash, 4-10'x3' Culvert (Upstream End)
Located at Park Place, Within the Pueblo El Mirage Property



Lower El Mirage Wash, Downstream View
Downstream of Park Place Culvert, Adjacent to Softball Field

Lower El Mirage Wash Reach With
Least Conveyance Capacity
Approx 400 cfs @ Top-of-Bank

APPENDIX I

As-Built LOMR Exhibits for the Lower El Mirage Wash and Lower El Mirage Wash Tributary Channelization

AS-BUILT L.O.M.R. EXHIBIT FOR THE LOWER EL MIRAGE WASH CHANNELIZATION
A PORTION OF THE EL MIRAGE MASTER DRAINAGE PLAN

SECTIONS 14 AND 23, T3N, R1W, OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA

GENERAL NOTES:

ALL WORK AND MATERIALS SHALL CONFORM TO THE CURRENT MAG UNIFORM STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC WORKS CONSTRUCTION AS AMENDED BY THE SPECIAL PROVISIONS.

THE CONTRACTOR IS TO OBTAIN ANY PERMITS REQUIRED UNLESS OTHERWISE NOTED.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION, PROTECTION AND REPAIR OF ALL UTILITIES, EXISTING AND PROPOSED DURING CONSTRUCTION. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR THE LOCATION OF THE EXISTING UNDERGROUND UTILITIES. THE UTILITIES SHOWN ON PLANS HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. TWO DAYS PRIOR TO EXCAVATION, THE CONTRACTOR SHALL CONTACT THE "BLUE STAKE CENTER" AT 263-1100 FOR THE LOCATION AND IDENTIFICATION OF UNDERGROUND UTILITIES.

THE TEMPORARY REMOVAL, BARRICADING, DE-ENERGIZATION OR SHUT-OFF OF APS AND/OR SOUTHWEST GAS LINES OR EQUIPMENT SHALL BE PERFORMED BY APS AND/OR SOUTHWEST GAS AS REQUIRED BY APS AND/OR SOUTHWEST GAS AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL INCLUDE AN AMOUNT FOR THE WORK DONE BY APS AND/OR SOUTHWEST GAS IN HIS OR HER BID FOR THIS PROJECT.

THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ADEQUATE DRAINAGE AND EROSION PROTECTION OF THE CONSTRUCTION AREA.

ALL SURROUNDING AREAS SHALL BE RESTORED TO MATCH THE EXISTING CONDITIONS PRIOR TO CONSTRUCTION, UNLESS NOTED OTHERWISE ON PLANS.

ANY WORK PERFORMED WITHOUT THE APPROVAL OF THE OWNER AND ALL WORK NOT IN CONFORMANCE WITH MAG SPECIFICATIONS AND DETAILS OR THE PROJECT PLANS OR SPECIFICATIONS IS SUBJECT TO REMOVAL AND REPLACEMENT AT THE CONTRACTOR'S EXPENSE.

ALL THE CONTRACTOR'S WORK SHALL BE SUBJECTED TO TESTING AS OUTLINED IN MAG AND AS REQUIRED BY THE ENGINEER.

ALL ELEVATIONS ARE BASED ON THE BRASS CAP LOCATED AT THE INTERSECTION OF EL MIRAGE ROAD AND CACTUS ROAD, ELEVATION=1116.93 PER COUNTY DATUM.*

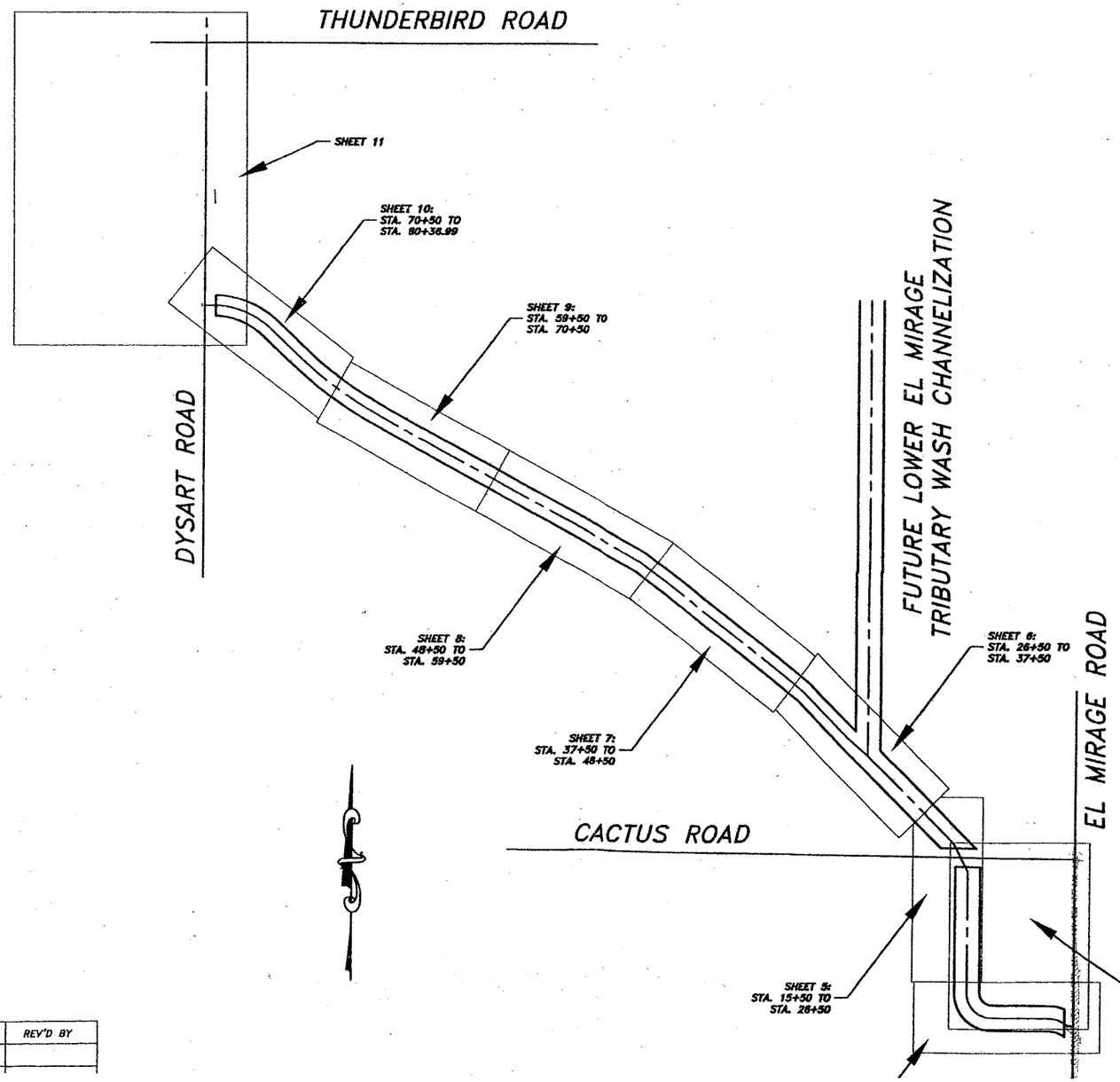
BASIS OF BEARINGS: THE CENTERLINE OF EL MIRAGE ROAD BETWEEN YARNEY RD. AND CACTUS RD., SAID LINE BEARS N00°02'33"E.

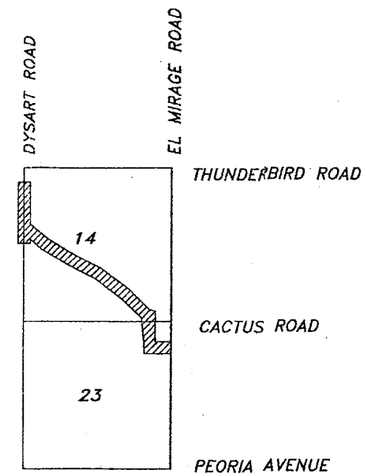
* COUNTY DATUM = FEMADATUM = NVGD (1929)

NOTE:

THE ELEVATIONS SHOWN ON THIS PLAN ARE BASED ON THE COUNTY DATUM. ALL CONSTRUCTION WITHIN THE CITY OF EL MIRAGE MUST BE DONE WITH PLANS USING THE EL MIRAGE DATUM.* THESE PLANS ARE TO BE USED AS A L.O.M.R. EXHIBIT AND SHOULD NOT BE USED FOR CONSTRUCTION.

UTILITY	CONTACT	DATE SUB.	RESPONSE	REV'D BY
APS ELECTRIC	BOB GARZA			





VICINITY MAP

FLOOD CONTROL DISTRICT
RECEIVED
MAY 10 '04
LANDS
O & M
P & PM
FILE

INDEX OF SHEETS:

SHEET NO.	SHEET TYPE
1	COVER
2 – 3	TYPICAL CHANNEL SECTIONS
4 – 10	PLANS & PROFILES
11	GRADING PLAN FOR AREA AT THE CORNER OF EL MIRAGE RD. AND CACTUS RD.
12	PLAN VIEW OF FLOODPLAIN AT DYSART ROAD TO RAILROAD
13 –16	CHANNEL CROSS SECTIONS

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

NO.	DATE	DESCRIPTION	BY

Registered Professional Engineer (Civil) CERTIFICATE NO. 13923 LAWRENCE L. TYSINC Date Signed 7/27/04 ARIZONA U.S.A.

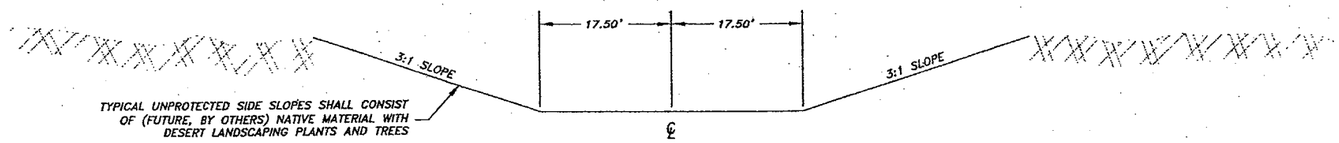
A-N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200
phoenix@anwestinc.com

PROJECT TITLE: EL MIRAGE MASTER DRAINAGE PLAN

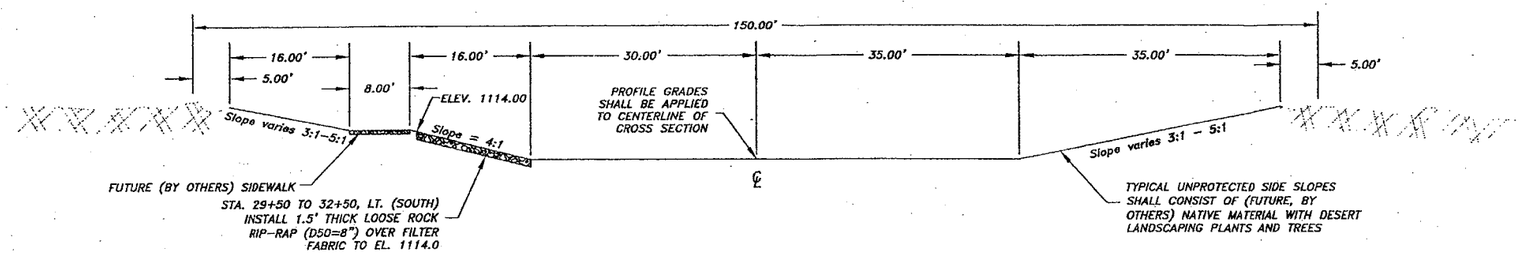
L.O.M.R. EXHIBIT – AS-BUILT CONSTRUCTION – AUG. 29, 2001

LOWER EL MIRAGE WASH CHANNELIZATION L.O.M.R.

7191-16	DESIGN	L.T.	SCALE N/A
7191B(SS)	DRAWN	WDR	H-0.5,Z N/A
8/29/2001	CHECK	L.T.	VERT. N/A



TYPICAL CHANNEL SECTION A
STA. 7+89.40 to 22+29.68

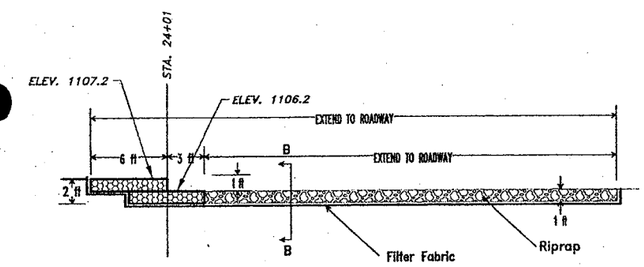


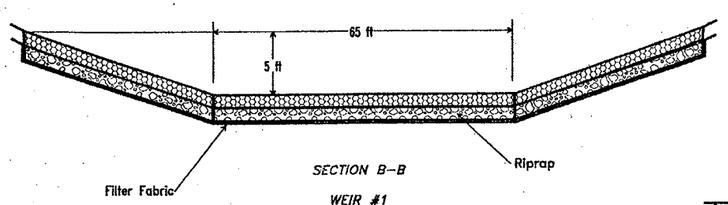
TYPICAL CHANNEL SECTION B
STA. 23+67.45 to 31+31.51

DESIGN GRADATION FOR SPECIFIED CLASSES OF RIPRAP

PERCENT PASSING	SIZE	D50 CLASS (IN)			
		6	8	12	18
100 TO 90	2.0 D50	12	16	24	36
85 TO 70	1.5 D50	9	12	18	27
50 TO 30	1.0 D50	6	8	12	18
15 TO 5	0.67 D50	4	5	8	12
5 TO 0	0.33 D50	2	3	4	6

NOTE: FILTER FABRIC UNDER RIPRAP PER ADOT SPEC. 1014–4.03, TYPICAL.

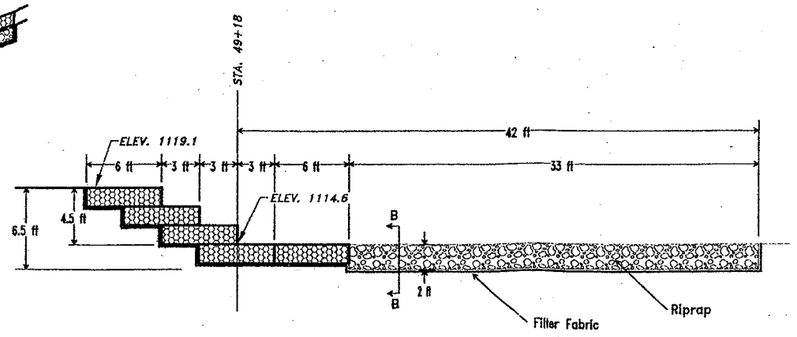


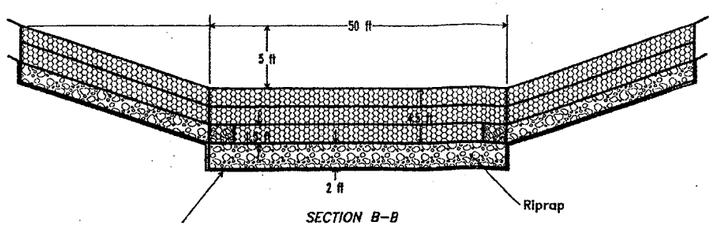


SECTION B–B

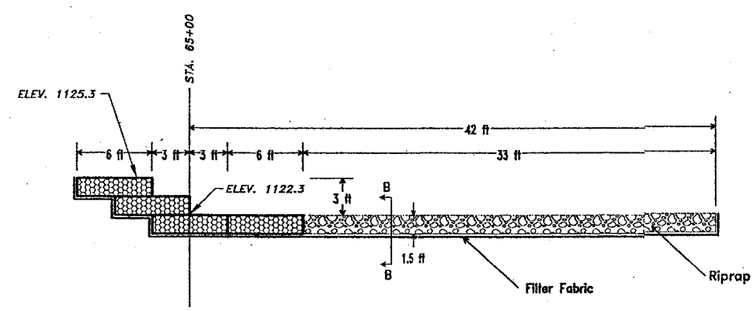
WEIR #1
STA 24+01

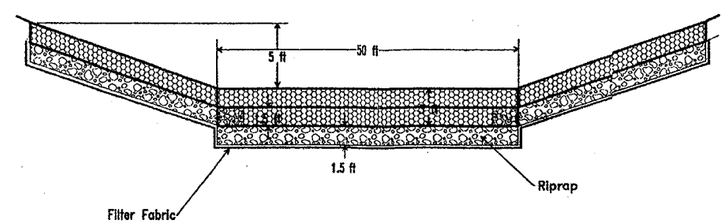
Not to Scale





SECTION B–B





SECTION B–B

WEIR #3
STA 65+00

Not to Scale

GENERAL GABION NOTES:

1. GABIONS: ASTM A 975–97.
2. FILTER FABRIC: MACTEX MX 275 OR APPROVED EQUAL.
3. ROCK: WEIR #1: 4 in. to 8 in., d^{50}=6 in.
   WEIR #2–3: 4 in. to 12 in., d^{50}=9 in.
4. RIPRAP: 4 in. to 12 in., d^{50}=9 in.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

NO.	DATE	DESCRIPTION	BY

Registered Professional Engineer (Civil)
CERTIFICATE NO. 13925
LAWRENCE L. TYSIAC
Date 8/29/01
ARIZONA U.S.A.

A·N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861–2200
phoenix@anwestinc.com

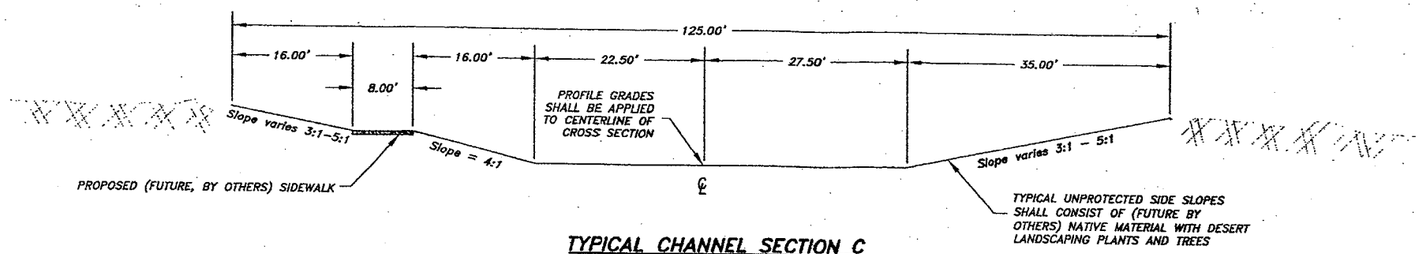
EL MIRAGE MASTER DRAINAGE PLAN

LOWER EL MIRAGE WASH CHANNELIZATION L.O.M.R.

7191–18	DESIGN	LLT	SCALE
911BTS01.DWG	DRAWN	WDR	HORIZ. N/A
5/25/00	CHECK	LLT	VERT. N/A

L.O.M.R. EXHIBIT – AS–BUILT CONSTRUCTION – AUG. 29. 2001

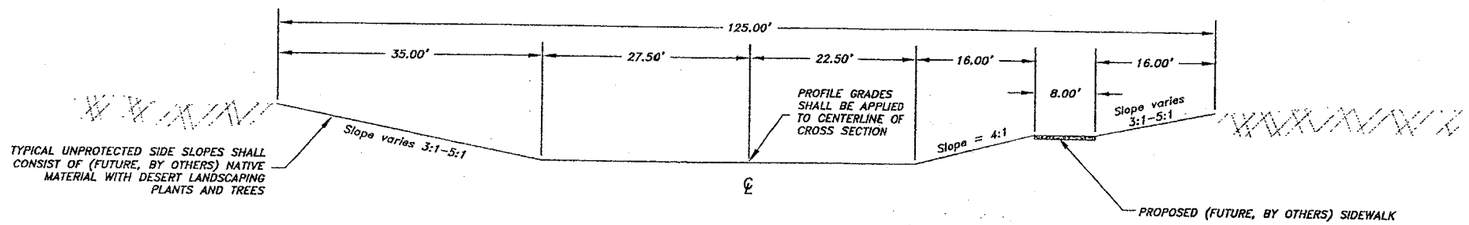
TRANSITION FROM CHANNEL SECTION B TO CHANNEL SECTION C
STA. 31+31.51 to 32+88.07, SEE SHEET 6



TYPICAL CHANNEL SECTION C
STA. 32+88.07 to 50+00.15
LOOKING UPSTREAM

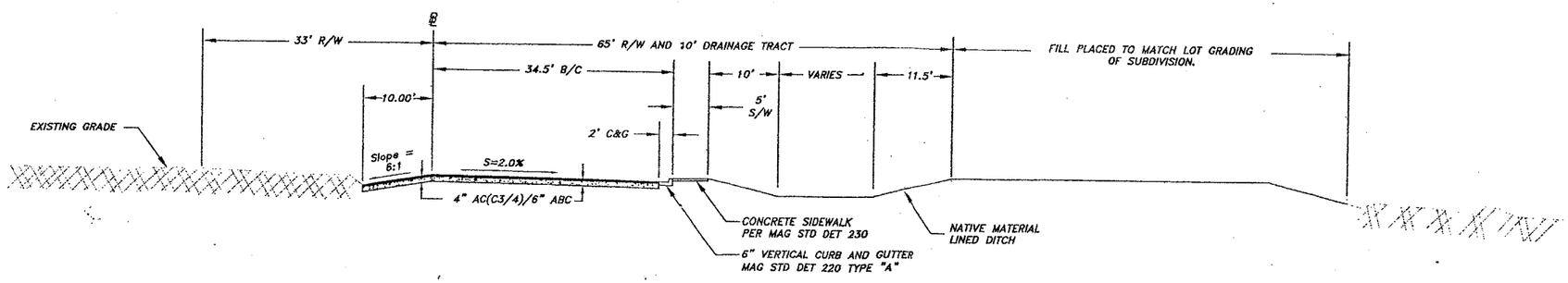
NOTE:
SIDE SLOPES SHALL BE GRADED AT 5:1 WHEN THE CHANNEL R.O.W. ALLOWS IT. OTHERWISE, THE R.O.W. SHALL BE HELD AS THE TOP OF SLOPE.

TRANSITION FROM CHANNEL SECTION C TO CHANNEL SECTION D
STA. 50+00.15 to 55+34.23, SEE SHEET 8



TYPICAL CHANNEL SECTION D
STA. 55+34.23 to 74+03.78
LOOKING UPSTREAM

TRANSITION FROM CHANNEL SECTION D TO DYSART RD. SECTION
STA. 74+03.78 TO DYSART RD. – SEE SHEETS 10 AND 11



TYPICAL DYSART ROAD SECTION
STA. 105+92.14 to 123+50

NO.	DATE	DESCRIPTION

Registered Professional Engineer (Civil) CERTIFICATE NO. 13925 LAWRENCE L. TRAN Date Signed 8/29/01 ARIZONA U.S.A.

A·N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200
phoenix@anwestinc.com

EL MIRAGE MASTER DRAINAGE PLAN

LOWER EL MIRAGE WASH CHANNELIZATION L.O.M.R.

JOB NO.	7191-18		
DWG. ID.	7191-18TS02.DWG	DESIGN	LLT
DATE	8/29/00	DRAWN	WDR
		CHECK	LLT
SCALE		HORIZ.	N/A
		VERT.	N/A

L.O.M.R. EXHIBIT – AS-BUILT CONSTRUCTION – AUG. 29, 2001

AS-BUILT L.O.M.R. EXHIBIT FOR THE LOWER EL MIRAGE WASH TRIBUTARY CHANNELIZATION
A PORTION OF THE EL MIRAGE MASTER DRAINAGE PLAN

SECTIONS 11 AND 14, T3N, R1W, OF THE GILA AND SALT RIVER BASE AND MERIDIAN, MARICOPA COUNTY, ARIZONA

GENERAL NOTES:

ALL WORK AND MATERIALS SHALL CONFORM TO THE CURRENT MAG UNIFORM STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC WORKS CONSTRUCTION AS AMENDED BY THE SPECIAL PROVISIONS.

THE CONTRACTOR IS TO OBTAIN ANY PERMITS REQUIRED UNLESS OTHERWISE NOTED.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION, PROTECTION AND REPAIR OF ALL UTILITIES, EXISTING AND PROPOSED DURING CONSTRUCTION. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR THE LOCATION OF THE EXISTING UNDERGROUND UTILITIES. THE UTILITIES SHOWN ON PLANS HAVE BEEN PLOTTED FROM THE BEST AVAILABLE INFORMATION. TWO DAYS PRIOR TO EXCAVATION, THE CONTRACTOR SHALL CONTACT THE "BLUE STAKE CENTER" AT 263-1100 FOR THE LOCATION AND VERIFICATION OF UNDERGROUND UTILITIES.

THE TEMPORARY REMOVAL, BARRICADING, DE-ENERGIZATION OR SHUT-OFF OF APS AND/OR SOUTHWEST GAS LINES OR EQUIPMENT SHALL BE PERFORMED BY APS AND/OR SOUTHWEST GAS AS REQUIRED BY APS AND/OR SOUTHWEST GAS AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL INCLUDE AN AMOUNT FOR THE WORK DONE BY APS AND/OR SOUTHWEST GAS IN HIS OR HER BID FOR THIS PROJECT.

THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ADEQUATE DRAINAGE AND EROSION PROTECTION TO THE CONSTRUCTION AREA.

ALL SURROUNDING AREAS SHALL BE RESTORED TO MATCH THE EXISTING CONDITIONS PRIOR TO CONSTRUCTION, UNLESS NOTED OTHERWISE ON PLANS.

ANY WORK PERFORMED WITHOUT THE APPROVAL OF THE OWNER AND ALL WORK NOT IN CONFORMANCE WITH MAG SPECIFICATIONS AND DETAILS OR THE PROJECT PLANS OR SPECIFICATIONS IS SUBJECT TO REMOVAL AND REPLACEMENT AT THE CONTRACTOR'S EXPENSE.

ALL THE CONTRACTOR'S WORK SHALL BE SUBJECTED TO TESTING AS OUTLINED IN MAG SPECIFICATIONS OR AS DIRECTED BY THE ENGINEER.

ALL ELEVATIONS ARE BASED ON THE BRASS CAP IN H.H. LOCATED AT THE INTERSECTION OF THUNDERBIRD ROAD AND EL MIRAGE ROAD, ELEVATION=1135.52 PER COUNTY DATUM.*

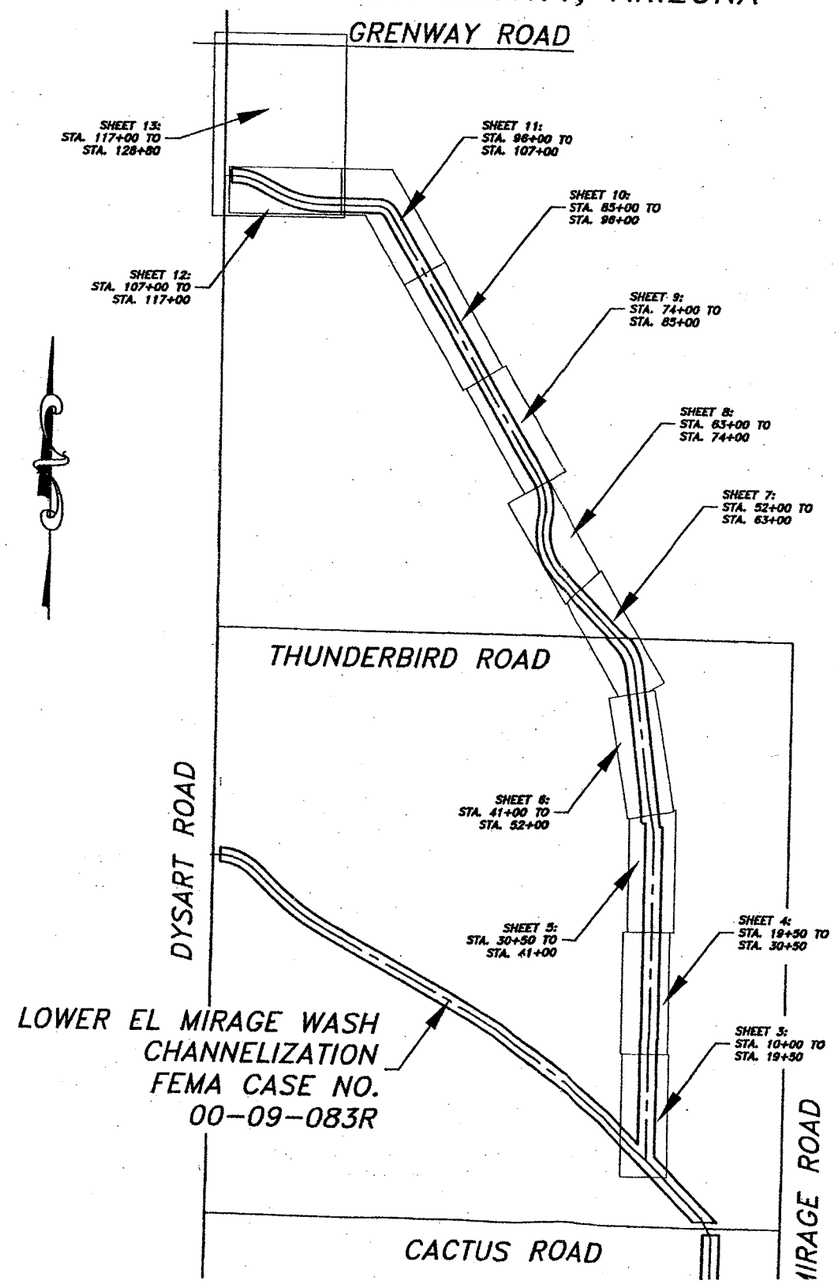
[illegible] ALONG THE NORTH LINE OF THE NE 1/4 OF SECTION 14, T3N, R1W, SAID [illegible]

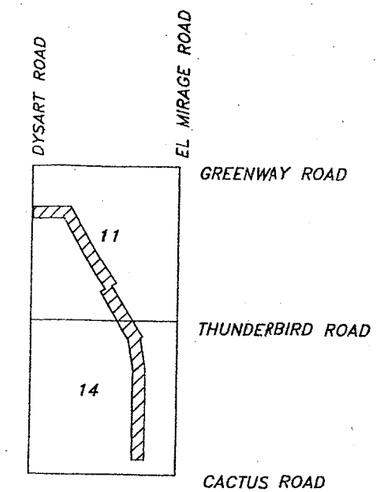
*MARICOPA COUNTY DATUM = FEMA DATUM = NVGD (1929)

NOTE:

THE ELEVATIONS SHOWN ON THIS [illegible] ARE BASED ON THE COUNTY [illegible] ALL CONSTRUCTION WITHIN [illegible] OF EL MIRAGE MUST BE [illegible] WITH PLANS USING THE EL [illegible] DATUM. THESE PLANS ARE [illegible] USED AS A L.O.M.R. EXHIBIT [illegible] SHOULD NOT BE USED FOR [illegible] CTION.

CONTACT	DATE SUB.	RESPONSE	REV'D BY
BOB GARZA			
ROBERT ARRIETA			
SUE MOSLEY			





VICINITY MAP

INDEX OF SHEETS:

SHEET NO.	SHEET TYPE
1	COVER
2	TYPICAL CHANNEL SECTIONS AND DETAILS
3 - 12	PLANS & PROFILES
13	PLAN VIEW OF DYSART AND GREENWAY
14 -19	CHANNEL CROSS SECTIONS

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

NO.	DATE	DESCRIPTION	BY

REGISTERED PROFESSIONAL ENGINEER (Civil) CERTIFICATE NO. 13925 LAWRENCE L. [illegible] ARIZONA U.S.A.

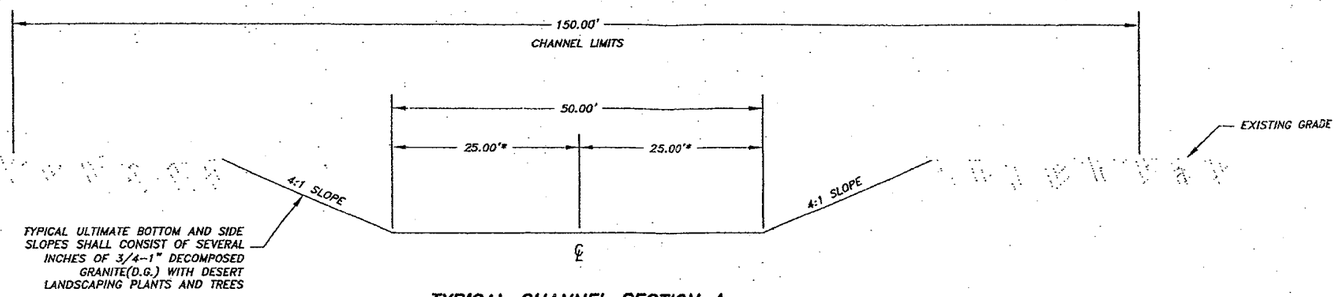
A-N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200
phoenix@anwestinc.com

EL MIRAGE MASTER DRAINAGE PLAN

ER EL MIRAGE WASH
TARY CHANNELIZATION
L.O.M.R.

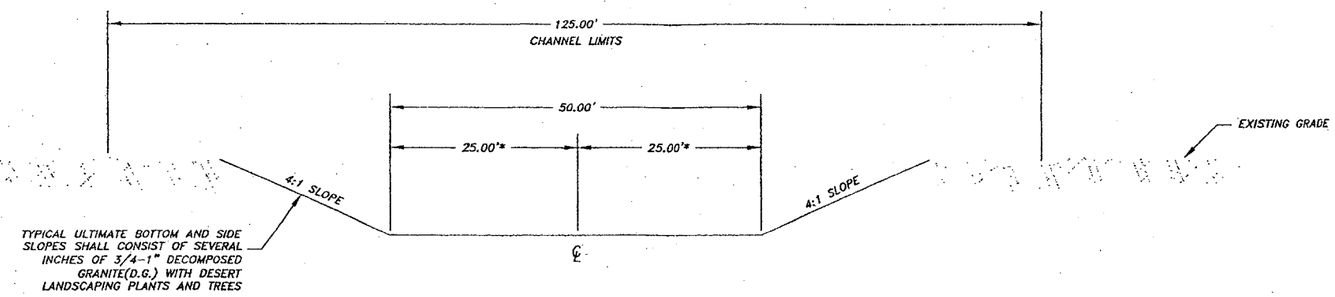
91-18	DESIGN	LLT	SCALE
181RCS01	DRAWN	WDR	HORIZ. N/A
7/5/99	CHECK	LLT	VERT. N/A

L.O.M.R. EXHIBIT - AS-BUILT CONSTRUCTION - AUG. 29, 2001



TYPICAL CHANNEL SECTION A
STA. 10+00.00 to 56+63.38

* 20' @ STA 40+25 to 56+63.38

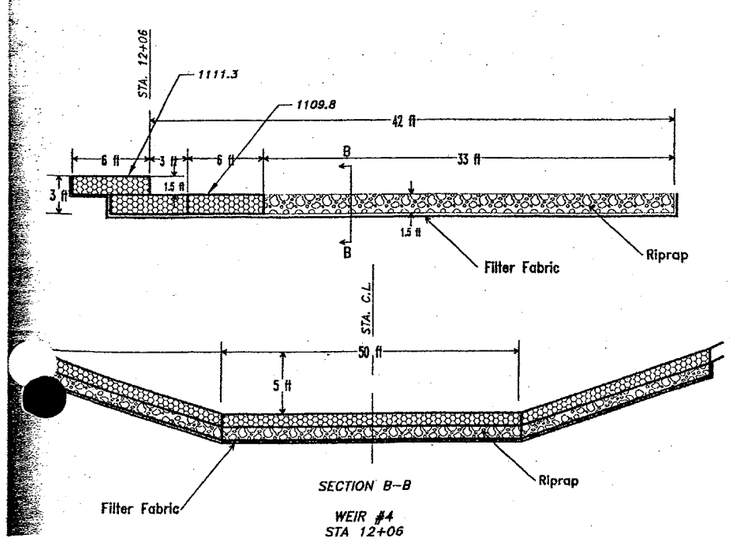


TYPICAL CHANNEL SECTION A
STA. 77+00 to 117+40.62

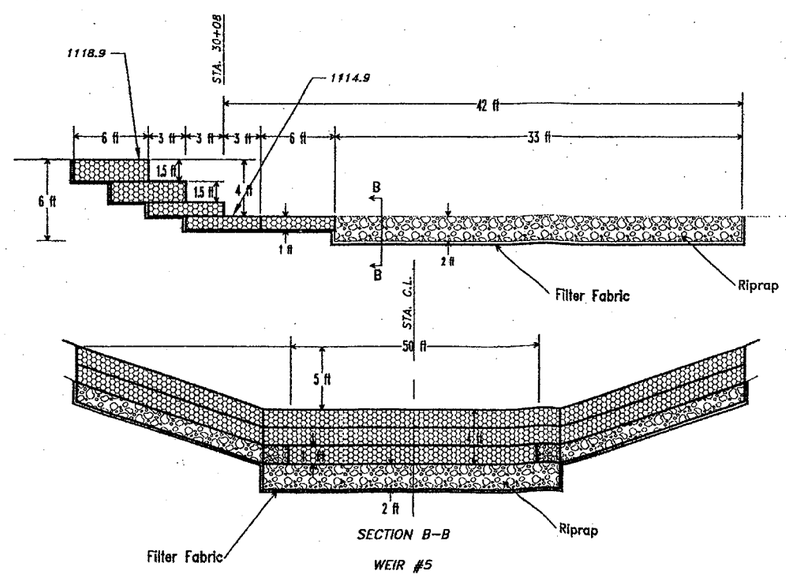
* 15' @ STA 59+28 to 77+00

GENERAL GABION NOTES:

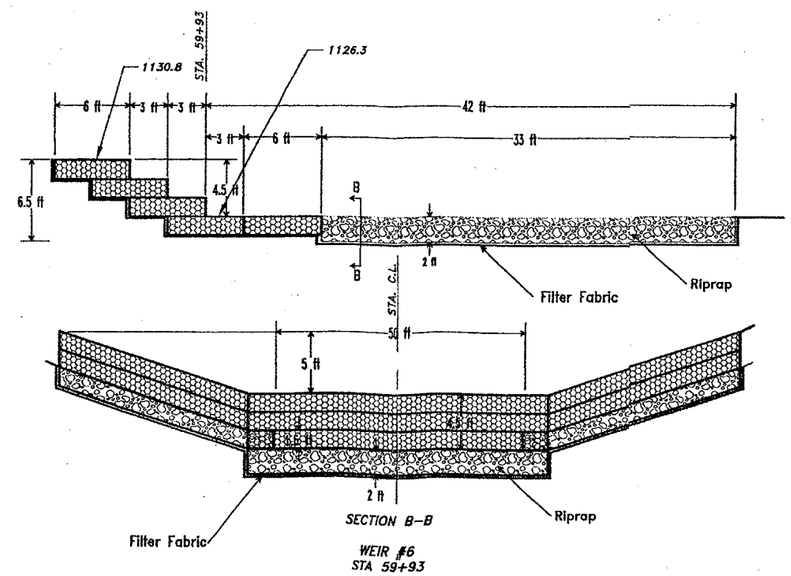
1. GABIONS: ASTM A 975-97
2. FILTER FABRIC: MACTEX MX 275 OR APPROVED EQUAL.
3. ROCK: WEIR #4 & #7: 4 in. to 8 in., d_{50}=6 in.
   WEIR #5-6: 4 in. to 12 in., d_{50}=9 in.
4. RIPRAP: 4 in. to 12 in., d_{50}=9 in.



WEIR #4
STA 12+06



WEIR #5



WEIR #6
STA 59+93

CALL TWO WORKING DAYS BEFORE YOU DIG
1-800-STAKE-IT
(STAKE MARICOPA COUNTY)

NO.	DATE	DESCRIPTION	BY

Registered Professional Engineer (Civil)
CERTIFICATE NO. 13925
LAWRENCE L. TYSIAC
Date Signed 7/24/01
ARIZONA, U.S.A.

A·N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602) 861-2200
phoenix@anwestinc.com

EL MIRAGE MASTER DRAINAGE PLAN

WEIR EL MIRAGE WASH
TUTARY CHANNELIZATION
L.O.M.R.

7191-18			SCALE
7118TRTSO1.DWG	DESIGN	LLT	HORIZ. N/A
	DRAWN	WDR	VERT. N/A
7/24/29	CHECK	LLT	

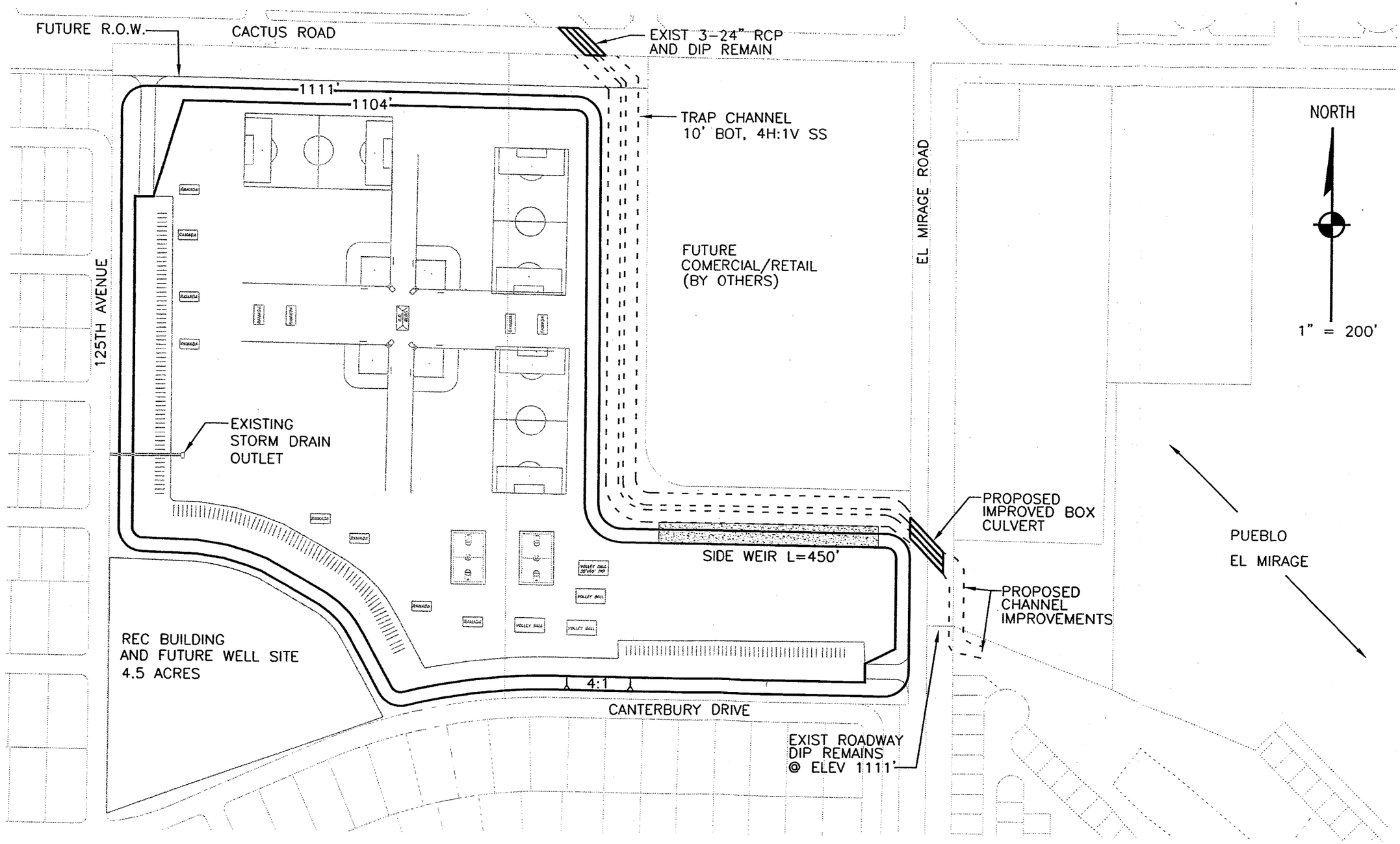
L.O.M.R. EXHIBIT - AS-BUILT CONSTRUCTION - AUG. 29, 2001

West Cactus Detention Basin and Channels Project
Preliminary Candidate Assessment Report

APPENDIX J

Selected Structural Alternative Exhibits

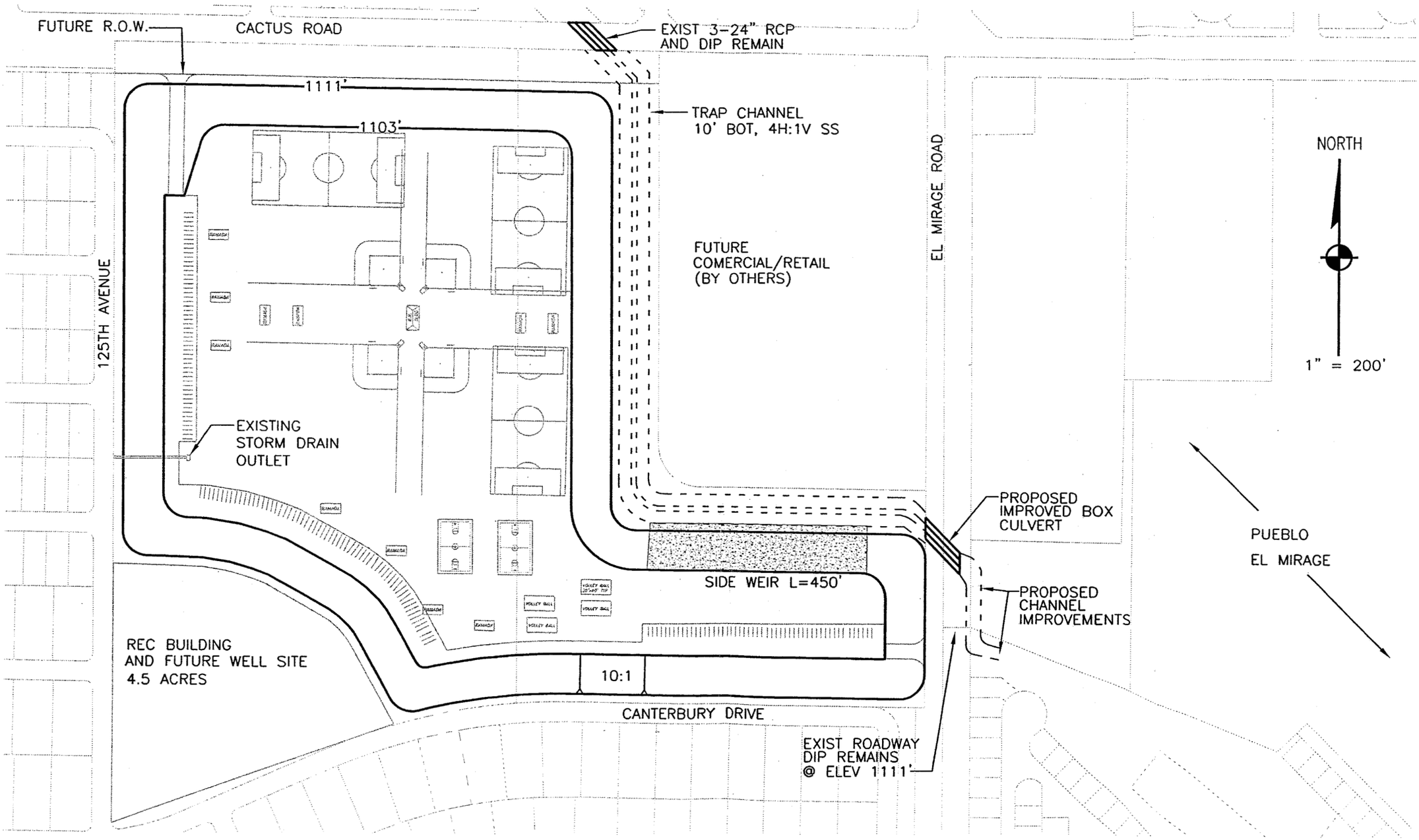
Stanley Consultants INC.



WEST CACTUS BASIN AND CHANNELS
ALTERNATIVE 2
BASIN TOP ELEV=1,111', AVG BOT ELEV=1,104'
4H:1V SIDES, VOL PROVIDED = 195 AC-FT

G:\15956\02-Jason 1 - West Cactus\05-Study Phase\05-Dwgs\schalk dwgs\ALT2Rev00.dwg

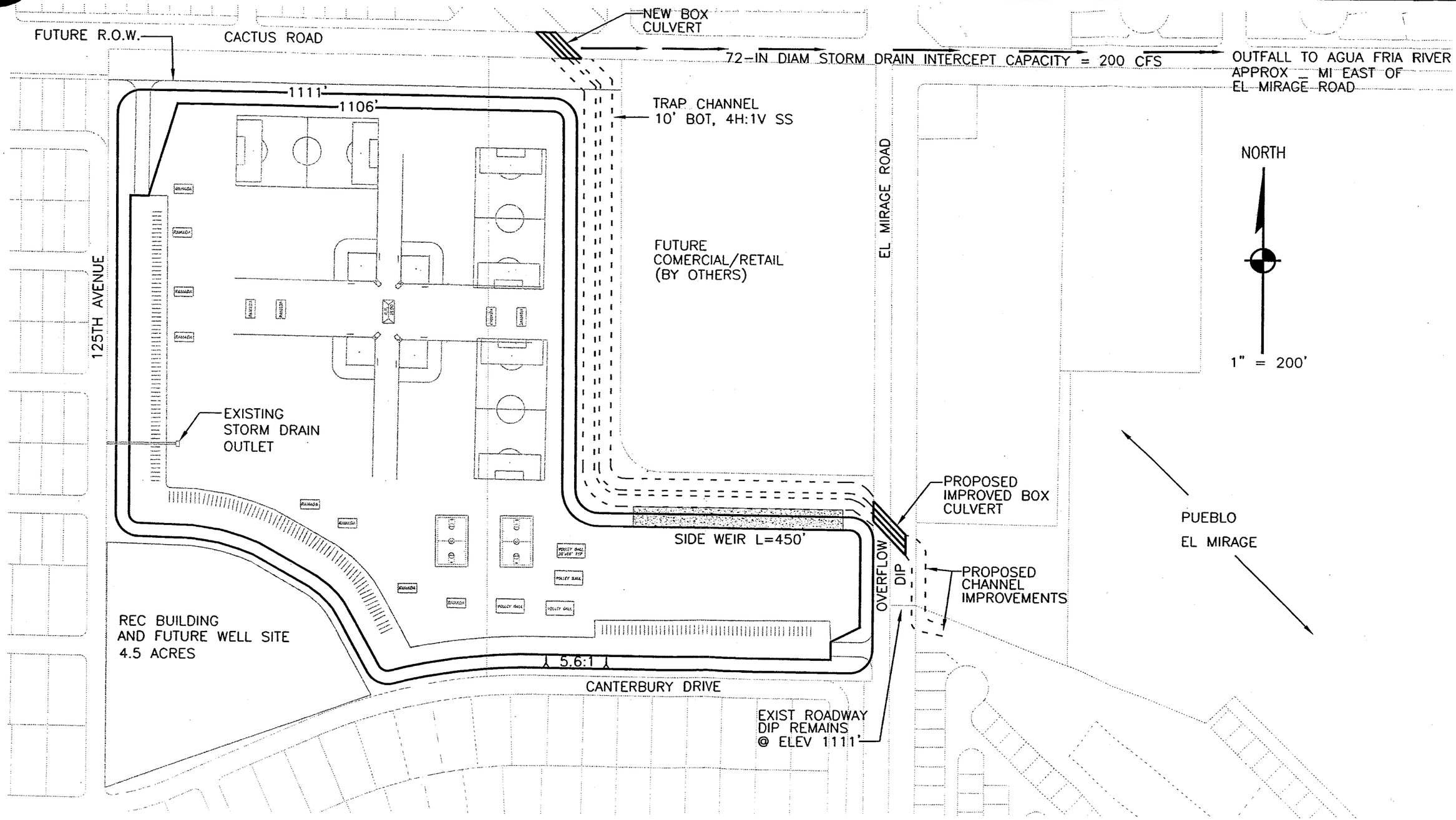
Stanley Consultants INC.



WEST CACTUS BASIN AND CHANNELS
ALTERNATIVE 4
BASIN TOP ELEV=1,111', AVG BOT ELEV=1,103'
10H:1V SIDES, VOL PROVIDED = 200 AC-FT

Q:\16956\02-Assgn 1 - West Cactus\03-Study Phase\05-Dwgs\scnotk dwgs\Alt4Rev01.dwg

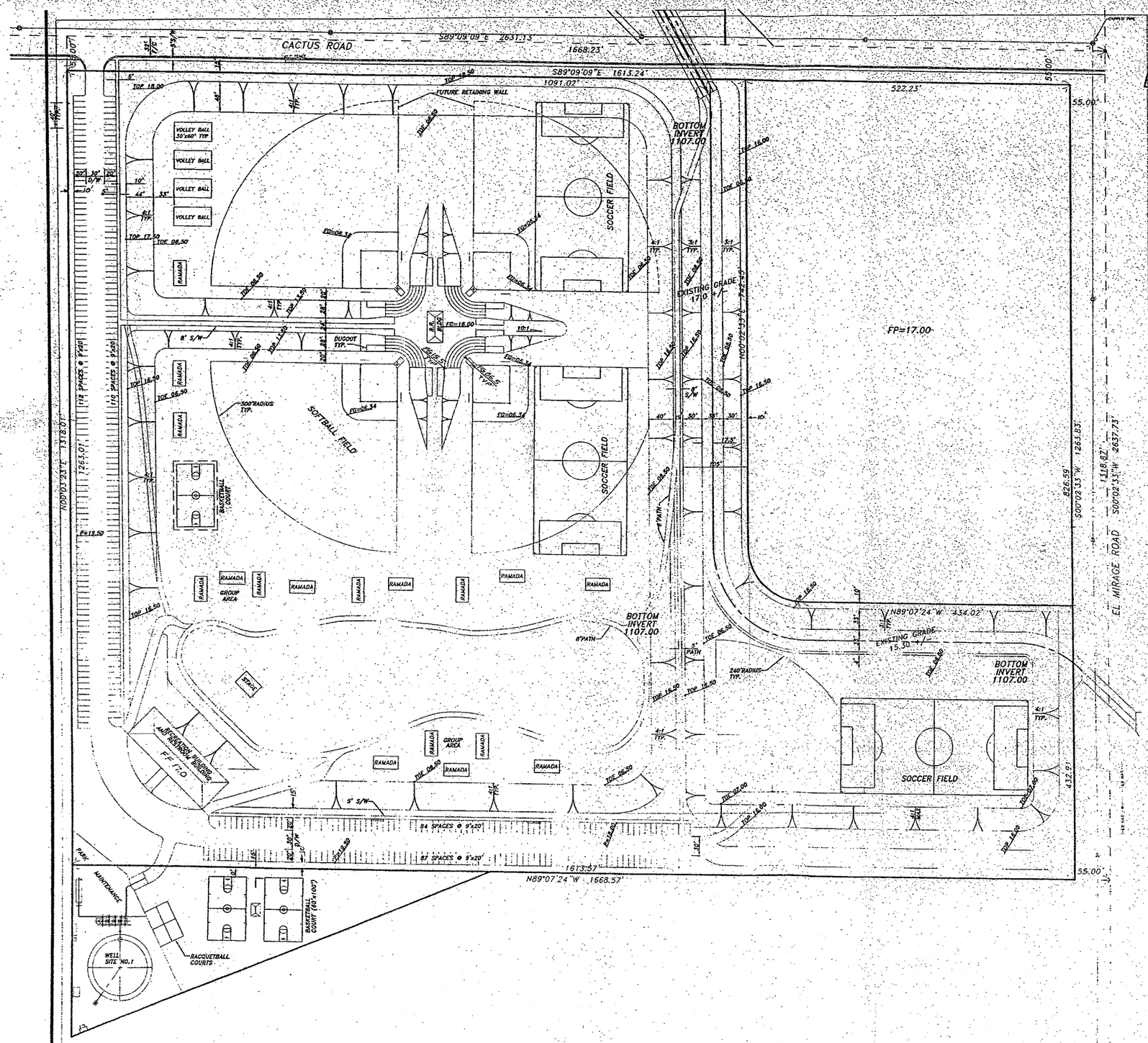
Stanley Consultants INC.



WEST CACTUS BASIN AND CHANNELS
ALTERNATIVE 2 + 8
BASIN TOP ELEV=1,111', AVG BOT ELEV=1,106'
5.6H:1V SIDES, VOL PROVIDED = 140 AC-FT

Q:\15956\02-Assgn 1 - West Cactus\05-Study Phase\05-Dwgs\schem dwgs\ALT2+5Rev01.dwg

SITE PLAN FOR EL MIRAGE REGIONAL PARK



REVISED 7/17/01

SITE PLAN
FOR
EL MIRAGE REGIONAL PARK

DESIGN	SKB	SCALE		JOB NO.	7191-18	SHEET
DRAWN	SKB	HORIZ.	1"=60'	DWG. ID.	7191-18MAST.	1
CHECK	LLT	VERT.	N/A	DATE	07/28/99	OF 1

A·N WEST INC.
Consulting Engineers
7600 N. 15th Street, Suite 200
Phoenix, Arizona 85020
(602)861-2200

APPENDIX K

Supplemental Hydrology and Hydraulics Documentation

Schematic for Surveyed Storm Drain Systems, Finish Floor Elevations and Street Grade Breaks in the Vicinity of Existing Basin

WEST CACTUS DETENTION BASIN AND CHANNELS PROJECT
On-Call Contract FCD2003C020, Assignment # 1

Scope Modification - Additional Hydrology and Hydraulics

Scope of Work

Task 2.2.1 - Field survey stormwater basins, storm drain @ 125th Ave. and Canterbury, finished floor elevations adjacent to same and verify sub-basin boundary. Using a combination of GPS and conventional level, perform field survey at:

- Existing stormwater retention / detention basins in ADMP Sub-basins 127, 139, 140, 156, 157, 171 (portions) and 172 as basis for estimating volumes to reflect in ADMP HEC-1 model.
- Existing street grades, catch basins and pipe inverts for the storm drain system in 125th Avenue and Canterbury Dr. including the outfall of same into West Cactus Basin.
- Existing finished floor elevations of residences adjacent to the storm drain system above.
- Existing grades in the area south and west of the West Cactus Basin to determine what area in upper ADMP Sub-basin 171 was constructed to drain to Sub-basin 172 (West Cactus Basin).

All survey will be performed using the same vertical datum as the CLOMR as-builts prepared by A-N West Consultants for the Lower El Mirage Wash. The field survey will be documented with a point list and simple point plot exhibit(s). There will be no comprehensive results of survey or topographic map generated from the field survey work.

Task 2.2.2 – Reduce the field survey data from Task 2.2.1 to determine the volumes of stormwater retention / detention within that portion of the area tributary to the West Cactus Basin that is within the City of El Mirage. This effort will be documented with simple exhibits and calculation sheets. The stormwater volume data generated from this effort will be reflected in revisions to the ADMP HEC-1 model.

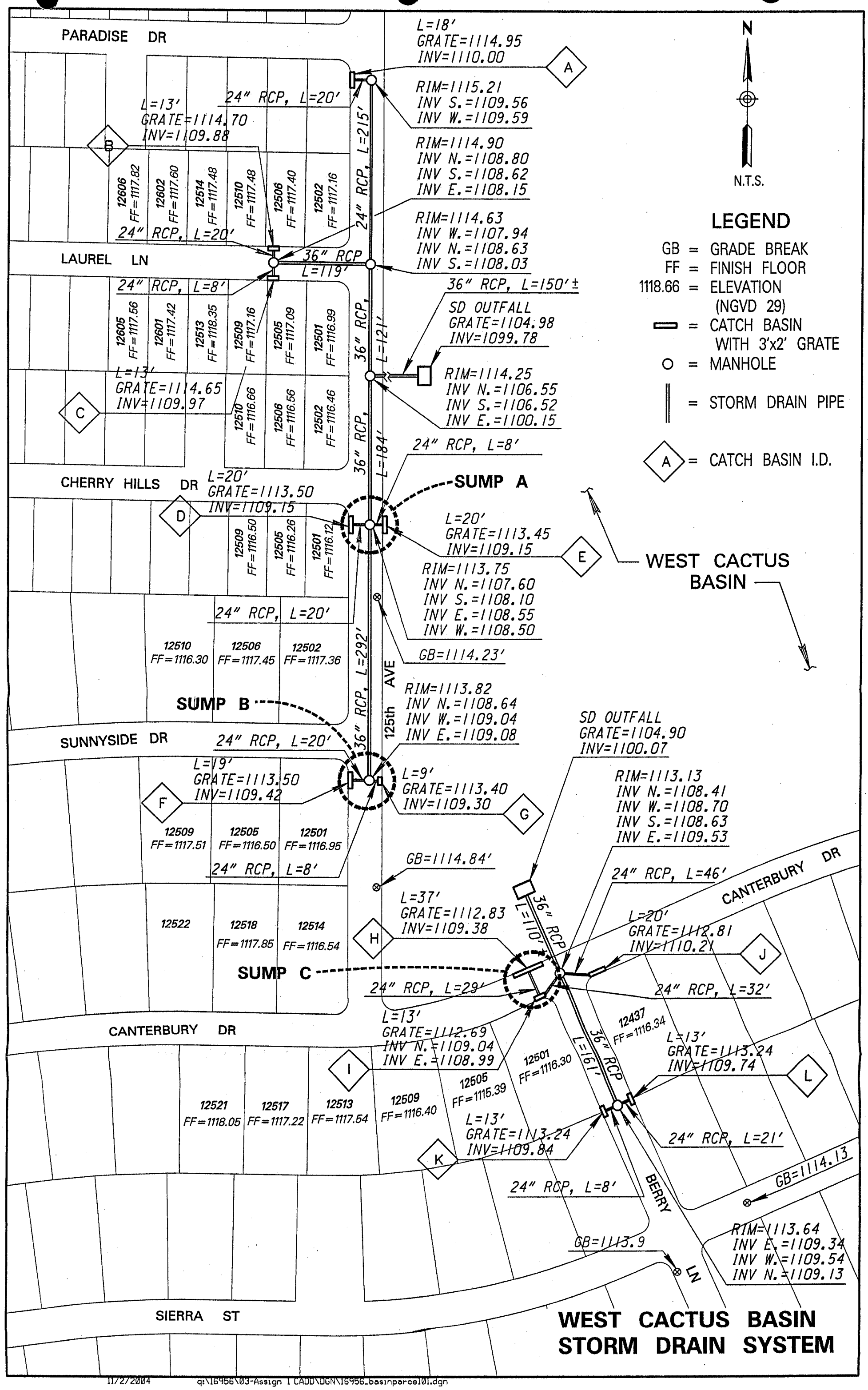
Task 2.2.3 – Perform hydrologic and hydraulic analysis for the existing storm drain in 125th Ave. and Canterbury to determine the system's capacity and associated hydraulic grade line in relation to the finished floors of residences adjacent to the storm drain system.

Task 2.2.4 – Modify the ADMP HEC-1 model with the new data produced from Tasks 2.2.1 and 2.2.2. That portion of ADMP Sub-basin 171 that now drains to the West Cactus Basin will be added to ADMP Sub-basins 157 and 172 as appropriate. The revised ADMP Sub-basin 172, which includes the West Cactus Basin, may be further subdivided to separate the area that drains to the existing storm drain in 125th Ave. and Canterbury. The new volumes of stormwater retention / detention will be reflected in the revised ADMP HEC-1 model using the same approach and assumptions that are currently employed by the model. The revised HEC-1 model will reflect existing conditions in that portion of the tributary area of West Cactus Basin that is within the City of El Mirage. As suggested by the District, only 80% of the estimated volume in the area tributary to West Cactus Basin will be reflected in the HEC-1 model. Results of Task 2.2.4 will be compared to previous hydrologic models and data to determine if recent development in the City of El Mirage has increased discharges. The lower portion of ADMP Sub-basin 171 that does not drain to the West Cactus Basin will be adjusted in the HEC-1 model to reflect revised drainage area and basin lag but no further analysis will be performed or adjustments made to the ADMP HEC-1 model from Sub-basin 171 downstream.

Task 2.2.5 – The existing land ownership and tenure status of the properties in the Pueblo El Mirage Golf Resort will be investigated to determine ownership versus rent / lease within and adjacent to the Lower El Mirage Wash floodplain.

Task 2.2.6 – The results of Tasks 2.2.1 through 2.2.5 will be documented in the final Candidate Assessment Report (CAR). The hydrology section in the current draft version of the CAR will be significantly expanded to include documentation of the hydrologic and hydraulic analyses covered by this change in scope. A new section will be added to document the field survey. Technical appendices will be added / expanded as necessary. An approximation of the properties that would be flooded by the "Do-Nothing" alternative will be made. As expressed on past occasions, this will be very approximate within the Pueblo El Mirage Golf Resort because of the sketchy nature of the floodplain delineation below El Mirage Road including potential impacts to the floodplain from development and improvements that have taken place subsequent to the floodplain delineation. Potential flood prone properties will include residential lots along 125th Ave. and Canterbury Dr. adjacent to the West Cactus Basin.

Supplemental Hydrology Scope of Work



WEST CACTUS BASIN STORM DRAIN SYSTEM

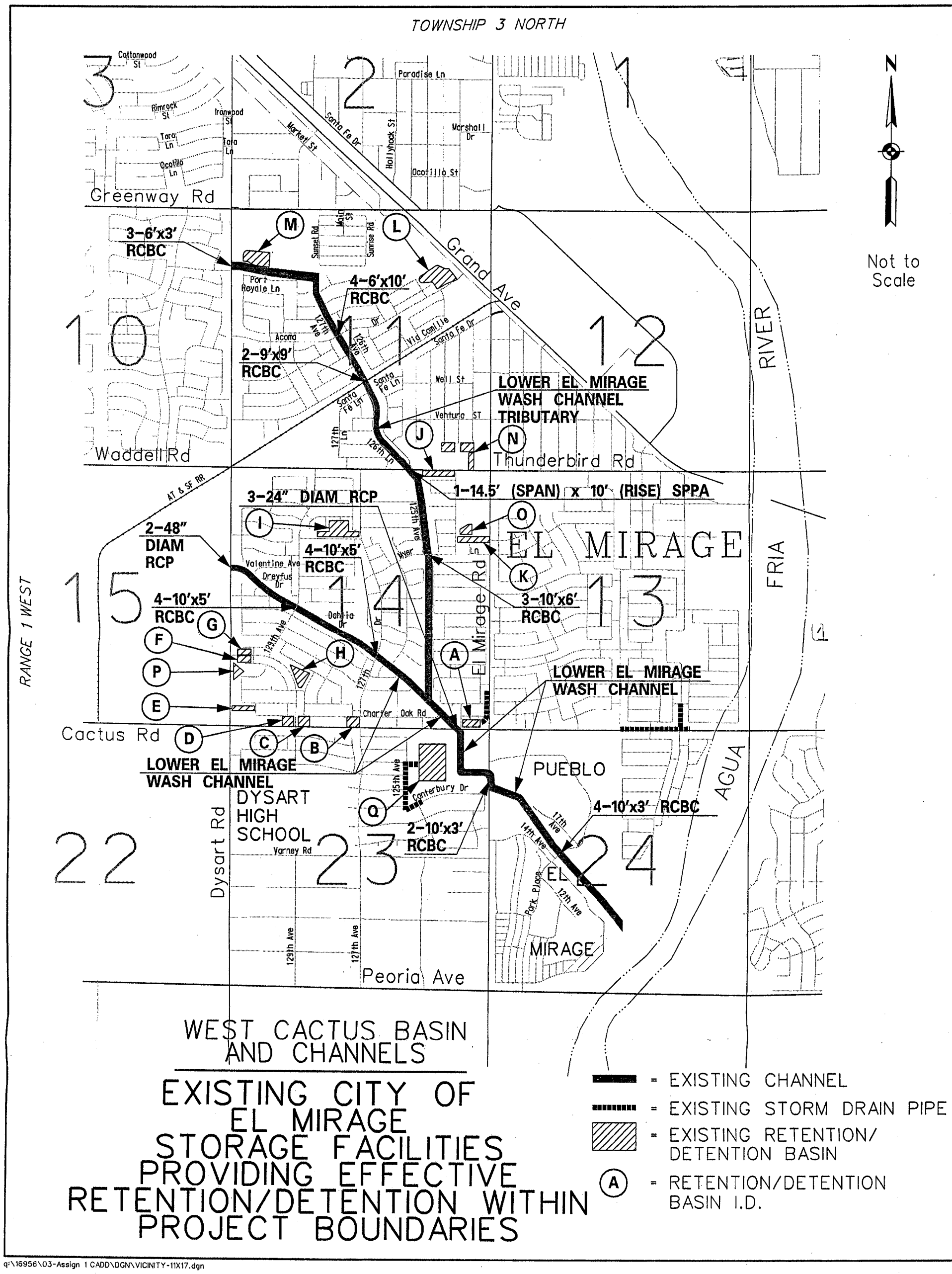
11/2/2004 q:\16956\03-Assign 1 CADD\DGN\16956_basinparcel01.dgn

Storage Estimate for Local Stormwater Basins In City of El Mirage

Storage Estimate for City of El Mirage Facilities
Providing Effective Detention Within the Project Boundaries

Basin I.D.	Storage Estimate (ac-ft)	Detention or Retention	HEC-1 Sub-Basin Location
A	0.4	Retention	157
B	1.0	Retention	157
C	0.5	Retention	157
D	0.6	Retention	157
E	0.7	Retention	157
F	0.1	Retention	157
G	0.3	Retention	157
H	4.6	Retention	157
I	3.3	Retention	157
J	0.4	Retention	157
K	0.3	Retention	157
L	4.5	Retention	140
M	1.3	Retention	139
N	0.5	Retention	156
O	1.5	Retention	157
P	0.1	Retention	157
Q	93.1	Detention	172

	SB 139	SB 140	SB 156	SB 157	SB172	Total
Detention:	-	-	-	-	93.1	93.1
Retention:	1.3	4.5	0.5	14	-	20.1



WEST CACTUS BASIN AND CHANNELS

EXISTING CITY OF EL MIRAGE STORAGE FACILITIES PROVIDING EFFECTIVE RETENTION/DETENTION WITHIN PROJECT BOUNDARIES

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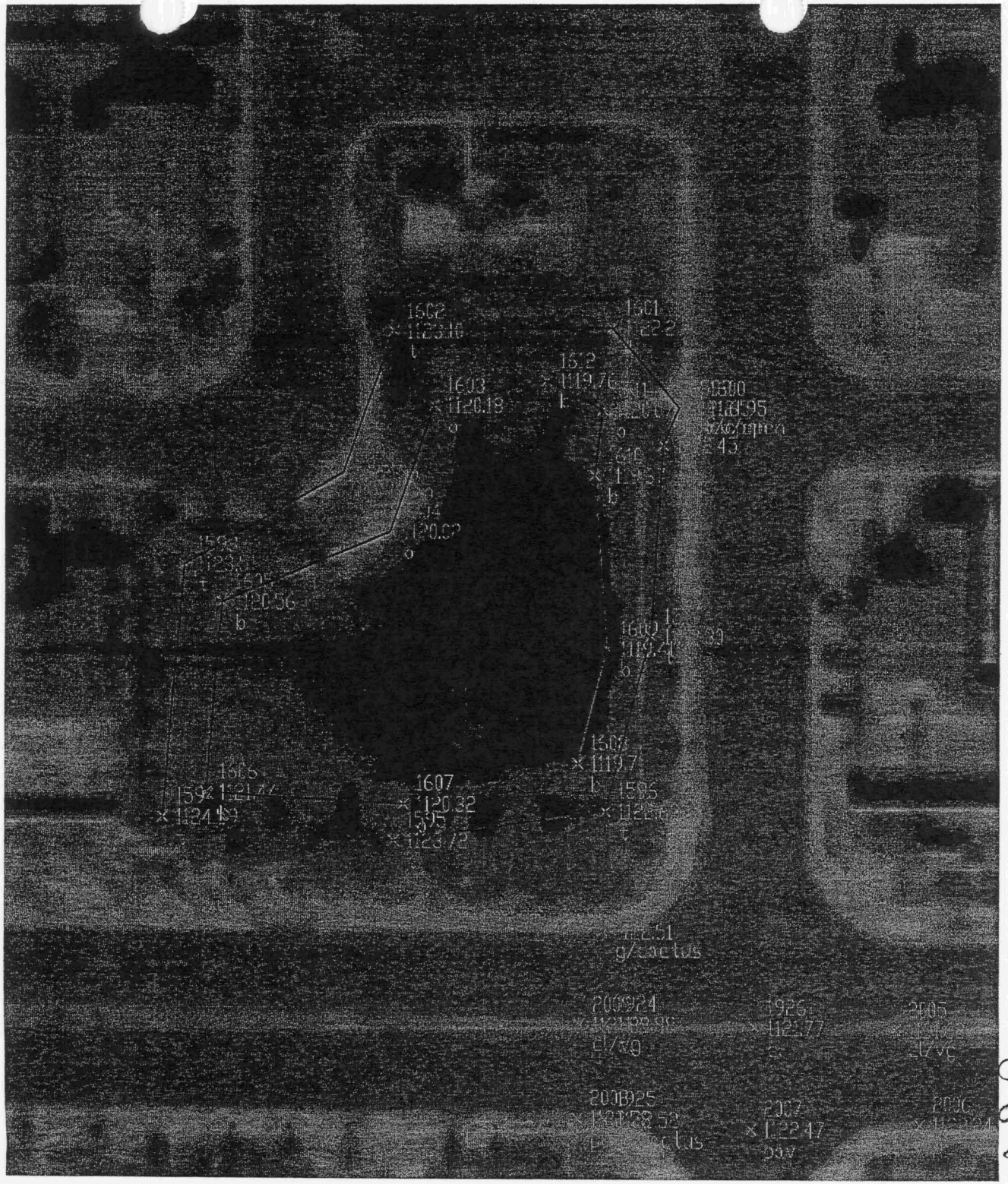

West Cactus Basin
SCI #16956

Basin B Storage Estimate:

Approx Bottom El = 1,120'

Approx Top El = 1,122.3'

Dept = 2.3'

Top Area = 0.53 ac

Bottom Area = 0.32 ac

$$\text{Storage} = \left(\tfrac{1}{2}\right)(.53 + .32)(2.3)$$

$$= 1.0 \text{ ac-ft}$$

Location: NW Corner of Cactus and 127TH Ave.

1" = 50'

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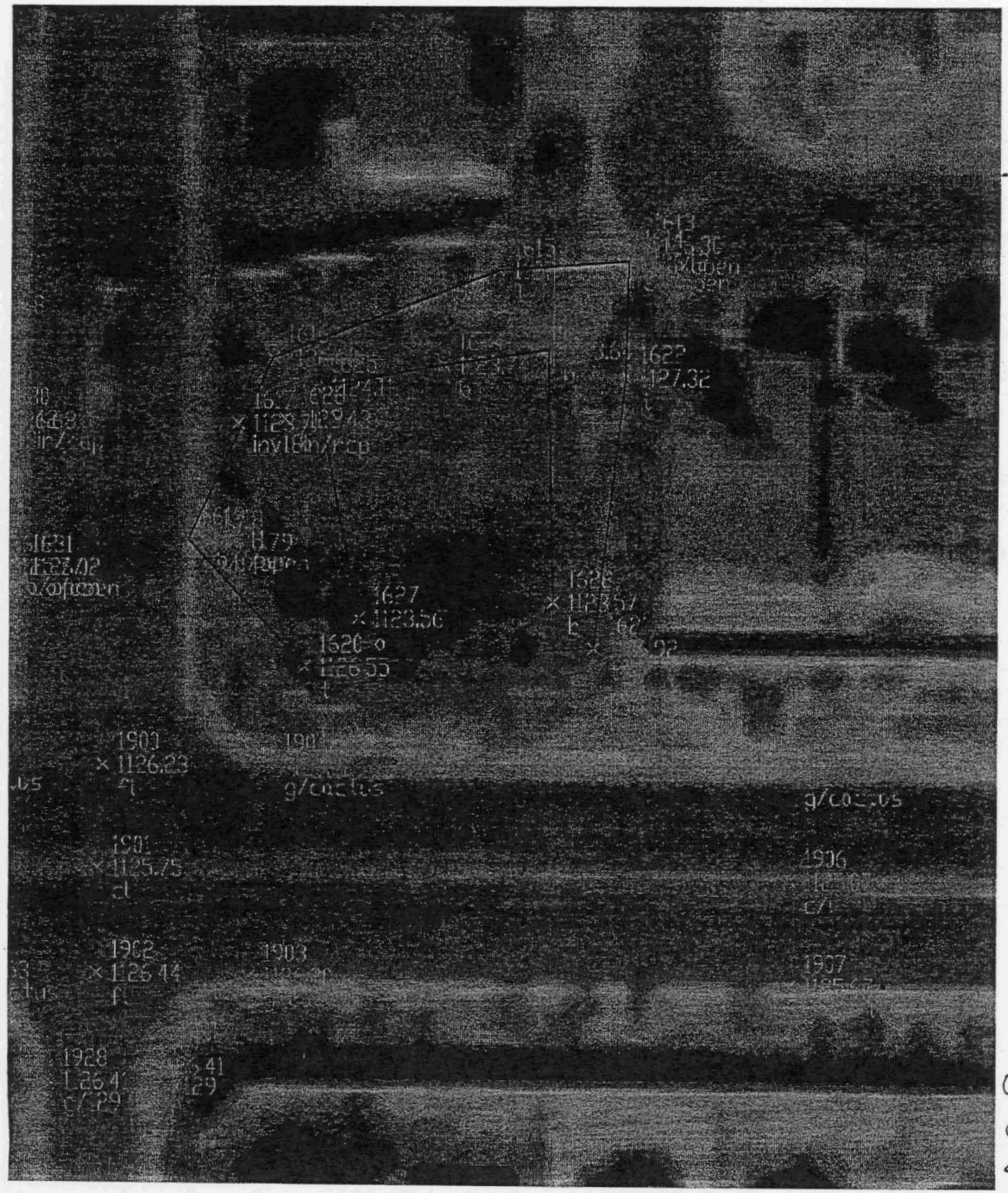

West Cactus Basin
SCI #16956

Basin C Storage Estimate:

Approx Bottom El = 1,123.6'

Approx Top El = 1,126.1'

Depth = 2.5'

Top Area = 0.28 ac

Bottom Area = 0.11 ac

Storage = (½)(.28 + .11)(2.5)
= 0.5 ac-ft

Location: NE Corner of Cactus and 129TH Ave

N

1" = 50'

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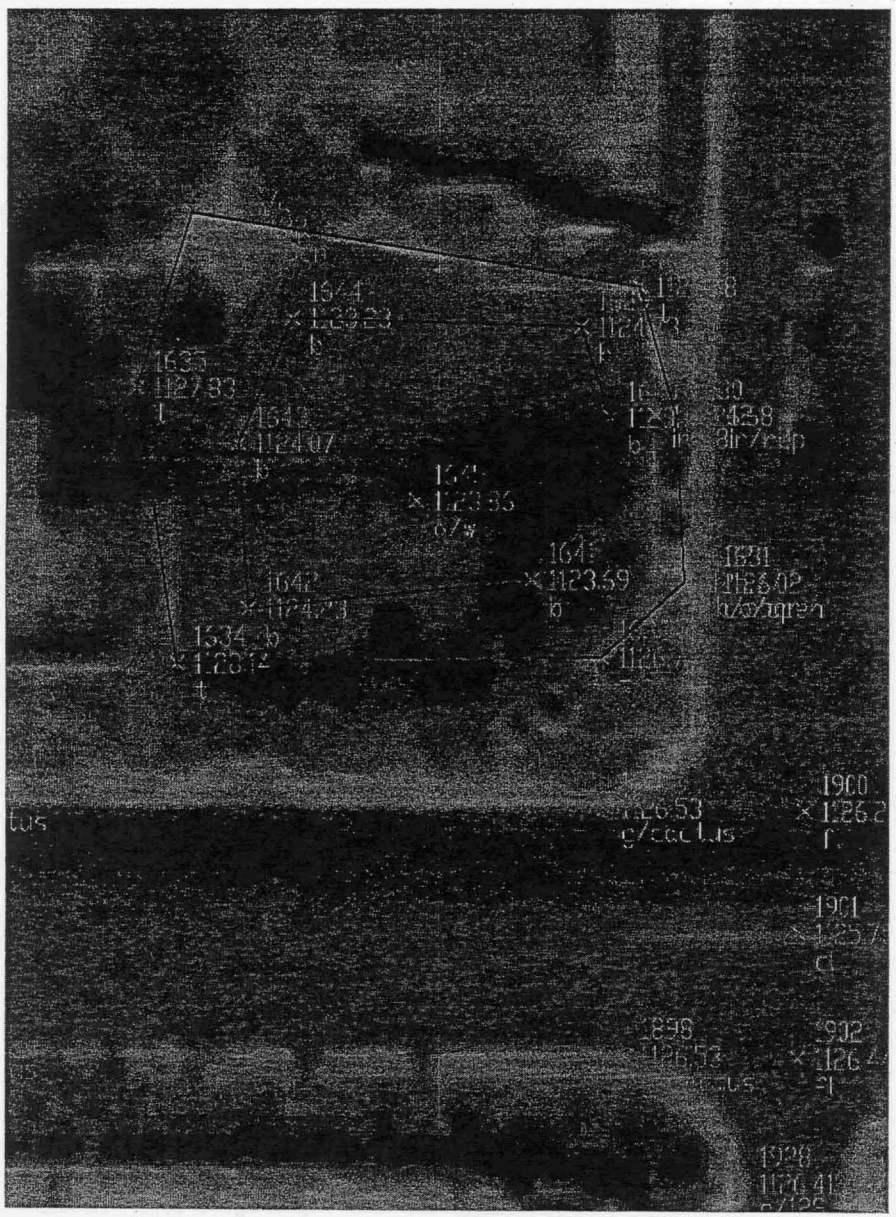


West Cactus Basin
SCI #16956

Basin D Storage Estimate:

Approx Bottom El = 1,124'

Approx Top El = 1,126.7'

Depth = 2.7'

Top Area = 0.32 ac

Bottom Area = 0.14 ac

Storage = (½)(.32 + .14)(2.7)

= 0.6 ac-ft

Location: NW Corner of Cactus and 129th Ave

N

1" = 50'

Q:\16956\02-Assgn I-West Cactus\05-Study Phase\05-Dwgs\Survey\Storage, rev ØØ.dwg

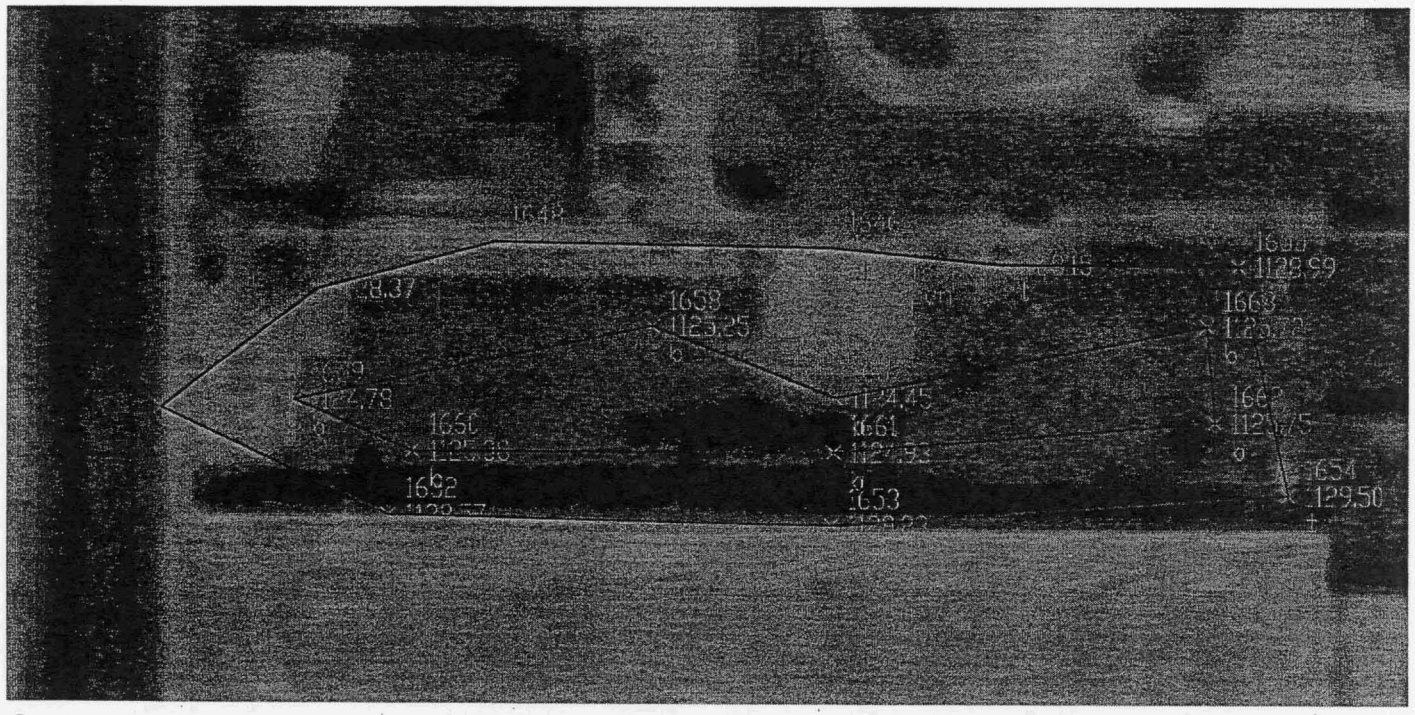
West Cactus Basin
SCI # 16956

Basin E Storage Estimate:

Approx Bottom El = 1,125'
Approx Top El = 1,127.5'
Depth = 2.5'
Bottom Area = 0.11 ac
Top Area = 0.41 ac

Storage = $(\frac{1}{2})(.11 + .41)(2.5) = 0.7$ ac-ft

Location: Catch Basins Located on Dyart Rd and Charter Oak Rd. Basin at Charter Oak Rd and 130th Dr.



N
1" = 50'

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West Cactus Basin
SCI #16956

Basin F Storage Estimate:

Approx. Bottom El = 1,128.5'

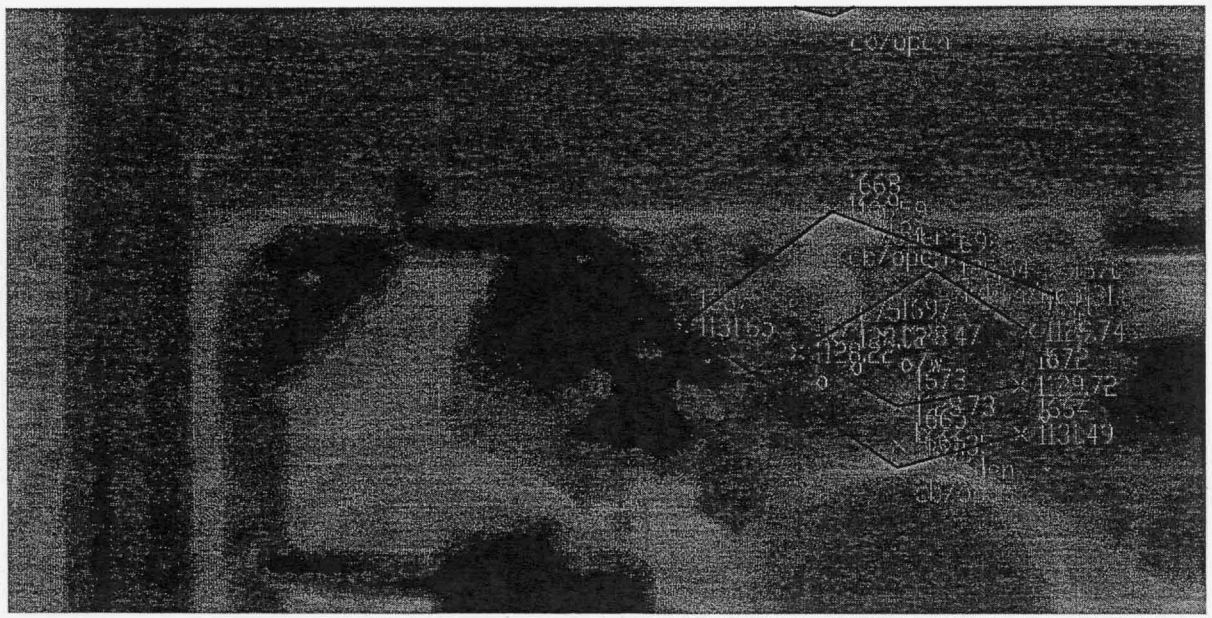
Approx. Top El = 1,130.6'

Depth = 2.1'

Top Area = 0.09 ac Bottom Area = 0.03 ac

Storage = $(\frac{1}{2})(0.09 + 0.03)(2.1)$

= 0.1 ac-ft



Parque Del Sol Blvd.

N

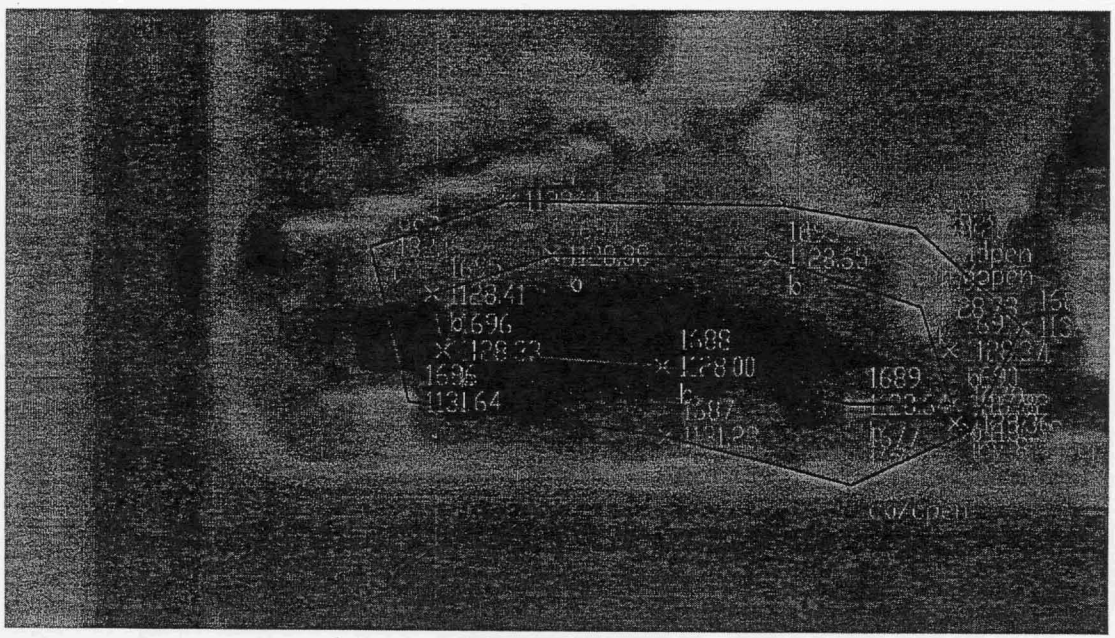
1" = 50'

Q:\16956\02-Assgn 1 - West Cactus\05-Study Phase\

West Cactus Basin
SCI #16956

Basin G Storage Estimate:

Approx Bottom El = 1,128.5'
Approx Top El = 1,130.7'
Depth = 2.2'
Top Area = 0.21 ac
Bottom Area = 0.08 ac
Storage = (1/2)(.21 + .08)(2.2)
= 0.3 ac-ft



N
1" = 50'

Parque Del Sol Blvd.

Q:\16956\02-Assgn 1-West Cactus\05-Study Phase\05-Dwgs\Survey\Storage.rev 00.dwg

West Cactus Basin
SCI #16956

Basin H Storage Estimate:

Approx Bottom El = 1,122.7'

Approx Top El = 1,125.6'

Depth = 2.9'

Top Area = 1.93 ac

Bottom Area = 1.24 ac

Storage = $(\frac{1}{2})(1.24 + 1.93)(2.9)$
= 4.6 ac-ft

Location: North of Columbine Dr, Between 128th Dr and 129th Ave.

N

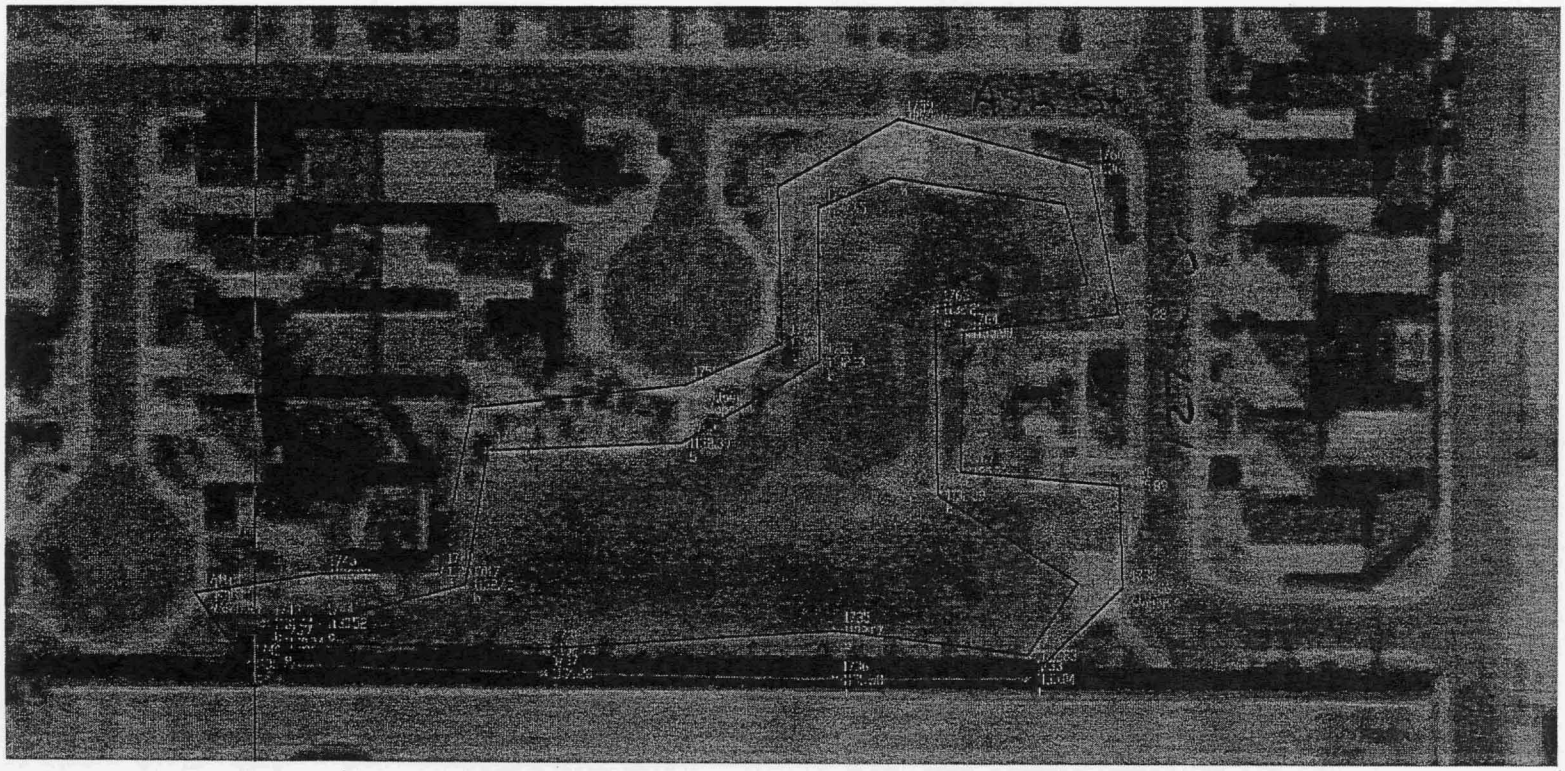
1" = 100'

Q:\16956\02-Assgn 1-West Cactus\05-Study Phase\05-Dwgs\Survey\Storage, rev 00.dwg

West Cactus Basin
SCI #16956

Basin I Storage Estimate:

Approx Bottom El = 1,132.5'
Approx Top El = 1,135'; Depth = 2.5'
Top Area = 1.65 ac Bottom Area = 1.01 ac
Storage = (½)(1.65 + 1.01)(2.5) = 3.3 ac-ft
Location: SW Corner of 127th Dr and Ash St.



N

1" = 100'

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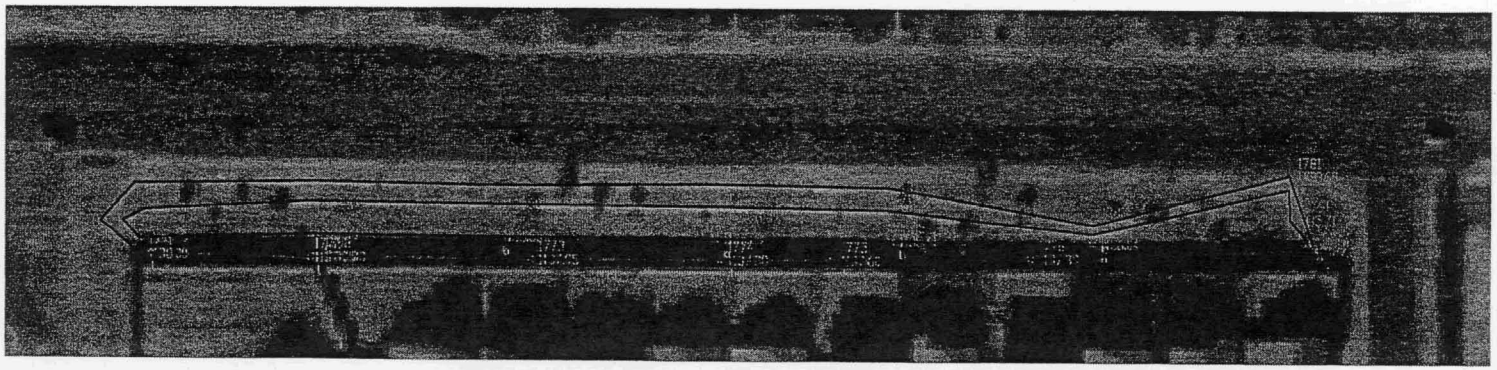
West Cactus Basin
SCI #16956

Basin J Storage Estimate:

Approx Bottom El = 1,135.5'
Approx Top El = 1,136.7'
Top Area = 0.49 ac
Bottom Area = 0.22 ac
Depth = 1.2'
Storage = (1/2)(.22 + .49)(1.2)
= 0.44 ac-ft

Location: Between Lower El Mirage Wash Channel Tributary and Elementary School, South of Thunderbird Rd.



Thunderbird Rd.

N

1" = 100'

School

Q:\16956\02-Assgn 1 - West Cactus\05-Study Phase\

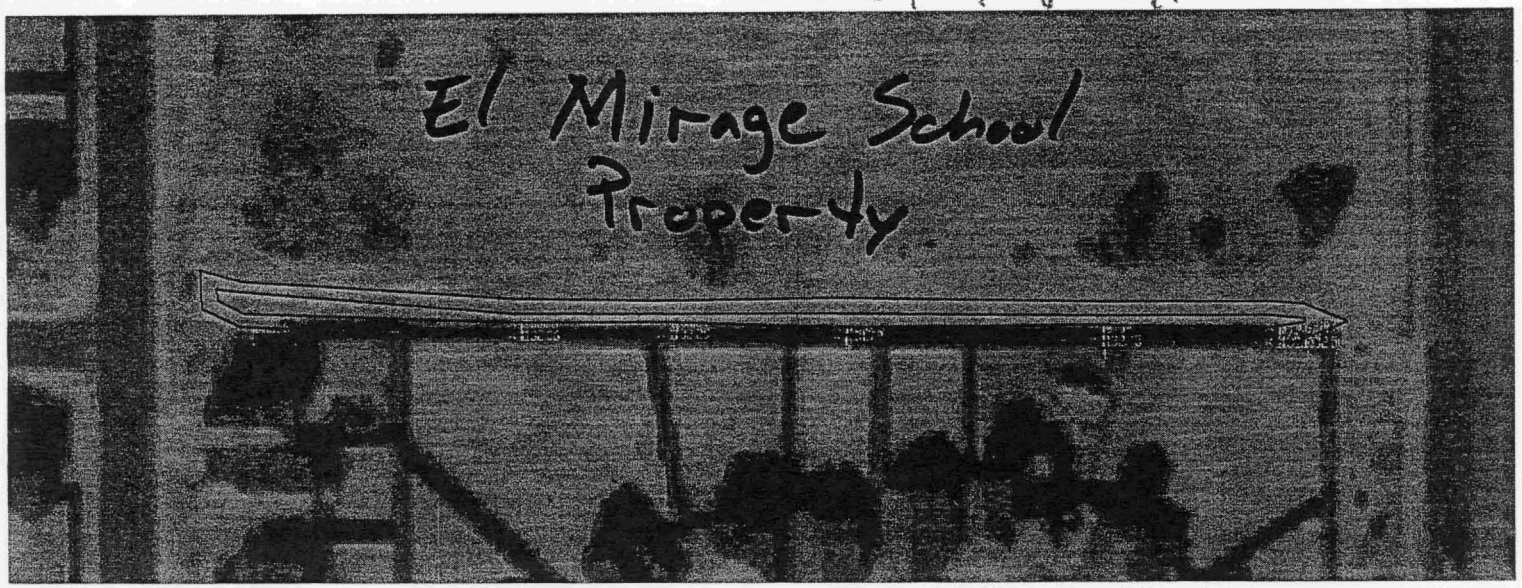
West Cactus Basin
SCI #16956

Basin K Storage Estimate:

Approx Bottom El = 1,130.2'
Approx Top El = 1,131.8'
Depth = 1.6'
Top Area = 0.27 ac
Bottom Area = 0.08 ac

Storage = $(\frac{1}{2})(.27 + .08)(1.6)$
= 0.3 ac-ft

Location: School located on SW corner of El Mirage and Thunderbird Roads. Basin located at south end of property.



N
1" = 100'

El Mirage Rd

Q:\16956\02-Assgn I-West Cactus\05-Study Phase\05-Dwgs\Survey\storage, rev 00.dwg

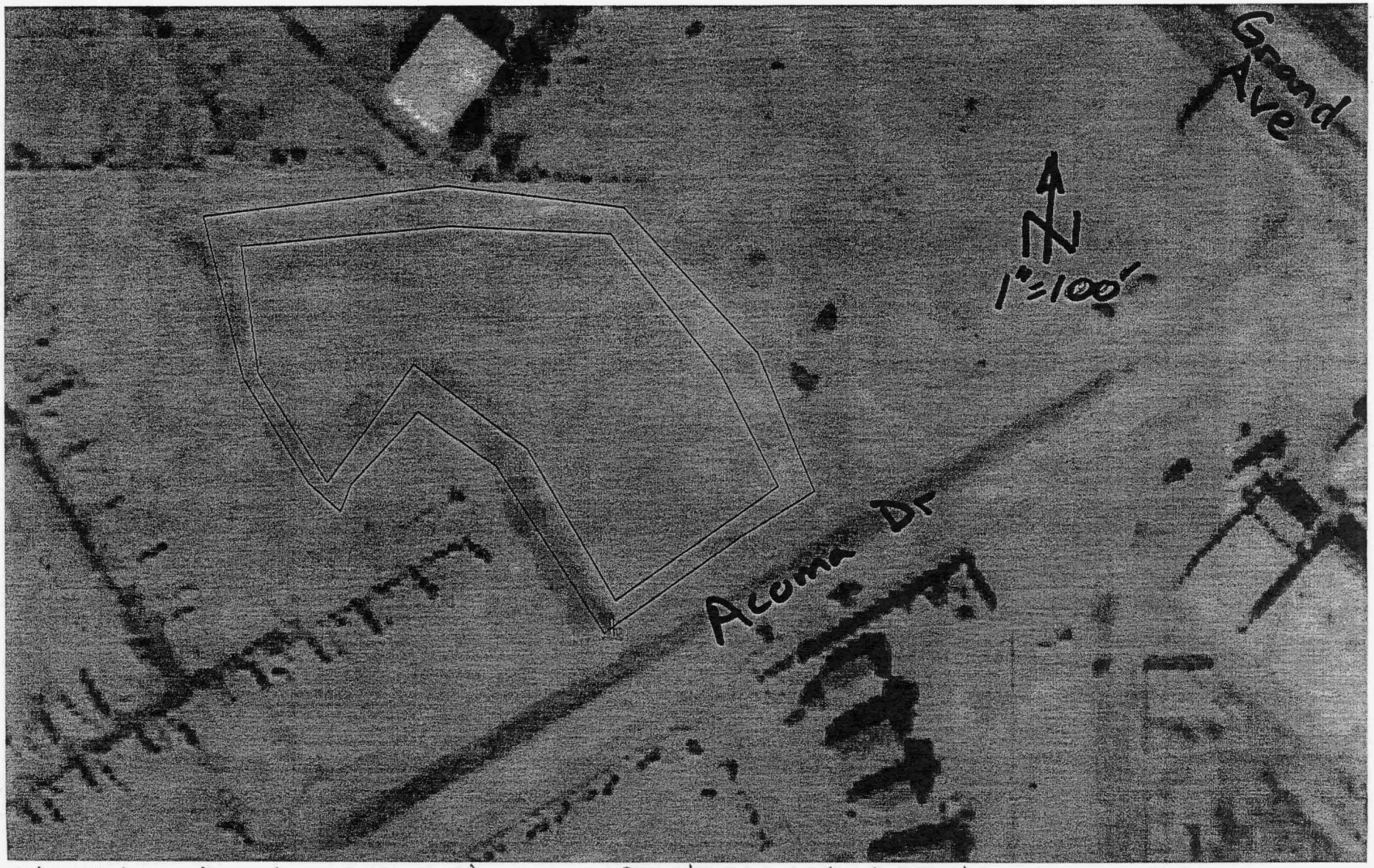
West Cactus Basin ; SCI #16956

Basin L Storage Estimate:

Approx Bottom El = 1,147' ; Approx Top El = 1,149.9' ; Depth = 2.9'

Top Area = 1.82 ac ; Bottom Area = 1.25 ac

Storage = (½)(1.82 + 1.25)(2.9) = 4.5 ac-ft



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West Cactus Basin - SCI #16956

Basin M Storage Estimate:

Approx Bottom El = 1,1156'

Approx Top El = 1,157.5'

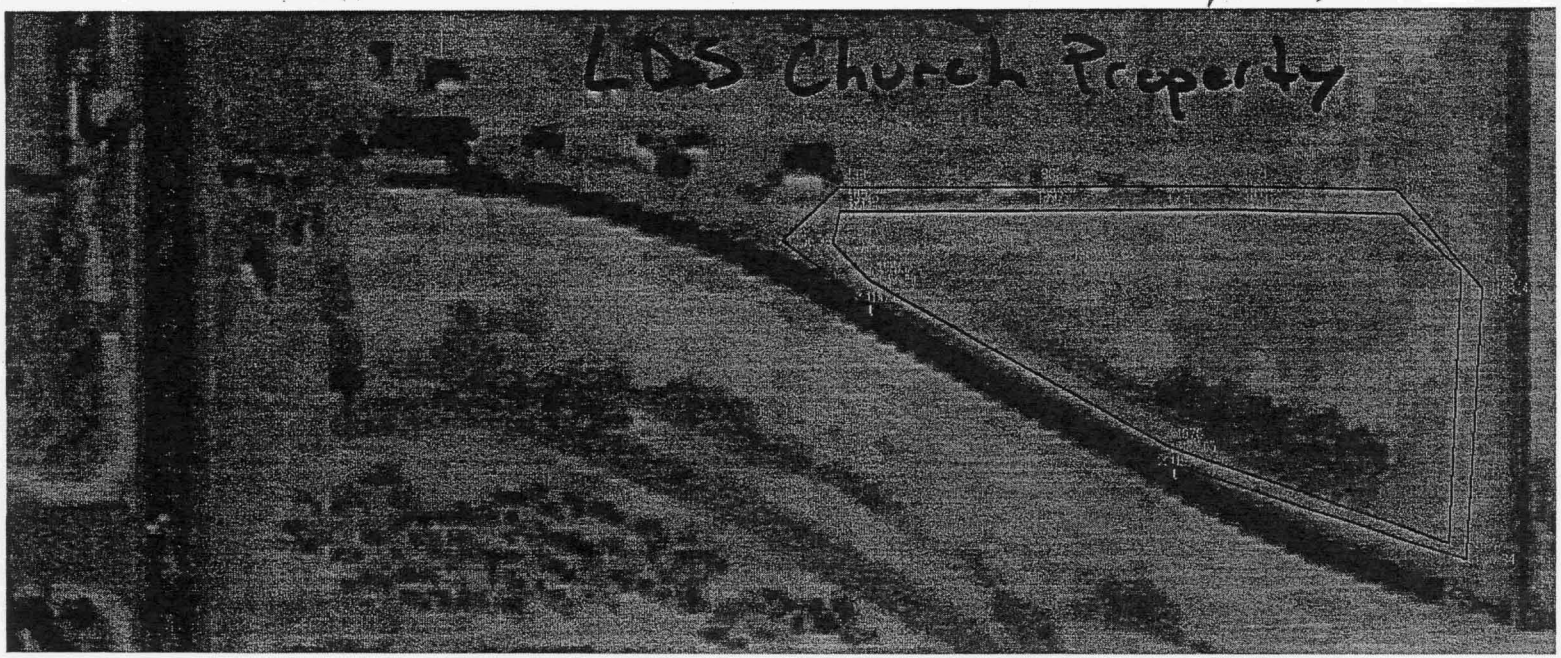
Depth = 1.5'

Top Area = 1.00 ac

Bottom Area = 0.79 ac

Storage = (1/2)(1.00 + 0.79)(1.5) = 1.3 ac-ft

Location: Approx. 0.2 miles south of Greenway Rd, east side of Dysart.



N

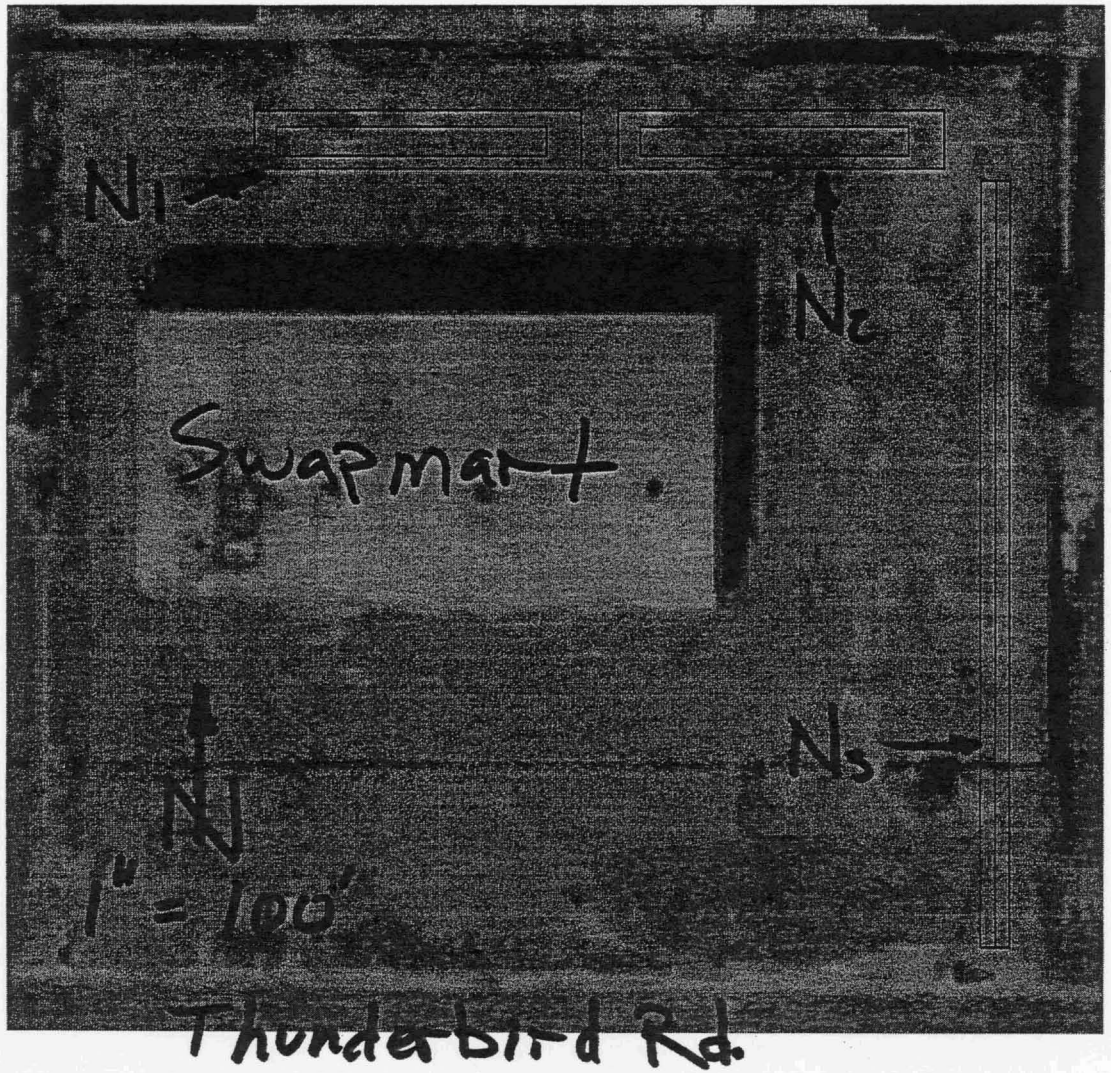
1" = 100'

C.G. Road

Q:\16956\02-Assgn 1-West Cactus\05-Study Phase\05-Dwgs\Survey\storage, rev ØØ.dwg

West Cactus Basin
SCI #16956

Basin N Storage Estimate 1



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Project No. 16956 Page No.

Subject West Cactus Basin

Computed by B Schalk Date 9-24-04 Basin N Storage Estimate

Checked by Date

Approved by Date Sheet No. of

Basin N1:

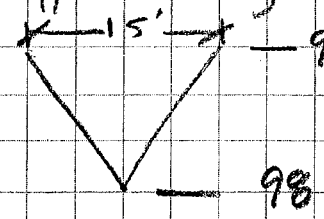
Approx Bottom El = 97.8'
Approx Top El = 100.2'
Depth = 2.4'
Top Area = 0.12 ac
Bottom Area = 0.05 ac
Storage = (1/2)(.12 + .05)(2.4)
= 0.2 ac-ft

Basin N2:

Approx Bottom El = 97.1'
Approx Top El = 100'
Depth = 2.9'
Top Area = 0.12 ac
Bottom Area = 0.05 ac
Storage = (1/2)(.12 + .05)(2.9)
= 0.2 ac-ft

Basin N3:

Approx Length = 400'



Area = (1/2)(15)(1.5)
= 11.3 ft²

Volume = (400 ft)(11.3 ft²) = 4,520 ft³
= 0.1 ac-ft

TOTAL STORAGE = 0.1 + 0.2 + 0.2 = 0.5 ac-ft

SC 3004 R4 898

West Cactus Basin ; SCI # 16956; Basin O Storage Estimate

Approx Bottom El = 98.75'

Approx Top El = 100'

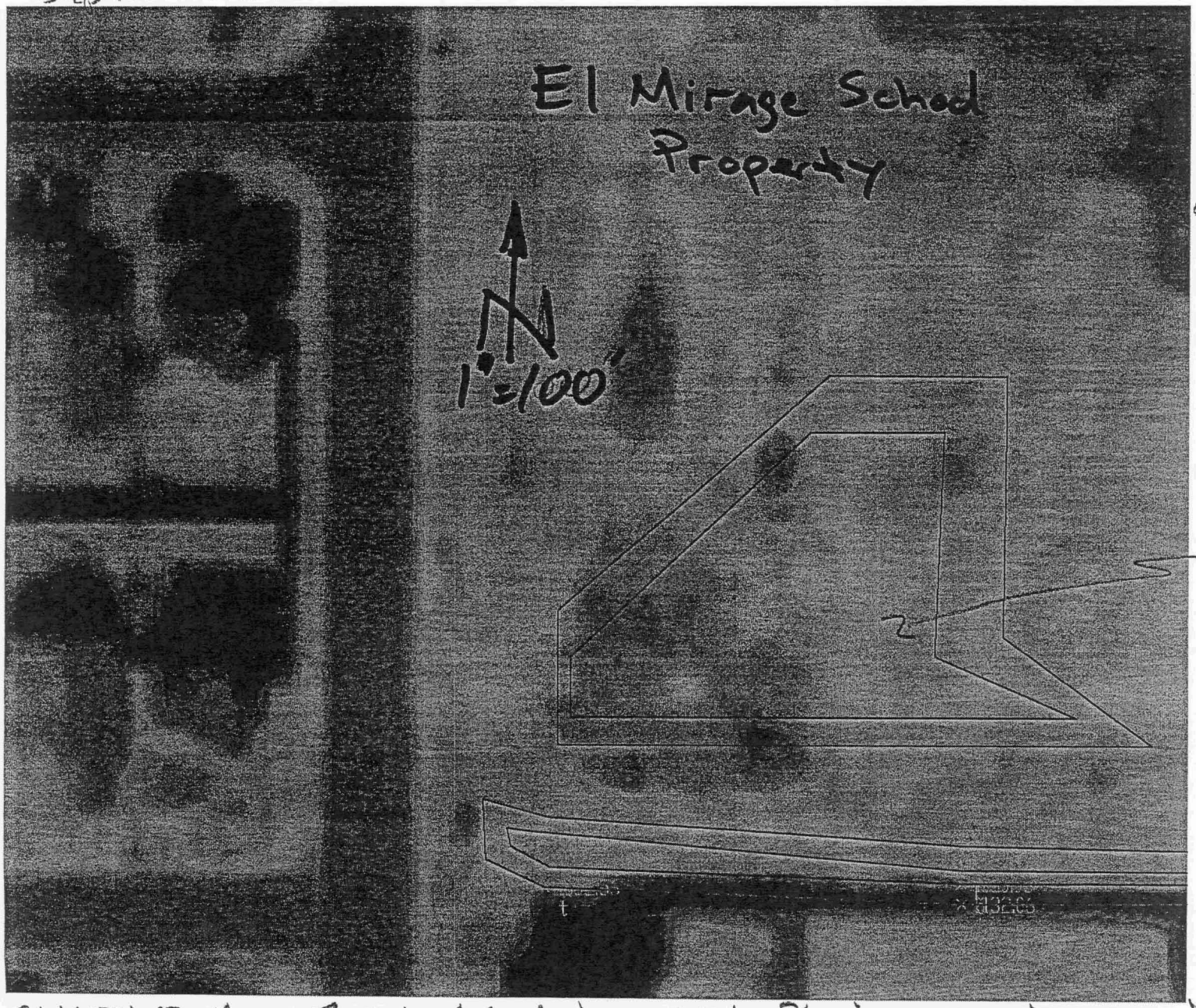
Depth = 1.25'

Top Area = 0.36

Bottom Area = 0.21

Storage = (½)(.36+.21)(1.25)

= 1.5 ac-ft

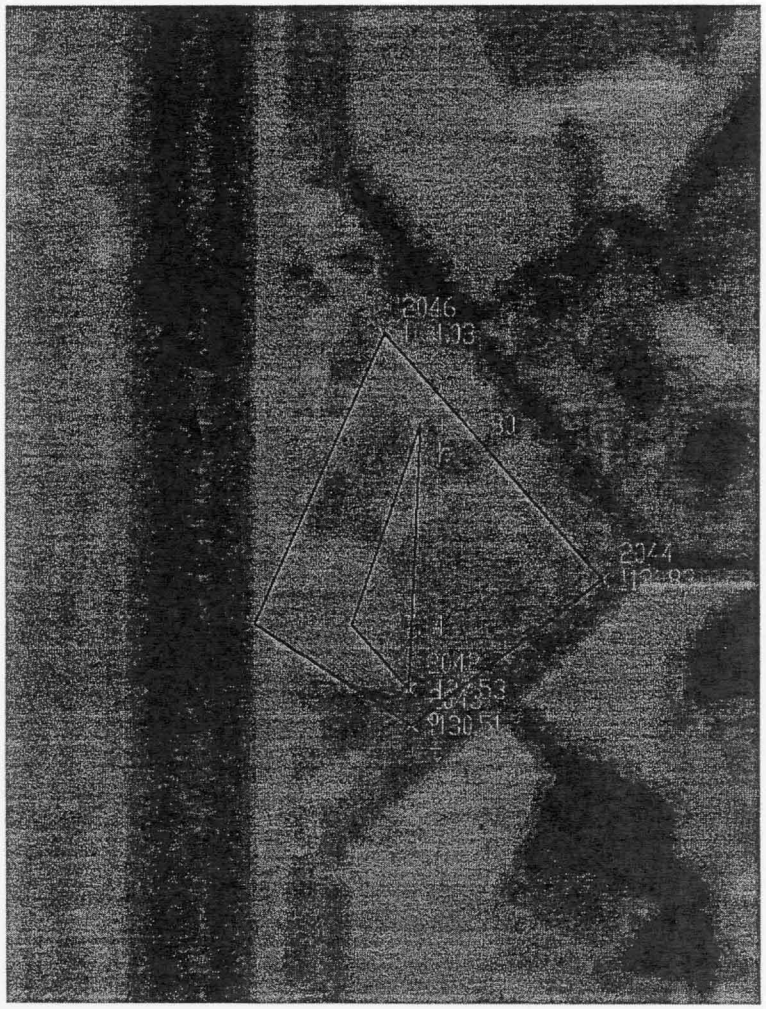


El Mirage School is located on SW corner of El Mirage and Thunderbird Roads.

Q:\16956\02-Assgn 1-West Cactus\05-Study Phase\05-Dwgs\Survey\storage, rev 00.dwg

West Cactus Basin
SCI #16956

Basin P Storage Estimate:



Approx Bottom El = 1,127.5'

Approx Top El = 1,129.6'

Depth = 2.1'

Top Area = 0.11 ac

Bottom Area = 0.01 ac

Storage = (1/2)(.11 + .01)(2.1)

= 0.1 ac-ft

Location: Approx 0.2 mi north of Cactus Rd, east side of Dysart Rd.

N

1" = 50'

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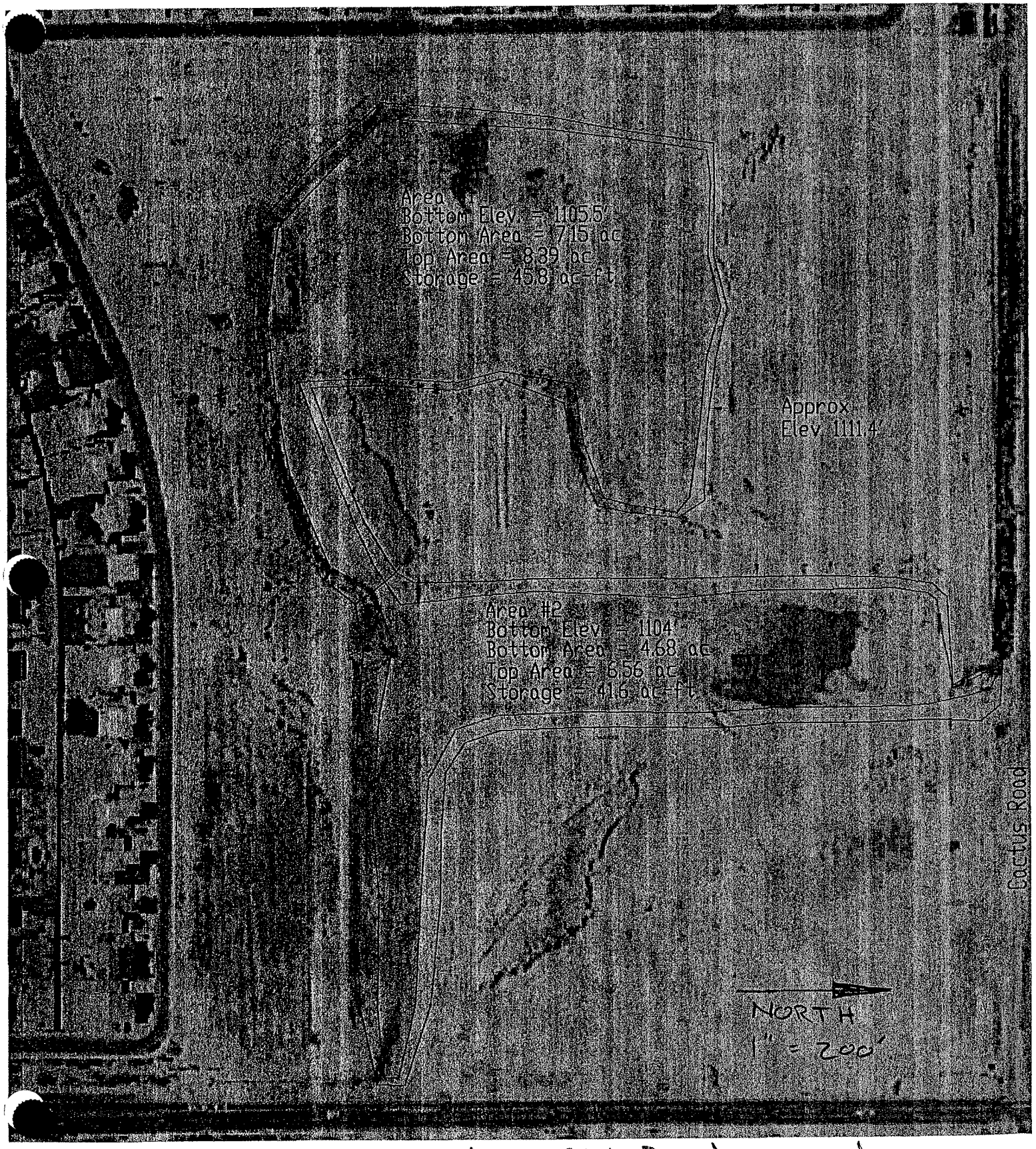
9-23-04 B. Schalk
West Cactus Basin
SCI #16956

BASIN Q - Existing Basin and Channel



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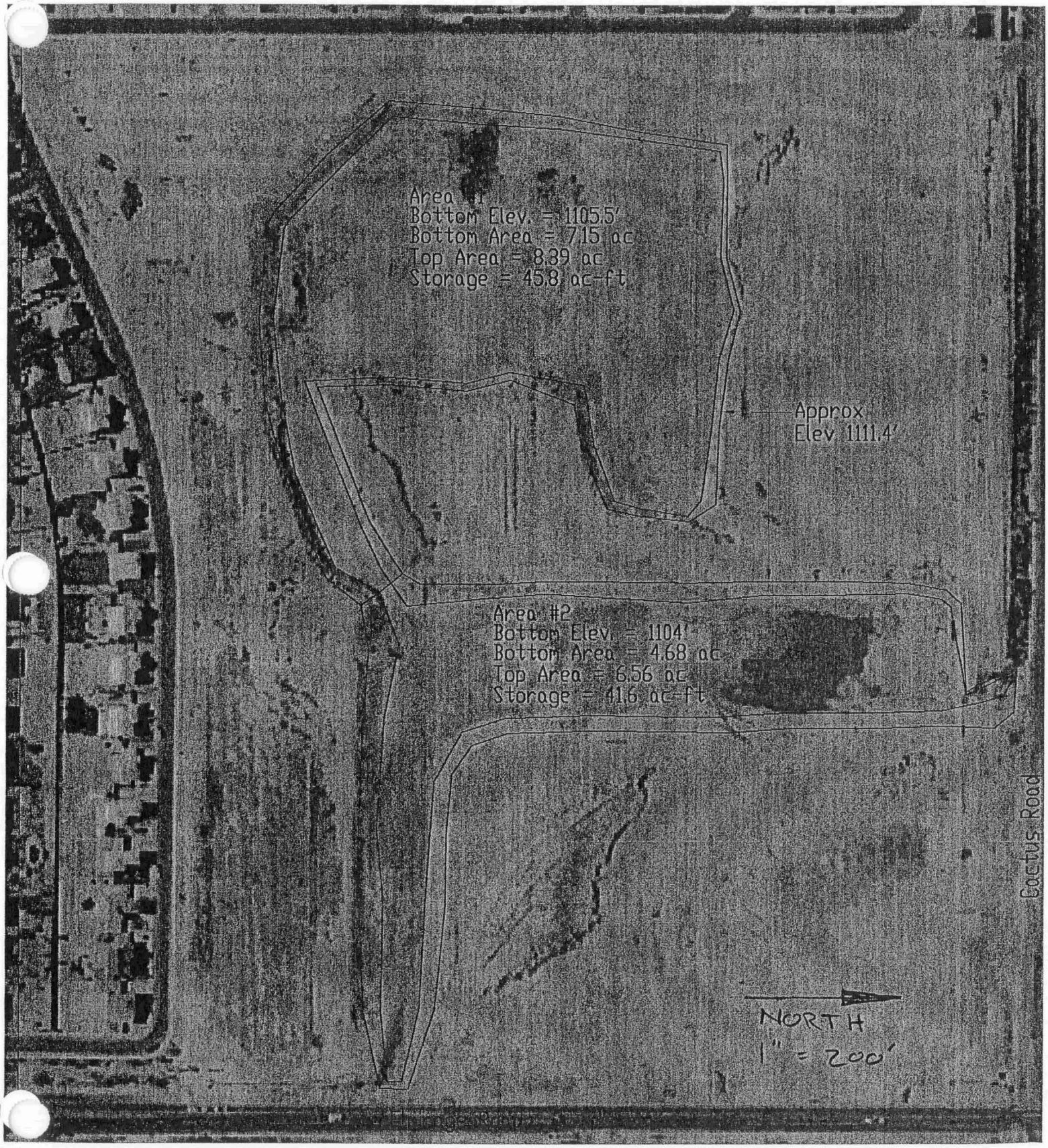
9-23-04 B. Schalk
West Cactus Basin
SCI #16956

BASIN Q - Existing Basin and Channel



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West Cactus Basin
SCI #16956

Basin A Storage Estimate

Approx Bottom Elev = 1,115'

Approx Top Elev = 1,116.7'

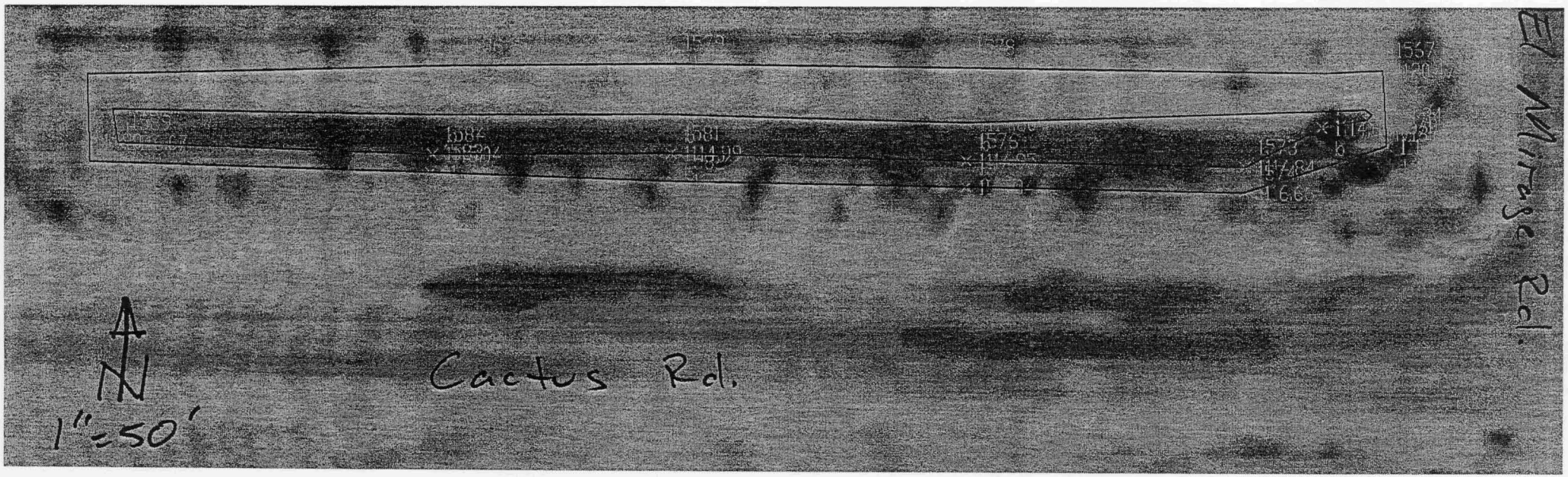
Depth = 1.7'

Bottom Area = 0.13 ac

Top Area = 0.38 ac

Storage = (1/2)(.13 + .38)(1.7)

= 0.4 ac-ft



Project No. 16956 Page No.

Subject West Centers Basin
Storage Estimate for
Lower El Mirage Wash Channel
& Tributary

Sheet No. 1 of 3

Computed by R. Schalk Date 9-23-04

Checked by Date

Approved by Date

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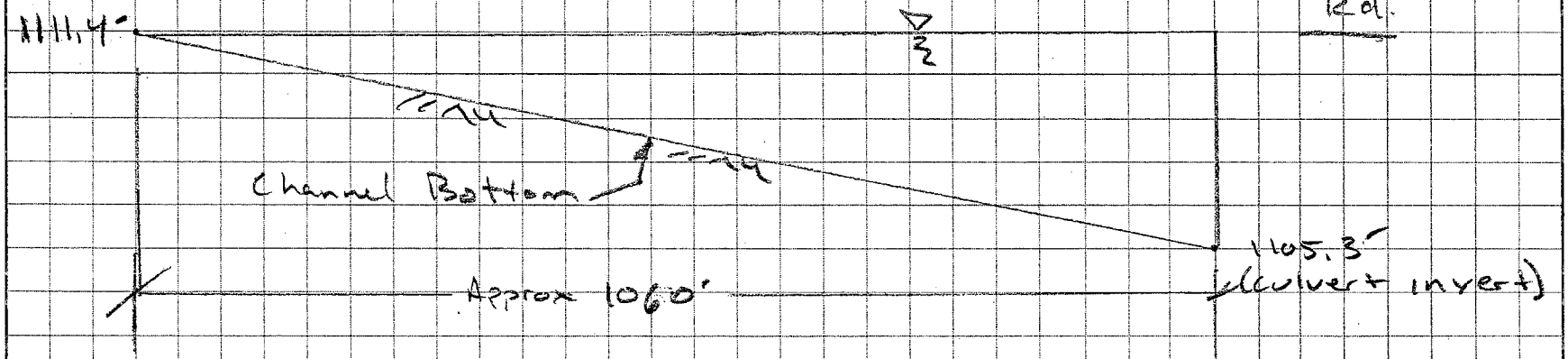
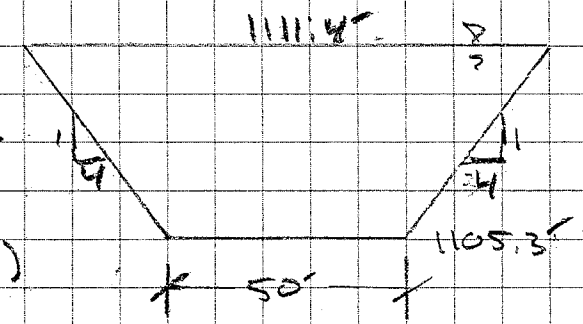
Centers
12 d.

Approx. Lower El Mirage Wash Channel Profile



Approx. Lower El Mirage Channel Cross-Section →



Area = ½ (BW + TW)(H)
H = 1111.4 - 1105.3
= 6.1'
BW = 50'
TW = 50 + 2(6.1)(4)
= 99'

Area = (½)(50 + 99)(6.1)
= 455 ft²

Approx Storage Volume = (½)(455 ft²)(1060 ft)
= 241150 ft³ = 5.5 ac-ft

Elev 1111.4' is Approx Low Point in El Mirage Road Dip Section At Basin Culvert Crossing

SC 3004 R4 898

Project No. 16956 Page No.

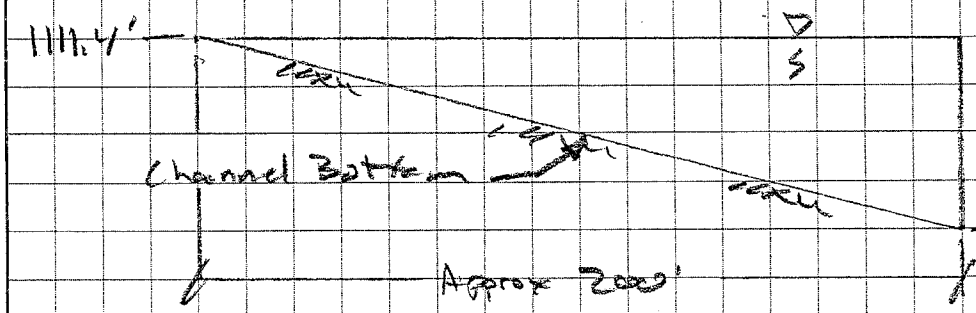
Subject West Centre Basin Storage Est. for Lower El Mirage Wash Channel & Tributary

Sheet No. 2 of 3

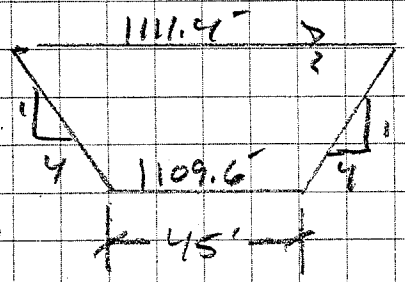
Computed by B Schalk Date 9-23-04

Checked by Date

Approved by Date



Approx Lower El Mirage Wash Channel Tributary Profile



Approx Lower El Mirage Wash Channel Tributary X-Section

$H = 1111.4 - 1109.6$
$= 1.8'$

$BW = 45'$

$TW = 45 + (2)(4)(1.8)$
$= 59.4'$

Approx Area @ Confluence $= (1/2)(45 + 59)(1.8) = 94\ ft^2$

Approx. Tributary Storage Volume $= (1/2)(94\ ft^2)(200\ ft)$
$= 9{,}400\ ft^3 = 0.2$ ac-ft

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Computed by B. Schalk Date 9-28-04

Checked by _____ Date _____

Approved by _____ Date _____

Project No. 16956 Page No. _____

Subject West Cactus Basin Channel Storage Estimate Above Cactus Rd.

Sheet No. 3 of 3

Reach	Approx Storage
Main Channel	5.5 ac-ft
Tributary	0.2 ac-ft
Total	5.7 ac-ft

SC 3004 R4 898

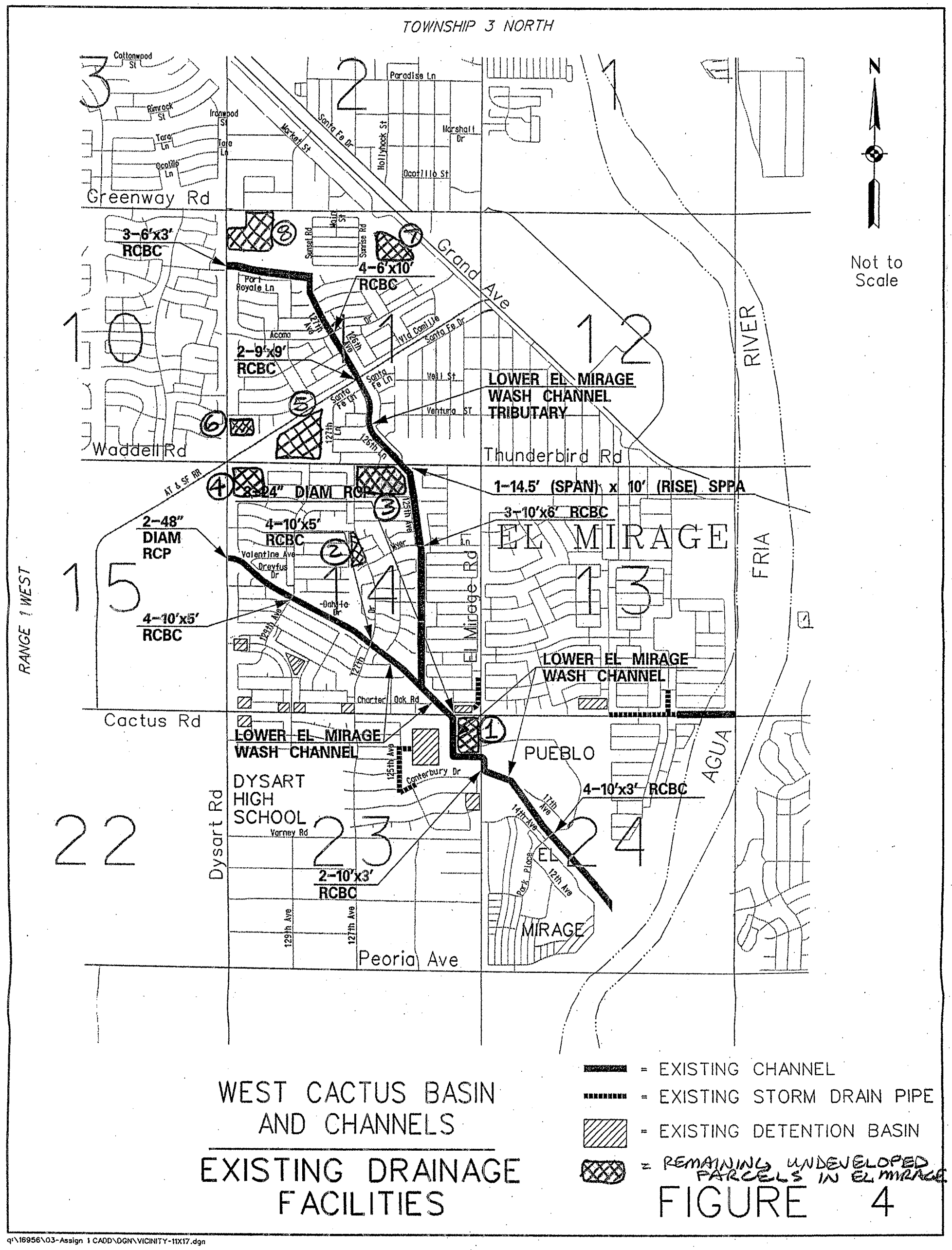
Estimate of Future Stormwater Basin Volumes for Undeveloped Parcels in City of El Mirage

Remaining Undeveloped Parcels in El Mirage
100-Yr, 2-Hr Storage Estimate

100-Yr, 2-Hr Precip: 2.61 in
Runoff "C" Value: 0.75
V = C(P/12)A

Parcel ID	Area (ac)	Retention Volume (ac-ft)	HEC-1 Sub-Basin Location
1	8.9	1.5	172
2	1.1	0.2	157
3	25.1	4.1	157
4	5.7	0.9	157
5	13.3	2.2	156
6	2.4	0.4	139
7	4.2	0.7	140
8	6.8	1.1	139

	SB 139	SB 140	SB 156	SB 157	SB172	Total
Retention:	1.5	0.7	2.2	5	1.5	11.0



WEST CACTUS BASIN AND CHANNELS

EXISTING DRAINAGE FACILITIES

FIGURE 4

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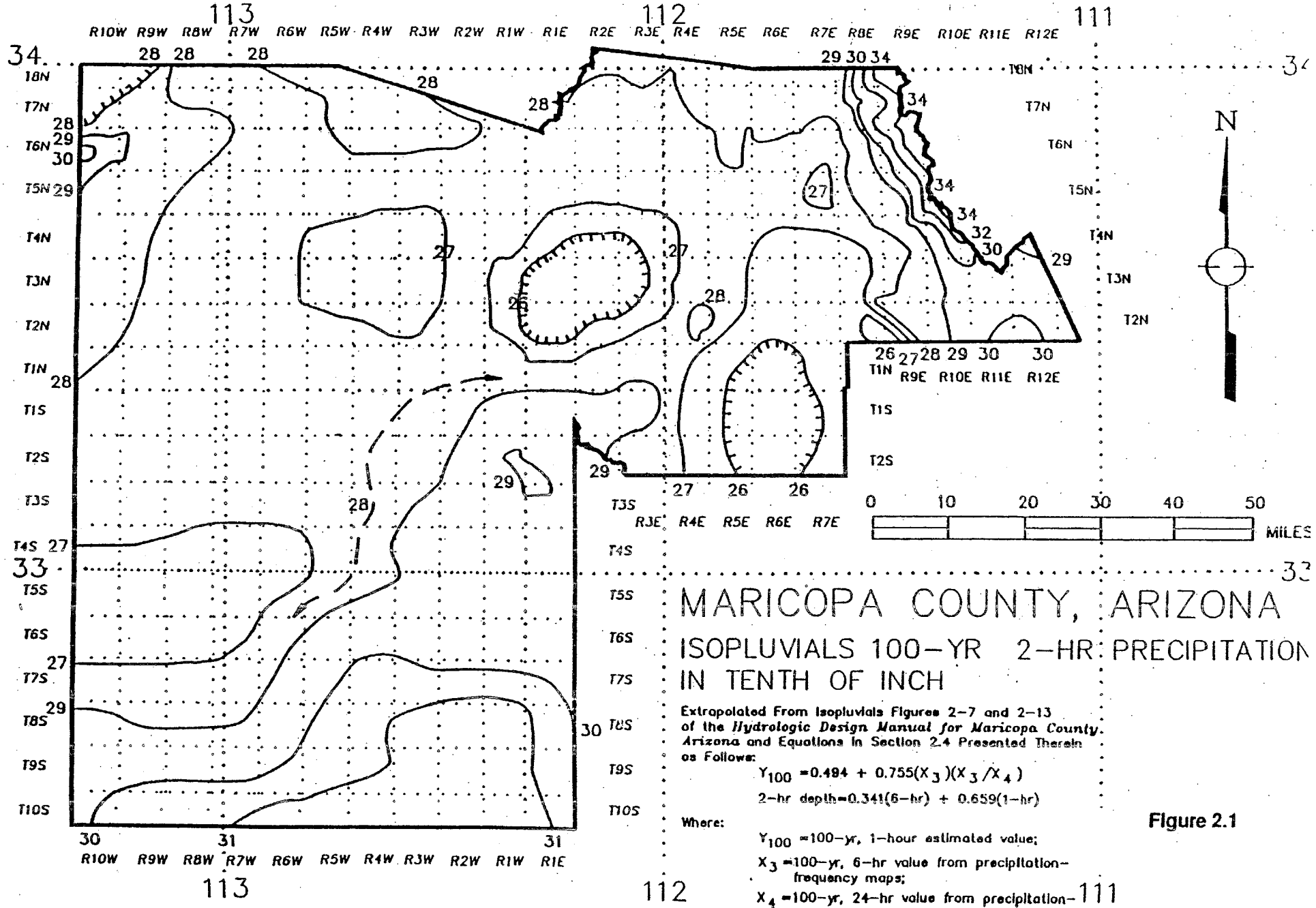
Table 3.2
C Coefficients for Use with the Rational Method

Land Use	Return Period			
	2-10 Year	25 Year	50 Year	100 Year
Streets and Roads				
Paved Roads	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Gravel Roadways & Shoulders	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Industrial Areas				
Heavy	0.70 – 0.80	0.77 – 0.88	0.84 – 0.95	0.88 – 0.95
Light	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Business Areas				
Downtown	0.75 – 0.85	0.83 – 0.94	0.90 – 0.95	0.94 – 0.95
Neighborhood	0.55 – 0.65	0.61 – 0.72	0.66 – 0.78	0.69 – 0.81
Residential Areas				
Lawns – Flat	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
– Steep	0.25 – 0.40	0.28 – 0.44	0.30 – 0.48	0.31 – 0.50
Suburban	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Single Family	0.45 – 0.55	0.50 – 0.61	0.54 – 0.66	0.56 – 0.69
Multi-Unit	0.50 – 0.60	0.55 – 0.66	0.60 – 0.72	0.63 – 0.75
Apartments	0.60 – 0.70	0.66 – 0.77	0.72 – 0.84	0.75 – 0.88
Parks/Cemetaries	0.10 – 0.25	0.11 – 0.28	0.12 – 0.30	0.13 – 0.31
Playgrounds	0.40 – 0.50	0.44 – 0.55	0.48 – 0.60	0.50 – 0.63
Agricultural Areas	0.10 – 0.20	0.11 – 0.22	0.12 – 0.24	0.13 – 0.25
Bare Ground	0.20 – 0.30	0.22 – 0.33	0.24 – 0.36	0.25 – 0.38
Undeveloped Desert	0.30 – 0.40	0.33 – 0.44	0.36 – 0.48	0.38 – 0.50
Mountain Terrain (Slopes > 10%)	0.60 – 0.80	0.66 – 0.88	0.72 – 0.95	0.75 – 0.95

Note: Values of C for 25, 50 and 100 Year were derived using frequency adjustment factors of 1.10, 1.20, and 1.25, respectively, with an upper limit of 0.95 for C for the 2-10 Year values.



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 2-HR PRECIPITATION IN TENTH OF INCH

Extrapolated From Isopluvials Figures 2-7 and 2-13 of the *Hydrologic Design Manual for Maricopa County, Arizona* and Equations in Section 2.4 Presented Therein as Follows:

$$Y_{100} = 0.494 + 0.755(X_3)(X_3/X_4)$$

$$\text{2-hr depth} = 0.341(\text{6-hr}) + 0.659(\text{1-hr})$$

Where:

Y_{100} = 100-yr, 1-hour estimated value;

X_3 = 100-yr, 6-hr value from precipitation-frequency maps;

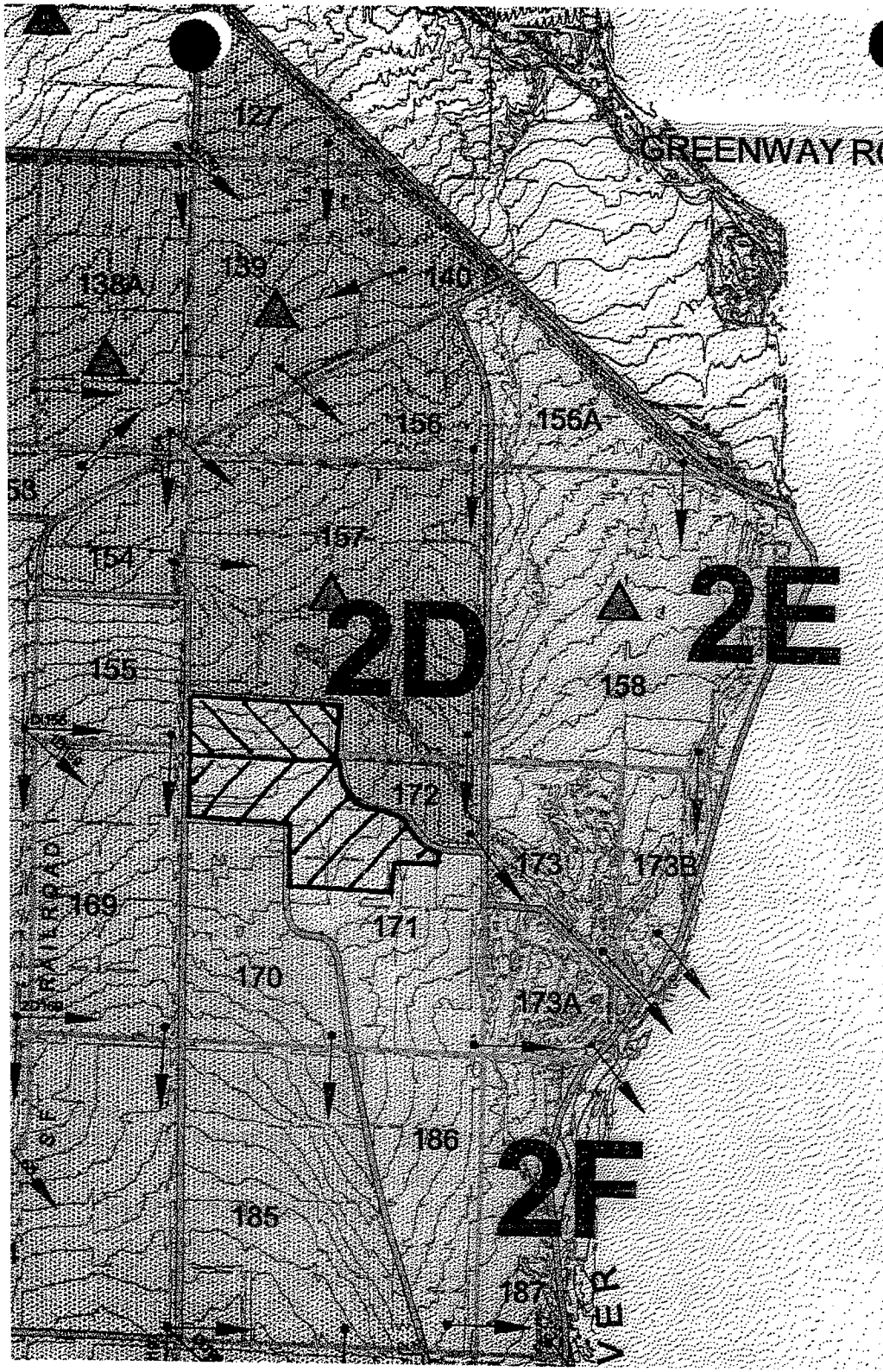
X_4 = 100-yr, 24-hr value from precipitation-frequency maps;

6-hr = isopluvial values from figure 2.7;

Figure 2.1

Revised Contributing Areas for Sub-Basins 157 and 172

West Cactus Basin
SCI #16956



Loop 303 Corridor/White Tanks
Area Drainage Master Plan Update
Existing Condition
HEC-1 Schematic
Revised Sub-Basin Areas
for West Cactus Basin Project

Portion of Sub-Basin 171
Added to Sub-Basin 157.
Approx 90 Acres.

Portion of Sub-Basin 171
Added to Sub-Basin 172.
Approx 115 Acres.

N

N.T.S.

Updated HEC-1 Model
"Do Nothing" Alternative (EXSTREV1.dat)
Output Excerpts

"Do Nothing" Alt. HEC-1
EXSTREV01.DAT
Oct 2004

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *              JUN   1998              *
CENTER    *
 *            VERSION 4.1               *
 *                                      *
 *                                      *
 *                                      *
 *  RUN DATE   13OCT04  TIME  12:34:44  *
 *                                      *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*                                      *
*                                      *
*   U.S. ARMY CORPS OF ENGINEERS       *
*   HYDROLOGIC ENGINEERING             *
*        609 SECOND STREET             *
*      DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104              *
*                                      *
```

```
X    X  XXXXXXX  XXXXX         X
X    X  X       X    X        XX
X    X  X       X              X
XXXXXXX  XXXX    X       XXXXX  X
X    X  X       X              X
X    X  X       X    X         X
X    X  XXXXXXX  XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID
   2          ID   ******************************************************************
   3          ID   ******************************************************************
   4          ID   ******************************************************************
   5          ID
   6          ID       WEST CACTUS DETENTION BASIN AND CHANNELS PROJECT (CAR)
   7          ID       PREPARED BY STANLEY CONSULTANTS FOR FCDMC, OCTOBER 2004
   8          ID       FCD 2003C020
```

```
  9        ID      SCI #16956.01.00
 10        ID      HEC-1 FILE NAME EXSTREV1.DAT
 11        ID
 12        ID
 13        ID      EXISTING CONDITIONS, REVISION 1 - 100-YR DISCHARGE
 14        ID      REDUCTION AT WEST CACTUS BASIN BASED ON EXISTING
 15        ID      CONDITIONS.
 16        ID
 17        ID
 18        ID      OBJECTIVE/PURPOSE OF MODIFIED HEC-1 MODEL:
 19        ID      THE OBJECTIVE OF THIS HEC-1 MODEL (EXSTREV1.DAT) IS TO
 20        ID      ESTIMATE THE FLOW THRU THE PUEBLO EL MIRAGE PROPERTY,
 21        ID      DOWNSTREAM OF EL MIRAGE ROAD, BASED ON EXISTING CONDITIONS.
 22        ID
 23        ID      THE EXISTING BASIN IS MODELED AS A LEVEL POOL (LP172).
 24        ID
 25        ID
 26        ID      BASE HYDROLOGY:  WHITE TANKS ADMP UPDATE, FUTURE CONDITIONS
 27        ID      WITH PROJECTS - LEVEL III (FILE:  L33PF6D.DAT)
 28        ID
 29        ID      MODIFICATIONS MADE TO BASE HYDROLOGY MODEL DONE BY
 30        ID      STANLEY CONSULTANTS (BNS) - OCTOBER 2004
 31        ID      FILE:  ALT1REV1.DAT
 32        ID
 33        ID      MODIFICATIONS TO BASE HYDROLOGY:
 34        ID      1. BASE HYDROLOGY SB172 SET ASIDE.  ADJUSTED SB172 UTILIZED.
 35        ID      2. BASE HYDROLOGY RETENTION MODIFIED FOR SUBBASINS 139, 140,
 36        ID      156, 157 AND 172.  THIS RETENTION IS REFLECTED IN THE MODEL BY
 37        ID      UTILIZING DIVERT STEPS IMMEDIATELY FOLLOWING EACH BASIN.
 38        ID      ADDED DIVERT STEPS:  DIV139, DIV140, DIV156, DIV157 AND DIV172.
 39        ID      RETENTION MODIFICATION BASED ON EXISTING RETENTION AND FUTURE
 40        ID      2-YR, 24-HR REQUIRED RETENTION THAT WILL BE ENFORCED BY CITY
 41        ID      OF EL MIRAGE.
 42        ID      3. THE AREA NORTH OF CACTUS ROAD THAT CONTRIBUTES TO SB172, BUT
 43        ID      IS NOT REFLECTED IN THE BASE HYDROLOGY, HAS BEEN ADDED TO SB157.
 44        ID      BOTH THE ADDED AREA AND SB157 ARE FULLY DEVELOPED.  ALL RUNOFF
 45        ID      FROM BOTH AREAS OUTFALL TO THE WEST CACTUS BASIN AT THE CACTUS
 46        ID      ROAD DIP CROSSING.  ADDING THIS AREA TO SB157 RATHER THAN TO
 47        ID      SB172 ALLOWS FOR DETERMINATION OF RUNOFF ENTERTING THE BASIN
 48        ID      FROM THE WEST, SOUTH OF CACTUS ROAD, WITH MINIMAL CHANGES TO THE
 49        ID      BASE HYDROLOGY.  SB157 AREA WAS INCREASED FROM 0.89 TO 1.03
 50        ID      SQUARE MILES.
 51        ID      4. THE FOLLOWING BASE HYDROLOGY STEPS WERE SET ASIDE: RLE3,
 52        ID      157OUT, 139OUT, 140OUT, 156OUT, 172, 172OUT, !LE4, SRLECH, DLE4,
 53        ID      SRLE4, DILE4 AND 2LE4.
 54        ID      5. THE FLOW AT CACTUS RD (!LE3) AND SUBBASIN 172 (172) ARE
 55        ID      COMBINED (AD172A) AND ROUTED THROUGH THE EXISTING BASIN (LP172)
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 56        ID      LOCATED ON THE SW INTERSECTION CORNER OF EL MIRAGE AND CACTUS
 57        ID      ROADS. THE FLOW IS THEN ROUTED THRU THE PUEBLO EL MIRAGE GOLF
 58        ID      COURSE (RLE4).  THE EXISTING BASIN IS AN ON-LINE BASIN.  THE
 59        ID      PORTION OF THE LOWER EL MIRAGE WASH THAT IS LOWER THAN THE
 60        ID      EL MIRAGE ROAD DIP AT THE CULVERT CROSSING IS CONSIDERED AS A
 61        ID      PORTION OF THE BASIN VOLUME - FLOW WILL BACK UP AND BE STORED
 62        ID      IN THE CHANNEL BEFORE OVERTOPPING ROADWAY.
```

```
 63          ID
 64          ID
 65          ID
 66          ID       SUBBASIN 172 ADJUSTED TO REFLECT EXISTING FIELD CONDTIONS:
 67          ID              1. INCREASED BASIN AREA FROM 0.12 TO 0.30 SQ MI.
 68          ID                 INCREASE IN BASIN AREA TO REFLECT THE AREA WEST
 69          ID                 OF THE BASIN AND SOUTH OF CACTUS RD THAT CONTRIBUTES
 70          ID                  TO SB172 (ORGINALLY PART OF SB171).
 71          ID              2. GREEN & AMPT PARAMETERS CHOSEN FROM SB171 OR SB172
 72          ID                 DEPENDING ON THE VALUE THAT WOULD GENERATE GREATER
 73          ID                 RUNOFF.
 74          ID              3. THE Kn VALUE USED TO DEVELOP THE ADJUSTED UNIT
 75          ID                 HYDROGRAPH IS BASED ON THE SUBBASIN 157 Kn VALUE:
 76          ID                 Kn = 0.084.
 77          ID
 78          ID
 79          ID   ********************************************************************
 80          ID   ********************************************************************
 81          ID   ********************************************************************
 82          ID
 83          ID        FUTURE CONDITION HDYROLOGY MODEL WITH PROJECTS - LEVEL III
 84          ID
 85          ID        WHITE TANKS AREA DRAINAGE MASTER STUDY *UPDATE*
 86          ID        Original MODEL BY THE WLB Group for FCDMC AS PART OF THE WHITE
 87          ID        TANKS/AGUA FRIA ADMS, Date: October 1991
 88          ID
 89          ID        ***REMOVED RETENTION AT SUPER BASIN #5 SUB BASINS 297, 315, ***
 90          ID        ***334, 335A, 335, 316 TO REFLECT RELAXED RETENTION REQUIRE-***
 91          ID        ***MENTS ADJACENT TO THE BULLARD CHANNEL S. OF I-10.        ***
 92          ID
 93          ID       * URS REVISED RTIMP PERCENT IMPERVIOUS VALUES *
 94          ID       * AS PER FCDMC GIS DATA - 6-27-01 *
 95          ID
 96          ID        REVISED HYDROLOGY HEC-1 RUN FOR WHITE TANKS ADMS
 97          ID        100-YEAR, 24-HOUR STORM                  original file: WTADMS.24
 98          ID
 99          ID        FUTURE CASE WITH RETENTION VOLUME DIVERTS
100          ID
101          ID                                      REVISED BY URS     DATE: 01-14-04
102          ID                                                         FILE: L33PF6D.DAT
103          ID
104          ID       NOTES:
105          ID       1. THIS HEC-1 MODEL CONTAINS THE FOLLOWING SUPER BASINS: WHITE TANKS 3,
106          ID          2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, 2 & 3, 4 THRU 26.
107          ID       2. REVISED TO REFLECT UPDATED SOILS MAPS AND NEW DEVELOPMENT.
108          ID       3. AVERAGE XKSAT VALUES FOR EACH SUBBASIN WAS RECEIVED FROM FCDMC
109          ID          GIS DATA AND THEN ADJUSTED FOR VEGETATION, OR LEFT AS ORIGINALLY IN
110          ID          THE WLB MODEL.
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

111          ID       4. FOR NEW DEVELOPMENTS ONLY 80% OF REPORTED PROVIDED RETENTION
112          ID          WAS INCLUDED IN THIS MODEL (AS A CONSERVATIVE ESTIMATE). RETENTION
113          ID          CAPACITIES WERE ESTIMATED BY EEC FOR DEVELOPMENTS WITH NO
114          ID          DRAINAGE REPORTS.
115          ID       5. REVISED DRAINAGE BOUNDARIES BASED UPON FIELD INSPECTION OF SUN CITY.
116          ID          GRAND.  COMBINED SEVERAL BASINS TOGETHER TO MAKE NEW BASINS 114 &115.
```

```
117          ID          ALSO REROUTED SUBBASINS 100A, 101, 102A AND 106 TO THE SOUTH TO 113A.
118          ID       6. CHANNEL ROUTE ALONG REEMS ROAD UPDATED TO REFLECT NEW CONSTRUCTION.
119          ID       7. REVISED SCS TYPE II RAINFALL DISTRIBUTION FOR THE 24-HOUR GENERAL
120          ID          STORM.
121          ID       8. REVISED RAINFALL DEPTH-AREA REDUCTION FACTORS.
122          ID       9. PSIF WERE ADJUSTED BASED ON THE VALUES OF XKSAT AND WERE EDITED INTO
123          ID          THE DATA FILE BY THE FCDMC.
124          ID      10. AVERAGE XKSAT VALUES FOR SUBBASINS WITH BORROW PITS (WHITE TANKS
125          ID          AREAS #3 & #4) WERE ESTIMATED BY EEC.
126          ID
             *DIAGRAM
127          IT       5                    1000
128          IO       5
129          IN      15
130          JD    4.03    .001
131          PC    .000    .002    .005    .008    .011    .014    .017    .020    .023    .026
132          PC    .029    .032    .035    .038    .041    .044    .048    .052    .056    .060
133          PC    .064    .068    .072    .076    .080    .085    .090    .095    .100    .105
134          PC    .110    .115    .120    .126    .133    .140    .147    .155    .163    .172
135          PC    .181    .191    .203    .218    .236    .257    .283    .387    .663    .707
136          PC    .735    .758    .776    .791    .804    .815    .825    .834    .842    .849
137          PC    .856    .863    .869    .875    .881    .887    .893    .898    .903    .908
138          PC    .913    .918    .922    .926    .930    .934    .938    .942    .946    .950
139          PC    .953    .956    .959    .962    .965    .968    .971    .974    .977    .980
140          PC    .983    .986    .989    .992    .995    .998    1.00   1.000   1.000   1.000
141          JD    3.79      10
142          JD    3.51      50
143          JD    3.39     100
144          JD    3.29     200


1823         KK     157
1824         KM         RUNOFF HYDROGRAPH FROM SUB-BASIN 157
1825         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1826         KM    L=      1.3  Lca=       .6   S=   26.8  Kn= .084  LAG=  59.9
1827         KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1828         KM    INCREASE IN BA FROM 0.89 TO 1.03 SQ. MI. TO REFLECT THE AREA NORTH OF
1829         KM    CACTUS RD THAT CONTRIBUTES TO SUBBASIN 172.
1830         BA    1.03
1831         LG     .40     .25    5.20     .36    22.7
1832         UI     50.     50.     78.    175.    219.    257.    289.    326.    373.    435.
1833         UI    560.    646.    535.    458.    407.    359.    312.    272.    238.    189.
1834         UI    133.     89.     84.     82.     51.     50.     43.     15.     15.     15.
1835         UI     15.     15.     15.     15.     15.      0.      0.      0.      0.      0.
1836         UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
             *
             *

1837         KK  DIV157
1838         KM        STANLEY, B. SCHALK, OCT 2004
1839         KM        DIVERT RETENTION VOLUME
1840         DT  RET157      19
1841         DI       0   10000
1842         DQ       0   10000
             *
             *
             * ******************************************************************************
```

```
                 * ***************************************************************************
                 * SET ASIDE BY STANLEY (BNS)
                 * KK157OUT
                 * KM      DIVERSION-RETENTION
                 * DT157RET    42.4
                 * DI     0   10000
                 * DQ     0   10000
                 * ***************************************************************************
                 * ***************************************************************************
                 *
                 *

1843             KK   1I157
1844             KM        ADD HYDROGRAPHS AT 1I157
1845             HC       2   25.08

1846             KK   2I157
1847             KM        ADD HYDROGRAPHS AT 2I157
1848             HC       2   25.08
                 *

1849             KK     127
1850             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 127
1851             BA     .22
1852             LG     .12     .18    7.00     .14   20.00
1853             UI     90.    276.    510.    430.    243.     91.     37.     15.      0.      0.
1854             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1                                                HEC-1 INPUT                                          PAGE 46

LINE             ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1855             KK    R127
1856             KM        ROUTE FLOW FROM CP127 TO CP139
1857             RS     29              -1       0
1858             RC     .08     .08     .08    3744   .0032
1859             RX    1000    1001    1002    1410    1820    2410    2860    3000
1860             RY    1155    1155    1155    1154    1154    1156    1158    1159
                 *

1861             KK     139
1862             KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 139
1863             KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1864             KM    L=      1.0  Lca=       .5   S=   17.0  Kn= .039  LAG=  24.5
1865             KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1866             BA     .47
1867             LG     .27     .24    6.20     .19    63.1
1868             UI     65.    224.    357.    488.    760.    602.    440.    311.    158.    100.
1869             UI     63.     20.     20.     20.      0.      0.      0.      0.      0.      0.
1870             UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
                 *
                 *

1871             KK  DIV139
1872             KM       STANLEY, B. SCHALK, OCT 2004
1873             KM       DIVERT RETENTION VOLUME
1874             DT  RET139     2.8
1875             DI       0   10000
```

```
1876          DQ       0   10000
              *
              * ******************************************************************************
              * ******************************************************************************
              * SET ASIDE BY STANLEY (BNS)
              * KK139OUT
              * KM      DIVERSION-RETENTION
              * DT139RET    40.8
              * DI      0   10000
              * DQ      0   10000
              * ******************************************************************************
              * ******************************************************************************
              *
              *

1877          KK   1I139
1878          KM        ADD HYDROGRAPHS AT 1I139
1879          HC       2     .69

1880          KK    D126
1881          KM        RETURN DIVERT AT CP126
1882          DR   DI139
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY
1                                          HEC-1 INPUT                                    PAGE 47

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1883          KK     RLE
1884          KM        ROUTE FLOW FROM CP126 TO CP139
1885          RS     1.6            -1.0     0.0
1886          RC   0.030   0.030   0.030    4062  0.0031
1887          RX     0.0    37.2    47.2    57.2    67.2    77.2    87.2   124.4
1888          RY  1160.5  1151.2  1151.2  1151.2  1151.2  1151.2  1151.2  1160.5
              * KK  R126
              * KM ROUTE FLOW TO LE1 (CP126 TO CP139)
              * DUMMY ROUTE
              * RS     1              -1       0
              * RC  0.03   0.028    0.03    2640   .0021
              * RX  1000    1030    1035    1070    1200    1300    1330    1360
              * RY  1100    1090    1090    1090    1090    1090    1090    1100

1889          KK   2I139
1890          KM        ADD HYDROGRAPHS AT 2I139
1891          HC       2    7.04
              *

1892          KK     140
1893          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 140
1894          BA     .18
1895          LG     .50     .00    5.64     .34    78.6
1896          UI     13.     13.     35.     53.     65.     75.     88.    104.    142.    155.
1897          UI    123.    105.     90.     76.     64.     52.     33.     22.     21.     16.
1898          UI     13.      9.      4.      4.      4.      4.      4.      4.      0.      0.
1899          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
              *
              *
```

```
1900          KK  DIV140
1901          KM        STANLEY, B. SCHALK, OCT 2004
1902          KM        DIVERT RETENTION VOLUME
1903          DT  RET140     5.2
1904          DI       0   10000
1905          DQ       0   10000
              *
              *
              * ****************************************************************************
              * ****************************************************************************
              * SET ASIDE BY STANLEY (BNS)
              * KK140OUT
              * KM       DIVERSION-RETENTION
              * DT140RET   16.56
              * DI     0   10000
              * DQ     0   10000
              * ****************************************************************************
              * ****************************************************************************
              *
              *
              * MODIFY PER LEVEL III
              *
              * KK CP139
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1906          KK    !LE1
1907          KM        ADD HYDROGRAPHS AT CP139
1908          HC       2    0.88
              *
              * REMOVE PONDING AT RAILROAD WITH PROPOSED CHANNEL
              *
              * KK SR139
              * KM       STOAGE ROUTE BEHIND RAILROAD.
              * RS     1    STOR       0       0
              * SV     0    1.14    3.12    6.43   29.35
              * SQ     0       0     170    1037    5977
              * SE1046.2  1047.2  1047.5    1048    1049
              *
              * KK  R139

1909          KK    RLE1
1910          KM        ROUTE FLOW FROM CP139 TO CP156
1911          RS     1.6            -1.0     0.0
1912          RC   0.030   0.030   0.030    1980  0.0023
1913          RX     0.0    19.2    29.2    39.2    49.2    59.2    69.2    88.4
1914          RY  1137.5  1132.7  1132.7  1132.7  1132.7  1132.7  1132.7  1137.5
              *

1915          KK     156
1916          KM        RUNOFF HYDROGRAPH FROM SUB-BASIN 156
1917          BA     .30
1918          LG     .35     .09    5.00     .41    54.8
1919          UI     18.     18.     33.     64.     82.     94.    106.    121.    139.    173.
1920          UI    223.    206.    171.    149.    132.    113.     99.     85.     69.     47.
1921          UI     31.     30.     28.     18.     18.     12.      5.      5.      5.      5.
```

```
1922          UI      5.      5.      5.      5.      0.      0.      0.      0.      0.      0.
1923          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
              *
              *

1924          KK  DIV156
1925          KM        STANLEY, B. SCHALK, OCT 2004
1926          KM        DIVERT RETENTION VOLUME
1927          DT  RET156     2.7
1928          DI       0   10000
1929          DQ       0   10000
              *
              *
              * ******************************************************************************
              * ******************************************************************************
              * SET ASIDE BY STANLEY (BNS)
              * KK156OUT
              * KM      DIVERSION-RETENTION
              * DT156RET    12.0
              * DI     0   10000
              * DQ     0   10000
              * ******************************************************************************
              * ******************************************************************************
              *
              *
              * MODIFY PER LEVEL III
              *
              * KK CP156
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1930          KK    !LE2
1931          KM   ADD HYDROGRAPHS AT LE2
1932          HC       2    1.18
              *
              * MODIFY PER LEVEL III
              *
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY

1933          KK    RLE2
1934          KM        ROUTE FLOW FROM CP156 TO CP157
1935          RS     3.4          -1.0     0.0
1936          RC   0.030   0.030   0.030    4888  0.0020
1937          RX     0.0    24.4    34.4    44.4    54.4    64.4    74.4    98.8
1938          RY  1128.5  1122.4  1122.4  1122.4  1122.4  1122.4  1122.4  1128.5
              *
              * MODIFY PER LEVEL III
              *
              * KK CP157

1939          KK    !LE3
1940          KO       2       2
1941          KM   ADD HYDROGRAPHS AT LE3 (CP157)
1942          HC       2    1.65
              * KK  R157
              * PER EL MIRAGE CHANNELIZATION OF LOWER EL MIRAGE WASH AND TRIBUTARY
```

```
*
*
* ******************************************************************
* ******************************************************************
* SET ASIDE BY STALNLEY (BNS)
* KK  RLE3
* KM ROUTE LE3 TO LE4
* RS   1.5            -1.0     0.0
* RC 0.030   0.030   0.030    2282  0.0020
* RX   0.0    25.2    35.2    45.2    55.2    65.2    75.2   100.4
* RY1113.6  1107.3  1107.3  1107.3  1107.3  1107.3  1107.3  1113.6
* ******************************************************************
* ******************************************************************
*
*
* ******************************************************************
* ******************************************************************
* INPUT BY STANLEY (BNS) FOR HEC-1 ALT2REV1.DAT
* KKDCP157
* KO     2       2
* KM SPLIT TO REFLECT FLOW ENTERING BASIN.  SPLIT BASED ON EXISTING 2-10'X3'
* KM CULVERT AT EL MIRAGE RD, A RECONSTRUCTED CHANNEL THRU BASIN PARCEL AND
* KM CACTUS ROAD CROSSING ALL HAVING AN APPROXIMATE CONVEYANCE CAPACITY OF
* KM 350 CFS.  IT IS ASSUMED THAT PEAK FLOWS (ABOVE 350 CFS) WILL BE SKIMMED
* KM OFF THE TOP OF THE HYDROGRAPH AND CONVEYED TO THE BASIN VIA A LATERAL
* KM WEIR.
* DTRCP157
* DI     0     350    2000
* DQ     0       0    1650
* ******************************************************************
* ******************************************************************
*
*
* ******************************************************************
* ******************************************************************
* ADJUSTED SB172, AD172A, LP172 INPUT BY STANLEY (BNS)
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1943          KK     172
1944          KO       2       2
1945          KM   BASIN SB172 ADJUSTED
1946          KM   Original basin area 0.12 sq mi.  Increase in basin area from
1947          KM   portion of SB171.  Adjusted Green & Ampt parameters based on
1948          KM   existing parameters for SB171 and SB172.  The adjusted value
1949          KM   used was taken from SB172 or SB171, depending on which value
1950          KM   would generate the larger runoff.  Unit graph computed by using
1951          KM   MCUHP2 program developed by the FCDMC.  Kn value based on SB157.
1952          KM   Original HEC-1 Model(Base Hydrology) is L33PF6D.dat, which was
1953          KM   developed for the WHITE TANKS AREA DRAINAGE MASTER STUDY UPDATE,
1954          KM   by URS for FCDMC, 01-14-04.
1955          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN:
1956          KM   L=      1.0  Lca=       .5   S=   11.0  Kn= .084  LAG=  58.9
1957          BA     .30
1958          LG     .50     .00    5.40     .38   62.20
1959          UI     15.     15.     25.     53.     66.     77.     87.     98.    113.    134.
```

```
1960          UI    174.    187.    153.    132.    118.    102.     90.     77.     67.     50.
1961          UI     34.     26.     24.     21.     15.     15.      8.      5.      5.      5.
1962          UI      5.      5.      5.      5.      5.      0.      0.      0.      0.      0.
1963          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
              *
              *

1964          KK  DIV172
1965          KM        STANLEY, B. SCHALK, OCT 2004
1966          KM        DIVERT RETENTION VOLUME
1967          DT  RET172     1.5
1968          DI       0   10000
1969          DQ       0   10000
              *
              *
              * DIV172 USED IN STANLEY MODEL ALT2REV1.DAT
              * KKDIV172
              * KO      2       2
              * KM SPLIT IS TO REFLECT TOTAL RUNOFF FROM SB172 ENTERING THE WEST CACUTS
              * KM BASIN.  BASIN IS TO BE DRAINED WITH SMALL DIAMETER BLEED-OFF PIPE AND
              * KM DRY WELLS, WHICH IS HYDRLOGICALLY IGNORED AND MODELED HERE AS RETENTION.
              * DTRET172
              * DI      0    1000    2000    3000
              * DQ      0    1000    2000    3000
              *
              *

1970          KK  AD172A
1971          KO       2       2
1972          KM   COMBINE DIV172 AND ADDITION STEP !LE3.
1973          KM   THIS IS THE FLOW TO BE CONVEYED TRU THE EXISTING BASIN (LP172).
1974          KM   THE ASSOCIATED AREA OF 1.77 SQ MI IS TAKEN FROM THE BASE HYDROLOGY HEC-1
1975          KM   STEP 2LE4.
1976          HC       2    1.77
```



```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1977          KK   LP172
1978          KO       2       2
1979          KM   LEVEL POOL TO REFLECT EXISTING BASIN AT INTERSECTION OF EL MIRAGE AND
1980          KM   CACTUS ROADS.  PRIMARY OUTLET IS EXISTING 2-10'x3' RCBC AT EL MIRAGE RD.
1981          KM   PRIMARY OUTLET INLET INVERT ELEV = 1,107.5'.  APPROX EL MIRAGE RD DIP
1982          KM   ELEV = 1,111.4'.  SQ RECORD IS BASED ON INLET CONTROL HYDRAULICS AND
1983          KM   WEIR CALCULATIONS.  SV RECORD REFLECTS EXISTING STORAGE ESTIMATE, WHICH
1984          KM   INCLUDES CHANNEL STORAGE UPSTREAM OF CACTUS RD, BELOW ELEV 1,111.4'.
1985          KM
1986          RS       1    STOR       0
1987          SV       0    10.8      32    93.1     102     117     132
1988          SQ       0       0       0     420     654    1319    2232
1989          SE    1104  1105.5  1107.5  1111.4    1112    1113    1114
              * ******************************************************************************
              * ******************************************************************************
              *
              *
              * ************************************************************************
              * ************************************************************************
```

```
* BASE HYDROLOGY FOR SUBBASIN 172 AND 172OUT SET ASIDE BY STANLEY (BNS)
* KK   172
* KM      RUNOFF HYDROGRAPH FROM SUB-BASIN 172
* BA   .12
* LG   .50     .00    4.58     .55    62.2
* UI    9.      9.     28.     39.     47.     55.     66.     82.    112. 96.
* UI   79.     68.     56.     47.     39.     26.     16.     15.     11.  9.
* UI    6.      3.      3.      3.      3.      3.      3.      0.      0.  0.
* UI    0.      0.      0.      0.      0.      0.      0.      0.      0.  0.
* KK172OUT
* KM      DIVERSION-RETENTION
* DT172RET     7.8
* DI     0   10000
* DQ     0   10000
* ************************************************************************
* ************************************************************************
*
* MODIFY PER LEVEL III
*
* KK CP172
*
*
* ************************************************************************
* ************************************************************************
* SET ASIDE BY STANLEY (BNS): !LE4, SRLECH, DLE4, SRLE4, DILE4 AND 2LE4.
* KK  !LE4
* * KO     1                                21
* KM ADD HYDROGRAPHS AT LE4 (CP172)
* HC     2    1.77
* KKSRLECH
* KO     1                                21
* KM STORAGE ROUTE THROUGH PONDED AREA BEHIND EXISTING 10'X3'X115' DBL RCBS
* RS     1    STOR       0       0
* SV     0     0.5     1.8     3.4     5.1     7.0     9.2    11.5
* SQ     0       5      15      25     509    1387    2519    3860
* SE1107.6    1108    1109    1110    1111    1112    1113    1114
* KK  DLE4
* KO     1                                21
* KM
* DTEM-CLV
* DI     0       5      15      25     509    1387    2519    3860
* DQ     0       5      15      25      35      45      54      64
* STORAGE ROUTE THROUGH PROPOSED BASIN AT EL MIRAGE ROAD & CACTUS
* KK SRLE4
* * KO     1                                21
* KM STORAGE ROUTE
* RS     1    STOR       0       0
* SV     0     8.3    16.5    24.8    70.1      80
* SQ     0       0       0     528    1056    1231
* SE1104.5  1105.5  1106.5  1107.5    1113    1114
* KK DILE4
* * KO     1                                21
* KM RETURN DISCHARGE DIVERTED TO EXISTING 10'X3'X115' RCB'S
* DREM-CLV
* * KK  R172
* KK  2LE4
* KM COMBINE ROUTED FLOW FROM OFFLINE BASIN WITH MAIN-CHANNEL FLOW AT LE4
* HC     2    1.77
```

```
                    * DUMMY ROUTE - ELEV'S FROM MAP
                    * KK  R172
                    * ***********************************************************************
                    * ***********************************************************************
                    *
                    *
LINE                ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1990                KK    RLE4
1991                KO       2       2
1992                RS     1.6            -1.0     0.0
1993                RC   0.030   0.030   0.030  4875.3  0.0038
1994                RX     0.0      36      39      42      45      48      51      87
1995                RY  1102.8  1096.8  1096.8  1096.8  1096.8  1096.8  1096.8  1096.8
                    *

1823                                        157
                                              .
1840                                          .-------> RET157
1837                                      DIV157
                                              .
                                              .
1843                                1I157............
                                              .
                                              .
1846                        2I157............
                                              .
                                              .
1849                                127
                                      V
                                      V
1855                                R127
                                              .
                                              .
1861                                          .        139
                                              .          .
                                              .          .
1874                                          .          .-------> RET139
1871                                          .      DIV139
                                              .          .
                                              .          .
1877                                1I139............
                                              .
                                              .
1882                                          .          .<-------   DI139
1880                                          .       D126
                                              .          V
                                              .          V
1883                                          .        RLE
                                              .          .
                                              .          .
1889                                2I139............
                                              .
```

```
1892                                  140
                                        .
1903                                    .-------> RET140
1900                              DIV140
                                        .
1906                          !LE1............
                                 V
                                 V
1909                          RLE1
                                 .
1915                                  156
                                        .
1927                                    .-------> RET156
1924                              DIV156
                                        .
1930                          !LE2............
                                 V
                                 V
1933                          RLE2
                                 .
1939                     !LE3............
                                 .
1943                              172
                                 .
1967                             .-------> RET172
1964                        DIV172
                                 .
1970                  AD172A............
                         V
                         V
1977                  LP172
                         V
                         V
1990                  RLE4
                         .
```

+	HYDROGRAPH AT	157	648.	12.83	135.	40.	13.	1.03
+	DIVERSION TO	RET157	314.	12.33	32.	10.	3.	1.03
+	HYDROGRAPH AT	DIV157	648.	12.83	113.	30.	10.	1.03

+	2 COMBINED AT	1I157	596.	12.83	120.	33.	11.	25.08
+	2 COMBINED AT	2I157	596.	12.83	132.	38.	13.	25.08
+	HYDROGRAPH AT	127	456.	12.08	41.	12.	4.	.22
+	ROUTED TO	R127	248.	13.42	41.	12.	4.	.22
+	HYDROGRAPH AT	139	772.	12.25	111.	37.	12.	.47
+	DIVERSION TO	RET139	10.	4.08	6.	1.	0.	.47
+	HYDROGRAPH AT	DIV139	772.	12.25	111.	35.	12.	.47
+	2 COMBINED AT	1I139	773.	12.25	150.	47.	16.	.69
+	HYDROGRAPH AT	D126	849.	12.67	162.	49.	16.	4.75
+	ROUTED TO	RLE	525.	12.92	157.	49.	16.	4.75
+	2 COMBINED AT	2I139	773.	12.25	301.	98.	33.	7.04
+	HYDROGRAPH AT	140	208.	12.67	48.	16.	5.	.18
+	DIVERSION TO	RET140	13.	10.50	8.	3.	1.	.18
+	HYDROGRAPH AT	DIV140	208.	12.67	47.	14.	5.	.18
+	2 COMBINED AT	!LE1	903.	12.25	346.	111.	37.	.88
+	ROUTED TO	RLE1	862.	12.33	345.	111.	37.	.88
+	HYDROGRAPH AT	156	280.	12.75	66.	21.	7.	.30
+	DIVERSION TO	RET156	7.	6.67	5.	1.	0.	.30
+	HYDROGRAPH AT	DIV156	280.	12.75	66.	20.	7.	.30
	2 COMBINED AT							

+		!LE2	1032.	12.92	407.	130.	44.	1.18
+	ROUTED TO	RLE2	998.	13.08	407.	130.	44.	1.18
+	2 COMBINED AT	!LE3	1560.	12.83	555.	173.	58.	1.65
+	HYDROGRAPH AT	172	252.	12.83	62.	20.	7.	.30
+	DIVERSION TO	RET172	5.	4.58	3.	1.	0.	.30
+	HYDROGRAPH AT	DIV172	252.	12.83	62.	20.	7.	.30
+	2 COMBINED AT	AD172A	1808.	12.83	613.	192.	64.	1.77
+	ROUTED TO	LP172	1387.	13.42	543.	176.	59.	1.77
+	ROUTED TO	RLE4	1326.	13.58	537.	176.	59.	1.77

Supporting Documentation for the Rational Method 100-Year Runoff Estimate Associated with the Storm Drain Systems Outfalling to the West Cactus Basin

Stanley Consultants
WEST CACTUS BAS - West Cactus Basin and Channels
Sub Basin Data - Rational Method

 10/6/2004

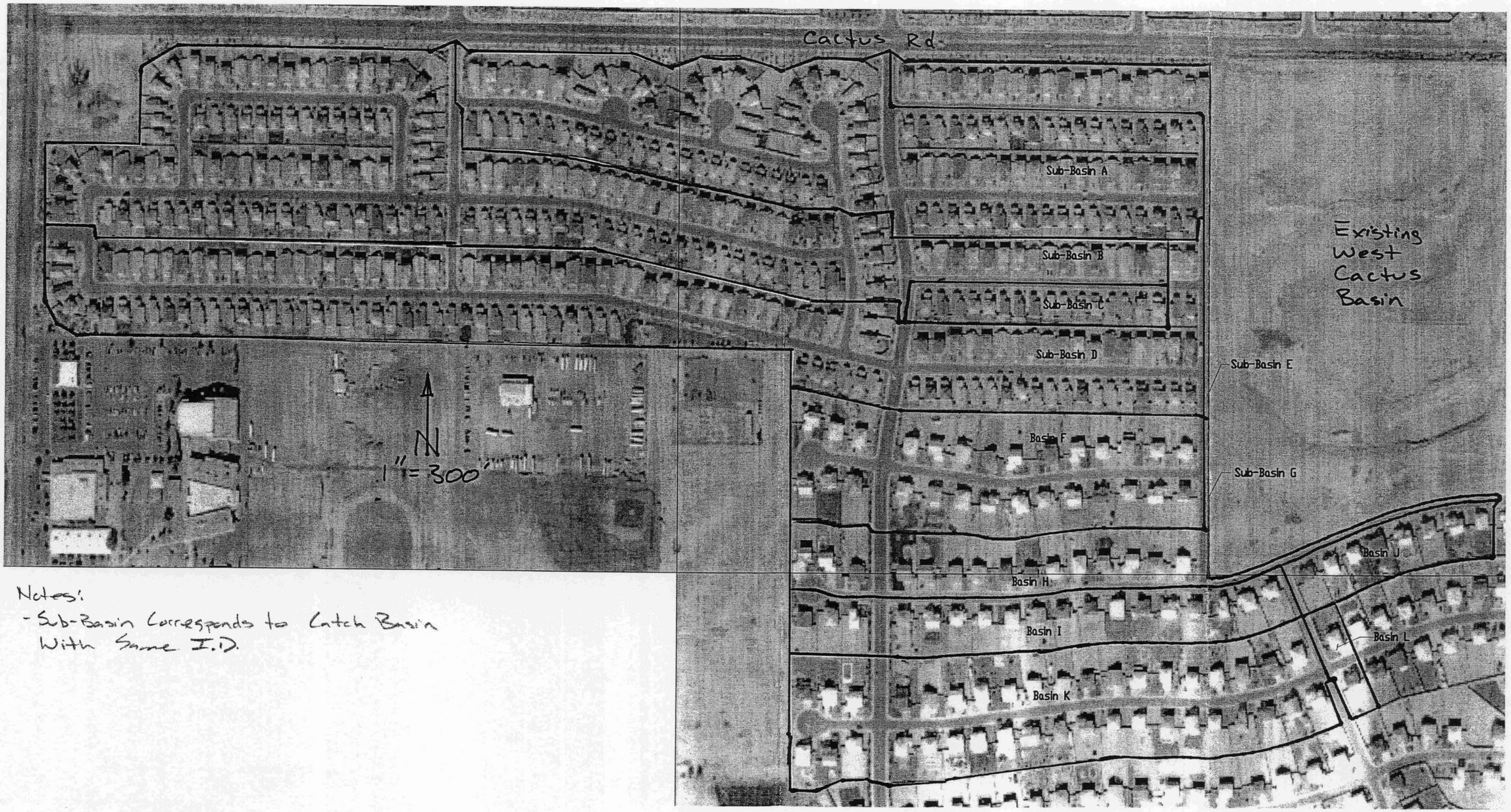
Sub Basin	Sub Basin Parameters: Area (acres)	Length (ft)	Slope (ft/ft)	Kb		Return Period (Years): 2	5	10	25	50	100	
A	19.30	2,400	0.0038	0.032	Q (cfs)	18	28	34	48	60	72	Sump A
					Tc (min)	25	21.2	19.6	17.8	16.8	16	
B	25.30	3,450	0.0029	0.031	Q (cfs)	18	29	38	52	67	82	
					Tc	34.9	29.3	26.9	24.4	23	21.7	
C	2.20	850	0.0040	0.038	Q (cfs)	3	4	5	7	9	10	
					Tc	14.1	12.2	11.3	10.4	9.8	9.4	
D	22.40	3,750	0.0030	0.032	Q (cfs)	16	25	31	45	58	70	
					Tc	37.4	31.4	28.7	26.1	24.5	23.1	
E	3.40	1,900	0.0043	0.037	Q (cfs)	3	5	6	9	11	13	
					Tc	22.4	19.1	17.6	16.1	15.2	14.4	
F	10.30	1,300	0.0042	0.034	Q (cfs)	12	18	22	30	38	45	Sump B
					Tc	16.7	14.4	13.3	12.2	11.5	11.0	
G	0.10	200	0.0042	0.046	Q (cfs)	0	0	0	0	1	1	
					Tc	6.5	5.7	5.3	4.9	4.9	4.9	
H	5.70	1,450	0.0043	0.035	Q (cfs)	6	9	12	16	20	24	Sump C
					Tc	18.2	15.7	14.5	13.3	12.5	11.9	
I	6.10	1,450	0.0044	0.035	Q (cfs)	7	10	12	17	22	26	
					Tc	18.1	15.5	14.4	13.1	12.4	11.8	
J	2.50	650	0.0034	0.038	Q (cfs)	3	5	6	8	10	12	
					Tc	12.7	11.1	10.3	9.4	8.9	8.5	
K	13.00	1,800	0.0032	0.033	Q (cfs)	13	19	24	33	42	51	
					Tc	22.5	19.2	17.7	16.2	15.3	14.5	
L	0.70	250	0.0037	0.041	Q (cfs)	1	2	2	3	4	4	
					Tc	7.2	6.4	5.9	5.5	5.2	4.9	

Notes: · 10-Yr C Value = 0.55
· Sub-Basin Corresponds To Catch Basin With Same I.D.

DDMSW Project ID: WEST CACTUS BAS

* Non default value

West Cactus Basin
Catch Basin Contributing Areas
SCI Project #16956
B. Schalk
7 Oct 2004



Notes:
- Sub-Basin Corresponds to Catch Basin With Same I.D.

Q:\16956\02-Assan I-West Cactus\05-Study Phase\05-Dwgs\Survey\Storage.rev00.dwg

Hydrologic Comparison of Peak Discharges and Runoff Volumes for Existing and Proposed Basins

West Cactus Basin and Channels CAR
Hydrology (HEC-1 Models) Comparison

	1985 FEMA Floodplain Delineation[1]	1992 ADMP[2]	September 2001 LOMR[3]	January 2004 ADMP Existing Condition[4]	January 2004 Base Hydrology, ADMP Future Condition with Project[5]		Alternative 1 "Do Nothing" (July 2004)[6]		Alternative 2 (July 2004)[7]		Alternative 4 (July 2004)[8]		Alternative 2 + 8 (July 2004)[9]		Alternative 1 "Do Nothing" (October 2004)[10]	
Location of Peak Q	Peak Q (cfs)	Peak Q (cfs)	Peak Q (cfs)	Peak Q (cfs)	Peak Q (cfs)	Runoff (ac-ft)	Peak Q (cfs)	Runoff (ac-ft)	Peak Q (cfs)	Runoff (ac-ft)	Peak Q (cfs)	Runoff (ac-ft)	Peak Q (cfs)	Runoff (ac-ft)	Peak Q (cfs)	Runoff (ac-ft)
Cactus Rd.	250	-	1771	1487	1384	261	1560	368	1560	368	1560	368	1560	368	1560	343
Subbasin 172	-	-	-	111	135	19	252	41	252	41	41	41	252	41	252	41
Entering Basin	-	-	-	-	1343	51*	1808	121*	1462	188*	1462	188*	1262	145*	1808	118*
Thru Basin Parcel Channel	250	-	-	1510	45	-	-	-	350	-	350	-	350	-	-	-
Thru Golf Course Channel	250	1800	1753	1462	857	-	1487	-	400	-	400	-	400	-	1326	-

Notes:

1. As reported in the FEMA Flood Insurance Study, Revised December 3, 1993.
2. White Tanks/Agua Fria ADMP prepared by WLB Group for FCD. Discharge reported in June 30, 1999 FCD Memo, Subject: El Mirage Drainage Improvement CIP - Project Status and Summary.
3. Lower El Mirage Wash Channelization, Application for As-Built Letter of Map Revision; Post-Project Conditions Model; Prepared by A-N West, Inc. for City of El Mirage.
4. White Tanks ADMP Update, Existing Condition, Without Projects in Place; Prepared by URS, 01-14-04. HEC-1 File: L303M1L.DAT. Reflects development in City of El Mirage, including retention for each subbasin.
5. White Tanks ADMP Update, Future Condition, With Project - Level III; Prepared by URS, 01-14-04. HEC-1 File: L33PF6D.DAT. Reflects concept level off-line basin at proposed West Cactus Basin location.
   Given to Stanley by the FCD at beginning of the project to use as the base hydrology when developing structural alternatives.
6. Future condition and existing basin configuration. HEC-1 File: EXSTREV0.DAT. The retention divert steps for subbasins located within El Mirage contributing area are set aside.
7. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach. HEC-1 File: ALT2REV1.DAT. The retention divert steps for subbasins located within El Mirage contributing area are set aside.
8. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach, emphasis on aesthetics and multi-use. HEC-1 File: ALT2REV1.DAT. The retention divert steps for subbasins located within El Mirage contributing area are set aside.
9. 100-year discharge reduction at West Cactus Basin using an optimized version of the ADMP off-line basin approach, with a proposed storm drain in Cactus Rd. HEC-1 File: ALT2+8.DAT. The retention divert steps for subbasins located within El Mirage contributing area are set aside.
10. Future condition and existing basin configuration. HEC-1 File: EXSTREV1.DAT. The retention divert steps for subbasins located within El Mirage contributing area, and West Cactus Basin level pool routing, are based on supplemental hydrology gathered in Sept & Oct of 2004.

*Portion of hydrograph stored at peak discharge.

Comparison of 100-Year Water Surface Elevations and Finish Floor Elevations for Areas in the Vicinity of Sumps Located in 125th Avenue and Canterbury Drive

Storm Drain Sump and WSEL Analysis

Street Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	3
Street Width (ft), L	32
Flow Depth Over Weir (ft), H	
Grade Break Elevation, (ft)	1114.84
Effective Weir Elev, (ft)	1115.04

WSEL	H	Q
1115.04	0	0
1115.14	0.1	3
1115.24	0.2	9
1115.34	0.3	16
1115.44	0.4	24
1115.54	0.5	34
1115.64	0.6	45
1115.74	0.7	56
1115.84	0.8	69
1115.94	0.9	82
1116.04	1	96
1116.14	1.1	111
1116.24	1.2	126
1116.34	1.3	142
1116.44	1.4	159
1116.54	1.5	176
1116.64	1.6	194
1116.74	1.7	213
1116.84	1.8	232
1116.94	1.9	251
1117.04	2	272

125th Ave Sidewalk/Landscaping Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	2.6
Street Width (ft), L	18
Flow Depth Over Weir (ft), H	
Grade Break Elevation, (ft)	1114.84
Effective Weir Elev, (ft)	1115.34

WSEL	H	Q
1115.04	-	0
1115.14	-	0
1115.24	-	0
1115.34	0	0
1115.44	0.1	1
1115.54	0.2	4
1115.64	0.3	8
1115.74	0.4	12
1115.84	0.5	17
1115.94	0.6	22
1116.04	0.7	27
1116.14	0.8	33
1116.24	0.9	40
1116.34	1	47
1116.44	1.1	54
1116.54	1.2	62
1116.64	1.3	69
1116.74	1.4	78
1116.84	1.5	86
1116.94	1.6	95
1117.04	1.7	104

Combined

WSEL	Q
1115.04	0
1115.14	3
1115.24	9
1115.34	16
1115.44	26
1115.54	38
1115.64	52
1115.74	68
1115.84	85
1115.94	104
1116.04	123
1116.14	144
1116.24	166
1116.34	**189**
1116.44	**213**
1116.54	238
1116.64	264
1116.74	290
1116.84	318
1116.94	346
1117.04	375

Freeboard @ Sumps A & B is approx -0.1 ft
Freeboard @ Sump C is approx 0.2 ft
(See Attached)

Berry Ln

Street Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	3
Street Width (ft), L	32
Flow Depth Over Weir (ft), H	
Grade Break Elevation, (ft)	1113.9
Effective Weir Elev, (ft)	1114.1

WSEL	H	Q
1114.1	0	0
1114.2	0.1	3
1114.3	0.2	9
1114.4	0.3	16
1114.5	0.4	24
1114.6	0.5	34
1114.7	0.6	45
1114.8	0.7	56
1114.9	0.8	69
1115.0	0.9	82
1115.1	1	96
1115.2	1.1	111
1115.3	1.2	126

Sidewalk/Landscaping Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	2.6
Street Width (ft), L	18
Flow Depth Over Weir (ft), H	
Grade Break Elevation, (ft)	1113.9
Effective Weir Elev, (ft)	1114.4

WSEL	H	Q
1114.1	-	0
1114.2	-	0
1114.3	-	0
1114.4	0	0
1114.5	0.1	1
1114.6	0.2	4
1114.7	0.3	8
1114.8	0.4	12
1114.9	0.5	17
1115	0.6	22
1115.1	0.7	27
1115.2	0.8	33
1115.3	0.9	40

Sierra St

Street Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	3
Street Width (ft), L	32
Flow Depth Over Weir (ft), H	
Grade Break Elevation, (ft)	1114.13
Effective Weir Elev, (ft)	1114.33

WSEL	H	Q
1114.1	-	0
1114.2	-	0
1114.3	-	0
1114.4	0.1	2
1114.5	0.2	7
1114.6	0.3	13
1114.7	0.4	22
1114.8	0.5	31
1114.9	0.6	41
1115.0	0.7	53
1115.1	0.8	65
1115.2	0.9	78
1115.3	1.0	96

Sidewalk/Landscaping Weir

Weir Eq: $Q = CLH^{1.5}$	
Weir Coefficient, C	2.6
Street Width (ft), L	18
Flow Depth Over Weir (ft), H	
Top-of-Curb Elevation, (ft)	1114.13
Effective Weir Elev, (ft)	1114.63

WSEL	H	Q
1114.1	-	0
1114.2	-	0
1114.3	-	0
1114.4	-	0
1114.5	-	0
1114.6	-	0
1114.7	0.1	1
1114.8	0.2	3
1114.9	0.3	7
1115.0	0.4	11
1115.1	0.5	15
1115.2	0.6	20
1115.3	0.7	26

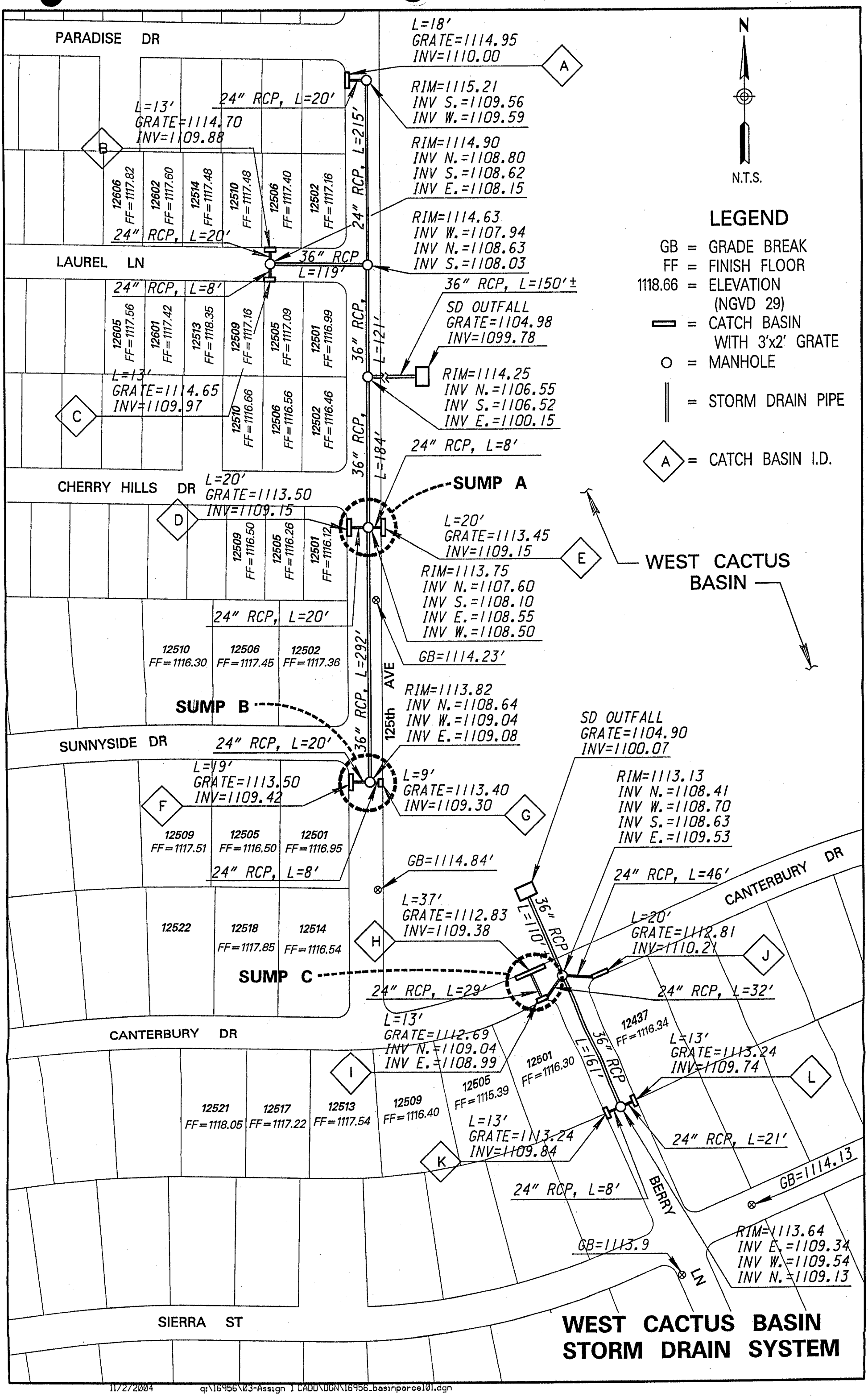
Berry Ln & Sierra St Combined

WSEL	Q
1114.1	0
1114.2	3
1114.3	9
1114.4	18
1114.5	32
1114.6	52
1114.7	75
1114.8	102
1114.9	133
1115.0	167
1115.1	203
1115.2	**242**
1115.3	**288**

Sump ID	100-Yr Flow at Sump[4] (cfs)	Storm Drain Capacity at Sump[5] (cfs)	Flow at Weir[6] (cfs)	Water Surface Elevation[7] (ft)	Low Finish Floor Elevation in Vicinity of Sump (ft)	Freeboard (ft)
A[1]	247	-	-	-	-	-
B[2]	46	-	-	-	-	-
A and B	293	97	196	**1116.4**	**1116.3**	-0.1
C[3]	117	63	250	**1115.2**	**1115.4**	0.2
	410	**160**				

Notes:

1. Sump located on 125th Ave, immediately south of Cherry Hills Dr.
2. Sump located on 125th Ave, immediately south of Sunnyside Dr.
3. Sump located on Canterbury Dr, immediately west of Berry Ln.
4. Based on FCDMC Rational Method
5. Approx 97 cfs is conveyed to the basin by the 125th Ave storm drain system, (5-yr event) before overtopping breakover elevation 1114.84 ft.
   Approx 63 cfs is conveyed to the basin by the Berry Ln and Canterbury Dr storm drain system (10-yr event) before overtopping breakover elevations at the intersection of Sierra and Berry (el 1113.9 ft).
6. 100-yr flow minus the storm drain system capacity. Sump C weir flow includes breakover from Sumps A and B.
7. Water surface elevations based on weir calculations for breakover locations



11/27/2004 q:\16956\03-Assign I CADD\DGN\16956_basinparcel01.dgn

Scenario: Base

Pipe Report

StormCAD: 125th St, 5-Yr, Rev 03

Label	Upstream Node	Downstream Node	Length (ft)	Constructed Slope (ft/ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Section Size	Mannings n	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Downstream Ground Elevation (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)	Velocity In (ft/s)	Velocity Head In (ft)	Velocity Head Out (ft)	Total Flow (cfs)
P-1	A	MH1	20.00	0.020500	1,110.00	1,109.59	24 inch	0.013	20.76	32.39	1,114.95	1,112.87	1,115.21	1,112.70	6.61	6.61	0.68	0.68	20.76
P-2	MH1	MH2	215.00	0.004326	1,109.56	1,108.63	36 inch	0.013	20.74	43.86	1,115.21	1,112.60	1,114.63	1,112.39	2.93	2.93	0.13	0.13	20.74
P-3	B	MH3	20.00	0.054000	1,109.88	1,108.80	24 inch	0.013	16.94	52.57	1,114.70	1,113.04	1,114.90	1,112.93	5.39	5.39	0.45	0.45	16.94
P-4	C	MH3	8.00	0.168750	1,109.97	1,108.62	24 inch	0.013	4.41	92.93	1,114.65	1,112.83	1,114.90	1,112.82	1.41	1.41	0.03	0.03	4.41
P-5	MH3	MH2	119.00	0.001765	1,108.15	1,107.94	36 inch	0.013	19.49	28.02	1,114.90	1,112.81	1,114.63	1,112.71	2.76	2.76	0.12	0.12	19.49
P-6	MH2	MH4	121.00	0.012231	1,108.03	1,106.55	36 inch	0.013	35.16	73.76	1,114.63	1,112.36	1,114.25	1,112.02	4.97	4.97	0.38	0.38	35.16
P-7	F	MH6	20.00	0.019000	1,109.42	1,109.04	24 inch	0.013	19.17	31.18	1,114.84	1,114.37	1,114.84	1,114.23	6.10	6.10	0.58	0.58	19.17
P-9	MH6	MH5	292.00	0.001849	1,108.64	1,108.10	36 inch	0.013	19.11	28.68	1,114.84	1,114.11	1,114.84	1,113.87	2.70	2.70	0.11	0.11	19.11
P-10	D	MH5	20.00	0.032500	1,109.15	1,108.50	24 inch	0.013	50.42	40.78	1,114.84	1,115.83	1,114.84	1,114.84	16.05	16.05	4.00	4.00	50.42
P-12	MH5	MH4	184.00	0.005870	1,107.60	1,106.52	36 inch	0.013	62.58	51.10	1,114.84	1,113.64	1,114.25	1,112.02	8.85	8.85	1.22	1.22	62.58
P-13	MH4	BASN OUTLET	151.00	0.002450	1,100.15	1,099.78	36 inch	0.013	96.71	33.01	1,114.25	1,108.17	1,104.98	1,105.00	13.68	13.68	2.91	2.91	96.71

Notes:

1. Elev 1114.84' is overtopping grade-break for Sump B.
2. Inlet D is in Sump A. Flow overtopping Sump A (Elev 1114.23') enters Sump B. Thus, Sump A is contained within Sump B. It is believed overtopping flow will be captured by Inlet F.
3. Capacity of Inlets D & F is approx 140 cfs (FCD Hydraulics Manual, Eq 3.10)

Scenario: Base

Node Report

StormCAD: 125th St, 5-Yr, Rev 03

Label	Area (acres)	Inlet C	Time of Concentration (min)	System Flow Time (min)	System Rational Flow (cfs)	Upstream Additional Flow (cfs)	Total System Flow (cfs)	Ground Elevation (ft)	Rim Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Local Intensity (in/hr)	Local Rational Flow (cfs)	Description
BASN OUTLET				31.95	96.48		96.48	1,104.98	1,104.98	1,105.00	1,105.00			
MH4				31.77	96.71		96.71	1,114.25	1,114.25	1,112.02	1,108.17			
MH2				30.08	35.16		35.16	1,114.63	1,114.63	1,112.39	1,112.36			
MH1				21.25	20.74		20.74	1,115.21	1,115.21	1,112.70	1,112.60			
A	19.30	0.55	21.20	21.20	20.76	0.00	20.76	1,114.95	1,114.95	1,112.87	1,112.87	2.77	29.66	
MH3				29.36	19.49		19.49	1,114.90	1,114.90	1,112.82	1,112.81			
B	25.30	0.55	29.30	29.30	16.94	0.00	16.94	1,114.70	1,114.70	1,113.04	1,113.04	2.20	30.85	
C	2.20	0.55	12.20	12.20	4.41	0.00	4.41	1,114.65	1,114.65	1,112.83	1,112.83	3.74	4.56	
MH5				31.42	62.58		62.58	1,114.84	1,114.84	1,113.87	1,113.64			
MH6				14.45	19.11		19.11	1,114.84	1,114.84	1,114.23	1,114.11			
F	10.40	0.55	14.40	14.40	19.17	0.00	19.17	1,114.84	1,114.84	1,114.37	1,114.37	3.32	19.17	
D	25.80	0.55	31.40	31.40	50.42	0.00	50.42	1,114.84	1,114.84	1,114.84	1,114.84	2.11	30.21	

Scenario: Base

Inlet Report

StormCAD: 125th St, 5-Yr, Rev03

Label	Ground Elevation (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Inlet Time of Concentration (min)	Inlet	Inlet Location	Clogging Factor (%)	Curb Opening Length (ft)	Total Flow To Inlet (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Gutter Ditch Spread (ft)	Gutter Ditch Depth (ft)
A	1,114.95	1,114.95	1,110.00	1,112.87	1,112.87	21.20	Combination DI-	On Grade	50.0	18.00	29.66	8.90	D	30.11	0.62
B	1,114.70	1,114.70	1,109.88	1,113.04	1,113.04	29.30	Combination DI-	On Grade	50.0	13.00	30.85	13.91	D	29.31	0.50
C	1,114.65	1,114.65	1,109.97	1,112.83	1,112.83	12.20	Combination DI-	On Grade	50.0	13.00	4.56	0.15	D	14.24	0.30
F	1,114.84	1,114.84	1,109.42	1,114.37	1,114.37	14.40	Combination DI-	In Sag	50.0	28.00	19.17	0.00		18.29	0.39
D	1,114.84	1,114.84	1,109.20	1,114.84	1,114.84	31.40	Combination DI-	In Sag	50.0	40.00	50.42	0.00		30.01	0.62

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Project No. 16956 Page No.

Subject BASIN WSEL @ 5-YR TIME-TO-PEAK

Computed by Date

Checked by Date

Approved by Date

Sheet No. of

$$\forall_T = C\left(P/12\right) A \quad ; \quad P = 5\text{-yr, 24-hr Precip.}$$

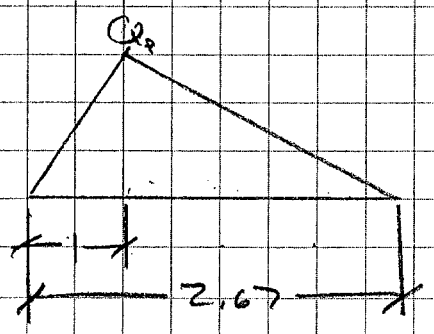
$$= (0.55)\left[\frac{2.0 \text{ in}}{12 \text{ in/ft}}\right](115 \text{ ac})$$

$$= 10.5 \text{ ac-ft}$$

FCDMC RATIONAL METHOD 5-YR DISCHARGE = 150 cfs

SCS DIMENSIONLESS UH:

- TIME BASE OF THE TRIANGULAR UH IS 2.67 TIMES THE TIME-TO-PEAK.



- $\dfrac{Q_p}{2.67\,Q_p} = 0.37$ = PERCENT OF TOTAL VOLUME AT TIME-TO-PEAK

∴ VOLUME OF 5-YR RUNOFF THAT IS IN BASIN AT TIME-TO-PEAK

$$\forall_P = (\forall_T)(.37) = (10.5)(.37) = 4 \text{ ac-ft}$$

WEST CACTUS BASIN WSEL @ 4 ac-ft = 1104.6 ft

SC 3004 R4 898

Scenario: Base

Pipe Report

StormCAD: Canterbury, 10-yr, Rev 01

Label	Upstream Node	Downstream Node	Length (ft)	Constructed Slope (ft/ft)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Section Size	Mannings n	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Downstream Ground Elevation (ft)	Hydraulic Grade Line Out (ft)	Velocity Out (ft/s)	Velocity In (ft/s)	Velocity Head In (ft)	Velocity Head Out (ft)	Total Flow (cfs)
P-14	K	MH7	8.00	0.037500	1,109.84	1,109.54	24 inch	0.013	12.90	43.81	1,113.24	1,111.13	1,113.64	1,111.29	4.42	6.01	0.56	0.30	12.90
P-15	L	MH7	21.00	0.019048	1,109.74	1,109.34	24 inch	0.013	2.23	31.22	1,113.24	1,111.24	1,113.64	1,111.24	0.72	0.88	0.01	0.01	2.23
P-16	MH7	MH8	161.00	0.003106	1,109.13	1,108.63	36 inch	0.013	14.49	37.17	1,113.64	1,111.24	1,113.13	1,111.19	2.26	2.73	0.12	0.08	14.49
P-17	H	I	29.00	0.011724	1,109.38	1,109.04	24 inch	0.013	14.45	24.49	1,113.90	1,113.19	1,113.90	1,113.07	4.60	4.60	0.33	0.33	14.45
P-18	I	MH8	32.00	0.009062	1,108.99	1,108.70	24 inch	0.013	49.00	21.53	1,113.90	1,113.07	1,113.13	1,111.57	15.60	15.60	3.78	3.78	49.00
P-19	J	MH8	46.00	0.014783	1,110.21	1,109.53	24 inch	0.013	6.60	27.50	1,112.81	1,112.00	1,113.13	1,111.97	2.10	2.23	0.08	0.07	6.60
P-20	MH8	SD OUTFALL	106.00	0.078679	1,108.41	1,100.07	36 inch	0.013	63.25	187.08	1,113.13	1,110.97	1,104.90	1,105.00	8.95	9.85	1.51	1.24	63.25

Notes:

① Elev 1113.9 ft is grade break elevation for Sump C. Sump C contains Inlets H & I.

② Capacity of Inlets H & I is approx 100 cfs (FCD Hydraulics Manual, Eq 3.10)

Scenario: Base

Node Report

StormCAD : Canterbury, 10-yr, Rev 01

Label	Area (acres)	Inlet C	Time of Concentration (min)	System Flow Time (min)	System Rational Flow (cfs)	Upstream Additional Flow (cfs)	Total System Flow (cfs)	Ground Elevation (ft)	Rim Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Local Intensity (in/hr)	Local Rational Flow (cfs)	Description
SD OUTFALL				18.33	63.10		63.10	1,104.90	1,104.90	1,105.00	1,105.00			
MH8				18.26	63.25		63.25	1,113.13	1,113.13	1,111.19	1,110.97			
MH7				17.71	14.49		14.49	1,113.64	1,113.64	1,111.24	1,111.24			
K	13.00	0.55	17.70	17.70	12.90	0.00	12.90	1,113.24	1,113.24	1,111.13	1,111.13	4.15	29.89	
L	0.70	0.55	5.90	5.90	2.23	0.00	2.23	1,113.24	1,113.24	1,111.24	1,111.24	5.80	2.25	
I	6.10	0.55	14.40	14.61	49.00	0.00	49.00	1,113.90	1,113.90	1,113.07	1,113.07	4.59	15.51	
H	5.70	0.55	14.50	14.50	14.45	0.00	14.45	1,113.90	1,113.90	1,113.19	1,113.19	4.57	14.45	
J	2.50	0.55	10.30	10.30	6.60	0.00	6.60	1,112.81	1,112.81	1,112.00	1,112.00	5.17	7.17	

Scenario: Base

Inlet Report

StormCAD: Canterbury, 10-yr, Rev 01

Label	Ground Elevation (ft)	Rim Elevation (ft)	Sump Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Inlet Time of Concentration (min)	Inlet	Inlet Location	Clogging Factor (%)	Curb Opening Length (ft)	Total Flow To Inlet (cfs)	Total Bypassed Flow (cfs)	Bypass Target	Gutter Ditch Spread (ft)	Gutter Ditch Depth (ft)
K	1,113.24	1,113.24	1,109.84	1,111.13	1,111.13	17.70	Combination DI-	On Grade	50.0	13.00	29.89	16.99	I	20.26	0.43
L	1,113.24	1,113.24	1,109.74	1,111.24	1,111.24	5.90	Combination DI-	On Grade	50.0	13.00	2.25	0.02	I	7.51	0.09
I	1,113.90	1,113.90	1,108.99	1,113.07	1,113.07	14.40	Combination DI-	In Sag	50.0	13.00	34.82	0.00		42.92	0.88
H	1,113.90	1,113.90	1,109.38	1,113.19	1,113.19	14.50	Combination DI-	In Sag	50.0	37.00	14.45	0.00		12.92	0.28
J	1,112.81	1,112.81	1,110.21	1,112.00	1,112.00	10.30	Combination DI-	On Grade	50.0	20.00	7.17	0.57	I	11.78	0.26

Stanley Consultants INC.

Project No. 16956 Page No.

Subject Basin WSEL @ 10-Yr Time-To-Peak

Computed by Date

Checked by Date

Approved by Date

Sheet No. of

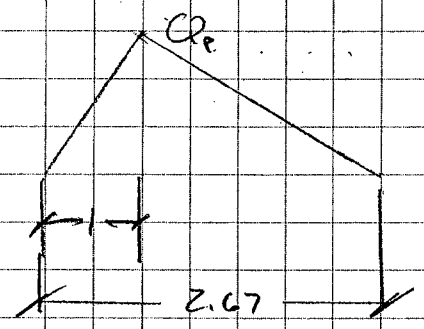
$V_T = C(P/12)A$; P = 10-yr, 24-hr Precip.

$= (0.55)\left(\frac{2.4\text{ in}}{12}\right)(115\text{ ac})$

$= 12.65$ ac-ft

SCS Dimensionless UH:

- Time base of the triangular UH is 2.67 times the time-to-peak.



- $Q_p / 2.67 Q_p = 0.37$ = Percent of total volume at time-to-peak

V_p = Volume of 10-yr runoff that is in basin at the time-to-peak.

$V_p = (0.37)(12.65\text{ ac-ft}) = 5$ ac-ft

Based on HEC-1 (exstrev01.dat), the existing basin WSEL @ 5 ac-ft of storage is 1104.7 ft.

∴ 10-yr starting WSEL for StormCAD modeling = 1105 ft

SC 3004 R4 898

Stanley Consultants
WEST CACTUS BAS - West Cactus Basin and Channels
Sub Basin Data - Rational Method

10/6/2004

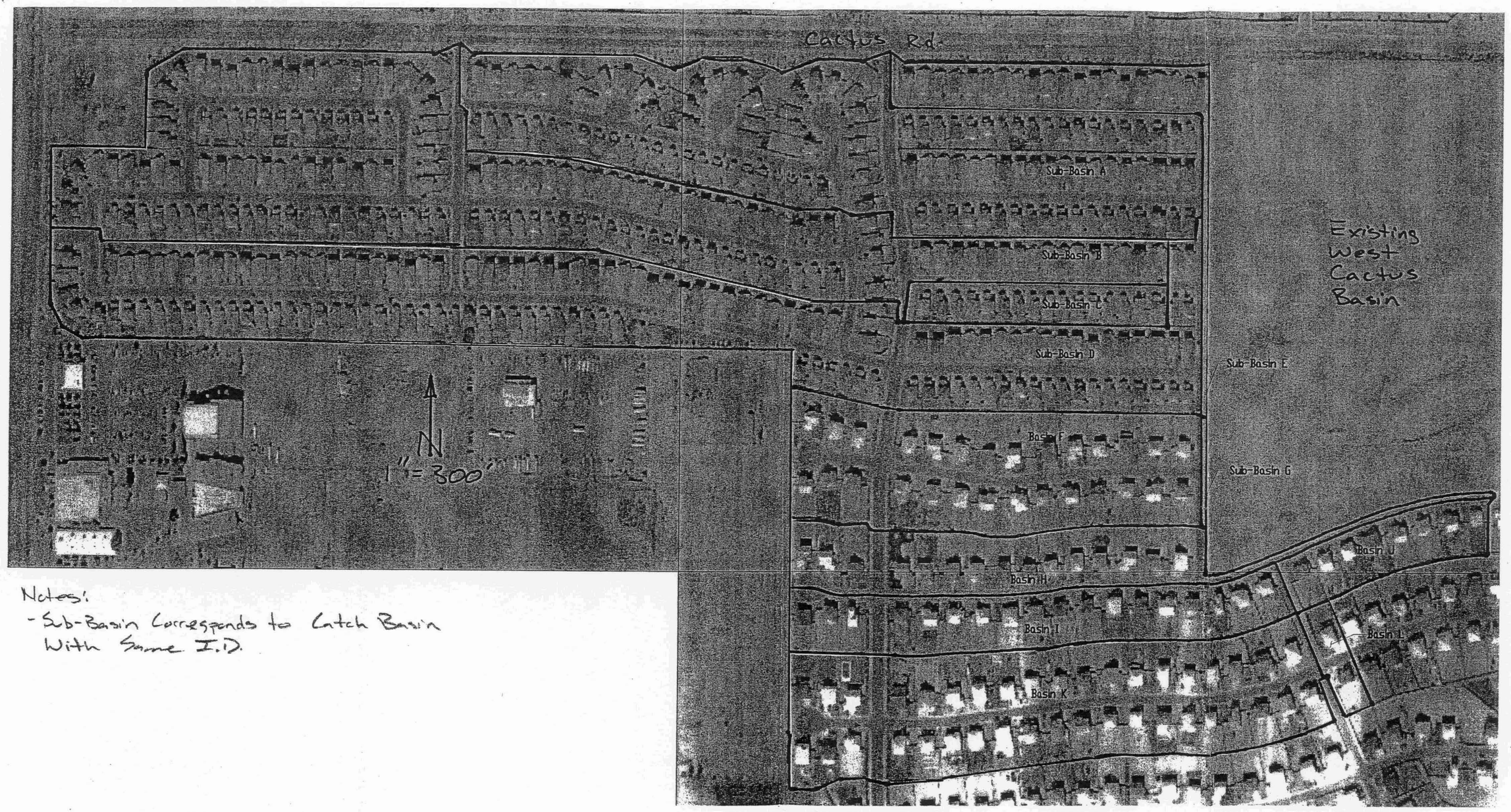
Sub Basin	Sub Basin Parameters: Area (acres)	Length (ft)	Slope (ft/ft)	Kb	Return Period (Years)	2	5	10	25	50	100	
A	19.30	2,400	0.0038	0.032	Q (cfs)	18	28	34	48	60	72	Sump A
					Tc (min)	25	21.2	19.6	17.8	16.8	16	
B	25.30	3,450	0.0029	0.031	Q (cfs)	18	29	38	52	67	82	
					Tc	34.9	29.3	26.9	24.4	23	21.7	
C	2.20	850	0.0040	0.038	Q (cfs)	3	4	5	7	9	10	
					Tc	14.1	12.2	11.3	10.4	9.8	9.4	
D	22.40	3,750	0.0030	0.032	Q (cfs)	16	25	31	45	58	70	
					Tc	37.4	31.4	28.7	26.1	24.5	23.1	
E	3.40	1,900	0.0043	0.037	Q (cfs)	3	5	6	9	11	13	
					Tc	22.4	19.1	17.6	16.1	15.2	14.4	
F	10.30	1,300	0.0042	0.034	Q (cfs)	12	18	22	30	38	45	Sump B
					Tc	16.7	14.4	13.3	12.2	11.5	11.0	
G	0.10	200	0.0042	0.046	Q (cfs)	0	0	0	0	1	1	
					Tc	6.5	5.7	5.3	4.9	4.9	4.9	
H	5.70	1,450	0.0043	0.035	Q (cfs)	6	9	12	16	20	24	Sump C
					Tc	18.2	15.7	14.5	13.3	12.5	11.9	
I	6.10	1,450	0.0044	0.035	Q (cfs)	7	10	12	17	22	26	
					Tc	18.1	15.5	14.4	13.1	12.4	11.8	
J	2.50	650	0.0034	0.038	Q (cfs)	3	5	6	8	10	12	
					Tc	12.7	11.1	10.3	9.4	8.9	8.5	
K	13.00	1,800	0.0032	0.033	Q (cfs)	13	19	24	33	42	51	
					Tc	22.5	19.2	17.7	16.2	15.3	14.5	
L	0.70	250	0.0037	0.041	Q (cfs)	1	2	2	3	4	4	
					Tc	7.2	6.4	5.9	5.5	5.2	4.9	

Notes: · 10-Yr C Value = 0.55
- Sub-Basin Corresponds To Catch Basin With Same I.D.

DDMSW Project ID: WEST CACTUS BAS

* Non default value

West Cactus Basin
Catch Basin Contributing Areas
SCI Project #16956
B. Schalk
7 Oct 2004



Notes:
- Sub-Basin Corresponds to Catch Basin With Same I.D.

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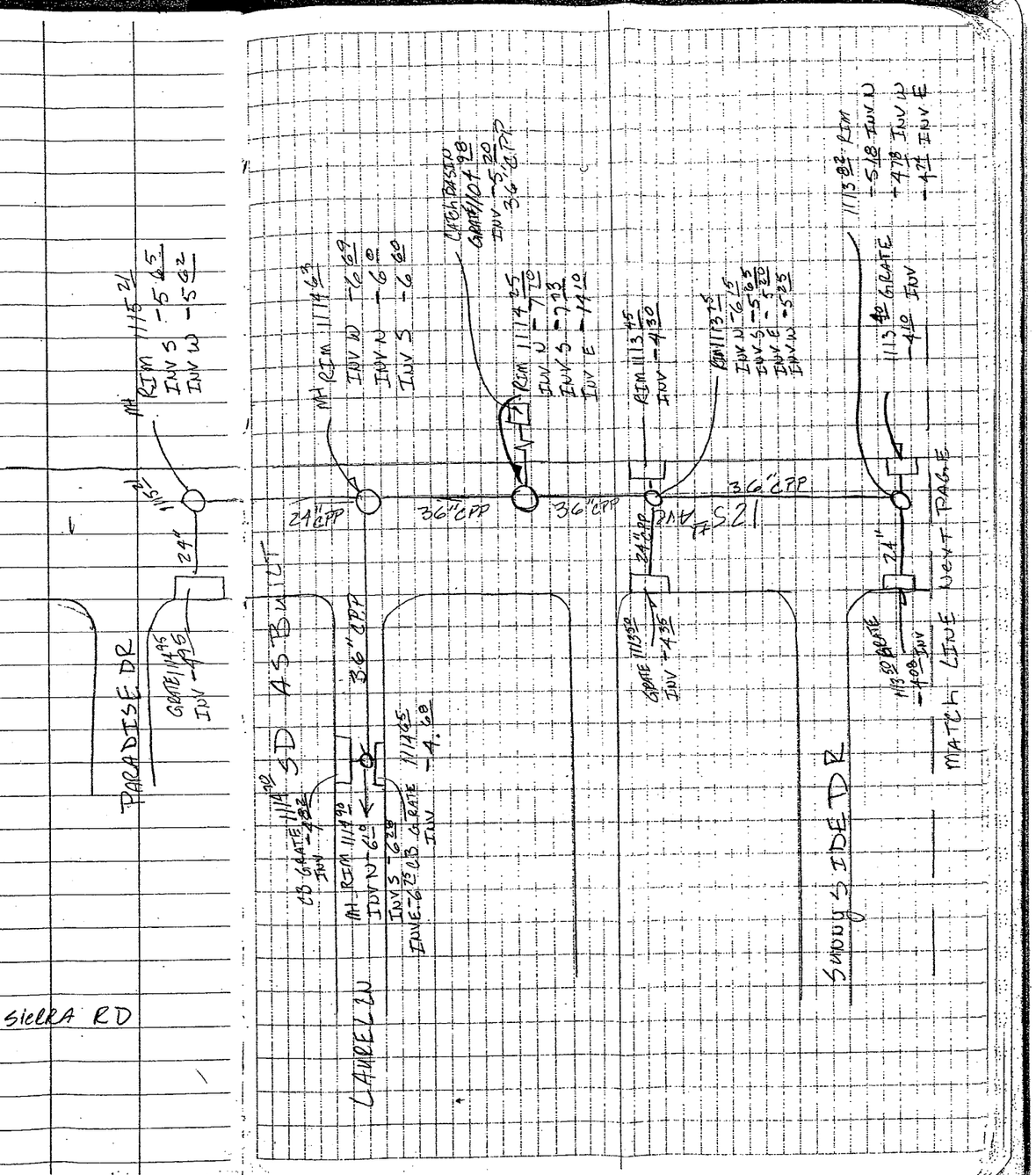
Rainfall Table

Return Periods				
Durations	2 year	5 year	10 year	100 year
2 min	3.92	5.11	5.93	8.87
5 min	3.92	5.11	5.93	8.87
15 min	2.38	3.21	4.50	5.79
30 min	1.57	2.15	2.54	3.93
60 min	0.96	1.33	1.58	2.45
360 min	0.20	0.28	0.33	0.52
1440 min	0.06	0.08	0.10	0.15

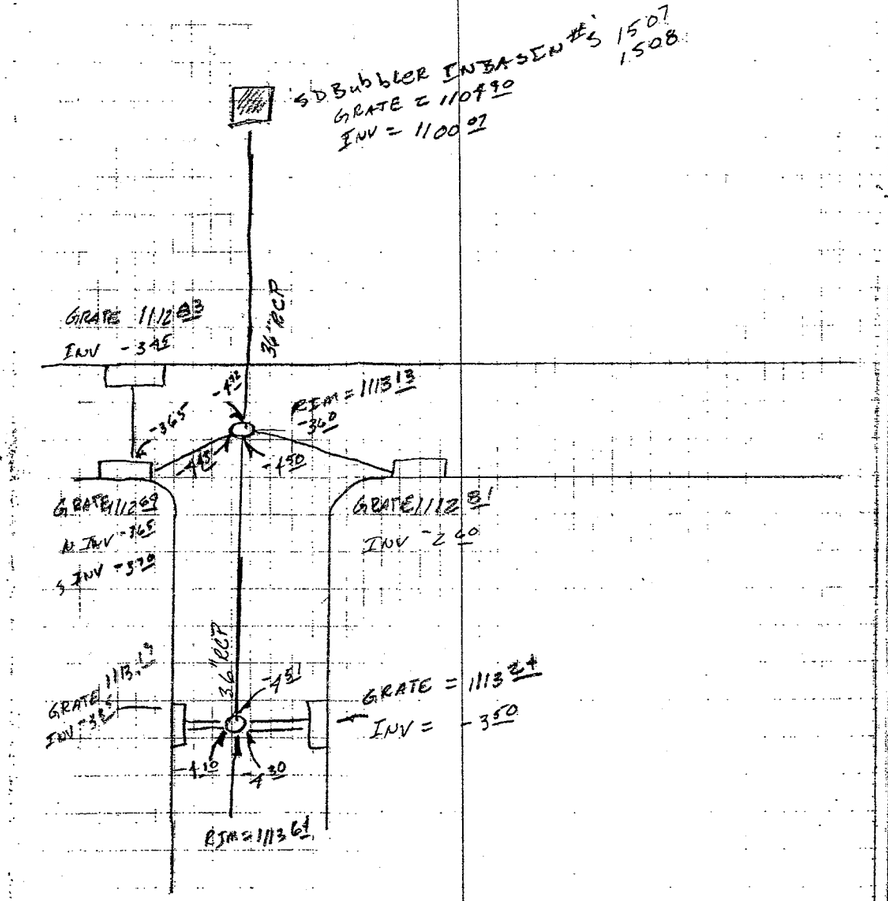
Rainfall Intensities are in (in/hr)

→ Used for both 125th Ave and Berry/Canterbury storm drain system models

53	G/127						
54	G/127						
55	G/127						
56	G/127						
57	G/127						
58	G/127						
59	G/127						
1460	G/127						
61	GB						
62	G						
63	GB						
14 64	G						
65	G/127						
66	G/127						
67	GB						
68	G						
69	GB						
1470	GB						
71	G						
72	GB						
73	GB						
74	G						
75	G						
76	G						
77	G						
78	G						
79	G						
1480	G						
81	VG						
82	GB SIERRA				SIERRA RD		
83	GB SIERRA						
84	VG						
85	GB						
86	GB						

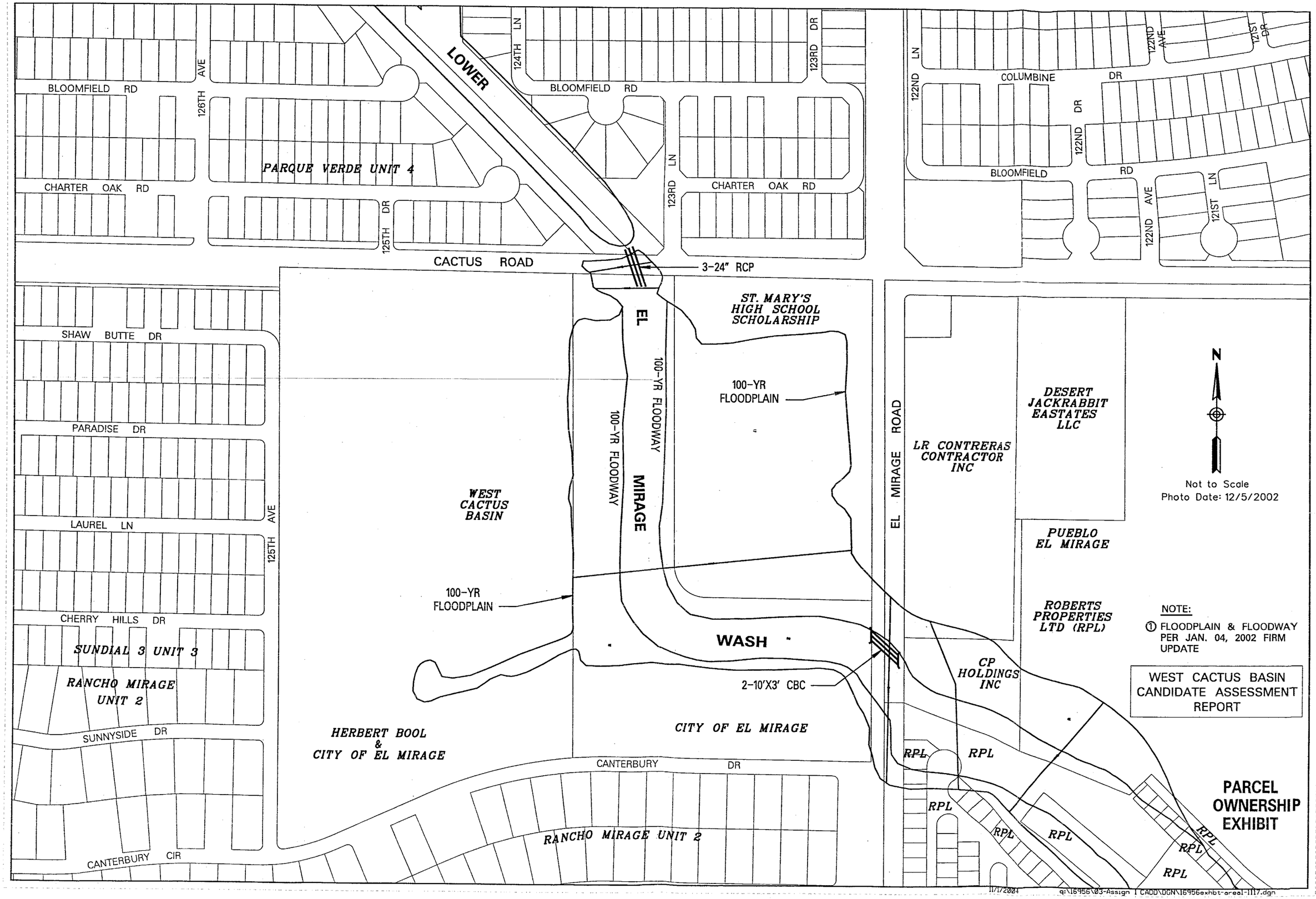


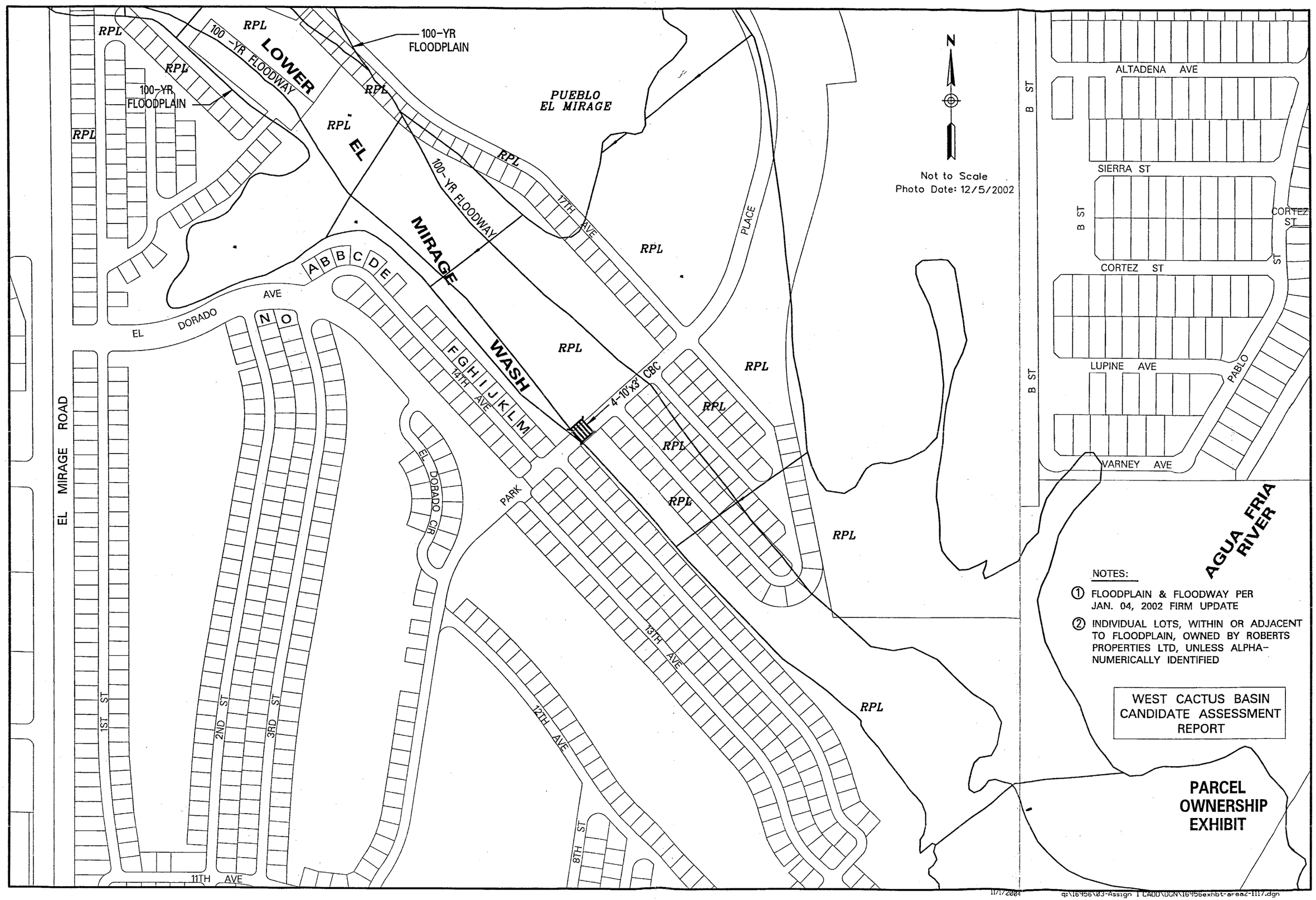
	VG		CONC VALLEY GUTTER
	VG		@ DYSART + LAUREL
89	GB?		Possible HIGH POINT
90	GB?		EL DIFF. NOT visible
91	CL		@ CACTUS RD
92	PC		G/E 127TH AVE
93	P		@ 127TH AVE
94	PC		G/W 127TH AVE
95	CL		@ CACTUS RD
96	CB 1113.24		GRATE
97	SDMH 1113.64		RIM
98	CB 1113.13		GRATE
99	CB 1112.81		GRATE
1500	CB 1112.69		GRATE
1501	CB 1112.83		GRATE
02	SDMH 1113.13		RIM
03	NG	EL INFO PREV PAGE	NATURAL GROUND NEXT TO SDBubbler INBASIN
04	INV 24" RCP		
05	INV 24" RCP		S. END N 2ND CULVERT
06	INV 24" RCP		@ CACTUS RD
07	Bubbler		SD Bubbler STR
08	INV		IN EX. BASIN 2' ± ABOVE NG
09	NG		
1510	WALL		FACE OF BRICK PROP WALL
1511	WALL		E. SIDE EL MIRAGE RD
1512	WALL		# 1512 ON WALL LINE 15' FROM END
1513	EP/GB		W. SIDE ELMIRAGE RD
14	EP		
15	EP		
16	EP G/B		
17	EP PC		SW COR INTX CACTUS + ELMIRAGE
18	EP PC		
19	EP PC		SE COR INTX CACTUS - EL MIRAGE



APPENDIX L

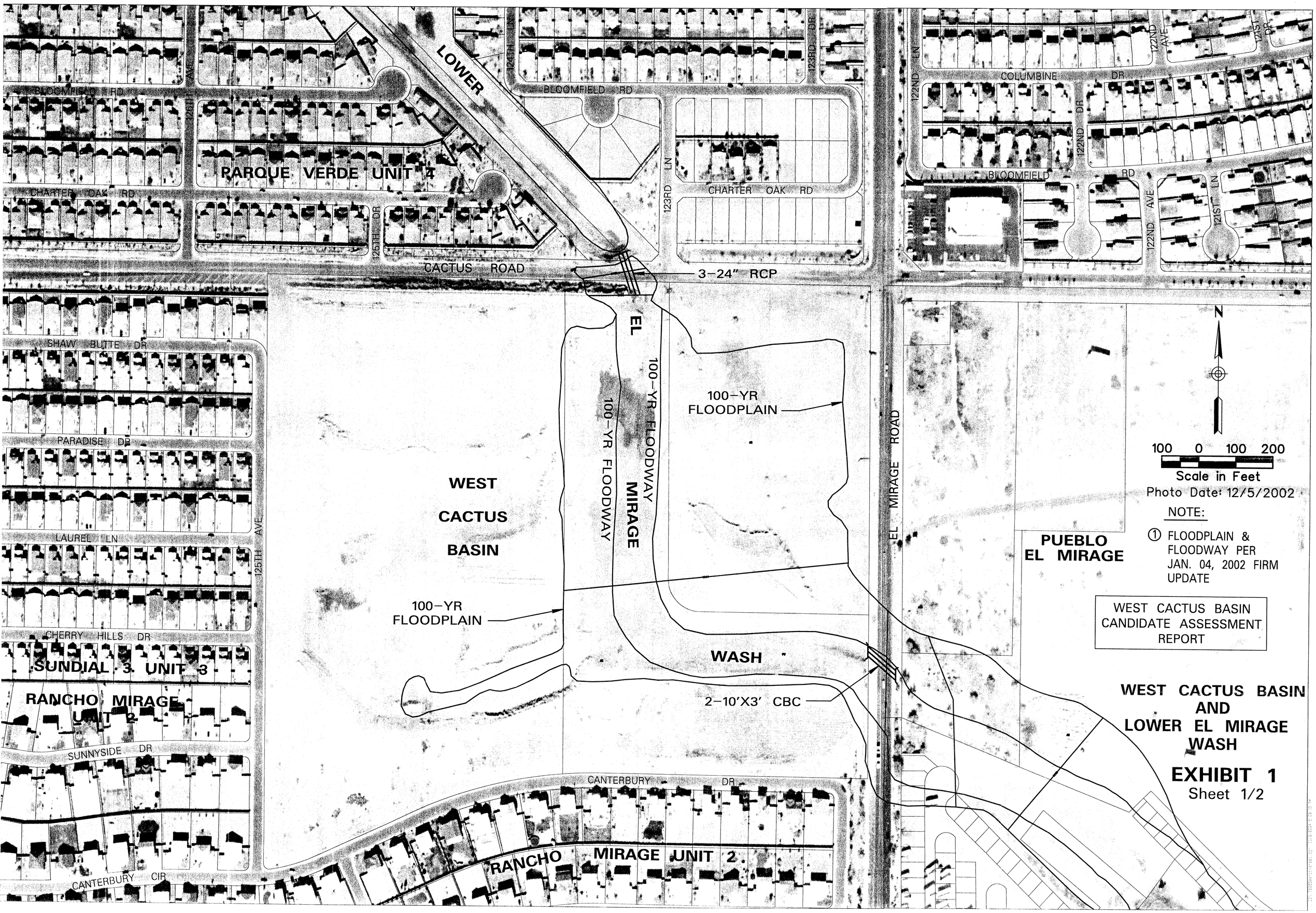
Property Ownership in the Vicinity of the West Cactus Basin

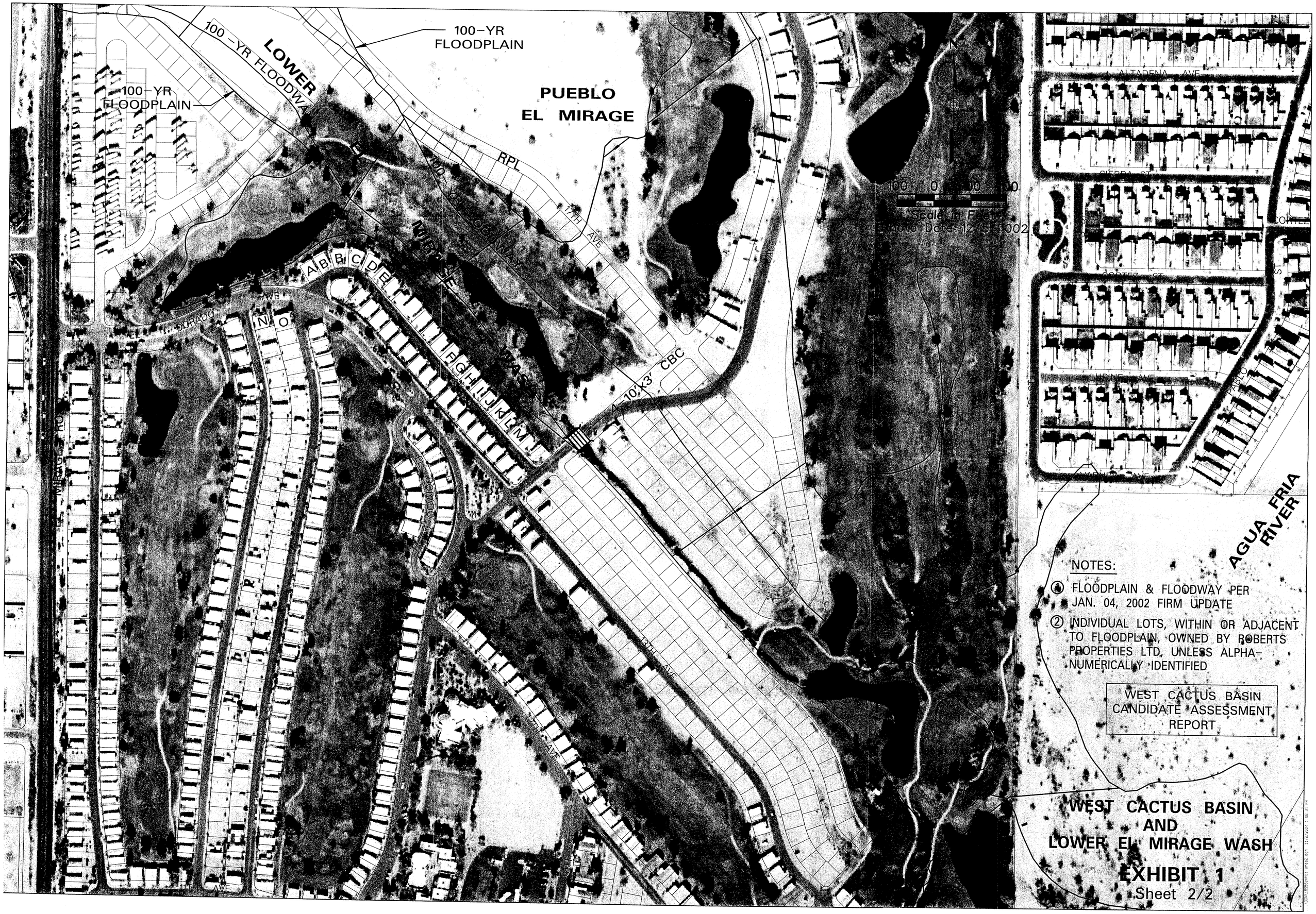

LOWER
BLOOMFIELD RD
126TH AVE
124TH LN
123RD DR
123RD LN
122ND LN
122ND AVE
121ST DR
COLUMBINE DR
122ND DR
BLOOMFIELD RD
121ST LN
PARQUE VERDE UNIT 4
CHARTER OAK RD
125TH DR
CACTUS ROAD
3-24" RCP
ST. MARY'S HIGH SCHOOL SCHOLARSHIP
SHAW BUTTE DR
PARADISE DR
LAUREL LN
125TH AVE
CHERRY HILLS DR
SUNDIAL 3 UNIT 3
RANCHO MIRAGE UNIT 2
SUNNYSIDE DR
CANTERBURY CIR
CANTERBURY DR
EL MIRAGE ROAD
100-YR FLOODWAY
100-YR FLOODPLAIN
WEST CACTUS BASIN
WASH
2-10'X3' CBC
HERBERT BOOL & CITY OF EL MIRAGE
CITY OF EL MIRAGE
LR CONTRERAS CONTRACTOR INC
DESERT JACKRABBIT EASTATES LLC
PUEBLO EL MIRAGE
ROBERTS PROPERTIES LTD (RPL)
CP HOLDINGS INC
RPL
N
Not to Scale
Photo Date: 12/5/2002
NOTE:
① FLOODPLAIN & FLOODWAY PER JAN. 04, 2002 FIRM UPDATE
WEST CACTUS BASIN CANDIDATE ASSESSMENT REPORT
PARCEL OWNERSHIP EXHIBIT
11/17/2004
q:\16956\03-Assign I CADD\DGN\16956exhbt-areal-1117.dgn


RPL
LOWER
EL
MIRAGE
WASH
100-YR FLOODWAY
100-YR FLOODPLAIN
PUEBLO EL MIRAGE
17TH AVE
14TH AVE
13TH AVE
12TH AVE
11TH AVE
EL DORADO AVE
EL DORADO CIR
PARK
PLACE
EL MIRAGE ROAD
1ST ST
2ND ST
3RD ST
8TH ST
A B C D E
F G H I J K L M
N O
4-10'x3' CBC
Not to Scale
Photo Date: 12/5/2002
N
B ST
ALTADENA AVE
SIERRA ST
CORTEZ ST
LUPINE AVE
VARNEY AVE
PABLO
AGUA FRIA RIVER
NOTES:
① FLOODPLAIN & FLOODWAY PER JAN. 04, 2002 FIRM UPDATE
② INDIVIDUAL LOTS, WITHIN OR ADJACENT TO FLOODPLAIN, OWNED BY ROBERTS PROPERTIES LTD, UNLESS ALPHA-NUMERICALLY IDENTIFIED
WEST CACTUS BASIN CANDIDATE ASSESSMENT REPORT
PARCEL OWNERSHIP EXHIBIT
11/17/2004
q:\16956\03-Assign 1 CADD\DGN\16956exhbt-area2-1117.dgn

PARCELS IN THE VICINITY OF THE 100-YR FLOODPLAIN
EAST OF EL MIRAGE ROAD

ALPA-NUMERIC ID	OWNERSHIP
A	CLOVER MICHAEL/CHERYL
B	KRESS ARTHUR L/DONNA M
B	KRESS ARTHUR L/DONNA M
C	DURR ROGER D/JEANNE T TR
D	RYDER MERRILL E
E	MORPHIS JAMES G/BARBARA D TR
F	COMBELLACK ROBERT W & HAZEL H
G	GILMORE WILLIS WILLIAM/BEVERLY ANN
H	CARTER CONNIE E
I	MARTIN JOHN/PRESCOTT-MARTIN MARION E
J	FEIOCK CHARLES E
K	RAINSBERGER CHARLES J/MARY ANN
L	COCHRAN JAMES W/BEVERLY ANN
M	LUCHETTA MICHAEL P
N	GHEZZI ERNEST E/ANN M
O	CARLEY WAYNE LKATHARINE


LOWER
BLOOMFIELD RD
126TH AVE
124TH LN
123RD DR
122ND LN
COLUMBINE DR
122ND AVE
121ST DR
PARQUE VERDE UNIT 4
CHARTER OAK RD
123RD LN
122ND DR
121ST LN
125TH DR
CACTUS ROAD
3-24" RCP
SHAW BUTTE DR
PARADISE DR
LAUREL LN
CHERRY HILLS DR
SUNDIAL 3 UNIT 3
RANCHO MIRAGE UNIT 2
SUNNYSIDE DR
CANTERBURY CIR
125TH AVE
WEST CACTUS BASIN
100-YR FLOODWAY
100-YR FLOODWAY
EL MIRAGE
100-YR FLOODPLAIN
100-YR FLOODPLAIN
WASH
2-10'X3' CBC
CANTERBURY DR
RANCHO MIRAGE UNIT 2
EL MIRAGE ROAD
PUEBLO EL MIRAGE
N
100 0 100 200
Scale in Feet
Photo Date: 12/5/2002
NOTE:
① FLOODPLAIN & FLOODWAY PER JAN. 04, 2002 FIRM UPDATE
WEST CACTUS BASIN CANDIDATE ASSESSMENT REPORT
WEST CACTUS BASIN AND LOWER EL MIRAGE WASH
EXHIBIT 1
Sheet 1/2


100-YR FLOODPLAIN
100-YR FLOODWAY
LOWER
100-YR FLOODPLAIN
PUEBLO EL MIRAGE
RPL
100-YR FLOODWAY
WEST
WASH
17TH AVE
A B C D E F G H I J K L M
N O P
EL DORADO AVE
EL DORADO
10'x3' CBC
13TH AVE
12TH AVE
ALTADENA AVE
SIERRA ST
CORTEZ ST
LUPINE AVE
PABLO ST
AGUA FRIA RIVER
Scale in Feet
Photo Date 12/5/2002
NOTES:
① FLOODPLAIN & FLOODWAY PER JAN. 04, 2002 FIRM UPDATE
② INDIVIDUAL LOTS, WITHIN OR ADJACENT TO FLOODPLAIN, OWNED BY ROBERTS PROPERTIES LTD, UNLESS ALPHA-NUMERICALLY IDENTIFIED
WEST CACTUS BASIN CANDIDATE ASSESSMENT REPORT
WEST CACTUS BASIN AND LOWER EL MIRAGE WASH
EXHIBIT 1
Sheet 2/2