POWER ROAD
GUADALUPE ROAD TO BASELINE ROAD

Contract No. CY 2000-22, Work Order No. 68969
Sverdrup Civil, Inc. Project No. W7X70500

FINAL DRAINAGE REPORT

NOVEMBER 2000

Prepared for
MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

Prepared by

SVERDRUP CIVIL, INC.
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Tempe, Arizona 85281

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ARIZONA U.S.A.

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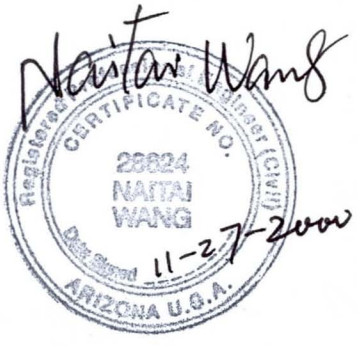


TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF WORK

Power Road project, from Guadalupe Road to Baseline Road, is identified as Maricopa County Department of Transportation (MCDOT) Contract No. CY 2000-22 and Work Order No. 68969. The project is located at east Maricopa County (See Figure 1 at Page 2). This project is within Maricopa County in Township 1 North, Range 7 East of the Gila and Salt River Base and Meridian in Section 31; T1N, R6E, Section 36; T1S, R7E, Sections 6 and 7; T1S, R6E, Sections 1 and 12. MCDOT, Flood Control District of Maricopa County (FCDMC), the City of Mesa, and the Town of Gilbert are part of an inter-government team formed to fund and construct roadway.

The project limits include the following roadways (see Figure 2, Vicinity Map at Page 3):

- Power Road – from 100 meters north of Baseline Road to 500 meters south of Guadalupe Road. (Located in City of Mesa)
- Baseline Road – from 400 meters east of Power Road to 350 meters west of Power Road. (Located in City of Mesa)
- Guadalupe Road – from 500 meters east of Power Road (in Town of Gilbert) to 20 meters west of Power Road (in City of Mesa).

1.1.1 Description of Roadway Improvements

Maricopa County proposes to upgrade the existing Power Road from 4-lane rural minor arterial roadway/5-lane urban minor arterial roadway, to a 6-lane urban principal arterial roadway.

1.1.2 Drainage Design Scope of Work

- The roadway shall be designed so that drainage follows the historic flow paths and does not create off site flooding or adverse ponding within the right-of way. Runoff from intersection streets shall be designed so as to maintain or improve existing drainage conditions, as economically feasible, and in no case adversely impact Power Road.

MARICOPA COUNTY

Not to Scale

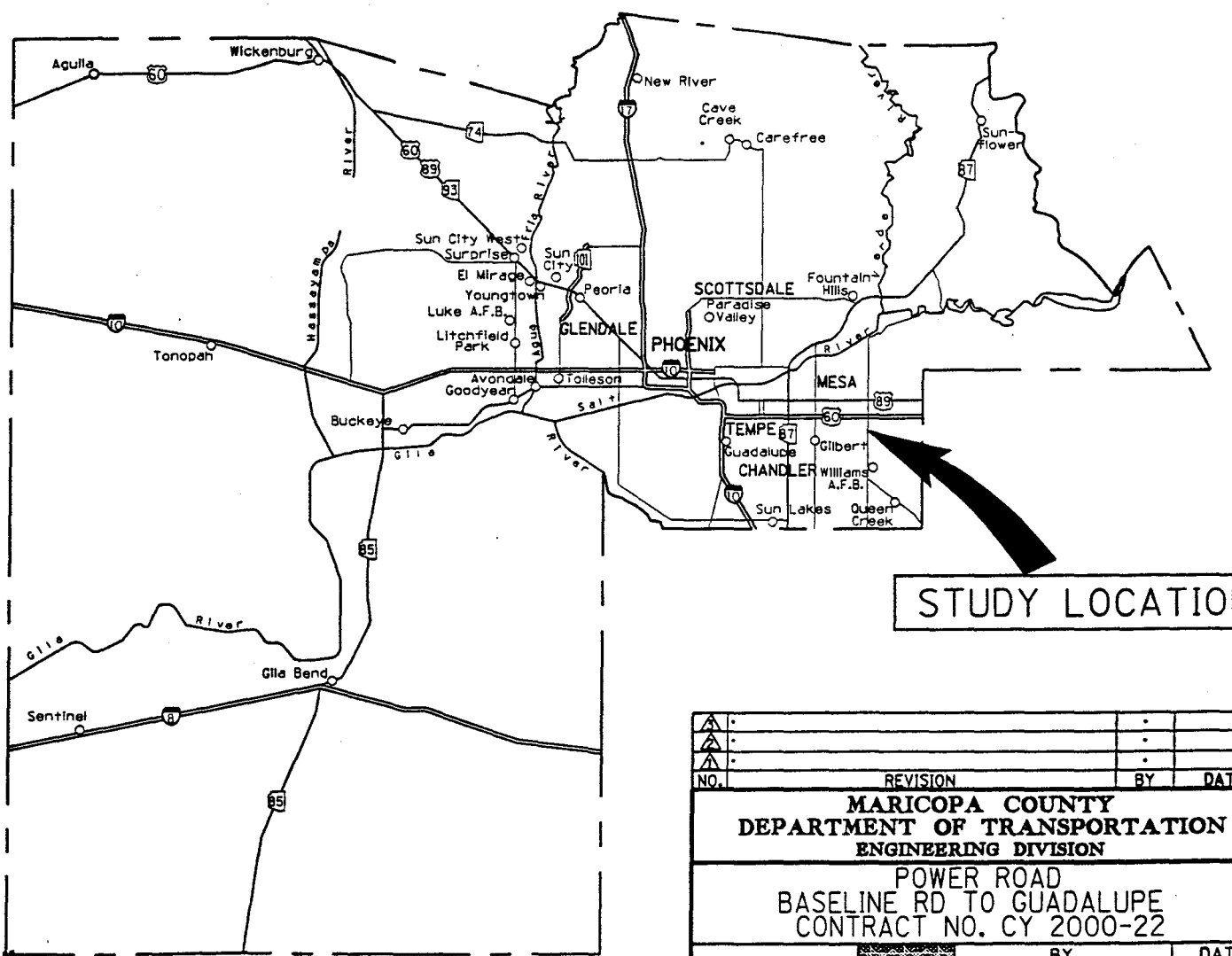


FIGURE 1
LOCATION MAP

NO.	REVISION	BY	DATE
3			
2			
1			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

POWER ROAD
BASELINE RD TO GUADALUPE
CONTRACT NO. CY 2000-22

		BY	DATE
PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED		2/3/2000
	DRAWN	NW	2/3/2000
	CHECKED		/ /

Sverdrup CORPORATION

LOCATION MAP

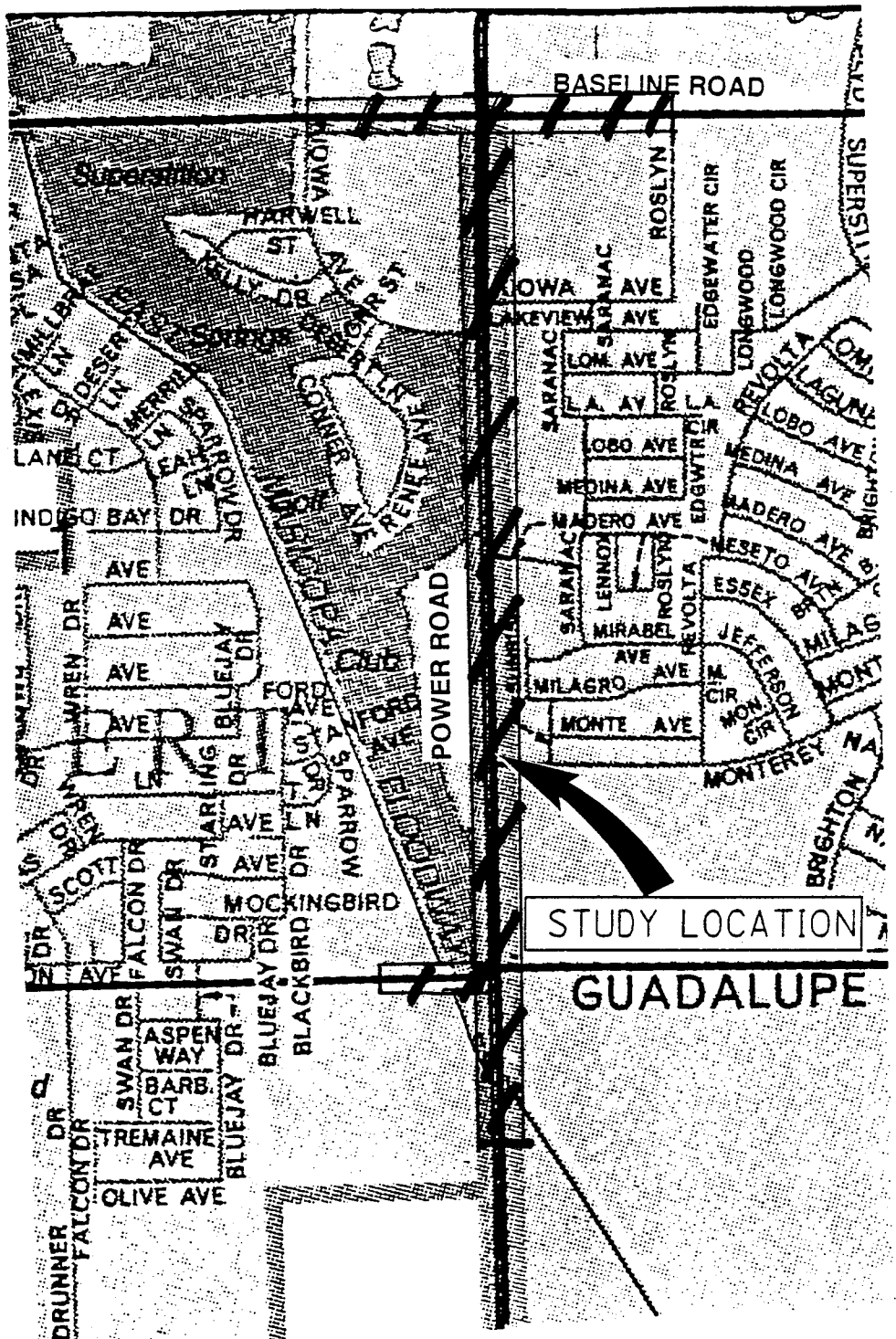


FIGURE 2
VICINITY MAP
Not to Scale

- The improvement to Power Road will result in increases to, and changes in, drainage patterns and surface runoff flows. Drainage improvements shall include the construction of storm drains and enlarging of drainage ditches behind the curb and gutter to accept greater flows. The proposed outfall of the surface runoff from Power Road will be conveyed to the existing East Maricopa Floodway (EMF) that runs parallel to the project.
- The design of drainage facilities with current and on-going drainage studies and roadway design projects should be coordinated. This will include the studies currently being prepared by the Flood Control District for the boundaries of the Preliminary Southeast Mesa Area Drainage Master Study (ADMS) which is in the process of being finalized by the FCDMC. This project does not lie within a Federal Emergency Management Agency (FEMA) 100-year flood plain.
- Curb opening catch basins shall be used within arterial and collector streets. City of Phoenix Type 'M' catch basins are preferred. The exception is to use combination catch basins along streets that have steep grades. Power Road runoff will be captured via a combination of storm drain and enlarged drainage ditches, which will be conveyed to the existing floodway (EMF, Reach 5) which runs parallel to the project.

1.2 DRAINAGE ANALYSIS CRITERIA

This report and the design concepts herein follow the guidelines stated in the City of Mesa Engineering & Design Standards for storm water management, hydrologic analysis, and hydraulic design. This report also complies with the Drainage Design Manuals for Maricopa County: Hydrology, Volume 1; Hydraulics Volume II. Since a portion of the project is located in Town of Gilbert, the design guidelines for Town of Gilbert are used in this report. The drainage design criteria is as follow:

- **Roadways**: 10-year peak storm shall be conveyed between curbs, and the runoff spread shall be limited to one lane. The peak flow during a 100-year storm event shall be carried within the right-of-way. (City of Mesa)
- **Storm Drainage Network:** The hydraulic grade line (HGL) of the network shall be at least 0.15 m (6 inches) below all inlet grates during the 10-year design storm. The system tailwater shall be based on the 10-year event in the East Maricopa Floodway (EMF). Maximum storm sewer manhole spacing shall be 182 meters (600 ft) for pipe

sizes from 460 mm to 910 mm (18-in to 36-in), and 243 meters (800 ft) for pipe size from 910 mm to 1520 mm (36-in to 60-in). (City of Mesa)

- **Parallel Roadside Ditches**: 10-year peak storm shall be conveyed within ditch. (Maricopa County)
- **Open Channels**: 50-year peak flow shall be conveyed without flooding beyond the right-of-way during the 100-year storm. (Maricopa County)
- **Retention**: 100-year, 2-hour storm (City of Mesa); 50-year 2-hour storm (Town of Gilbert). All retention basins shall drain in 36 hours or less.
- **Bridges**: Designed to have a minimum freeboard of two feet during the 100-year event. Bridge scour shall be analyzed for the 100-year event (Maricopa County). Design flow for bridge over the EMF is 138.7 cubic meters per second (4,900 cfs). This peak flow is based on the EMF Capacity Study, Design and Estimated Flows, Flood Control District Maricopa County.
- **Spread Width**: Arterial streets and major collectors shall be designed to concentrate the runoff spread to one lane. (City of Mesa)

Most of the project site is located in the City of Mesa. City of Mesa drainage design criteria will be used in this report otherwise noted.

1.3 METRIC UNITS

All size references, stations, distances, flow rates and volumes are in Standard Metric units.

1.4 PREVIOUS STUDIES

The roadway aspects of the project are being coordinated with the following studies:

East Mesa Area Drainage Master Plan, October 1998 by Flood Control District of Maricopa County.

The purpose of this project was to identify drainage problems and develop cost-effective solutions for a storm water collection and disposal system for the east Mesa area. The project area covers eastern Maricopa County including portions of the City of Mesa, the Town of Gilbert, the Town of Queen Creek, and incorporated Maricopa County.

The Preliminary Southeast Mesa Area Drainage Master Study (ADMS) by the Maricopa County Flood Control District.

The Power Road project site lies within the boundaries of the ADMS. The study shows that the project site does not lie within a Federal Emergency Management Agency (FEMA) 100-year floodplain. Based on the results of the ADMS, storm water from Power Road can be drained into the EMF without retention.. The Maricopa County Flood Control District has approved the direct discharge of runoff from this project to the EMF. The Flood Control District will provide the 10-year water surface elevation within the EMF for use as the tailwater of the proposed outfall system..

Master Drainage Plan for Superstition Springs, Maricopa County, Arizona by Coe & Van Loo Consulting Engineers, Inc.

The purpose of the report was to present the proposed Preliminary Master Drainage Plan for Superstition Springs for approval by Flood Control District of Maricopa County, City of Mesa, and the Town of Gilbert. This report will be used in successive phases of the Superstition Springs project as development progresses. Included in this report are analyses of off-site drainage impacting the Superstition Springs project site and proposed on-site flood control and retention facilities. This report includes the retention volume requirements for each parcel, and indicates that surface water runoff from the development north of Baseline Road has been routed to retention facilities and is no longer conveyed by the Baseline Road drainage system, thereby reducing the capacity requirement of this existing system. See Appendix I, Onsite Retention Map

3.2 FEMA FLOOD INSURANCE RATE MAPS

The Federal Emergency Management Agency (FEMA) flood insurance rate maps show that this project area is located in Flood Area Zone X. Zone X is defined by FEMA as an "Area of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood". The Flood Insurance Rate Map (FIRM) includes 04013C2215F, Map revised: December 3, 1993; 04013C2215F, effective date: April 15, 1988; 04013C2680F, Map revised: December 3, 1993; 04013C2685F, Map revised December 3, 1993. See Figure 3 at Page 8, FIRM Map.

1.6 AS-BUILT ROADWAY PLANS (MCDOT)

As-built roadway plans were used to verify the type, size and location of existing drainage structures. The plans reviewed were Power Road – Williams Field Road to Baseline Road, Project No. 68219, dated 2-11-87; and Baseline Road – Power Road to Ellsworth Road, Project No. 68377, dated 3-19-87.

1.7 FIELD RECONNAISSANCE

Aerial photography of Power Road from US 60 to south of Guadalupe Road was provided by MCDOT. Sverdrup personnel visited the site in March, April, May and June 1999, and January and February 2000 for the purpose of photo documentation, to observe existing drainage structures, and to determine land-uses and runoff flow patterns. See Appendix I, Photographic Documentation for more detail of existing conditions.

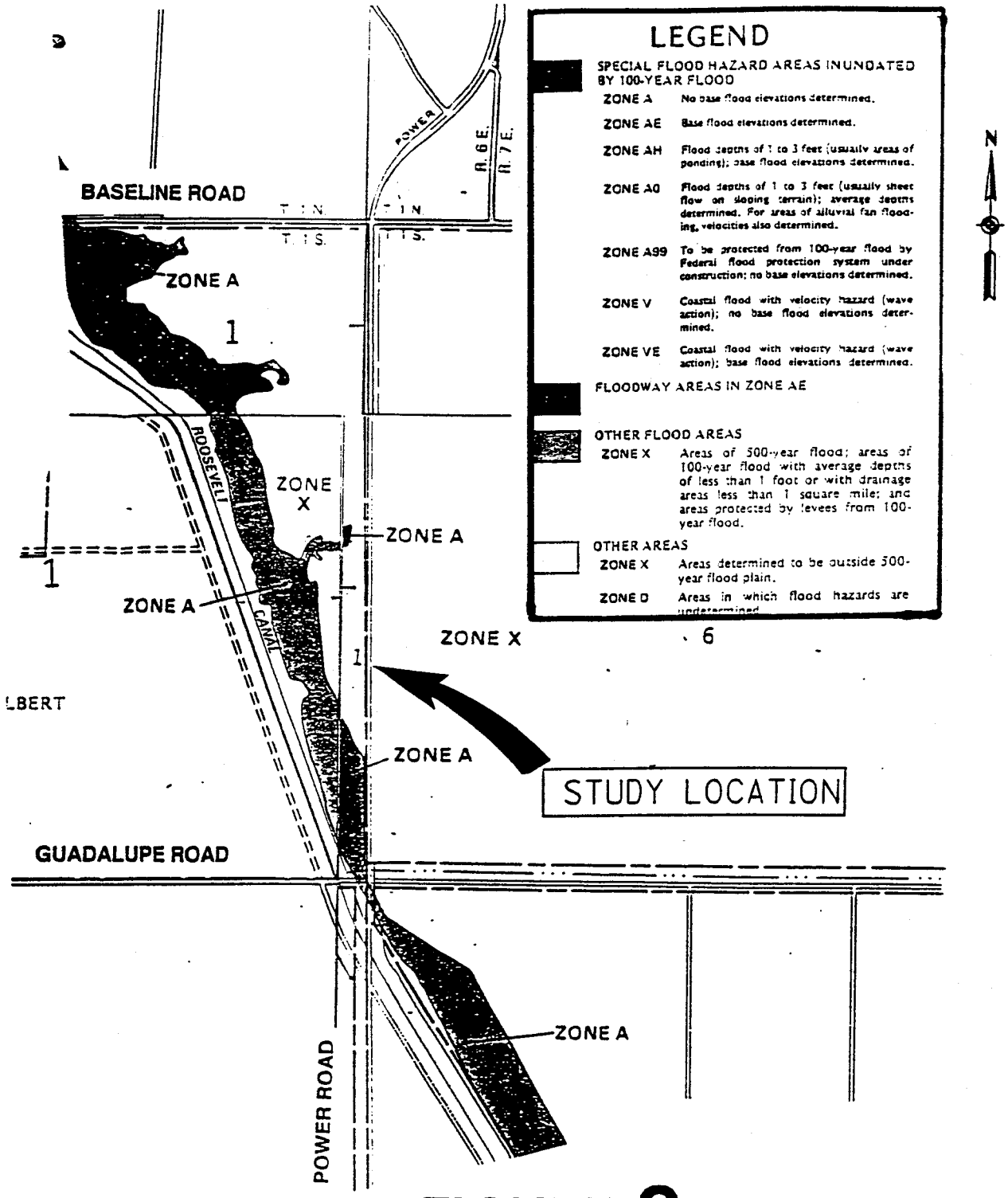


FIGURE 3
FIRM MAP
Not to Scale

2.0 HYDROLOGY

2.1 WATERSHED DESCRIPTION

The project is located within the City of Mesa, Town of Gilbert, and Maricopa County. The overall topography is flat, with the area generally draining from the northeast to the southwest. (See Figure 4, USGS Map, at Page 10). Most area adjacent to Power Road is developed and is served by on-site retention facilities. There are commercial sites at the southeast and southwest corners of the intersection of Power Road and Baseline Road. A golf course is located along the west edge of the Power Road right-of-way, and residential development abuts the east right-of-way. There are also two undeveloped parcels along the east right-of-way. Refer to Figure 5, Aerial Photo, at page 22 for more detail. The project site watershed is formed by the following boundaries:

- **Guadalupe Road:** Surface water runoff from land outside the right-of-way south of Guadalupe Road will not drain to the project site.
- **Power Road:** Surface water runoff from land west of Power Road will flow into the East Maricopa Floodway (EMF), and will not impact the project site. On-site retention areas serve the majority of land east of Power Road. However, improved roadside ditches are necessary to convey runoff from Undeveloped Areas One and Two to the proposed Power Road storm drainage system. These ditches will remain in service until such time as the Undeveloped Areas are developed and on-site retention facilities are constructed and approved
- **Baseline Road:** Surface water runoff from land north of Baseline Road will be retained on-site, and will not impact the project area.

2.2 RAINFALL INTENSITY-DURATION-FREQUENCY

The rainfall intensity versus duration (IDF) relationship for each storm frequency is expressed using the curves from *Drainage Design Manual*, Maricopa County, Arizona, and *Engineering & Design Standards, Second Edition*, City of Mesa. The IDF curves utilized in this report are included in Appendix A.

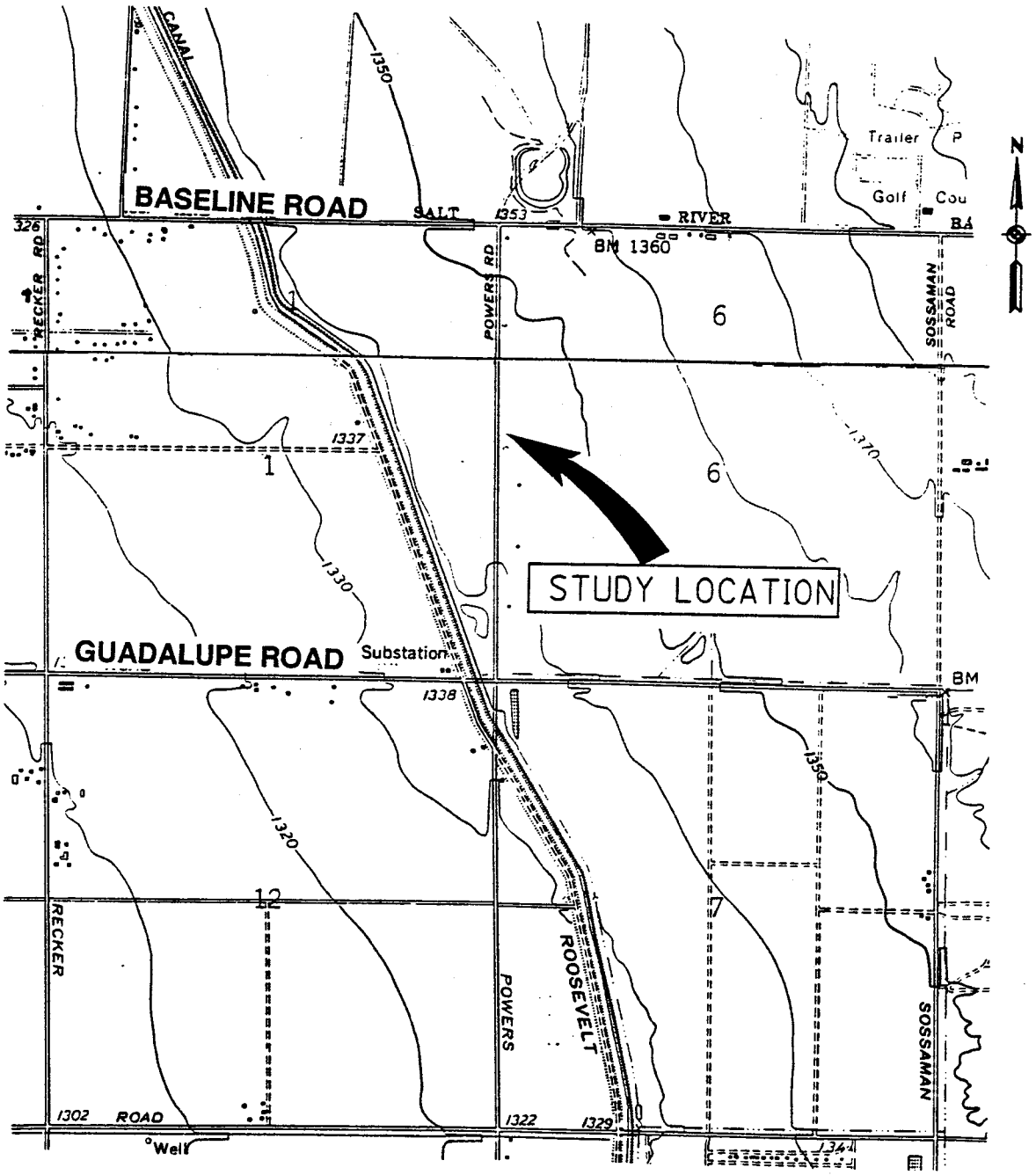


FIGURE 4
USGS MAP
1"=2000'

2.3 RATIONAL EQUATION

The Rational Equation relates rainfall intensity, runoff coefficient and watershed size to the generated peak discharge. The peak discharge is used for roadside ditch, catch basin, and storm drain system design. The following equation shows this relationship:

Q=CiA (City of Mesa)

where: Q = the peak discharge from given area (cfs);

C = a coefficient relating the runoff to rainfall;

i = average rainfall intensity (in/hr), lasting for a time equal to Tc;

Tc = the time of concentration (min);

A = drainage area (ac).

Calculations utilizing the Rational Method are included in Appendix B "Roadside Ditch Design" and Appendix D "Roadway Catch Basin Design."

The runoff coefficient "C" in the Rational Equation is defined by the local jurisdiction. The City of Mesa and the Town of Gilbert use the following runoff coefficients:

Turf (grass) landscaping ---------- C=0.15
Combined desert and turf landscaping ----------C=0.45
Desert landscaping ----------C=0.70
Asphalt pavement or roofs ----------C=0.85
Concrete ----------C=0.95

These coefficients were tabulated and combined to determine a "weighted" runoff coefficient for each specific roadway section in a spreadsheet included in Appendix A "Runoff Coefficient and Rainfall Intensity." The coefficients are also utilized in Appendix B "Roadside Ditch Design," Appendix D "Roadway Catch Basin Design," and Appendix F "Retention Basin Design."

The time of concentration is the interval of time from the beginning of rainfall, for water from the

hydraulically most remote point of the drainage area to reach the point of concentration. Time of concentration (Tc) is calculated by the formula:

$$T_c = L/V \qquad \textbf{(City of Mesa)}$$

where: L = the length of hydraulic route (meter, ft);

V = velocity (mps or fps).

For street flow, velocity can be obtained from the Manning's Equation. For sheet flow, velocity can be obtained from the figure "Overland Flow Velocities for Upland method of Estimating T_c", *Design Standards and Policies Manual*, City of Scottsdale, Arizona. This figure is included in Appendix B.

3.0 HYDRAULICS

3.1 EXISTING DRAINAGE SYSTEMS

3.1.1 Existing Bridges and Box Culvert

Power Road crosses both the Roosevelt Water Conservation District (RWCD) Canal and the East Maricopa Floodway (EMF) within the project limits. Both of these facilities travel from northwest to southeast and are essentially parallel. The Power Road Bridges are located at approximately Stations 0+800 and 0+905 (Power Road). The first bridge spans the RWCD Canal with one 19-meter (62-foot) span. The second bridge crosses the EMF with 6 spans and a length of 67 meters (221 feet)..

Guadalupe Road also crosses the RWCD Canal and EMF within the project limits. The RWCD Canal is carried in a box culvert at approximately Station 0+905 (Guadalupe Road). The bridge over the EMF is located at approximately Station 0+960 (Guadalupe Road). This bridge has 3 spans with the length of 35 meters (115 feet). The design peak flow for the EMF is 138.75 cubic meters per second (4,900 cfs), according to the Flood Control District, Maricopa County.

3.1.2 Existing Power Road Drainage System

A storm drainage pipeline is located in Power Road from East Kiowa Avenue to Guadalupe Road, east of the Power Road centerline. This system drains south and is constructed of 460 mm (18-inch) to 760 mm (30-inch) pipelines. It includes four existing Type E single catch basins along the east side of Power Road, which serve a portion of the east side of the right-of-way. The pipeline serves development located east of Power Road and the four roadway catch basins and it drains to the Guadalupe Channel which in turn outfalls to the EMF. Additional discussions with the City of Mesa should be held to ascertain the adequacy of this system for continued service of the limited portion of Power Road. Refer to Appendix H, Existing City of Mesa Storm Drain System for more detail of existing drainage systems in Power Road.

3.1.3 Existing Baseline Road Drainage System

The Baseline Road storm drain system conveys both roadway and surface runoff from the right-of-way and conveys it to the EMF. This storm drainage system includes two 1370 mm (54-inch) pipes along the north side of Baseline Road. A lateral from this pipeline extends north along Power Road to serve several inlets and retention basin bleed-off lines. Refer to Appendix H, Existing City of Mesa Storm Drain System for more detail. The Superstition Springs project redirected runoff from large areas adjacent to Baseline Road to on-site retention facilities, thereby reducing the amount of flow in the Baseline Road system. Existing catch basins have sufficient capacity for the 10-year event along the north side of Baseline Road between Power Road and Kiowa Avenue. Additional information about the Superstition Springs project is provided by *Master Drainage Plan for Superstition Springs, Maricopa County, Arizona by Coe & Van Loo Consulting Engineers, Inc.*

3.1.4 Existing Retention Facilities

Several existing retention basins are located east of Power Road, outside the project area. These retention basins infiltrate storm water from subdivisions and parcels east of Power Road.

3.2 PROPOSED DRAINAGE SYSTEMS

3.2.1 Proposed Bridges and Box Culvert

Bridges over the EMF will be widened. The bridge at Power Road will be widened to 13 meters (5.4 meters west and 7.6 meters east). The bridge at Guadalupe Road will be widened to 13.6 meters (2.7 meters north and 10.9 meters south).

The bridge spanning the RWCD Canal at Power Road will be widened to 13 meters (5.4 meters west and 7.6 meters east).

The RCWD Canal box culvert at Guadalupe Road will be lengthened to accommodate the proposed widening of Guadalupe Road.

3.2.2 Proposed Power Road Drainage System

Power Road will be upgraded to a six-lane urban principal arterial roadway. Since the upgraded roadway does not have enough capacity to convey storm water into the EMF, a new drainage system is proposed for Power Road. The proposed system includes catch basins, scuppers, manholes, pipelines and an outfall, and will extend from Baseline Road south to Guadalupe Road. The system will outfall at the northwest corner of the intersection of Power Road and Guadalupe Road to the EMF. In addition, several inlets north of Baseline Road will be relocated to the proposed curb line. The proposed system is shown in Figure 6, on Page 23.

1.1.3 Proposed Baseline Road Drainage System

The proposed widening of Baseline Road will require construction of four additional catch basins. Each of these catch basins is proposed to be connected to the existing storm drainage system within Baseline Road. The proposed system is shown in Figure 6, on Page 23.

1.1.4 Proposed Power Road Ditches

Surface water runoff from Undeveloped Areas One and Two will be conveyed in proposed roadside ditches that will drain to the proposed Power Road Drainage System. A proposed ditch will also convey runoff from the eastern half of Power Road lying south of Guadalupe Road. This ditch will drain to a proposed retention facility. The proposed system is shown in Figure 6, on Page 23.

1.1.5 Proposed Retention Facilities

Runoff from Power Road south of Guadalupe Road will be collected in three proposed retention facilities. Runoff from the southern half of Guadalupe Road (west of Power Road) will be collected in three proposed retention facilities located to the south of Guadalupe Road. Scuppers are proposed to intercept gutter flow and direct it to roadside ditches or directly to each of these six retention facilities.

1.1.6 Coordination With Existing Utilities

There are existing underground utilities along the project corridor that may require adjustment to clear the proposed drainage system. These utilities will be potholed at potential points of conflict during the 70 percent design phase.

3.3 HYDRAULIC ANALYSIS AND DESIGN

3.3.1 Bridge and Box Culvert Analysis

A HEC-RAS hydraulic model for the EMF was obtained from the Maricopa County Flood Control District. The model was used to evaluate the bridges for both existing and proposed conditions. Four existing cross sections (river stations) were renamed to match the upstream and downstream edges of the widened bridges (note, however, that new cross sections were not developed). The widened bridges are required to convey the 100-year storm with 0.6 meters (2 feet) of freeboard. These analyses are presented in Appendix G.

The existing hydraulic conditions at the bridge crossing of the RWCD at Power Road are adequate. Widening this bridge will not change the hydraulic conditions of the canal, therefore, no analysis was prepared.

RWCD has indicated that the existing box culvert at Guadalupe Road is hydraulically adequate. Lengthening this box culvert will not add significant head losses, therefore, no analysis was prepared.

3.3.2 Roadway Drainage System Analysis and Design

Roadway hydraulic design is based on the criteria that streets shall be designed to carry runoff from a 10-year storm between the curbs with the further limitation that runoff spread shall not exceed one lane. This results in a maximum spread width of 5.18 meters (17 feet). The software FlowMaster, Version 6, by Haestad Methods was used to determine the roadway gutter capacity with 5.18 meters (17 feet) spread width. The spread width calculations use a Manning's "n" of 0.015. Refer to Appendix C, Roadway Spread Width Calculation, for more detail.

Where calculations indicate spread width approaches 5.18 meters (17 feet), a catch basin has been proposed. Chapter 4, Pavement Drainage, of the *Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22* (HEC-22) provides equations used to determine catch basin length requirements, bypass flows and efficiency. These equations are as follows:

Curb-Opening Inlets (On-Grade):

$L_T = K_C * Q^{0.42} * S_L^{0.3} (1/n * S_X)^{0.6}$ (HEC-22 Eqn. 4-22)

where:

L_T = curb opening length required to intercept 100% of the gutter flow, m (ft)

K_C= 0.817 (0.6 in English Units)

Q = gutter flow, m^3/s (cfs)

S_L = longitudinal slope

n = Manning's roughness coefficient

S_X =cross slope

The efficiency of curb-opening inlets shorter than the length required for total interception is expressed by below equation:

$E = 1-(1 - L/L_T)$ (HEC-22 Eqn. 4-23)

where:

L = curb opening length, m (ft).

Curb-Opening Inlets (In Sag):

$Q_i = C_w * (L+1.8W) d^{1.5}$ (HEC-22 Eqn. 4-28)

where:

Q_i = interception capacity of a depressed curb-opening inlet, m^3/s

C_w = 1.25 (2.3 in English)

L = length of curb opening, m (ft);

W=lateral width of depression, m (ft);

d=depth at curb measured from normal cross slope, m (ft).

Gutter flow analysis and curb opening inlet sizing and efficiency analyses are included in Appendix D, Roadway Catch Basin Design.

Storm drainage system pipe size is based on the criteria that hydraulic gradient shall be at least 0.15 m (6 inches) below all inlet grates during the 10-year design storm (Flood Control District of Maricopa County, Arizona, *Drainage Design Manual, Volume II).* The storm drain system is also required to convey peak flows from the 100-year storm within the roadway right-of way. The software StormCad by Haestad Method, will be used to analyze the proposed storm drainage network for these conditions during the next phase of design. These analyses will be included in Appendix E, Proposed Storm Drainage System Analyses

3.3.3 Roadside Ditch Design

Roadside ditches are necessary to convey runoff from each of two undeveloped areas east of Power Road into the proposed Power Road storm drain system. These ditches are required to convey the 10-year storm flow. The Rational Method was used to determine runoff from each of the undeveloped areas. The ditches were analyzed as triangular earth channels with grass (Manning's "n" of 0.03), 4:1 (horizontal:vertical) sideslopes and 0.4% longitudinal slope. A roadside ditch is also proposed to convey runoff from the eastern half of Power Road lying south of Guadalupe Road. This ditch will be designed with the same considerations as the other Power Road ditches. Ditch designs are included in Appendix B, Roadside Ditch Design.

3.3.4 Retention Basin Design

Three retention basins are necessary to serve the southern half of Guadalupe Road located west of Power Road. Three more basins are necessary to serve Power Road south of Guadalupe Road. The maximum depth of retention basins as measured from natural grade to the bottom of the basin shall be 1 meter (3.5 feet). Excavation for a retention basin within public street right-of way is not permitted, therefore all but two of these basins have been located just outside the right-of-way. The two retention facilities serving Guadalupe Road and located within the right-of-way will require drainage easements. Retention basins are required to contain the 100-year, 2-hour storm event runoff for City of Mesa, and 50-year, 2-hour storm event runoff for the Town of Gilbert. In

addition, all retention basins are required to be designed to empty within 36 hours. Retention basin analyses are included in Appendix F, Retention Basin Design.

3.4 SUMMARY OF HYDRAULIC ANALYSES

3.4.1 Bridge and Box Culvert Summary

Two existing bridges over the EMF are proposed to be widened by this project. The bridges were evaluated using the HEC-RAS program. The high water elevations following construction of this project are essentially the same as they are under existing conditions, and therefore, the bridges will continue to meet requirements for 100-year peak flows following widening. Refer to Appendix G, HEC-RAS Analysis of Existing and Widened Bridges for detailed information. A summary is shown below:

EMF Bridge High Water Elevations
Existing and Proposed Conditions
100-Year Peak Flow (138.75 cubic meters per second)

Bridge Name	River Station ID	Existing HW (m)	Proposed HW (m)
Guadalupe Road	21.413	406.06	406.07
Guadalupe Road	21.402	406.00	406.00
Power Road	21.355	405.93	405.95
Power Road	21.326	405.67	405.67

The proposed RWCD Canal Bridge widening at Power Road will not impact the hydraulics of the canal. The proposed lengthening of the RWCD box culvert at Guadalupe road will not adversely affect the hydraulics of the canal.

3.4.2 Roadway Drainage System Summary

Roadway spread width was designed to be less than one lane width (5.18 meters, or 17 feet) for a 10-year storm, as detailed in Appendix C, Roadway Spread Width Calculation. Numerous Type P-1596 catch basins are proposed to be constructed to intercept 10-year peak runoff from the project roadways, and several existing catch basins serving Power Road will be rerouted to drain

to the storm drainage system proposed within Power Road. The storm drainage network in Power Road is conceptually designed to convey the 10-year storm to the EMF. The Hydraulic Grade Line (HGL) will be designed to be at least 0.15 m (6 in) below the bottom curb opening catch basins as part of the next phase of design, and capacity of the overall roadway will be checked to ensure that the 100-year event can be conveyed within the right-of-way. See Appendices D and E for more detail.

3.4.3 Roadway Ditch Summary

Two of the roadway ditches proposed for this project serve two undeveloped areas located east of Power Road.. A third ditch is proposed to convey runoff from the eastern half of Power Road lying south of Guadalupe Road. These ditches may not be needed in the future when the undeveloped properties are improved and on-site retention basins are constructed and approved. At that point, runoff from the undeveloped sites will no longer be conveyed by the Power Road drainage network. The proposed ditches will convey the 10-year design flow. Ditch designs are included in Appendix B, Roadside Ditch Design.

3.4.4 Retention Basin Summary

Six retention basins are proposed for this project. These facilities can be removed when the undeveloped properties adjacent to the roadway served by them are improved and on-site retention basins are constructed and approved. At that time, runoff from the project roadways generally fronting the properties will be collected in the on-site retention basins. Retention volume is provided to contain the 100-year, 2-hour storm event runoff for City of Mesa, and 50-year, 2-hour storm event runoff for the Town of Gilbert. In addition, all retention basins will empty within 36 hours. Retention basin designs are included in Appendix F, Retention Basin Design.

4.0 CONCLUSIONS

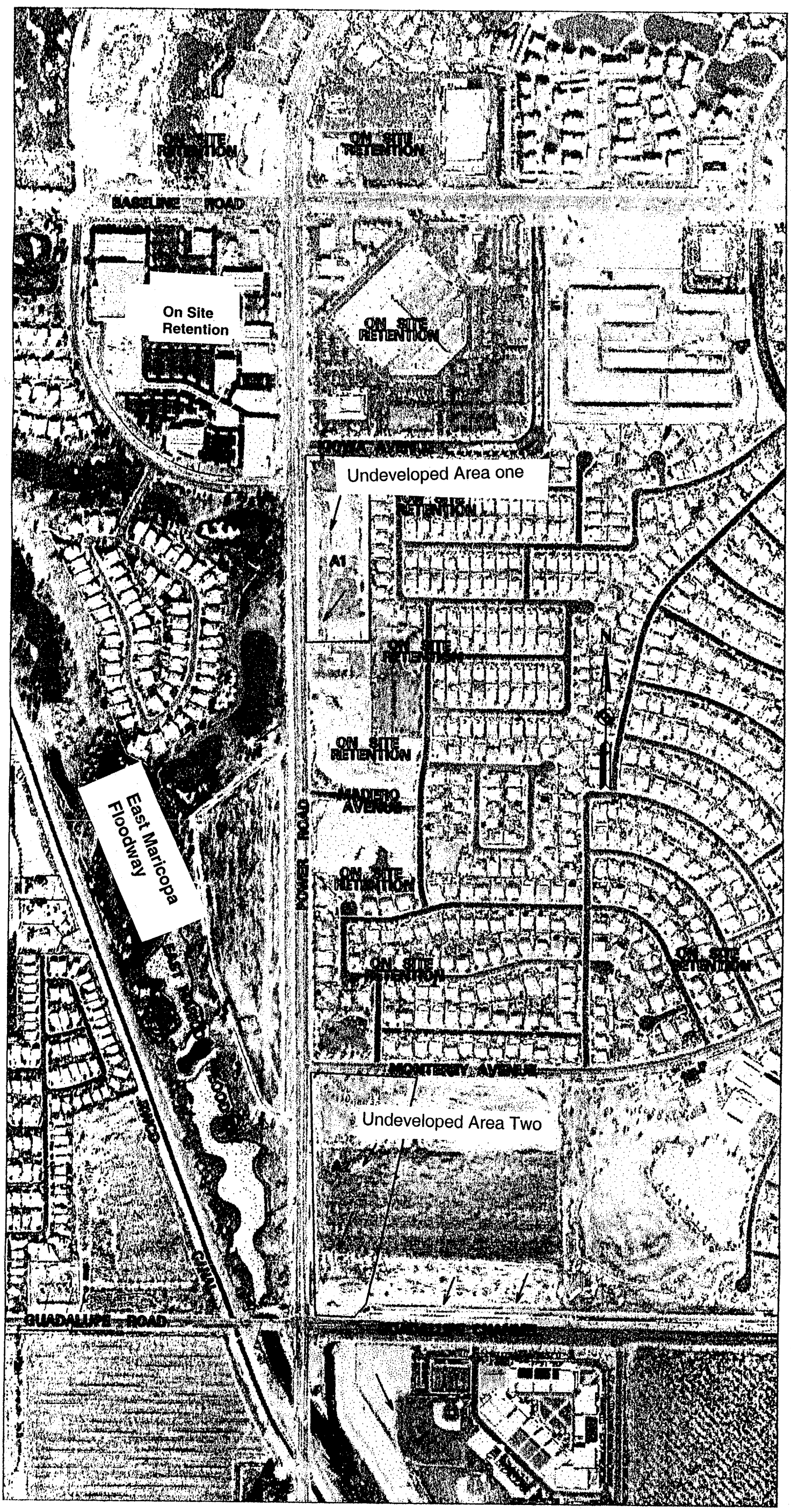
This report documents the hydrologic and hydraulic analyses for the existing and proposed drainage facilities in the project area. It also demonstrates that the proposed storm drainage system elements can be constructed to meet the requirements of the City of Mesa, the Town of Gilbert and the Maricopa County Flood Control District as part of the Power Road project.

A storm drainage system network, including catch basins, scuppers, roadside ditches, retention basins and an outfall are necessary to accommodate the roadway project. No modifications to the EMF are necessary to accommodate widening of the Power Road Bridge nor the Guadalupe Bridge. No modifications to the RWCD Canal are necessary to accommodate widening the Power Road Bridge crossing nor lengthening the Guadalupe Road box culvert.

Figure 5

Aerial Photo

Refer to next Page



Aerial Photo

Not To Scale

Figure 6

Drainage Map

Refer to next Page

DRAINAGE MAP

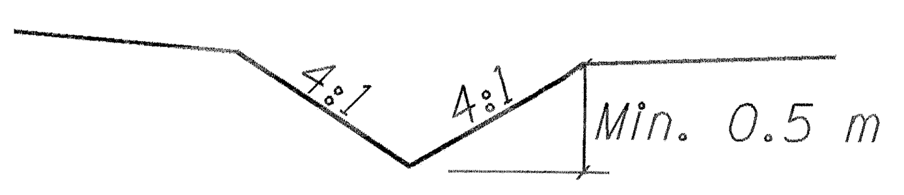
NOT TO SCALE

LEGEND

S-2	Proposed Scupper & ID No.
	Existing Catch Basin
⑫	Proposed Catch Basin & ID No.
○	Proposed Manhole
←	Flow direction
	Proposed Roadside Ditch
	Existing Storm Drain w/ MH

NOTES:

1. Drainage system shown on this map is schematic.
2. Other utilites are omitted.



Typical Roadside Ditch X-Section

CB Location

LEFT SIDE OF POWER RD

CB ID	Station	Catch Basin Type
②	2+480	2-GRATE CB
④	2+210	10-FT SLOT W/ 1-GRATE CB
⑥	2+005	20-FT SLOT W/ 1-GRATE CB
⑧	1+840	10-FT SLOT W/ 1-GRATE CB
⑩	1+670	10-FT SLOT W/ 1-GRATE CB
⑪	1+470	10-FT SLOT W/ 1-GRATE CB
⑬	1+295	10-FT SLOT W/ 1-GRATE CB
⑮	1+125	10-FT SLOT W/ 1-GRATE CB
⑯	1+060	2-GRATE CB
⑰	0+975	2-GRATE CB

RIGHT SIDE OF POWER RD

CB ID	Station	Catch Basin Type
①	2+480	10-FT SLOT W/ 1-GRATE CB
③	2+210	20-FT SLOT W/ 1-GRATE CB
⑤	2+005	20-FT SLOT W/ 1-GRATE CB
EX4	1+875	EXIST. CB
EX3	1+775	EXIST. CB
EX2	1+655	EXIST. CB
⑦	1+470	10-FT SLOT W/ 1-GRATE CB
EX1	1+385	EXIST. CB
⑨	1+295	2-GRATE CB
⑫	1+125	2-GRATE CB
⑭	1+060	1-GRATE CB

BASELINE RD

CB ID	Station	Catch Basin Type
㉒	1+037	2-GRATE CB
㉓	1+220	1-GRATE CB
⑱	1+095	1-GRATE CB
⑲	1+030	20-FT SLOT W/ 1-GRATE CB
⑳	0+910	1-GRATE CB
㉑	0+777	2-GRATE CB

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

POWER ROAD
GUADALUPE ROAD TO BASELINE ROAD
PROJECT NO. CY 2000-22

	BY	DATE
DESIGNED	-	02/25/00
DRAWN	-	02/25/00
CHECKED	-	-

DRAINAGE MAP
FIGURE 6

SHEET	OF
0	0

TRACS NO.

5.0 REFERENCES

City of Mesa, Arizona, *Engineering & Design Standards, Second Edition*, December, 1990.

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Flood Control District of Maricopa County, *East Mesa Area Drainage Plan, FCD #95-32, Recommended Design Report*, July, 1988.

City of Scottsdale, Arizona, *Design Standards and Policies Manual*, June, 1996.

Coe & Van Loo Consulting Engineers, Inc., *Master Drainage Plan for Superstition Springs*, Maricopa County, Arizona, November, 1987.

US Department of Transportation, *Urban Drainage Design Manual, HEC-22*, November, 1996.

Appendix A

Runoff Coefficient and Rainfall Intensity

This appendix contains information related to Section 2.3 "Rational Equation" and is organized as follows:

1. Weighted Runoff Coefficient Table

2. Runoff Coefficient Figures

3. Rainfall Intensity-Duration-Frequency Relations

Weighted Runoff Coefficient

POWER ROAD

City of Mesa — See Fig. A-1

	Runoff Coefficient (1)	Width (m) (2)	(1)x(2)	Weighted C
C1	0.7	4	2.8	
C2	0.95	2	1.9	
C3	0.85	14.3	12.2	
C3	0.85	14.3	12.2	
C2	0.95	2.00	1.9	
C1	0.7	4.00	2.8	
Sum		40.60	33.7	**0.830**

Weighted Runoff Coefficient

BASELINE ROAD (POWER ROAD WEST)

City of Mesa — See Fig. A-2

	Runoff Coefficient (1)	Width (m) (2)	(1)x(2)	Weighted C
C2	0.95	2	1.9	
C3	0.85	15.5	13.2	
Sum		17.50	15.1	**0.861**

Weighted Runoff Coefficient

BASELINE ROAD (POWER ROAD EAST)

City of Mesa — See Fig. A-3

	Runoff Coefficient (1)	Width (m) (2)	(1)x(2)	Weighted C
C2	0.95	2	1.9	
C3	0.85	14.3	12.2	
Sum		16.30	14.1	**0.862**

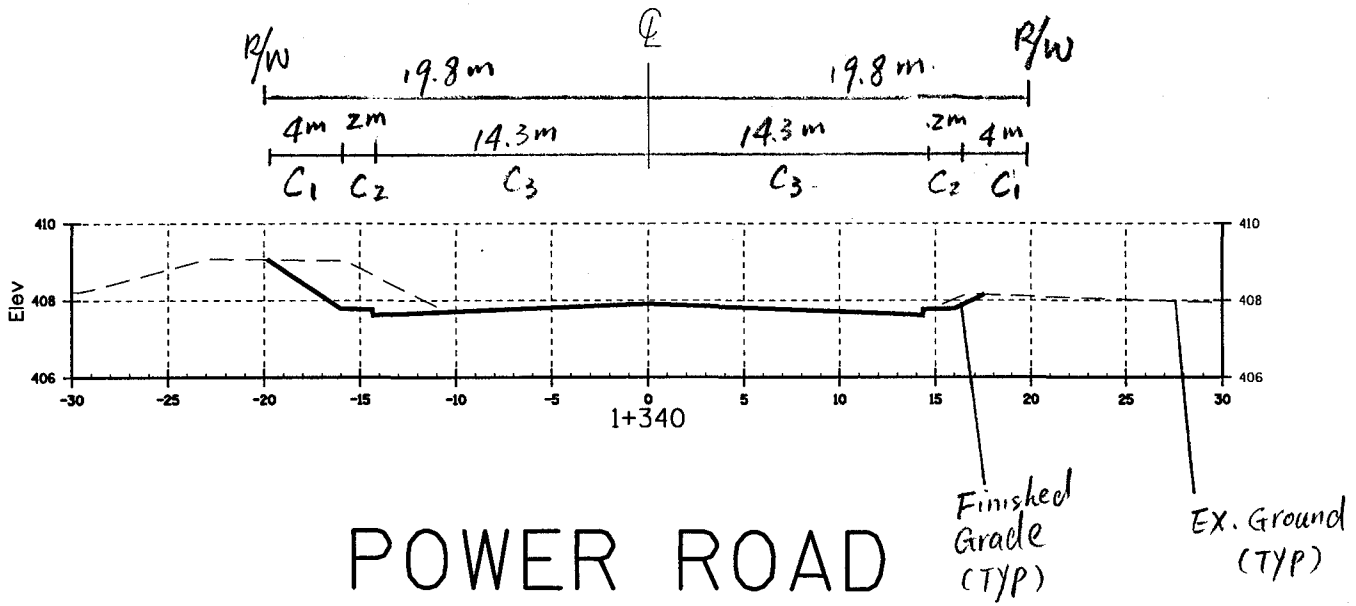
Weighted Runoff Coefficient

GUADALUPE ROAD

Town of Gilbert — See Fig. A-4

	Runoff Coefficient (1)	Width (m) (2)	(1)x(2)	Weighted C
C2	0.95	2	1.9	
C3	0.85	14	11.9	
C3	0.85	13	11.1	
C2	0.95	2	1.9	
Sum		31.00	26.8	**0.863**

RUNOFF COEFFICIENT



POWER ROAD

(TYP X-SECTION)
City of Mesa

Runoff Coefficient

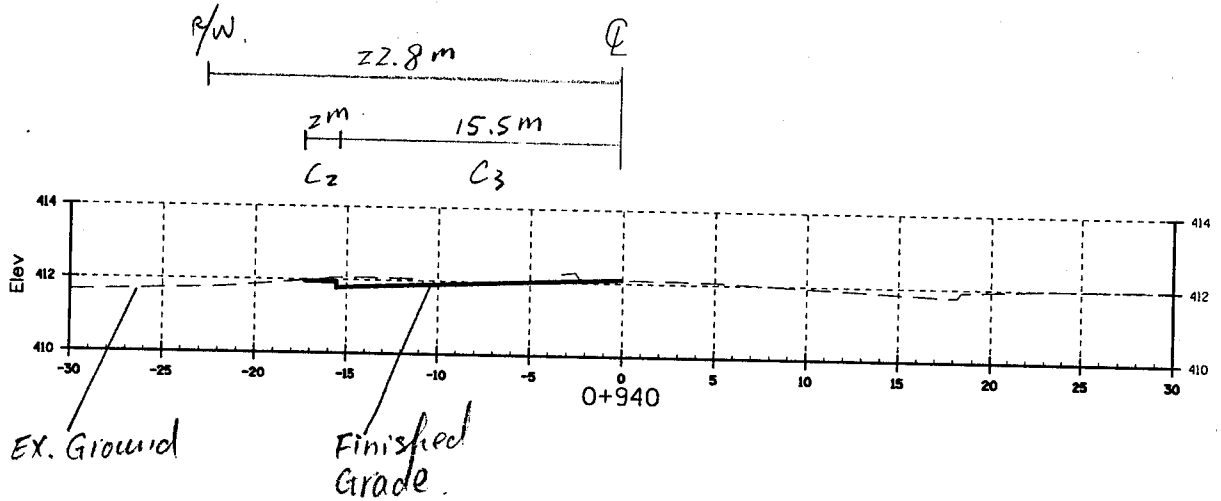
$C_1 = 0.7$, Desert Landscaping

$C_2 = 0.95$, Concrete

$C_3 = 0.85$, Asphalt Pavement

Fig A-1

RUNOFF COEFFICIENT



BASELINE ROAD

Power Road West

(TYP X-SECTION)
City of Mesa

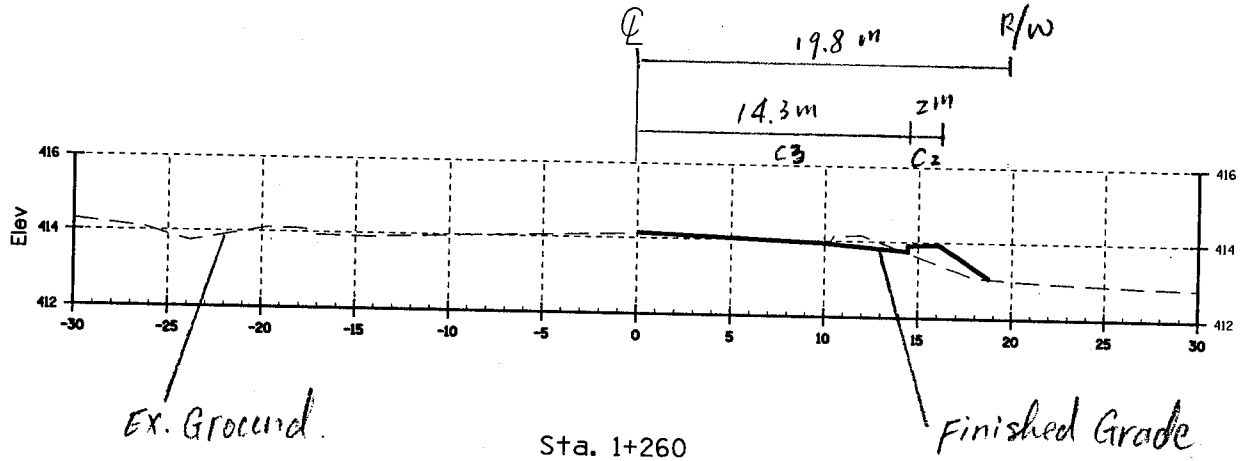
Runoff Coefficient

$C_2 = 0.95$. Concrete

$C_3 = 0.85$ Asphalt pavement

Fig. A-2

RUNOFF COEFFICIENT



Sta. 1+260

BASELINE ROAD

Power Road East

(TYP X-SECTION)

City of Mesa

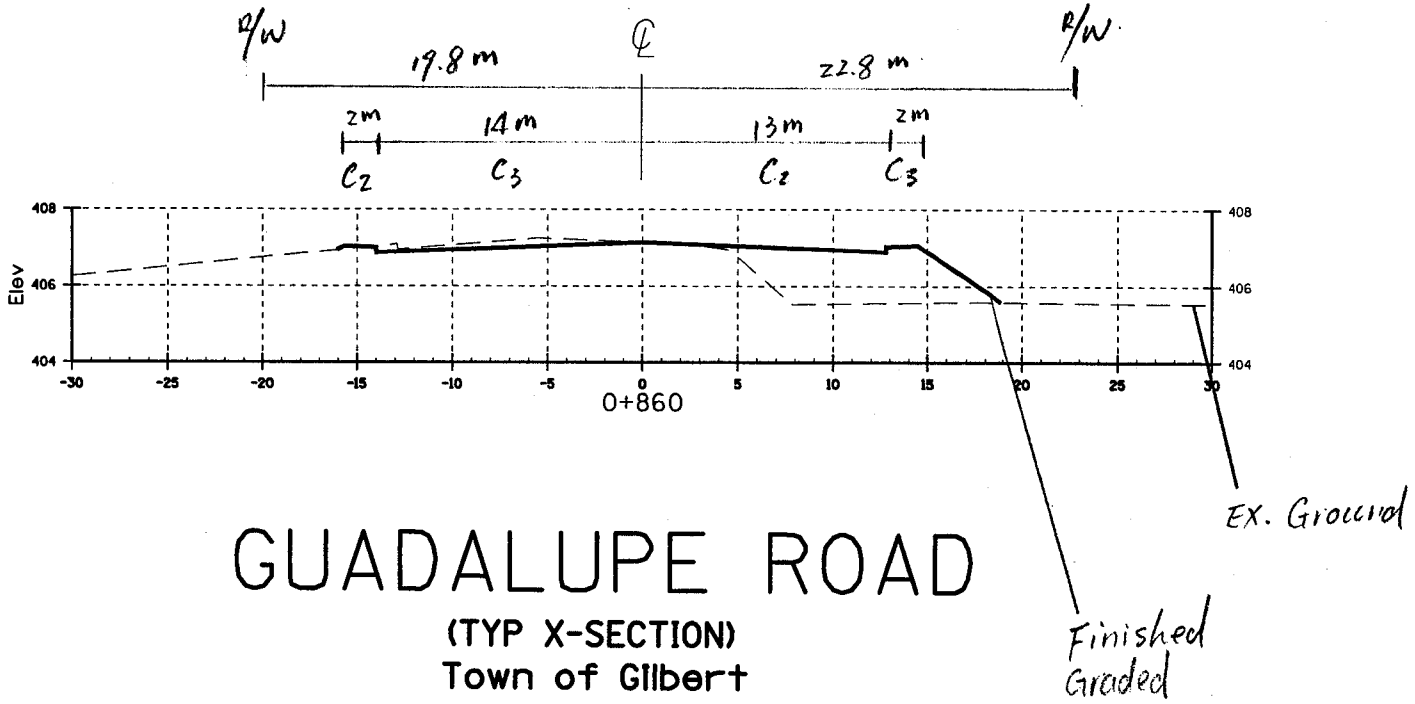
Runoff Coefficient

$C_2 = 0.95$, Concrete

$C_3 = 0.85$, Asphalt pavement

Fig A-3

RUNOFF COEFFICIENT



GUADALUPE ROAD

(TYP X-SECTION)
Town of Gilbert

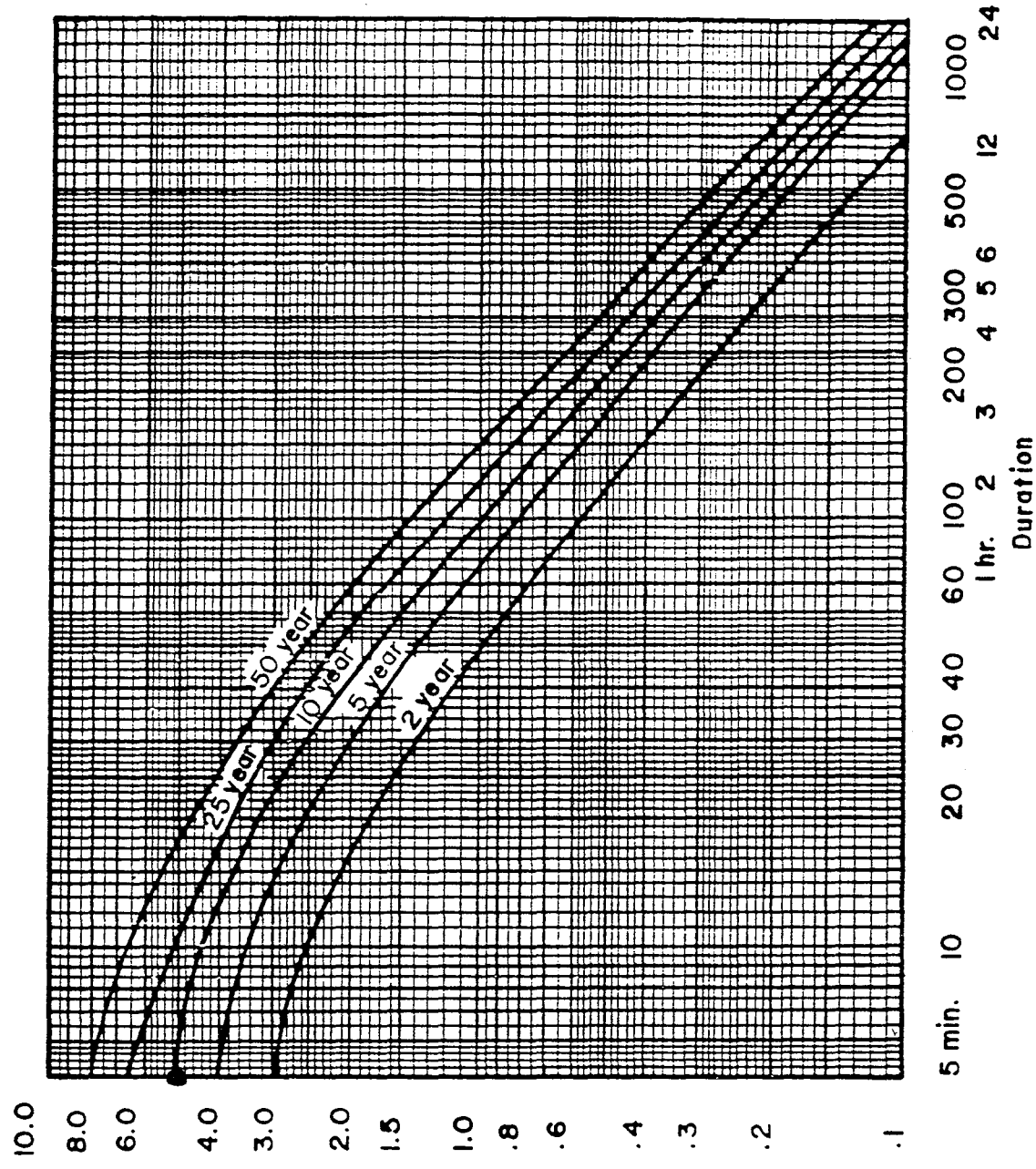
Runoff Coefficient

$C_2 = 0.95$ Concrete

$C_3 = 0.85$ Asphalt Pavement

Note: Based on the phone call with Richard Allred, an engineer with Town of Gilbert, We can use City of Mesa's standards for the portion located in Town of Gilbert.

Fig A-4



RAINFALL INTENSITY-DURATION-FREQUENCY RELATION FOR MESA, ARIZONA

(PARTIAL DURATION SERIES)

Curves are based on methods of U.S. Weather Bureau Technical Paper No. 40, Technical Memorandum WBTM WR-44, and rainfall data from pages 37c through 39 of the Arizona Highway Department Hydrologic Design Manual (1970 Revision).

FIGURE 6-3

City of Mesa, procedure Manual.

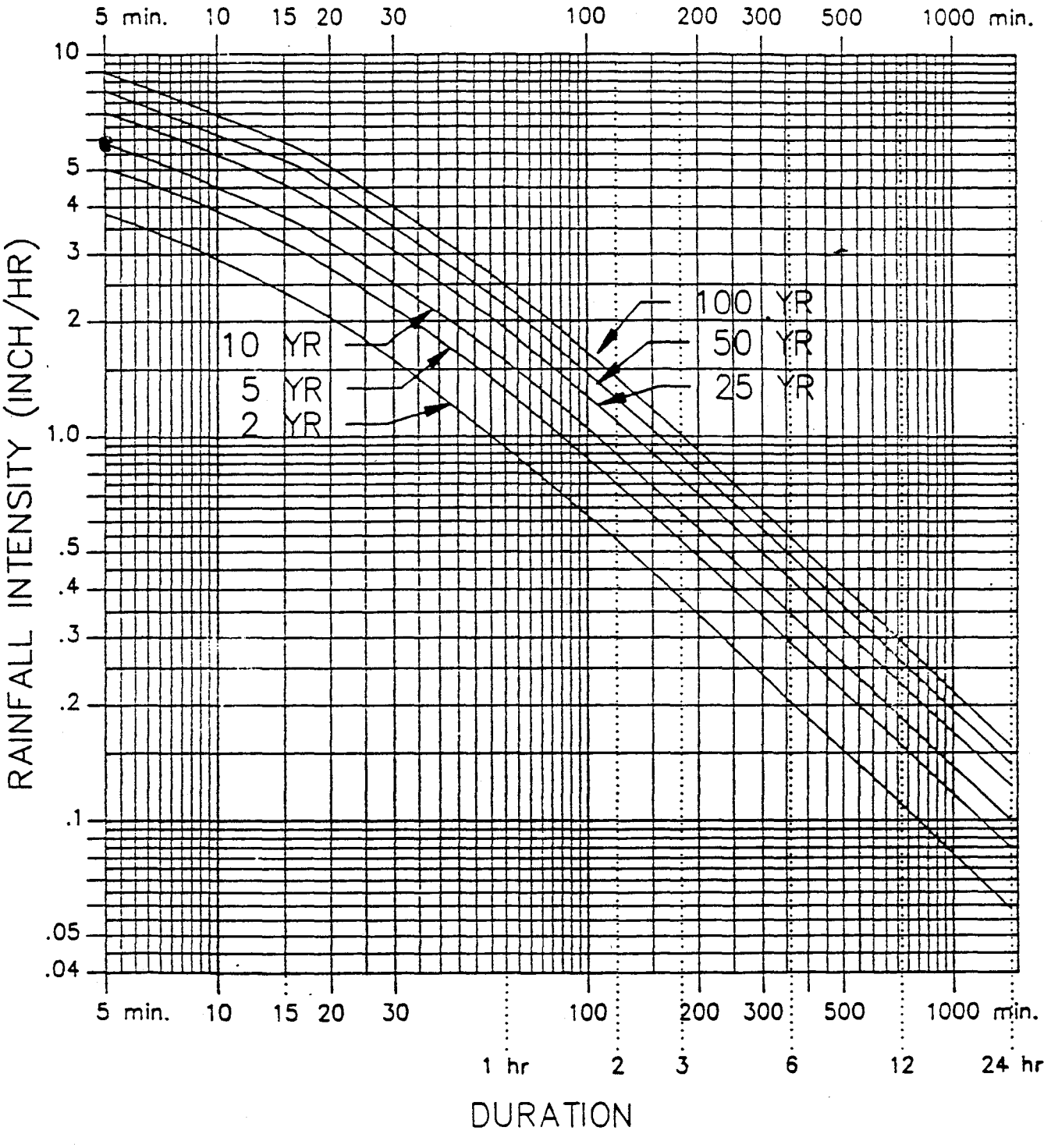


Figure 3.2
Rainfall Intensity-Duration-Frequency Relation
(Phoenix Metro Area)

Design

Flood Control District, Maricopa County, Drainage Manual
Volume one Hydrology

Appendix B

Roadside Ditch Design

This appendix contains information related to Section 3.3.3 "Roadside Ditch Design" and is organized as follows:

1. Rational Method Calculations for Undeveloped Areas

Table B-1 100-Year Undeveloped Area Peak Flow Calculation
50-Year Undeveloped Area Peak Flow Calculation
10-Year Undeveloped Area Peak Flow Calculation

2. Overland Flow Velocities for Estimating Time of Concentration

Figure B-1 Overland Flow Velocities for Upland Method of Estimating Time of Concentration

3. Ditch Analysis

- Undeveloped Area One - Cross Section for Triangular Channel, 10-year design
- Undeveloped Area Two - Cross Section for Triangular Channel, 10-year design

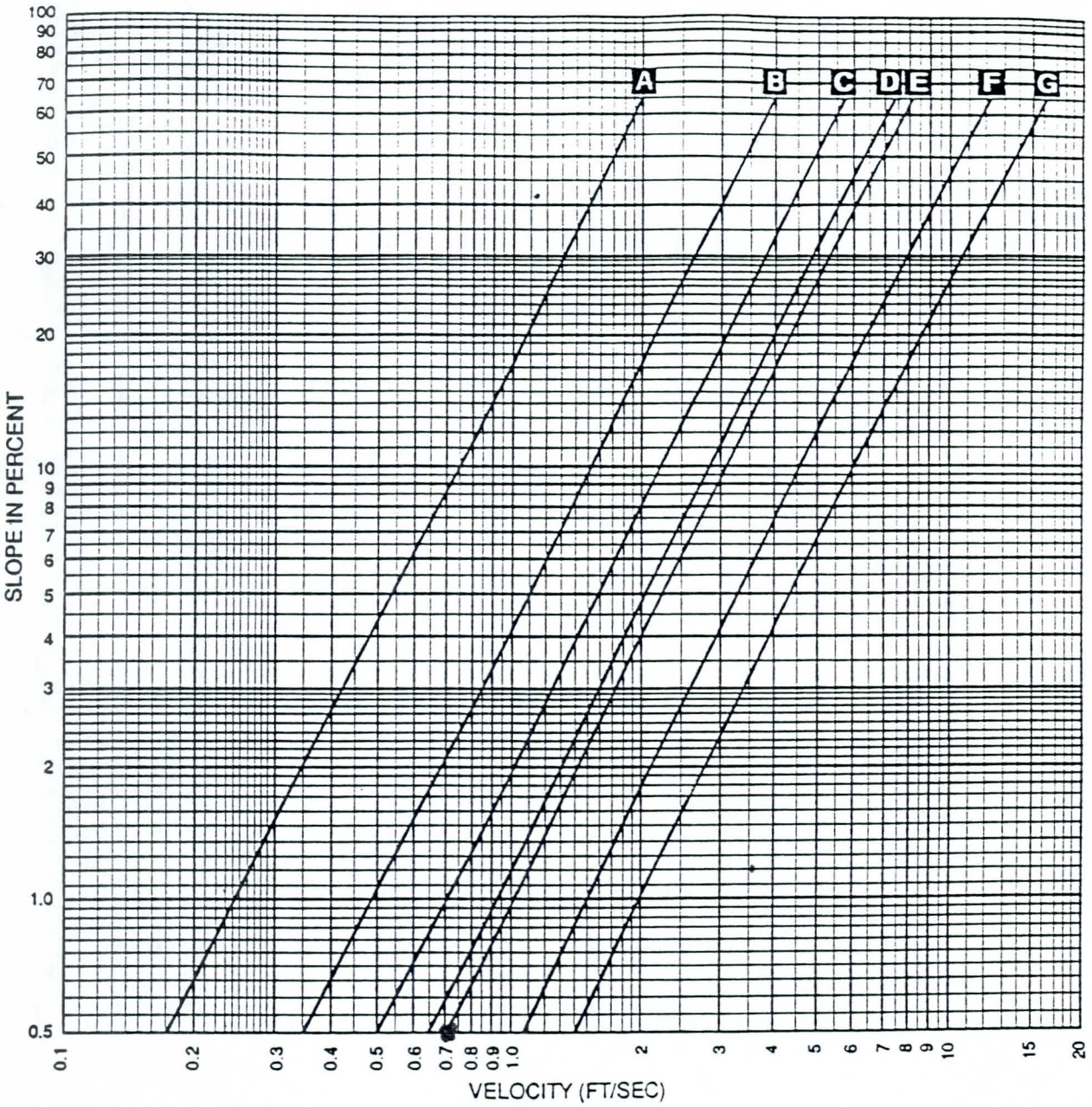
100-year Undeveloped Area Peak Flow Calculation
Rational Method

ID No.	area (m^2)	area (ac)	hydraulic route Length (m)	velocity (m/s)	Tc (min)	Average slope (%)	I (in/hr)	C	Q (cms)	Q (cfs)
One	15760	3.895	200	0.21	15.6	0.50	6.0	0.45	0.298	10.5
Two	19080	4.715	240	0.21	18.7	0.50	5.3	0.45	0.319	11.2

10-year Undeveloped Area Peak Flow Calculation
Rational Method

ID No.	area (m^2)	area (ac)	hydraulic route Length (m)	velocity (m/s)	Tc (min)	Average slope (%)	I (in/hr)	C	Q (cms)	Q (cfs)
One	15760	3.895	200	0.21	15.6	0.50	3.6	0.45	0.179	6.3
Two	19080	4.715	240	0.21	18.7	0.50	3.4	0.45	0.204	7.2

Notes: 1) See Overland Flow Velocities for Upland Method of Estimating Tc, next page
2) See Appendix A for runoff coefficient and rainfall intensity.
3) See Drainage Map for Undeveloped Area location.
4) C=0.45, Combined desert and turf landscaping, City of Mesa.
5) The undeveloped areas are located in City of Mesa.
6) The average slope is 0.5% based on USGS Map. See Figure 4 in the report.



A Forest with heavy ground litter & hay meadow (overland flow)
B Trash fallow or minimum tillage cultivation; contour or strip cropped & woodland (overland flow)
C Short grass pasture (overland flow)
D Cultivated, straight row (overland flow)
E Nearly bare and untilled (overland flow); alluvial fans western mountain regions
F Grassed waterway
G Paved area (sheet flow); small upland gullies

$S = 0.5\%$

$V = 0.7$ fps

$= 0.21$ m/s

using Line E

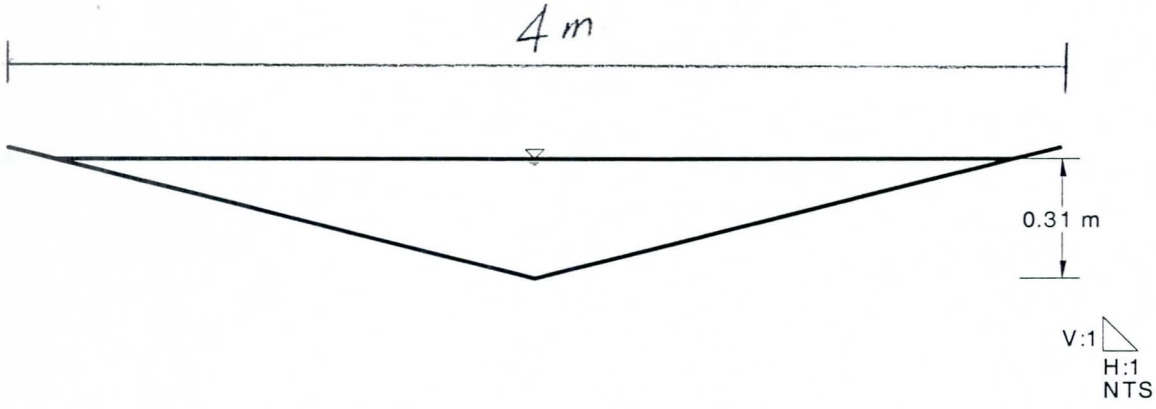
Overland Flow Velocities for Upland Method of Estimating T_c

Design Standards and Policies Manual
City of Scottsdale, Arizona

Cross Section
Cross Section for Triangular Channel

Project Description	
Worksheet	Roadside Ditch for Undeveloped Area One (10-yr design storm)
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Slope	0.004000	m/m
Depth	0.31	m
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	0.2340	m^3/s



Notes:

① $n = 0.03$. Earth with grass.

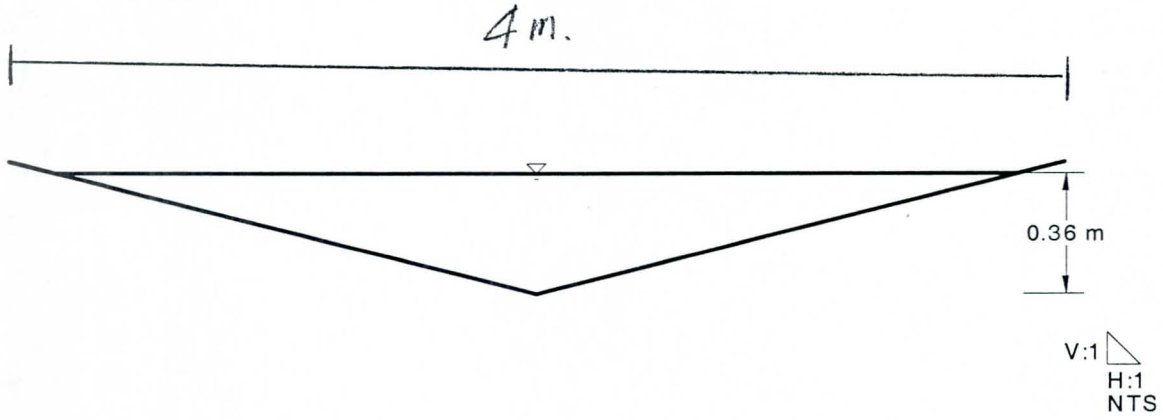
② min. channel slope is 0.4%

Sverdrup Civil 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Cross Section
Cross Section for Triangular Channel

Project Description	
Worksheet	Roadside Ditch for Undeveloped Area Two (10-yr design storm)
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Slope	0.004000	m/m
Depth	0.36	m
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Discharge	0.3430	m^3/s



Notes:

① n=0.03. Earth with grass

② min. channel slope is 0.4%

Appendix C

Roadway Spread Width Calculation

This appendix contains information related to Section 3.3.2 "Roadway Spread Width Calculation" and is organized as follows:

1. Gutter Section Analysis

Table
Rating Table for Gutter Section

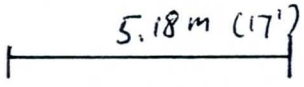
Project Description	
Worksheet	Max. Flow at 5.18 m (17') Spread Width
Type	Gutter Section
Solve For	Discharge

Input Data		
Gutter Width	0.61	m
Gutter Cross Slope	0.020000	m/m
Road Cross Slope	0.020000	m/m
Spread	5.18	m
Mannings Coefficient	0.015	*

Attribute	Minimum	Maximum	Increment
Slope (m/m)	0.002000	0.010000	0.000500

Slope (m/m)	Discharge (m^3/s)	Velocity (m/s)
0.002000	0.1326	0.49
0.002500	0.1483	0.55
0.003000	0.1625	0.61
0.003500	0.1755	0.65
0.004000	0.1876	0.70
0.004500	0.1990	0.74
0.005000	0.2097	0.78
0.005500	0.2200	0.82
0.006000	0.2297	0.86
0.006500	0.2391	0.89
0.007000	0.2481	0.92
0.007500	0.2569	0.96
0.008000	0.2653	0.99
0.008500	0.2734	1.02
0.009000	0.2814	1.05
0.009500	0.2891	1.08
0.010000	0.2966	1.10

Longitudinal slope



power Road x-section

* Note:
n = 0.015, see "open Channel Hydraulics", Ven Te Chow. p-111.

Appendix D

Rational Method and Catch Basin Location

- Calculation Sample
- Baseline Road
- Power Road
- Guadalupe Road

Calculation Sample

SVERDRUP

JOB Power Road

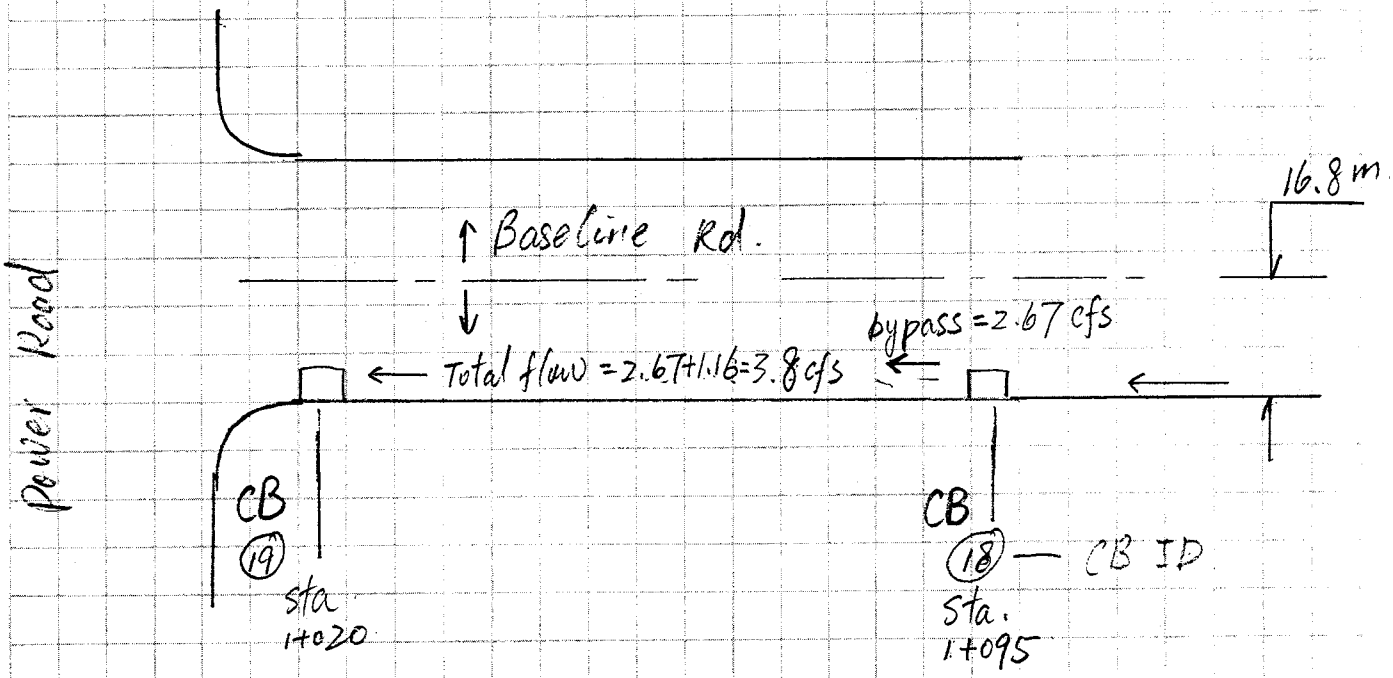
COMPUTATIONS FOR Rational Method & C.B. Location

SHEET NO. 1. OF 3

DATE 7-24-2000

BY N.W CHKD

Baseline Road:



A. Rational method for CB (19)

Area = [(1+095) − (1+030)] × 16.8 = 1092 m² = 0.270 ac.

C = 0.86. (see Appendix A)

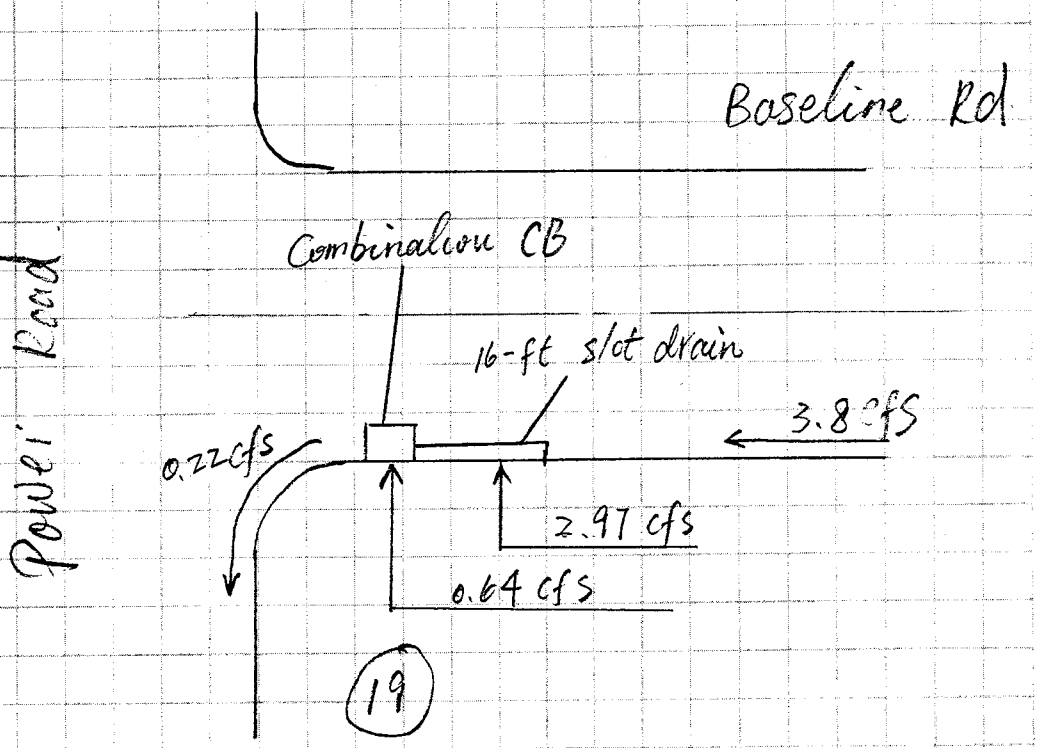
I_{10} = 5. (see Table D-1 in this appendix.)

$Q_{10} = A \cdot C \cdot I = 0.27 \times 0.86 \times 5 = 1.16$ cfs

Total Flow = Q_{10} + bypass flow = 1.16 + 2.67

= 3.8 cfs

B. Catch Basin



Flowmaster is used to compute the intercepted flows by slot drain & Combination CB. See worksheet "#19 slot inlet 16-ft" & "#19 Combination Inlet. 1-grate" in Table D-1. This Appendix.

SVERDRUP

JOB

COMPUTATIONS FOR

SHEET NO. 3 OF 3

DATE

BY CHKD

According to FlowMaster Calculation,
2.97 cfs flows into slot inlet and
0.64 cfs flows into Combination inlet,
and 0.20 cfs bypasses #19 Catch Basin.
This bypass flow 0.24 cfs drains into
next catch basin on Power Road.

Baseline Road

Table D-1

BASELINE ROAD

Gutter Flow Analysis
Using Rational Method with 10-Year Storm Event

(City of Mesa Jurisdiction)

Rational Method											slot inlet			Combination inlet						
Catch Basin ID No.	Station In (m)	Station Out (m)	Segment Length (m)	Segment Width (m)	Area (m^2)	Area (Acres)	Rainfall Intensity, I (in/hr) [3]	C [3]	Gutter Flow, Q (cfs)	Gutter Flow, Q (cms)	flow into slot inlet (cfs)	inlet length (ft)	bypass slot inlet (cfs)	flow into grate inlet (cfs)	No. of grate	bypass grate inlet (cfs)	total flow at CB (cfs)	total flow intercepted (cms)	total flow intercepted (cfs)	Spraed Width (m)
22	1+600	1+370	230	16.8	3864	0.955	5	0.86	4.1	0.116				2.36	2-grate	1.74	4.10	0.067	2.36	3.8
23	1+370	1+220	150	16.8	2520	0.623	5	0.86	2.7	0.076				1.94	1-grate	2.48	4.42	0.055	1.94	3.7
18	1+220	1+095	125	16.8	2100	0.519	5	0.86	2.2	0.063				2.04	1-grate	2.67	4.71	0.058	2.04	3.8
19	1+095	1+030	65	16.8	1092	0.270	5	0.86	1.2	0.033	2.97	16-ft	0.86	0.64	1-grate	0.22(6)	3.83	0.102	3.61	3.6
20	1+000	0+910	90	16.8	1512	0.374	5	0.86	1.6	0.046				0.94	1-grate	0.66	2.30	0.027	0.94	3.0
21	0+910	0+777	133	16.8	2234	0.552	5	0.86	2.4	0.067				1.91	2-grate	1.12	3.03	0.054	1.91	3.4

Notes: 1) See Appendix C for roadway gutter conveyance velocity, which is a function of gutter slope
2) Minimum Tc is 5 minutes. If calculated Tc is less than 5 min, use 5 minutes
3) See Appendix A for runoff coefficient "C" and rainfall intensity "i"
4) When a catch basin has a slot drain, the slot drain should be installed at upstream
5) Maximum spread width should be less than 5.18 meters (17')
6) this flow into Catch Basin #1 on Power Road.
7) slot inlet - ADOT Std Dte c-13.60 type D
8) 1-grate, MAG Std Det 534, type E
9) 2-grate COM Std Det M-64

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#22 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1161	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.010770	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.58	
Intercepted Flow	0.0669	m^3/s
Bypass Flow	0.0492	m^3/s
Spread	3.51	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.91	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.25	
Grate Flow Ratio	0.44	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	23
Worksheet	#~~1~~ Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1252	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.006100	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.44	
Intercepted Flow	0.0549	m^3/s
Bypass Flow	0.0703	m^3/s
Spread	4.04	m
Depth	0.09	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.75	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.09	
Grate Flow Ratio	0.38	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#18 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1334	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.006800	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.43	
Intercepted Flow	0.0577	m³/s
Bypass Flow	0.0757	m³/s
Spread	4.05	m
Depth	0.09	m
Flow Area	0.2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.79	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.08	
Grate Flow Ratio	0.38	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#19 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0244	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.008600	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.74	
Intercepted Flow	0.0180	m³/s
Bypass Flow	0.0064	m³/s
Spread	1.94	m
Depth	0.05	m
Flow Area	4.1e-2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.59	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.13	
Grate Flow Ratio	0.70	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#19 Slot Inlet 16-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1085	m^3/s
Slope	0.008600	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	4.88	m
Local Depression	50.8	mm
Local Depression Width	4.88	m

Results		
Efficiency	0.77	
Intercepted Flow	0.0840	m^3/s
Bypass Flow	0.0244	m^3/s
Spread	3.57	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.83	m/s
Equivalent Cross Slope	0.025552	m/m
Length Factor	0.56	
Total Interception Length	8.66	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#20Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0453	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.003700	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.59	
Intercepted Flow	0.0266	m³/s
Bypass Flow	0.0187	m³/s
Spread	2.99	m
Depth	0.07	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.49	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.17	
Grate Flow Ratio	0.50	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#21 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0858	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.008000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.63	
Intercepted Flow	0.0541	m^3/s
Bypass Flow	0.0317	m^3/s
Spread	3.30	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.76	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.31	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

Table D-2
POWER ROAD

Gutter Flow Analysis
Using Rational Method with 10-Year Storm Event
Left Side of Roadway (City of Mesa Jurisdiction)

Rtionl Method											slot inlet			Commbintion inlet						
Catch Basin ID No.	Station In (m)	Station Out (m)	Segment Length (m)	Segment Width (m)	Area (m^2)	Area (Acres)	Rainfall Intensity, I (in/hr) [3]	C [3]	Gutter Flow, Q (cfs)	Gutter Flow, Q (cms)	flow into slot inlet (cfs)	slot inlet length (ft)	bypass slot inlet (cfs)	flow into grate inlet (cfs)	No. of grate	bypass grate inlet (cfs)	total flow at CB (cfs)	total flow intercepted (cms)	total flow intercepted (cfs)	spraed width (m)
2	2+591	2+480	111	19.8	2198	0.543	5	0.83	2.3	0.064				1.57	2-grate	0.73	2.30	0.044	1.57	3.1
4	2+480	2+210	270	19.8	5346	1.321	5	0.83	5.5	0.155	2.96	8-ft	3.25	1.54	1-grate	1.71	6.21	0.128	4.50	4.95
6	2+210	2+005	205	19.8	4059	1.003	5	0.83	4.2	0.118	4.56	16-ft	1.31	0.82	1-grate	0.49	5.87	0.152	5.38	4.84
8	2+005	1+840	165	19.8	3267	0.807	5	0.83	3.4	0.095	2.60	8-ft	1.24	0.78	1-grate	0.46	3.84	0.096	3.38	4.75
10	1+840	1+670	170	19.8	3366	0.832	5	0.83	3.5	0.098	2.63	8-ft	1.28	0.79	1-grate	0.49	3.91	0.097	3.42	4.78
11	1+670	1+470	200	19.8	3960	0.979	5	0.83	4.1	0.115	2.89	8-ft	1.66	0.96	1-grate	0.70	4.55	0.109	3.85	5.07
13	1+470	1+295	175	19.8	3465	0.856	5	0.83	3.6	0.101	2.77	8-ft	1.48	0.88	1-grate	0.60	4.25	0.103	3.65	4.94
15	1+295	1+125	170	19.8	3366	0.832	5	0.83	3.5	0.098	2.49	8-ft	1.56	0.92	1-grate	0.64	4.05	0.097	3.41	4.51
	1+125	1+060	65	19.8	1287	0.318	5	0.83	1.3	0.037										
16	1+060	sag															4.88	0.138	4.88	0.89
	1+060	0+975	85	19.8	1683	0.416	5	0.83	1.7	0.049										
17	0+975	0+820	155	19.8	3069	0.758	5	0.83	3.1	0.089				1.96	2-grate	1.19	3.15	0.056	1.96	0.00
	0+820	ridge																		
s-4 (9)	0+820	0+745	75	19.8	1485	0.367	5	0.83	1.5	0.043				0.76	scupper	0.74	1.50	0.022	0.76	2.49
s-5	0+745	0+685	60	19.8	1188	0.294	5	0.83	1.2	0.035				0.89	scupper	1.07	1.96	0.025	0.89	2.78

Notes:

1) See Appendix C for roadway gutter conveyance velocity, which is a function of gutter slope
2) Minimum Tc is 5 minutes. If calculated Tc is less than 5 min, use 5 minutes
3) See Appendix A for runoff coefficient "C" and rainfall intensity "i"
4) When a catch basin has a slot drain, the slot drain should be installed at upstream
5) Maximum spread width should be less than 5.18 meters (17')
6) slot inlet - ADOT Std Dte c-13.60 type D
7) 1-grate, MAG Std Det 534, type E
8) 2-grate COM Std Det M-64
9) s-4, s-5, scupper catch basin

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#2 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0651	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.006200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.68	
Intercepted Flow	0.0443	m^3/s
Bypass Flow	0.0208	m^3/s
Spread	3.11	m
Depth	0.07	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.65	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.38	
Grate Flow Ratio	0.48	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#4 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1758	m^3/s
Slope	0.004200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.48	
Intercepted Flow	0.0839	m^3/s
Bypass Flow	0.0919	m^3/s
Spread	4.95	m
Depth	0.11	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.71	m/s
Equivalent Cross Slope	0.028231	m/m
Length Factor	0.30	
Total Interception Length	8.06	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#4 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0920	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.004200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.48	
Intercepted Flow	0.0437	m^3/s
Bypass Flow	0.0483	m^3/s
Spread	3.85	m
Depth	0.09	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.60	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.12	
Grate Flow Ratio	0.40	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#6 Slot Inlet 16-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1662	m³/s
Slope	0.004200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	4.88	m
Local Depression	50.8	mm
Local Depression Width	4.88	m

Results		
Efficiency	0.78	
Intercepted Flow	0.1291	m³/s
Bypass Flow	0.0371	m³/s
Spread	4.84	m
Depth	0.11	m
Flow Area	0.2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.70	m/s
Equivalent Cross Slope	0.024200	m/m
Length Factor	0.57	
Total Interception Length	8.63	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#6 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0371	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.004200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.63	
Intercepted Flow	0.0232	m³/s
Bypass Flow	0.0139	m³/s
Spread	2.69	m
Depth	0.07	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.49	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.17	
Grate Flow Ratio	0.55	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#8 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1087	m^3/s
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.68	
Intercepted Flow	0.0736	m^3/s
Bypass Flow	0.0352	m^3/s
Spread	4.75	m
Depth	0.11	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.48	m/s
Equivalent Cross Slope	0.028563	m/m
Length Factor	0.47	
Total Interception Length	5.23	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#8 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0351	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.63	
Intercepted Flow	0.0220	m^3/s
Bypass Flow	0.0132	m^3/s
Spread	3.05	m
Depth	0.07	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.36	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.26	
Grate Flow Ratio	0.49	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#10 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1107	m^3/s
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.67	
Intercepted Flow	0.0744	m^3/s
Bypass Flow	0.0363	m^3/s
Spread	4.78	m
Depth	0.11	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.48	m/s
Equivalent Cross Slope	0.028507	m/m
Length Factor	0.46	
Total Interception Length	5.28	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#10 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0362	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.62	
Intercepted Flow	0.0225	m^3/s
Bypass Flow	0.0138	m^3/s
Spread	3.09	m
Depth	0.07	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.37	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.26	
Grate Flow Ratio	0.49	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#11 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1288	m^3/s
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.64	
Intercepted Flow	0.0819	m^3/s
Bypass Flow	0.0470	m^3/s
Spread	5.06	m
Depth	0.11	m
Flow Area	0.3	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.50	m/s
Equivalent Cross Slope	0.028054	m/m
Length Factor	0.43	
Total Interception Length	5.68	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#11 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0470	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.58	
Intercepted Flow	0.0272	m³/s
Bypass Flow	0.0198	m³/s
Spread	3.42	m
Depth	0.08	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.39	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.24	
Grate Flow Ratio	0.45	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#13 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1203	m^3/s
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.65	
Intercepted Flow	0.0785	m^3/s
Bypass Flow	0.0419	m^3/s
Spread	4.93	m
Depth	0.11	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.49	m/s
Equivalent Cross Slope	0.028255	m/m
Length Factor	0.44	
Total Interception Length	5.50	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#13 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0419	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.60	
Intercepted Flow	0.0250	m^3/s
Bypass Flow	0.0169	m^3/s
Spread	3.27	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.38	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.25	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#15 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1147	m^3/s
Slope	0.002900	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.61	
Intercepted Flow	0.0705	m^3/s
Bypass Flow	0.0442	m^3/s
Spread	4.51	m
Depth	0.10	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.55	m/s
Equivalent Cross Slope	0.028980	m/m
Length Factor	0.41	
Total Interception Length	5.93	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#15 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0442	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002900	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.59	
Intercepted Flow	0.0260	m³/s
Bypass Flow	0.0182	m³/s
Spread	3.10	m
Depth	0.07	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.44	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.20	
Grate Flow Ratio	0.49	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Combination Inlet In Sag

Project Description	
Worksheet	#16 Combination Inlet 2-grtes, -sag
Type	Combination Inlet In Sag
Solve For	Spread

Input Data		
Discharge	0.1382	m³/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Curb Opening Length	2.13	m
Opening Height	0.12	m
Curb Throat Type	Horizontal	
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both

Results		
Spread	0.71	m
Throat Incline Angle	1.57	radians
Depth	0.04	m
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Open Grate Area	0.6	m²
Active Grate Weir Length	2.74	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#17 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0892	m³/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.008200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.62	
Intercepted Flow	0.0556	m³/s
Bypass Flow	0.0336	m³/s
Spread	3.34	m
Depth	0.08	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.77	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.31	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-4, 6ft scupper
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0425	m^3/s
Slope	0.008000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	6.10	m

Results		
Efficiency	0.51	
Intercepted Flow	0.0215	m^3/s
Bypass Flow	0.0210	m^3/s
Spread	2.49	m
Depth	0.06	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.65	m/s
Equivalent Cross Slope	0.026021	m/m
Length Factor	0.32	
Total Interception Length	5.65	m

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Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-5, 6ft scupper
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0555	m^3/s
Slope	0.008000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	6.10	m

Results		
Efficiency	0.45	
Intercepted Flow	0.0252	m^3/s
Bypass Flow	0.0303	m^3/s
Spread	2.78	m
Depth	0.07	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.69	m/s
Equivalent Cross Slope	0.025515	m/m
Length Factor	0.29	
Total Interception Length	6.40	m

Table D-3
POWER ROAD

Gutter Flow Analysis
Using Rational Method with 10-Year Storm Event
Right Side of Roadway (City of Mesa Jurisdiction)

Rtional Method											slot inlet			Combintion inlet						
Catch Basin ID No.	Station In (m)	Station Out (m)	Segment Length (m)	Segment Width (m)	Area (m^2)	Area (Acres)	Rainfall Intensity, I (in/hr) [3]	C [3]	Gutter Flow, Q (cfs)	Gutter Flow, Q (cms)	flow into slot inlet (cfs)	slot inlet length (ft)	bypass slot inlet (cfs)	flow into grate inlet (cfs)	No. of grate	bypass inlet (cfs)	total flow at CB (cfs)	total flow intercepted (cms)	total flow intercepted (cfs)	Spraed width (m)
																0.22 *				
1	2+590	2+480	110	19.8	2178	0.538	5	0.83	2.2	0.063	1.59	8-ft	0.86	0.61	1-grate	0.25	2.45	0.062	2.20	3.3
3	2+480	2+210	270	19.8	5346	1.321	5	0.83	5.5	0.155	5.05	16-ft	0.68	0.50	1-grate	0.18	5.73	0.157	5.55	5.2
5	2+210	2+005	205	19.8	4059	1.003	5	0.83	4.2	0.118	3.61	16-ft	0.73	0.52	1-grate	0.21	4.34	0.117	4.13	4.2
Ex 4	2+005	1+875	130	15.8	2054	0.508	5	0.83	2.1	0.060				1.22	1-grate	1.10	2.32	0.035	1.22	3.9
Ex 3	1+875	1+775	100	15.8	1580	0.390	5	0.83	1.6	0.046				1.36	1-grate	1.36	2.72	0.039	1.36	4.2
Ex 2	1+775	1+655	120	15.8	1896	0.469	5	0.83	1.9	0.055				1.56	1-grate	1.74	3.30	0.044	1.56	4.5
7	1+655	1+470	185	15.8	2923	0.722	5	0.83	3.0	0.085	2.97	8-ft	1.77	1.00	1-grate	0.77	4.74	0.113	3.97	5.1
Ex 1	1+470	1+385	85	15.8	1343	0.332	5	0.83	1.4	0.039				1.15	1-grate	1.00	2.15	0.033	1.15	3.7
9	1+385	1+295	90	19.8	1782	0.440	5	0.83	1.8	0.052				2.03	2-grate	0.80	2.83	0.058	2.03	4.2
12	1+295	1+125	170	19.8	3366	0.832	5	0.83	3.5	0.098				2.77	2-grate	1.48	4.25	0.078	2.77	4.8
	1+125	1+060	65	19.8	1287	0.318	5	0.83	1.3	0.037										
14	1+060	sag															5.80			1.0
	1+060	0+960	100	19.8	1980	0.489	5	0.83	2.0	0.058										
s-1 (9)	0+960	0+820	140	19.8	2772	0.685	5	0.83	2.8	0.081				1.83	scupper	0.97	1.00	0.052	1.83	3.2
	0+820	ridge																		
s-2	0+820	0+720	100	19.8	1980	0.489	5	0.83	2.0	0.058				1.22	scupper	0.78	2.00	0.035	1.22	2.2
s-3	0+720	0+650	70	19.8	1386	0.342	5	0.83	1.4	0.040				1.60	scupper	0.60	2.20	0.045	1.60	2.3

Notes: 1) See Appendix C for roadway gutter conveyance velocity, which is a function of gutter slope
2) Minimum Tc is 5 minutes. If calculated Tc is less than 5 min, use 5 minutes
3) See Appendix A for runoff coefficient "C" and rainfall intensity "i"
4) When a catch basin has a slot drain, the slot drain should be installed at upstream
5) Maximum spread width should be less than 5.18 meters (17')
6) slot inlet - ADOT Std Dte c-13.60 type D
7) 1-grate, MAG Std Det 534, type E
8) 2-grate COM Std Det M-64
9) s-1, s-2, s-3, scupper catch basin
* This flow (0.22 cfs) from Baseline Road.

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#1 Slot Inlet 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0694	m^3/s
Slope	0.005700	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.65	
Intercepted Flow	0.0450	m^3/s
Bypass Flow	0.0244	m^3/s
Spread	3.25	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.64	m/s
Equivalent Cross Slope	0.032071	m/m
Length Factor	0.44	
Total Interception Length	5.53	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#1 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0244	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.005700	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.71	
Intercepted Flow	0.0174	m^3/s
Bypass Flow	0.0070	m^3/s
Spread	2.12	m
Depth	0.05	m
Flow Area	4.9e-2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.50	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.16	
Grate Flow Ratio	0.66	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#3 Slot Inlet, 16-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1623	m^3/s
Slope	0.002900	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	4.88	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.88	
Intercepted Flow	0.1431	m^3/s
Bypass Flow	0.0191	m^3/s
Spread	5.15	m
Depth	0.12	m
Flow Area	0.3	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.60	m/s
Equivalent Cross Slope	0.027925	m/m
Length Factor	0.70	
Total Interception Length	7.02	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#3 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0193	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.003600	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.74	
Intercepted Flow	0.0142	m^3/s
Bypass Flow	0.0051	m^3/s
Spread	2.11	m
Depth	0.05	m
Flow Area	4.8e-2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.40	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.23	
Grate Flow Ratio	0.66	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#5 Slot Inlet 16-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1229	m^3/s
Slope	0.004700	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	4.88	m
Local Depression	50.8	mm
Local Depression Width	4.88	m

Results		
Efficiency	0.83	
Intercepted Flow	0.1023	m^3/s
Bypass Flow	0.0206	m^3/s
Spread	4.22	m
Depth	0.10	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.68	m/s
Equivalent Cross Slope	0.024775	m/m
Length Factor	0.63	
Total Interception Length	7.75	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#5 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0207	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002900	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.72	
Intercepted Flow	0.0149	m³/s
Bypass Flow	0.0058	m³/s
Spread	2.28	m
Depth	0.06	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.37	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.25	
Grate Flow Ratio	0.62	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	Ex-4, 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0657	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.53	
Intercepted Flow	0.0345	m³/s
Bypass Flow	0.0312	m³/s
Spread	3.90	m
Depth	0.09	m
Flow Area	0.2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.42	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.21	
Grate Flow Ratio	0.40	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	Ex-3, 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0770	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.50	
Intercepted Flow	0.0386	m³/s
Bypass Flow	0.0384	m³/s
Spread	4.15	m
Depth	0.10	m
Flow Area	0.2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.44	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.20	
Grate Flow Ratio	0.37	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	Ex-2, 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0934	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.47	
Intercepted Flow	0.0441	m³/s
Bypass Flow	0.0493	m³/s
Spread	4.48	m
Depth	0.10	m
Flow Area	0.2	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.46	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.19	
Grate Flow Ratio	0.35	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Slot Inlet On Grade

Project Description	
Worksheet	#7 Slot Inlet, 8-ft
Type	Slot Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1342	m^3/s
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Slot Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	2.44	m

Results		
Efficiency	0.63	
Intercepted Flow	0.0840	m^3/s
Bypass Flow	0.0502	m^3/s
Spread	5.14	m
Depth	0.12	m
Flow Area	0.3	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.50	m/s
Equivalent Cross Slope	0.027936	m/m
Length Factor	0.42	
Total Interception Length	5.79	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#7 Combination Inlet - 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0501	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.57	
Intercepted Flow	0.0284	m^3/s
Bypass Flow	0.0217	m^3/s
Spread	3.51	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.39	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.23	
Grate Flow Ratio	0.44	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	Ex-1, 1-grate
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0609	m³/s
Local Depression	50.8	mm
Local Depression Width	1.62	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.07	m
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.54	
Intercepted Flow	0.0327	m³/s
Bypass Flow	0.0282	m³/s
Spread	3.79	m
Depth	0.09	m
Flow Area	0.1	m²
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.41	m/s
Splash Over Velocity	2.31	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.22	
Grate Flow Ratio	0.41	
Equivalent Cross Slope	0.032399	m/m
Active Grate Length	0.53	m
Length Factor	0.00	
Total Interception Length	0.00	m

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Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#9 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0801	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.002000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.72	
Intercepted Flow	0.0574	m^3/s
Bypass Flow	0.0227	m^3/s
Spread	4.22	m
Depth	0.10	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.44	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.55	
Grate Flow Ratio	0.37	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet On Grade

Project Description	
Worksheet	#12 Combination Inlet - 2-grate.
Type	Combination Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.1203	m^3/s
Local Depression	50.8	mm
Local Depression Width	3.66	m
Slope	0.002300	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.13	m
Grate Width	0.61	m
Grate Length	2.13	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None

Results		
Efficiency	0.65	
Intercepted Flow	0.0784	m^3/s
Bypass Flow	0.0419	m^3/s
Spread	4.80	m
Depth	0.11	m
Flow Area	0.2	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.51	m/s
Splash Over Velocity	3.28	m/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.48	
Grate Flow Ratio	0.33	
Equivalent Cross Slope	0.024610	m/m
Active Grate Length	1.07	m
Length Factor	0.00	
Total Interception Length	0.00	m

Worksheet
Worksheet for Combination Inlet In Sag

Project Description	
Worksheet	#14 Combination Inlet, sag
Type	Combination Inlet In Sag
Solve For	Spread

Input Data		
Discharge	0.1642	m^3/s
Local Depression	50.8	mm
Local Depression Width	1.52	m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Curb Opening Length	1.07	m
Opening Height	0.12	m
Curb Throat Type	Horizontal	
Grate Width	0.61	m
Grate Length	1.07	m
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.0	%

Options	
Calculation Option	Use Both

Results		
Spread	0.97	m
Throat Incline Angle	1.57	radians
Depth	0.07	m
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Open Grate Area	0.3	m^2
Active Grate Weir Length	1.68	m

Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-1, 6' wide
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0793	m^3/s
Slope	0.008200	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	0.61	m

Results		
Efficiency	0.65	
Intercepted Flow	0.0517	m^3/s
Bypass Flow	0.0276	m^3/s
Spread	3.19	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.75	m/s
Equivalent Cross Slope	0.069090	m/m
Length Factor	0.44	
Total Interception Length	4.12	m

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Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-2, 6'-wide
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0566	m^3/s
Slope	0.027600	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	0.61	m

Results		
Efficiency	0.61	
Intercepted Flow	0.0346	m^3/s
Bypass Flow	0.0221	m^3/s
Spread	2.17	m
Depth	0.06	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	1.12	m/s
Equivalent Cross Slope	0.086866	m/m
Length Factor	0.41	
Total Interception Length	4.49	m

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Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-3, 8'-wide
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0623	m^3/s
Slope	0.027600	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	2.44	m
Local Depression	50.8	mm
Local Depression Width	0.61	m

Results		
Efficiency	0.73	
Intercepted Flow	0.0454	m^3/s
Bypass Flow	0.0169	m^3/s
Spread	2.26	m
Depth	0.06	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	1.14	m/s
Equivalent Cross Slope	0.084915	m/m
Length Factor	0.52	
Total Interception Length	4.73	m

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Table D-4
GUADALUPE ROAD

Gutter Flow Analysis
Using Rational Method with 10-Year Storm Event
(Town of Guadalupe Jurisdiction)

Rational Method											slot inlet			Scupper inlet						
Catch Basin ID No.	Station In (m)	Station Out (m)	Segment Length (m)	Segment Width (m)	Area (m^2)	Area (Acres)	Rainfall Intensity, I (in/hr) [3]	C [3]	Gutter Flow, Q (cfs)	Gutter Flow, Q (cms)	flow into slot inlet (cfs)	inlet length (ft)	bypass slot inlet (cfs)	flow into inlet (cfs)	length of curb opening	bypass inlet (cfs)	total flow at CB (cfs)	total flow intercepted (cms)	total flow intercepted (cfs)	Spraed Width (m)
s-6	0+900	0+750	150	16.8	2520	0.623	5	0.86	2.7	0.076				1.84	6 ft	0.86	2.70	0.052	1.84	3.2
s-7	0+750	0+650	100	16.8	1680	0.415	5	0.86	1.8	0.051				1.82	6 ft	0.83	2.65	0.052	1.82	3.2

Notes: 1) See Appendix C for roadway gutter conveyance velocity, which is a function of gutter slope
2) Minimum Tc is 5 minutes. If calculated Tc is less than 5 min, use 5 minutes
3) See Appendix A for runoff coefficient "C" and rainfall intensity "i"
4) When a catch basin has a slot drain, the slot drain should be installed at upstream
5) Maximum spread width should be less than 5.18 meters (17')

Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-6, 6'-wide
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0765	m^3/s
Slope	0.007000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	0.61	m

Results		
Efficiency	0.68	
Intercepted Flow	0.0521	m^3/s
Bypass Flow	0.0244	m^3/s
Spread	3.24	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.70	m/s
Equivalent Cross Slope	0.068375	m/m
Length Factor	0.47	
Total Interception Length	3.89	m

Worksheet
Worksheet for Curb Inlet On Grade

Project Description	
Worksheet	s-7, 6'-wide
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Discharge	0.0750	m^3/s
Slope	0.007000	m/m
Gutter Width	0.61	m
Gutter Cross Slope	0.040000	m/m
Road Cross Slope	0.020000	m/m
Mannings Coefficient	0.015	
Curb Opening Length	1.83	m
Local Depression	50.8	mm
Local Depression Width	0.61	m

Results		
Efficiency	0.69	
Intercepted Flow	0.0515	m^3/s
Bypass Flow	0.0235	m^3/s
Spread	3.22	m
Depth	0.08	m
Flow Area	0.1	m^2
Gutter Depression	12.2	mm
Total Depression	63.0	mm
Velocity	0.70	m/s
Equivalent Cross Slope	0.068687	m/m
Length Factor	0.47	
Total Interception Length	3.85	m

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Appendix E

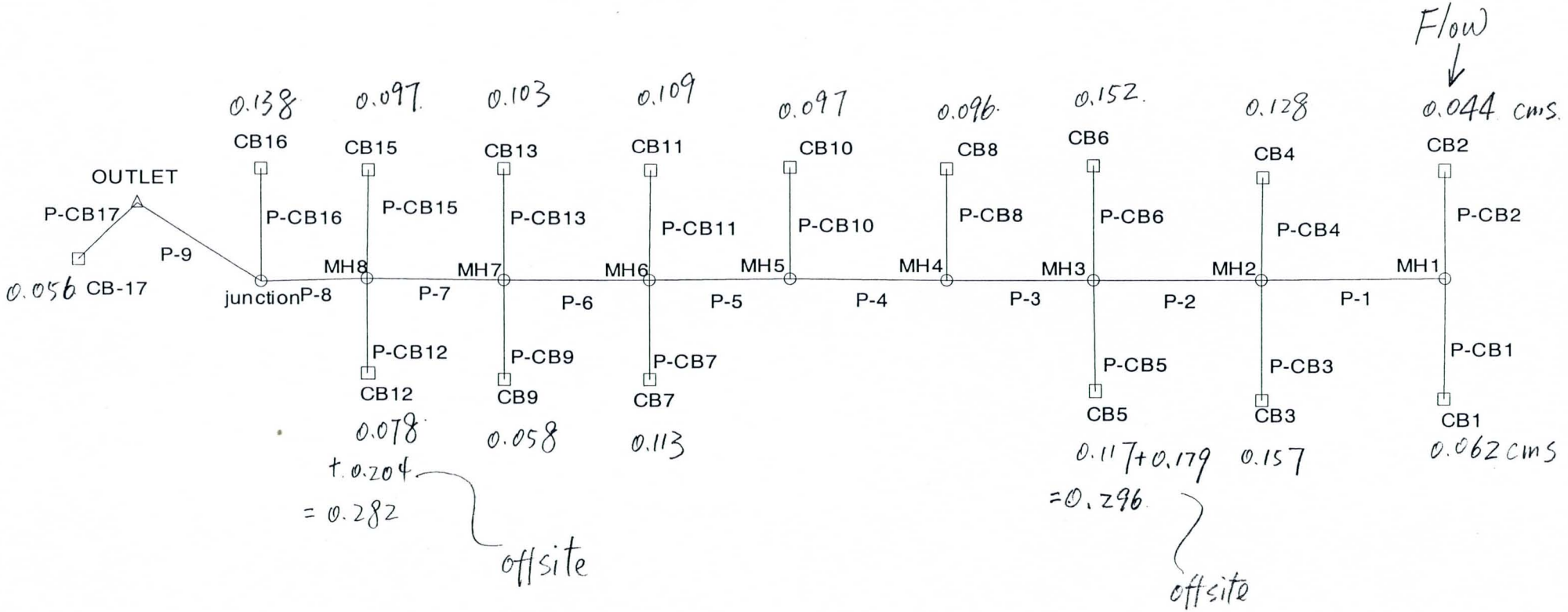
Proposed Storm Drain System Ana

1. Storm Drain Layout
2. Node Report (StormCad)
3. Table E-1, Trunk Line Analysis
4. Table E-2, Lateral Line Analysis
5. StormCad Electronical Input File (3.5" disk)
6. High Water Elevation at Outlet

1

POWER ROAD BASELINE TO GUADALUPE

STORM DRAIN LAYOUT



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Scenario: Base

Node Report

Label	Total System Flow (m^3/s)	Ground Elevation (m)	Rim Elevation (m)	Hydraulic Grade In (m)	Hydraulic Grade Out (m)
CB1	0.0620	410.97	410.97	410.00	409.97
CB2	0.0440	410.99	410.99	410.07	410.04
CB3	0.1570	409.78	409.78	409.16	409.11
CB4	0.1280	409.87	409.87	409.14	409.09
CB5	0.2960	409.17	409.17	408.57	408.49
CB6	0.1520	409.22	409.22	408.33	408.27
CB7	0.1130	407.82	407.82	406.82	406.81
CB8	0.0960	408.56	408.56	407.87	407.86
CB9	0.0580	407.50	407.50	406.36	406.36
CB10	0.0970	408.23	408.23	407.36	407.32
CB11	0.1090	407.87	407.87	406.97	406.93
CB12	0.2820	407.11	407.11	406.41	406.34
CB13	0.1030	407.83	407.83	406.59	406.54
CB15	0.0970	407.08	407.08	405.83	405.81
CB16	0.1380	407.10	407.10	406.11	406.06
CB17	0.0560	407.48	407.48	406.48	406.45
junction	1.9320	407.10	407.10	405.58	405.39
MH1	0.1060	411.13	411.13	409.78	409.71
MH2	0.3910	410.06	410.06	408.81	408.70
MH3	0.8390	409.32	409.32	408.30	408.15
MH4	0.9350	408.70	408.70	407.85	407.69
MH5	1.0320	408.35	408.35	407.16	407.01
MH6	1.2540	407.95	407.95	406.77	406.65
MH7	1.4150	407.60	407.60	406.35	406.22
MH8	1.7940	407.23	407.23	405.82	405.69
OUTLET	1.9880	407.00	407.00	404.76	404.76

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3.

Table E- 1

POWER ROAD
GUADALUPE ROAD TO BASELINE ROAD

Proposed Storm Drainage Network Analysis
StormCAD Input File

STORM DRAIN (TRUNK LINE)

StormCad File: main-line.stm

n=0.013 unit :meter

Station	MH ID	Pipe ID	Length (M)	Pipe Slope (m/m)	Pipe Size (mm)	Inv. at MH (up)	Inv. At MH (down)	finished grd	HGL at MH
2+480	MH1						409.500	411.125	409.780
		P-1	270	0.004	610				
2+210	MH2					408.420	408.270	410.056	408.810
		P-2	205	0.003	760				
2+005	MH3					407.655	407.505	409.319	408.300
		P-3	165	0.003	910				
1+840	MH4					407.010	407.010	408.690	407.850
		P-4	170	0.003	910				
1+670	MH5					406.500	406.340	408.350	407.160
		P-5	200	0.003	1070				
1+470	MH6					405.740	405.740	407.949	406.770
		P-6	175	0.003	1070				
1+295	MH7					405.210	405.210	407.599	406.350
		P-7	170	0.003	1070				
1+125	MH8					404.710	404.560	407.234	405.820
		P-8	65	0.002	1220				
1+060	Junction					404.430	404.430	407.104	405.580
		P-9	90	0.002	1220				
0+970	OUTLET					404.244		407.000	404.760

4.

Table E-2

POWER ROAD
GUADALUPE ROAD TO BASELINE ROAD

Proposed Storm Drainage Network Analysis
StormCAD Input File

STORM DRAIN SYSTEM (LATERAL)

StormCad File: main-line.stm

n=0.013 unit :meter

CB ID	Flow (cms)	pipe length	pipe size (mm)	invert at CB	invert at MH	slope m/m	Top of grate	HGL	Trunk Line MH ID	Trunk Invert (Down)	CB ID	Flow (cms)	pipe length (m)	pipe size (mm)	invert at CB	invert at MH	slope (m/m)	Top of grate	HGL
2	0.0440	4.6	460	409.900	409.650	0.054	410.989	410.07	MH1	409.500	1	0.062	28.8	460	409.800	409.650	0.005	410.973	410.00
4	0.1280	3.3	460	408.840	408.570	0.082	409.868	409.14	MH2	408.420	3	0.157	25.3	460	408.830	408.570	0.010	409.782	409.16
6	0.1520	3.3	460	407.998	407.955	0.013	409.223	408.33	MH3	407.655	5	0.296	25.3	610	408.140	407.805	0.013	409.168	408.57
8	0.0960	3.3	460	407.250	407.150	0.030	408.562	407.87	MH4	407.010									
10	0.0970	3.3	460	407.100	406.875	0.068	408.225	407.36	MH5	406.500									
11	0.1090	3.3	460	406.700	406.350	0.106	407.87	406.97	MH6	405.740	7	0.113	25.3	460	405.900	405.740	0.006	407.815	406.82
13	0.1030	3.3	460	406.320	405.820	0.152	407.825	406.59	MH7	405.210	9	0.058	25.3	460	405.440	405.210	0.009	407.497	406.36
15	0.0970	4.9	460	405.500	405.320	0.037	407.075	405.83	MH8	404.710	12	0.282	27.4	610	405.997	405.170	0.030	407.114	406.41
16	0.1380	6.1	460	405.800	405.120	0.111	407.104	406.11	Junction	404.710									
17	0.0560	4.7	375	406.280	404.862	0.302	407.478	406.48	outlet	404.430									

5. StormCad Electronical Input File (3.5" disk)

6.

From: "Valerie Swick - FCDX" <vas@mail.maricopa.gov>
To: "'Ned Wang'" <WANGN@sverdrup.com>
Date: 3/27/00 4:14PM
Subject: RE: Power Road

The cross-section as identified in the HEC-RAS as upstream of Guadalupe Bridge is cross-section 21.418. Here are the files again.

Let me know if you have any other questions.

-----Original Message-----
From: Ned Wang [mailto:WANGN@sverdrup.com]
Sent: Monday, March 27, 2000 2:57 PM
To: vas@mail.maricopa.gov
Subject: RE: Power Road

Valerie:

You left a message in my answering machine which said the 10-year HW elevation at Guadalupe bridge was 1327.60 feet (upstream). Could you e-mail me the x-section ID number for the HW elevation?

Thanks a lot.

Ned

HW elevation at outfall is 1327.60 ft or 404.76 meters for 10-yr event, based on the e-mail with Valerie swick. Ned

Appendix F

Retention Basin Design

This appendix contains information related to Section 3.3.4 "Retention Basin Design" and is organized as follows:

1. Power Road Retention Basin Design

2. Guadalupe Road Retention Basin Design

3. Rainfall Depths Used for Retention Basin Design

Retention Volume Calculation (City of Mesa)

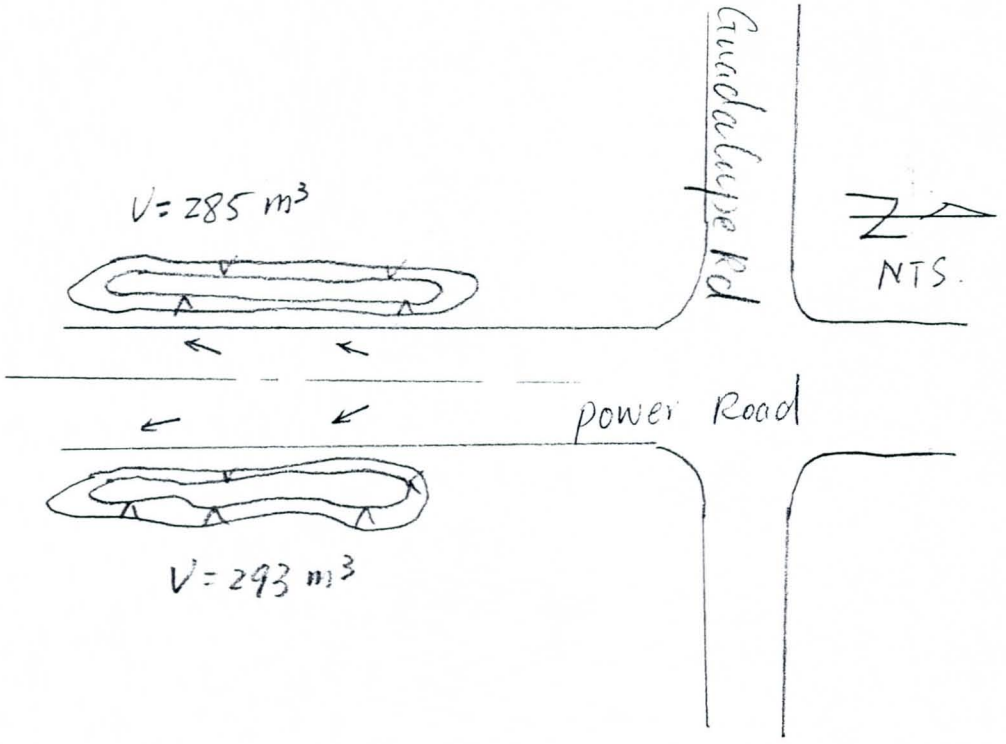
Power Road, East of Guadalupe Road

Location: west of Power Road				
area id	area (m^2)	C	rainfall (mm)	volume (m^3)
1	3197	0.85	65.8	179
2	3588	0.45	65.8	106
Required retention volume:				**285**
Location: East of Power Road				
area id	area (m^2)	C	rainfall (mm)	volume (m^3)
3	3854	0.85	65.8	216
4	2622	0.45	65.8	78
Required retention volume:				**293**

Notes:

1) See next page for area calculation. 1 area = D.

2) 100-year, 2-hour rainfall. The table in this Appendix. see



Location: Power Road, South of Guadalupe Road

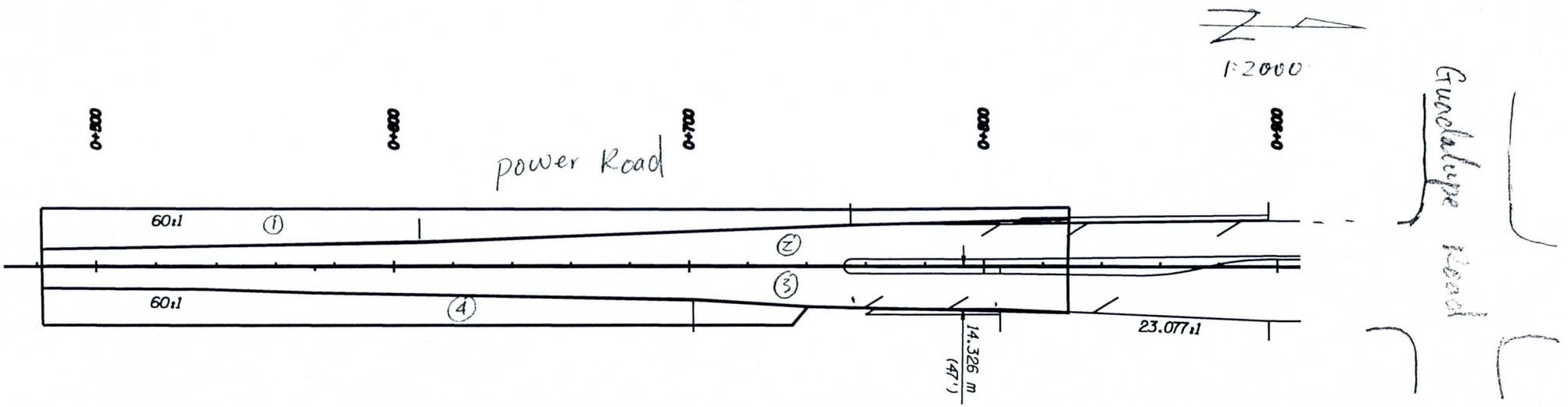
Calculation of Area (From Electronic file).

Area ① = 3197 m² (Dirt)

Area ② = 3588 m² (pavement)

Area ③ = 3854 m² (pavement)

Area ④ = 2622 m² (Dirt)



Retention Volume Calculation

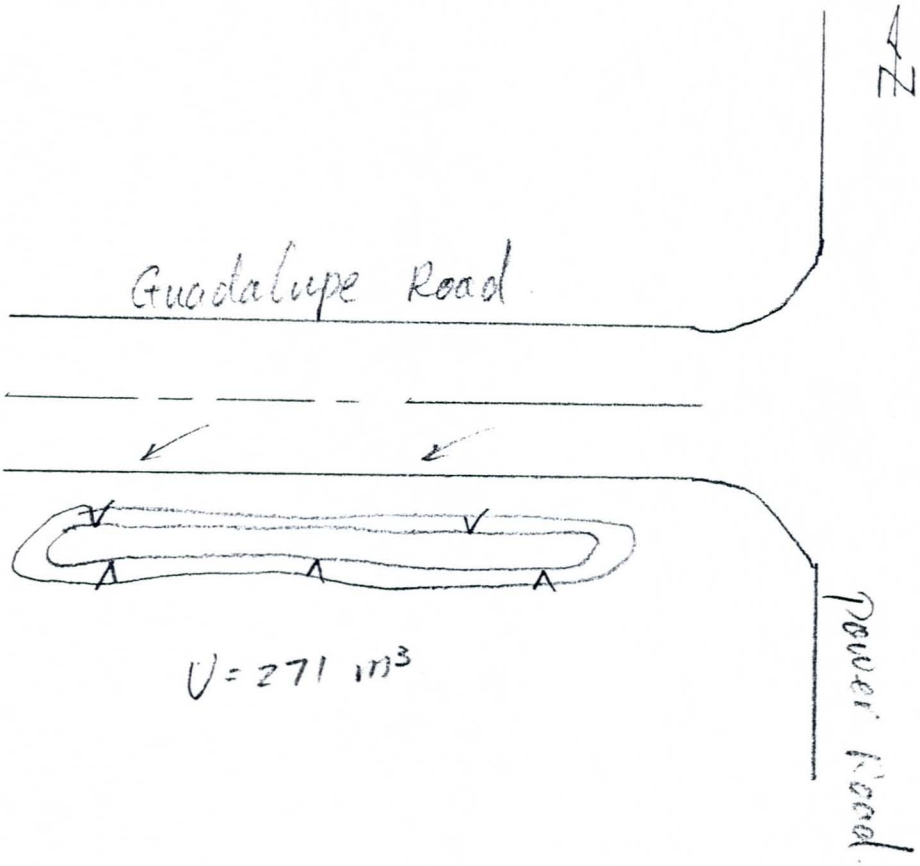
Guadalupe Road, West of Power Road
(Town of Gilbert)

Location: west of Power Road				
area id	area (m^2)	C	rainfall (mm)	volume (m^3)
5	4045	0.85	58.5	201
6	2671	0.45	58.5	70
Required retention volume:				**271**

Notes:

1) See next page for area calculation.

2) 50-year, 2-hour rainfall. See the table in this Appendix.



Area Calculation (from electronic file)

Location: Guadalupe Road, west of Powerd

Area (5) = 4045 m²

Area (6) = 2671 m².

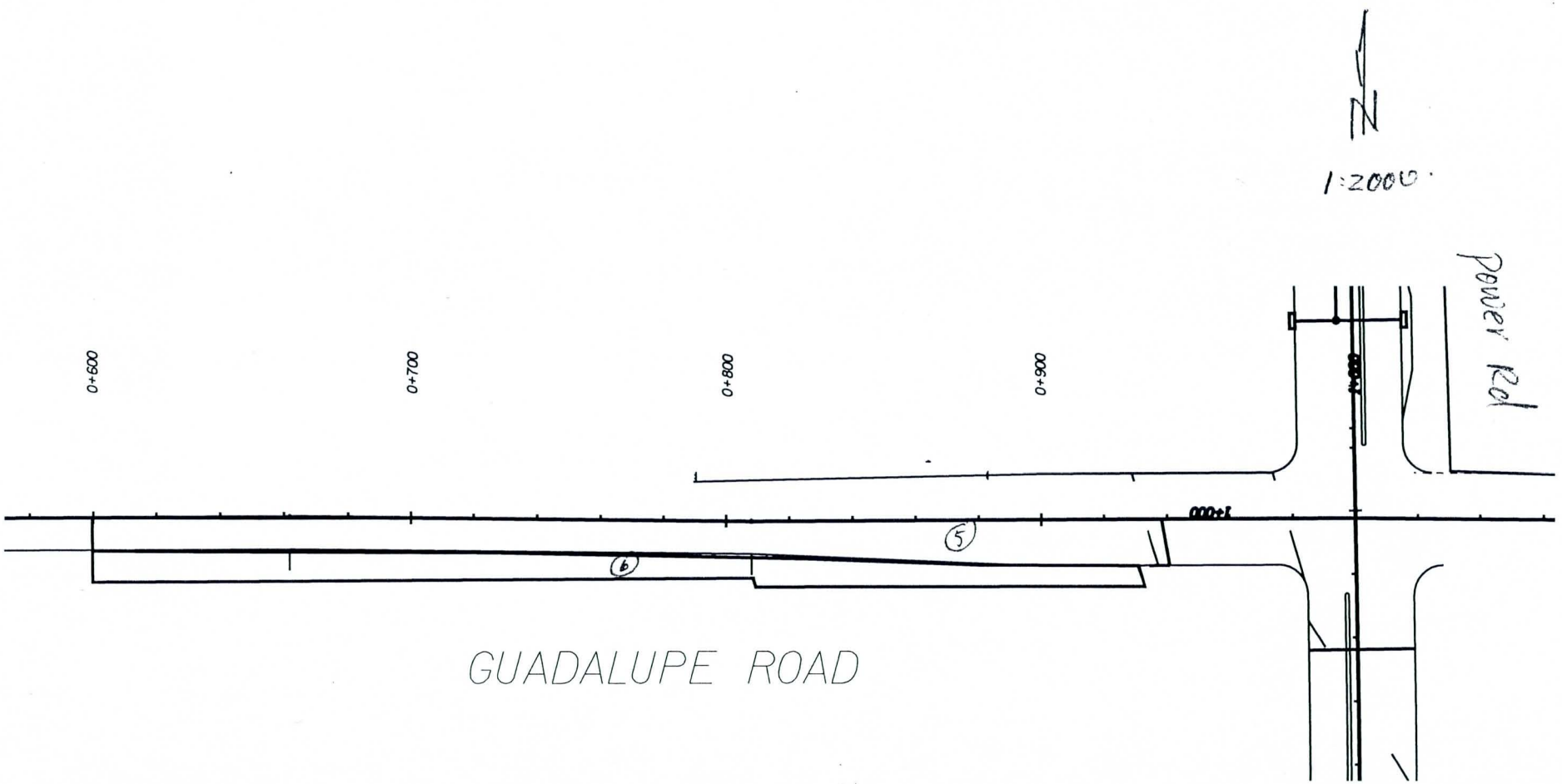


Table F-3

Rainfall Depth

Project No. w7x70500 TRACS NO. _____
Project Name: Power Road, Baseline to Guadalupe Date: 11/27/00
Location/Station Mesa & Gilbert, Az
Designer: NW Checker _____

SUMMARY OF ALL VALUES: Depth in Inches

	2 year	5 year	10 year	25 year	50 year	100 year	500 year
5 min P(__,5") =	0.29	0.40	0.47	0.56	0.64	0.71	0.89
10 min P(__,10") =	0.44	0.60	0.71	0.86	0.98	1.10	1.36
15 min P(__,15") =	0.54	0.75	0.90	1.10	1.25	1.41	1.76
30 min P(__,30") =	0.71	1.01	1.21	1.48	1.69	1.91	2.39
1 hour P(__,1') =	0.87	1.25	1.50	1.85	2.11	2.38	3.00
2 hour P(__,2') =	0.95	1.36	1.63	2.01	2.30	2.59	3.26
3 hour P(__,3') =	1.00	1.43	1.72	2.12	2.43	2.73	3.44
6 hour P(__,6') =	1.10	1.58	1.89	2.33	2.67	3.00	3.77
12 hour P(__,12') =	1.20	1.73	2.08	2.56	2.93	3.30	4.15
24 hour P(__,24') =	1.30	1.88	2.26	2.79	3.20	3.60	4.53

SUMMARY OF ALL VALUES: Depth in Millimeters

	2 year	5 year	10 year	25 year	50 year	100 year	500 year
5 min P(__,5") =	7.5	10.1	11.9	14.3	16.2	18.1	22.5
10 min P(__,10") =	11.2	15.3	18.1	21.9	24.9	27.8	34.6
15 min P(__,15") =	13.6	19.1	22.8	27.9	31.8	35.7	44.7
30 min P(__,30") =	18.0	25.6	30.7	37.7	43.0	48.4	60.8
1 hour P(__,1') =	22.0	31.6	38.1	46.9	53.7	60.5	76.1
2 hour P(__,2') =	24.0	34.5	41.5	51.1	58.5	65.8	82.8
3 hour P(__,3') =	25.4	36.4	43.8	53.9	61.7	69.4	87.3
6 hour P(__,6') =	27.9	40.0	48.1	59.2	67.7	76.2	95.8
12 hour P(__,12') =	30.5	43.8	52.8	65.0	74.4	83.8	105.5
24 hour P(__,24') =	33.0	47.7	57.4	70.8	81.2	91.4	115.2

Note :
Rainfall depth calculation is based on ADOT Highway Drainage Design Manual, Hydrology.
See Chapter 1 for rainfall calculation procedures.

Appendix G

HEC-RAS Analysis of Existing and Widened Bridges

This appendix contains information related to Section 3.3.1 "Bridge and Box Culvert Analysis" and is organized as follows:

1. HEC-RAS Analysis

Figure G-1	Bridge Limits
Figure G-2	EMF Capacity Study Design and Estimated Flows
Table G-1	HEC-RAS Plan: Reach 5, Existing and Proposed Conditions
Disk	Floppy Disk of HEC-RAS Input Files (Existing and proposed Conditions)

Notes about this information:

1. HEC-RAS input data file and EMF Capacity Study (shown in this Appendix) were obtained from the Flood Control District, Maricopa County. For more information about peak flows, design flows, and cross-section locations, please call Valerie Swick at 602-506-4872.

2. See attached a disk copy of the HEC-RAS input files, existing and proposed conditions.

3. Since the bridges located on the East Maricopa Floodway are widened, the bridge cross-sections are relocated for proposed condition. The bridge cross-section ID is same as the ID in existing condition, but the cross section itself has not been redefined.

EMF Capacity Study
Design and Estimated Flows

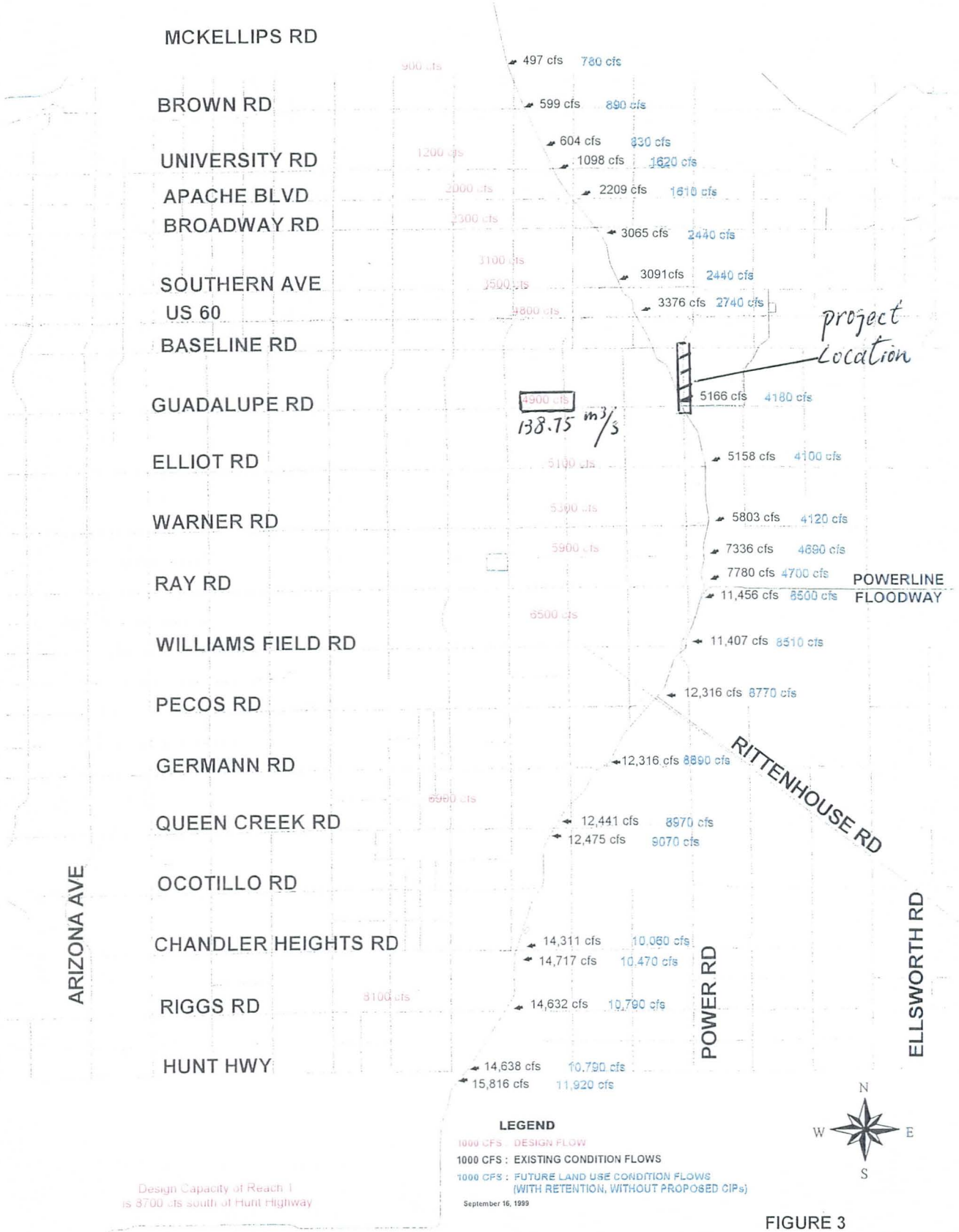
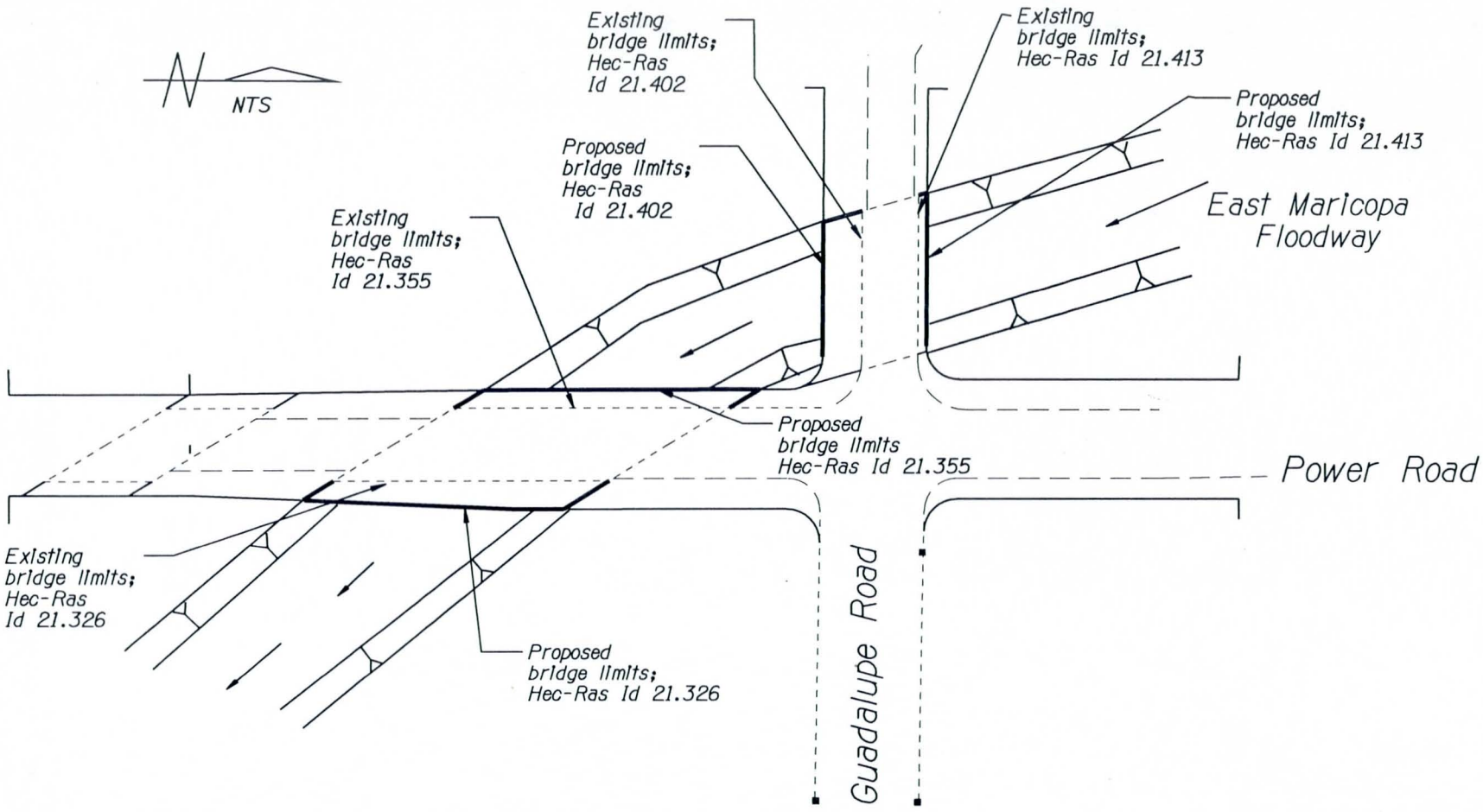


FIGURE 3
SUMMARY OF DISCHARGE RATES



Note:

See Hec-Ras output data for highwater elevation for existing condition and proposed condition.

Bridge Limits

For Hec-Ras

HEC-RAS Plan: Reach 5 River: EMF Reach: Reach 5

Proposed Condition

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach 5	21.439	138.75	400.93	406.25	402.4	406.27	0.000143	0.6	229.76	65.84	0.1
Reach 5	21.418	138.75	403.61	406.02	405.15	406.24	0.001629	2.07	66.93	34.05	0.47
Reach 5	21.413	138.75	403.03	406.07	404.61	406.21	0.000748	1.64	84.53	32.89	0.33
Reach 5	21.407	**Guadalupe Road Bridge**									
Reach 5	21.402	138.75	403.11	406	404.67	406.15	0.00088	1.73	80.31	32.95	0.35
Reach 5	21.391	138.75	403.15	405.98	404.72	406.14	0.00099	1.77	78.29	34.38	0.37
Reach 5	21.355	138.75	403.12	405.95	404.58	406.08	0.000806	1.65	83.97	34.56	0.34
Reach 5	21.339	**Power Road Bridge**									
Reach 5	21.326	138.75	403.13	405.67	404.61	405.86	0.001262	1.92	72.22	33.81	0.42
Reach 5	21.282	138.75	403.09	405.68	404.28	405.76	0.000373	1.26	109.78	51.69	0.28
Reach 5	21.188	138.75	403.03	405.64	404.26	405.71	0.000332	1.16	119.57	58.81	0.26

4900 cfs

HEC-RAS Plan: Reach 5 River: EMF Reach: Reach 5

Existing Condition

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Reach 5	21.439	138.75	400.93	406.24	402.4	406.26	0.000144	0.61	229.29	65.78	0.1
Reach 5	21.418	138.75	403.61	406.01	405.15	406.23	0.001653	2.08	66.61	34.02	0.48
Reach 5	21.413	138.75	403.03	406.06	404.61	406.2	0.000759	1.65	84.15	32.89	0.33
Reach 5	21.407	**Guadalupe Road Bridge**									
Reach 5	21.402	138.75	403.11	406	404.67	406.15	0.000877	1.73	80.39	32.95	0.35
Reach 5	21.391	138.75	403.15	405.97	404.72	406.13	0.001003	1.78	77.94	34.33	0.38
Reach 5	21.355	138.75	403.12	405.93	404.58	406.07	0.000822	1.66	83.42	34.56	0.34
Reach 5	21.339	**Power Road Bridge**									
Reach 5	21.326	138.75	403.13	405.67	404.61	405.86	0.001253	1.92	72.39	33.83	0.42
Reach 5	21.282	138.75	403.09	405.68	404.28	405.76	0.000373	1.26	109.78	51.69	0.28
Reach 5	21.188	138.75	403.03	405.64	404.26	405.71	0.000332	1.16	119.57	58.81	0.26

4900 cfs

Hec-Ras Electronical Input Files

(3.5" disk)

Appendix H

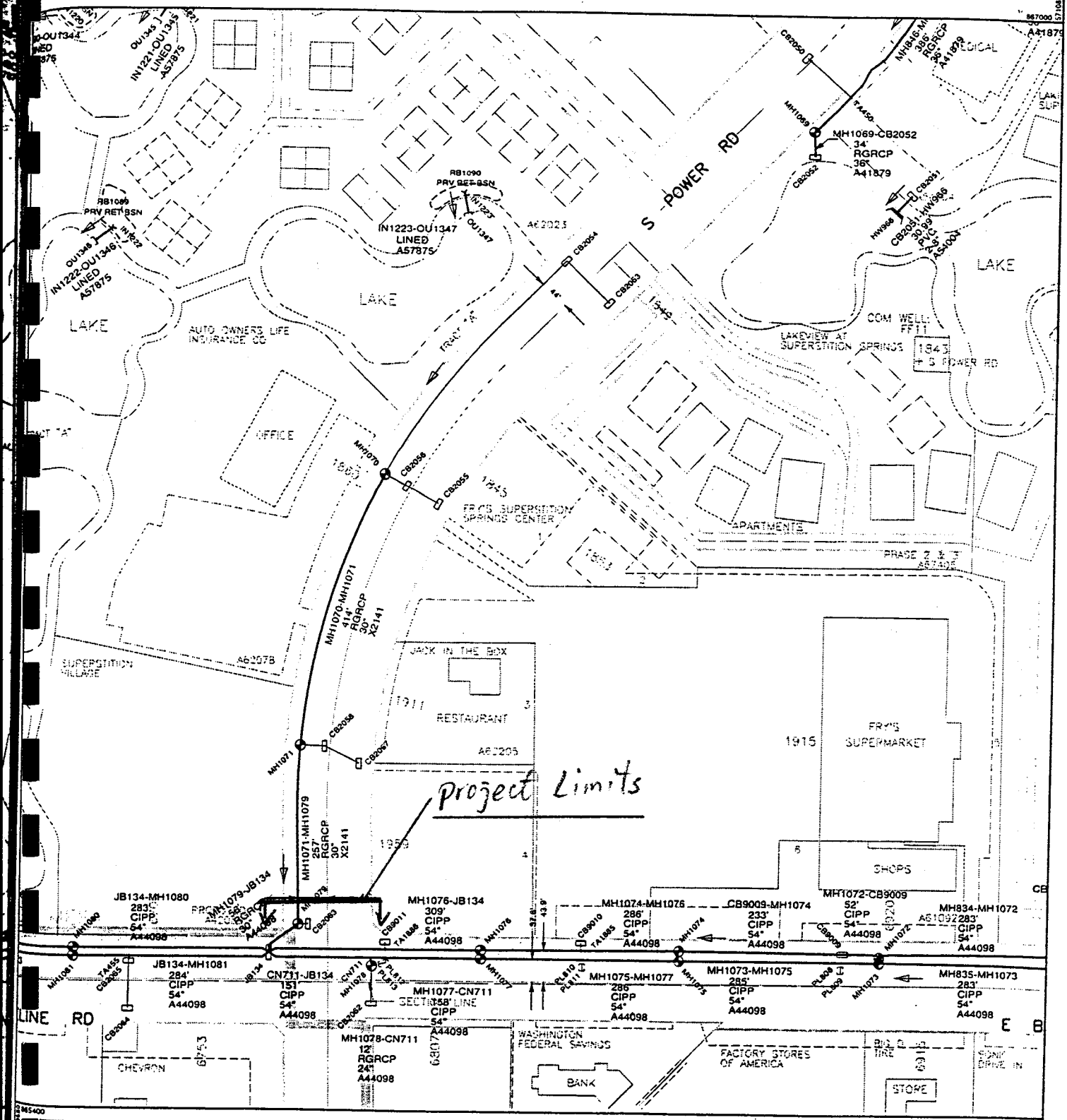
Existing City of Mesa Storm Drain System

This appendix contains information related to Section 3.1.2 "Existing Power Road Drainage System" and Section 3.1.3 "Existing Baseline Road Drainage System" and is organized as follows:

1. City of Mesa Storm Drain System Mapping

095D SE
095D SW
096C NE
104A NW
104A SW
104B NW
104B SW
312A NW

STORM DRAIN SYSTEM



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N

200' 0 200'

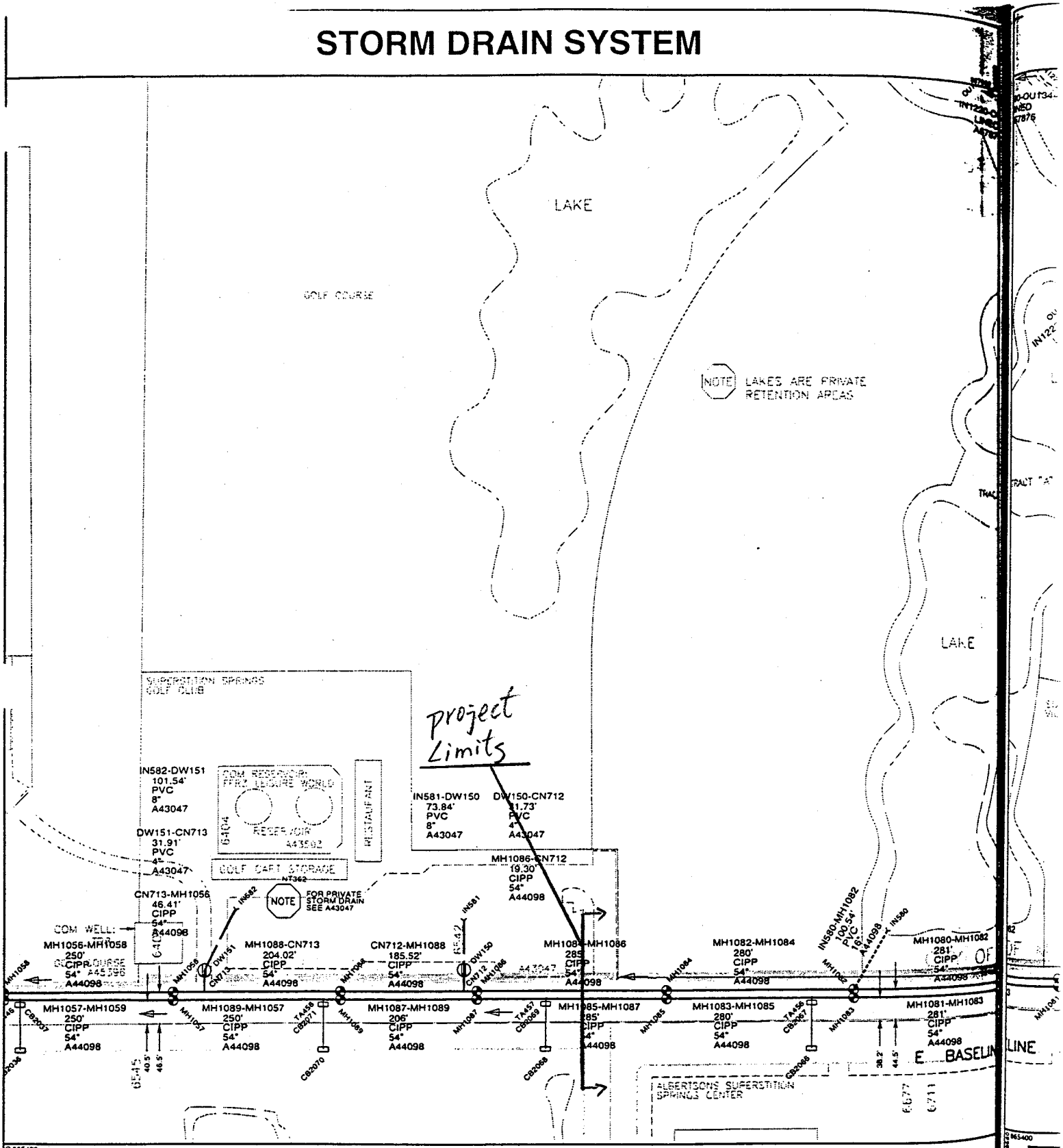
STORM REVISION DATE: 04/27/98
LAND REVISION DATE: 02/24/98
PLOT COMPILATION DATE: 04/27/98

95D
SE

095D	095D	103B
095D	095D	103B
096C	096C	104A

095D

STORM DRAIN SYSTEM



095B	095D	095D
095B	095D	095D
096A	096C	096C

95D
SW

095D

200' 0 200'

STORM REVISION DATE: 04/27/98
LAND REVISION DATE: 02/24/98
PLOT COMPILATION DATE: 04/27/98

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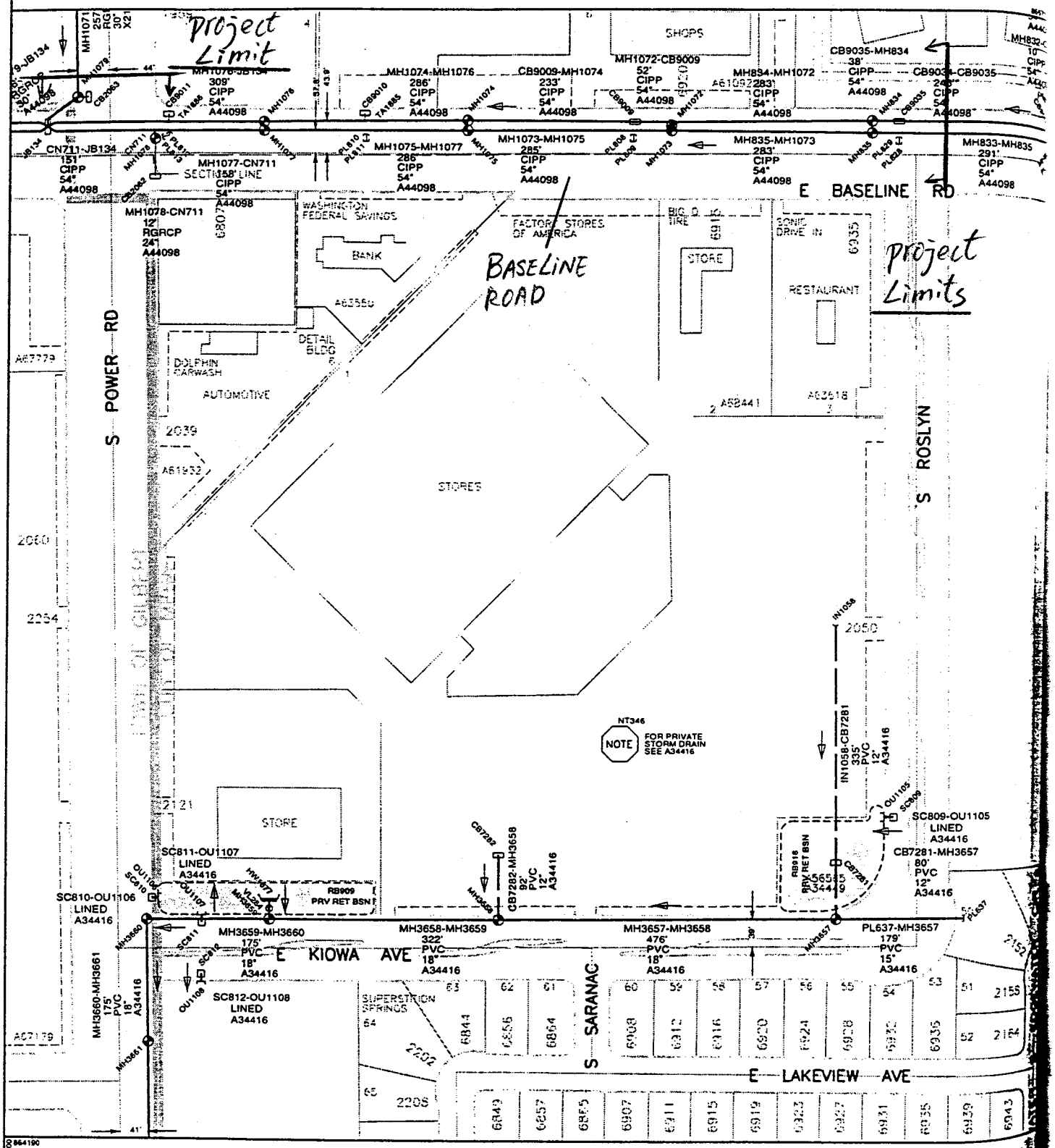
STORM DRAIN SYSTEM



095D	103B	103B
096C	104A	104A
096C	104A	104A

104A
NW

104A

200' 0 200'

STORM REVISION DATE: 05/08/98
LAND REVISION DATE: 03/17/98
PLOT COMPILATION DATE: 05/11/98

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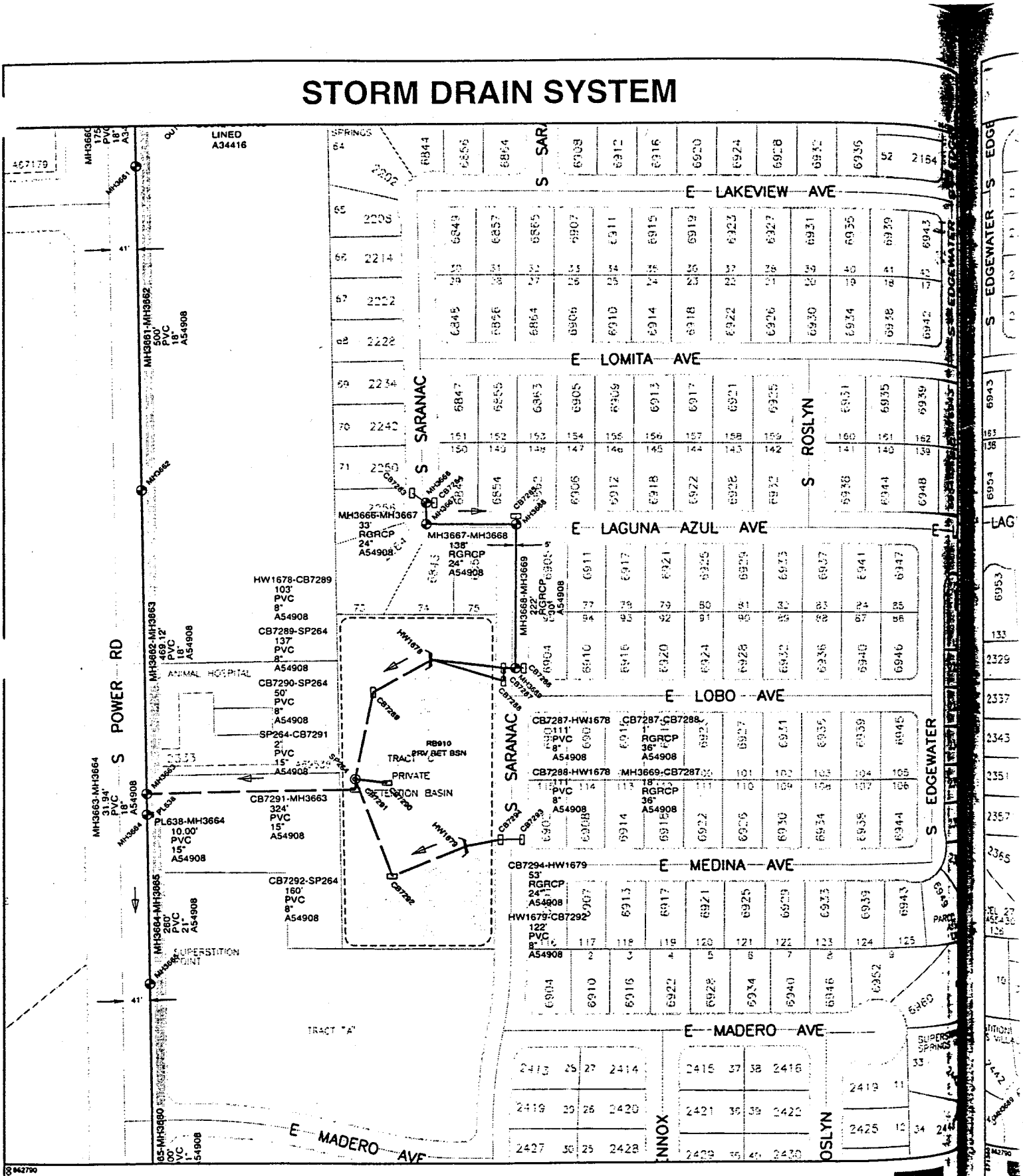
STORM DRAIN SYSTEM



096C	104A	104A
096C	104A	104A
096D	104B	104B

104A

SW

104A

200' 0 200'

STORM REVISION DATE: 05/08/98
LAND REVISION DATE: 03/17/98
PLOT COMPILATION DATE: 05/11/98

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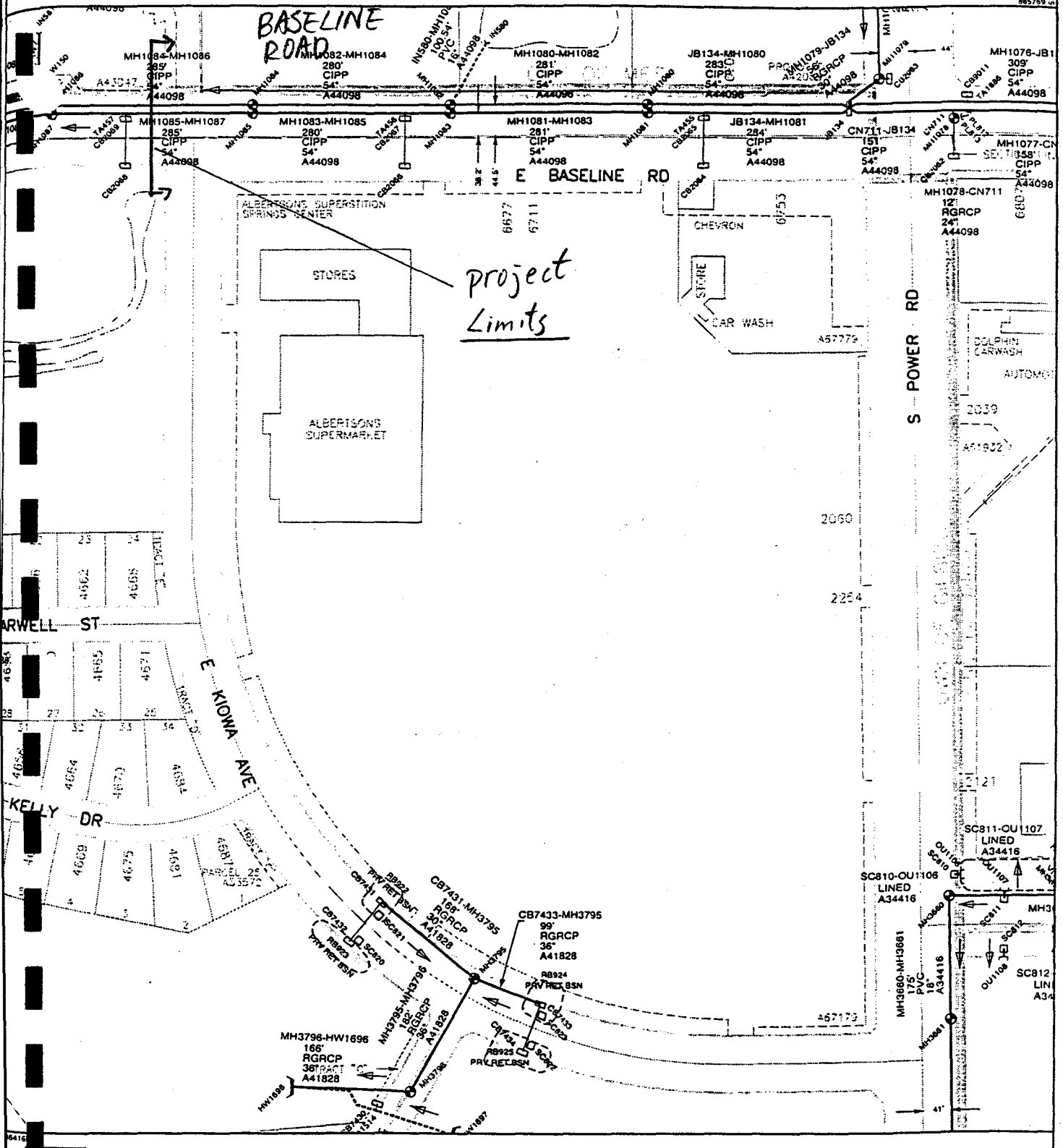
STORM DRAIN SYSTEM



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200' 0 200'

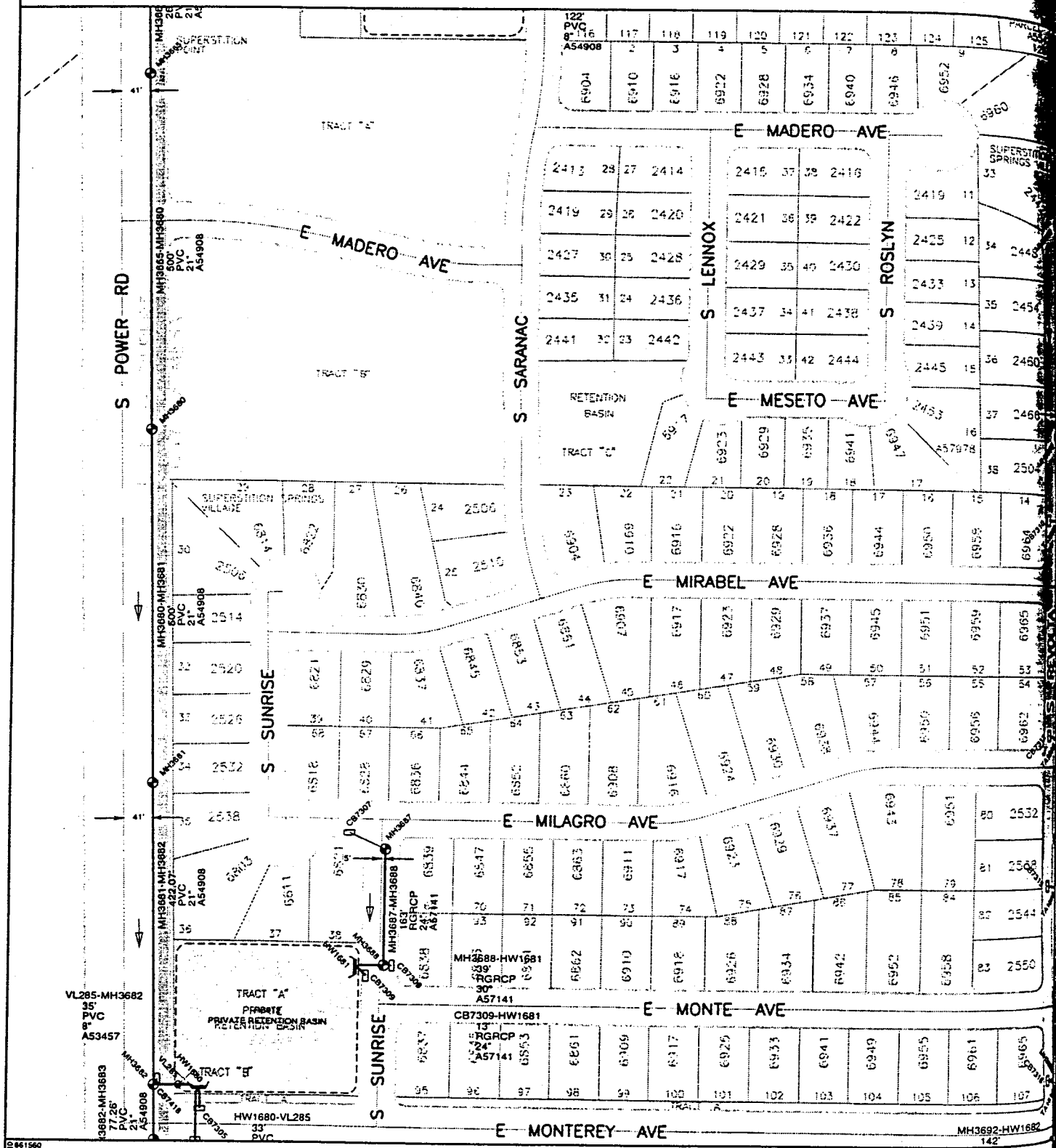
STORM REVISION DATE: 04/27/98
LAND REVISION DATE: 03/31/98
PLOT COMPILATION DATE: 04/27/98

96C
NE

095D	095D	103B
096C	096C	104A
096C	096C	104A

096C

STORM DRAIN SYSTEM



096C	104A	104A
096D	104B	104B
096D	104B	104B

104B

NW

104B

200' 0 200'

STORM REVISION DATE: 05/08/98
LAND REVISION DATE: 11/26/97
PLOT COMPILATION DATE: 05/08/98

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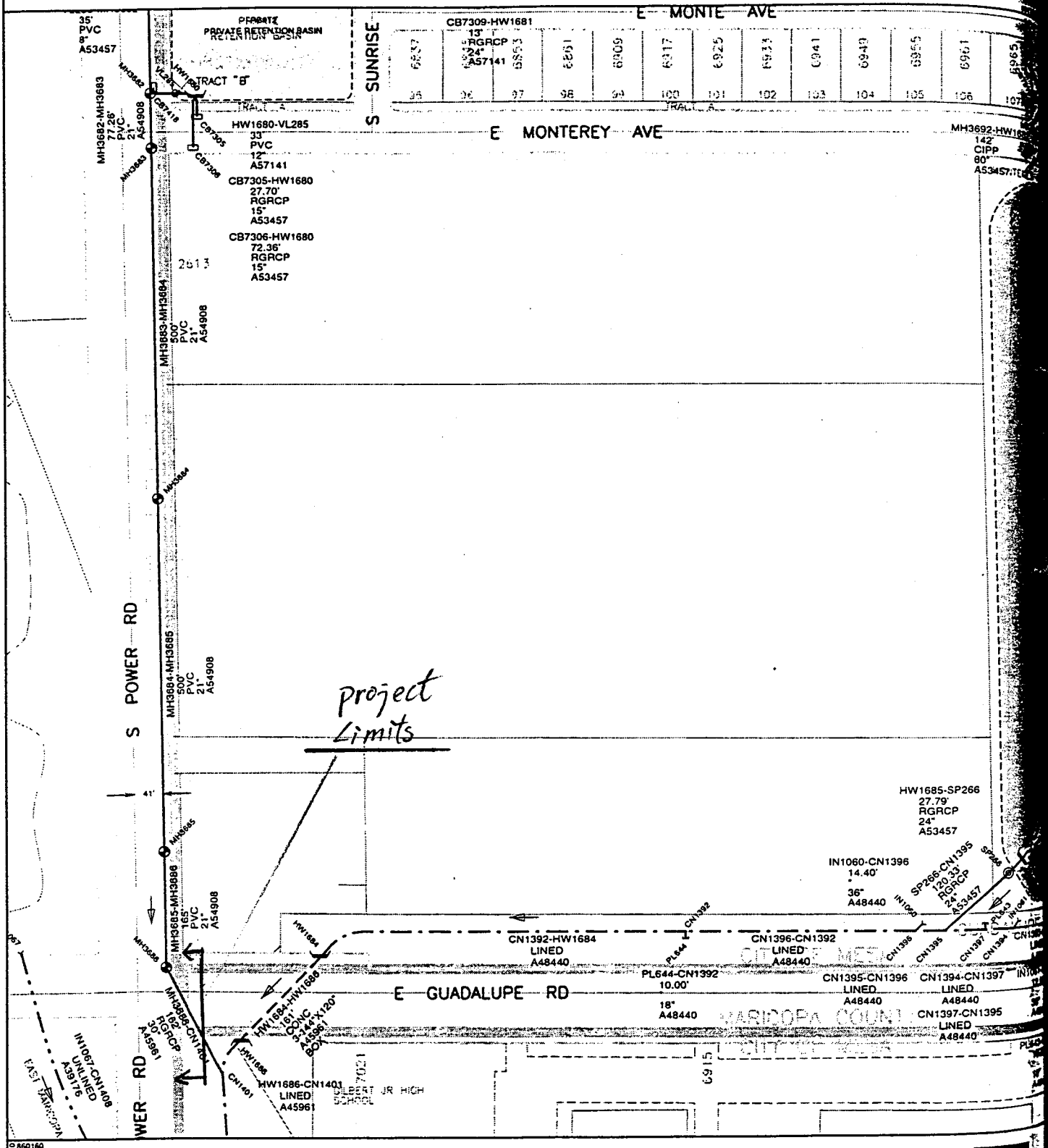
STORM DRAIN SYSTEM



096D	104B	104B
096D	104B	104B
311C	312A	312A

104B

SW

104B

200' 0 200'

STORM REVISION DATE: 05/08/98
LAND REVISION DATE: 11/26/97
PLOT COMPILATION DATE: 05/08/98

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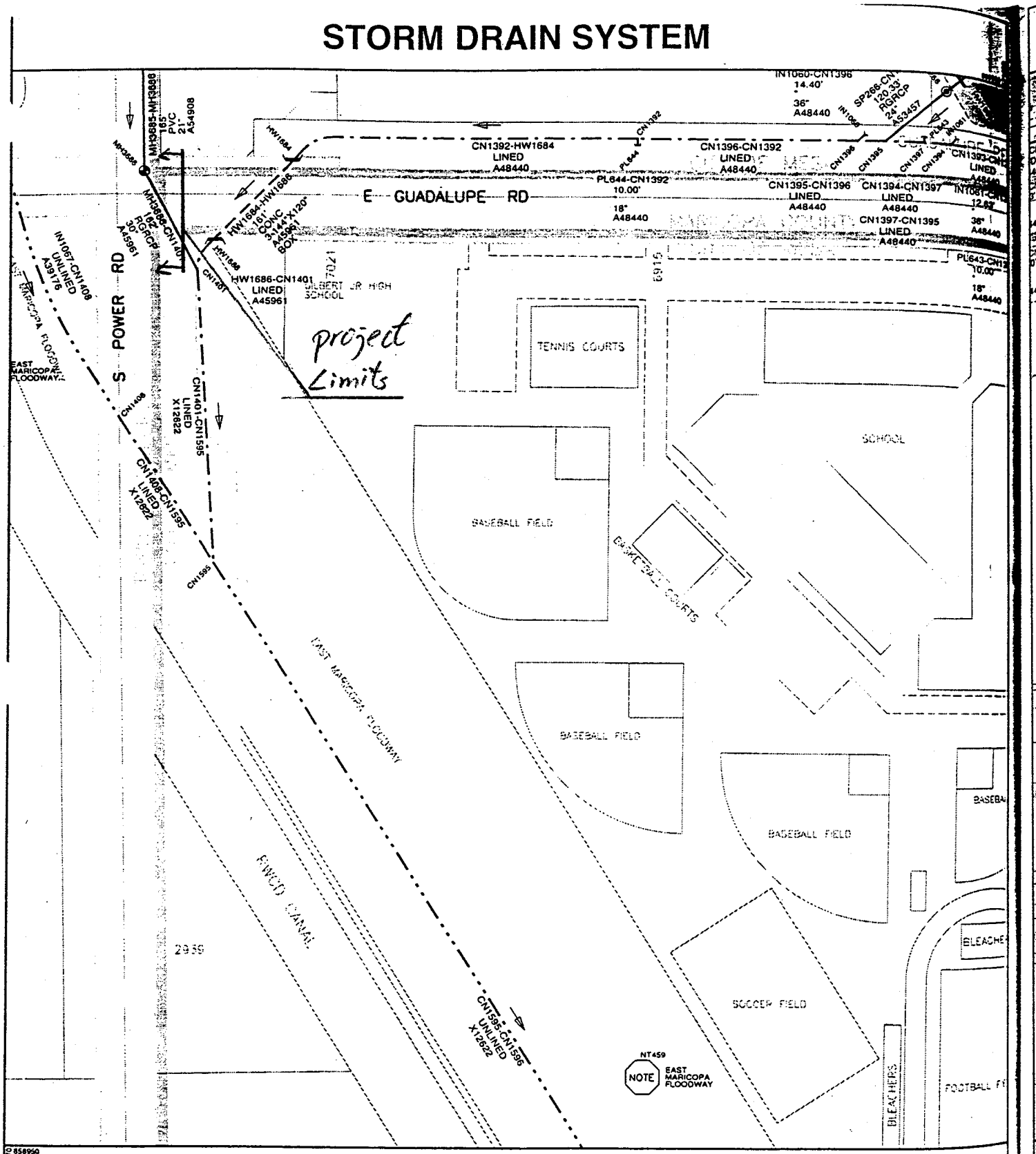
STORM DRAIN SYSTEM



096D	104B	104B
311C	312A	312A
311C	312A	312A

312A

NW

312A

200' 0 200'

STORM REVISION DATE: 05/08/98
LAND REVISION DATE: 01/05/98
PLOT COMPILATION DATE: 05/08/98

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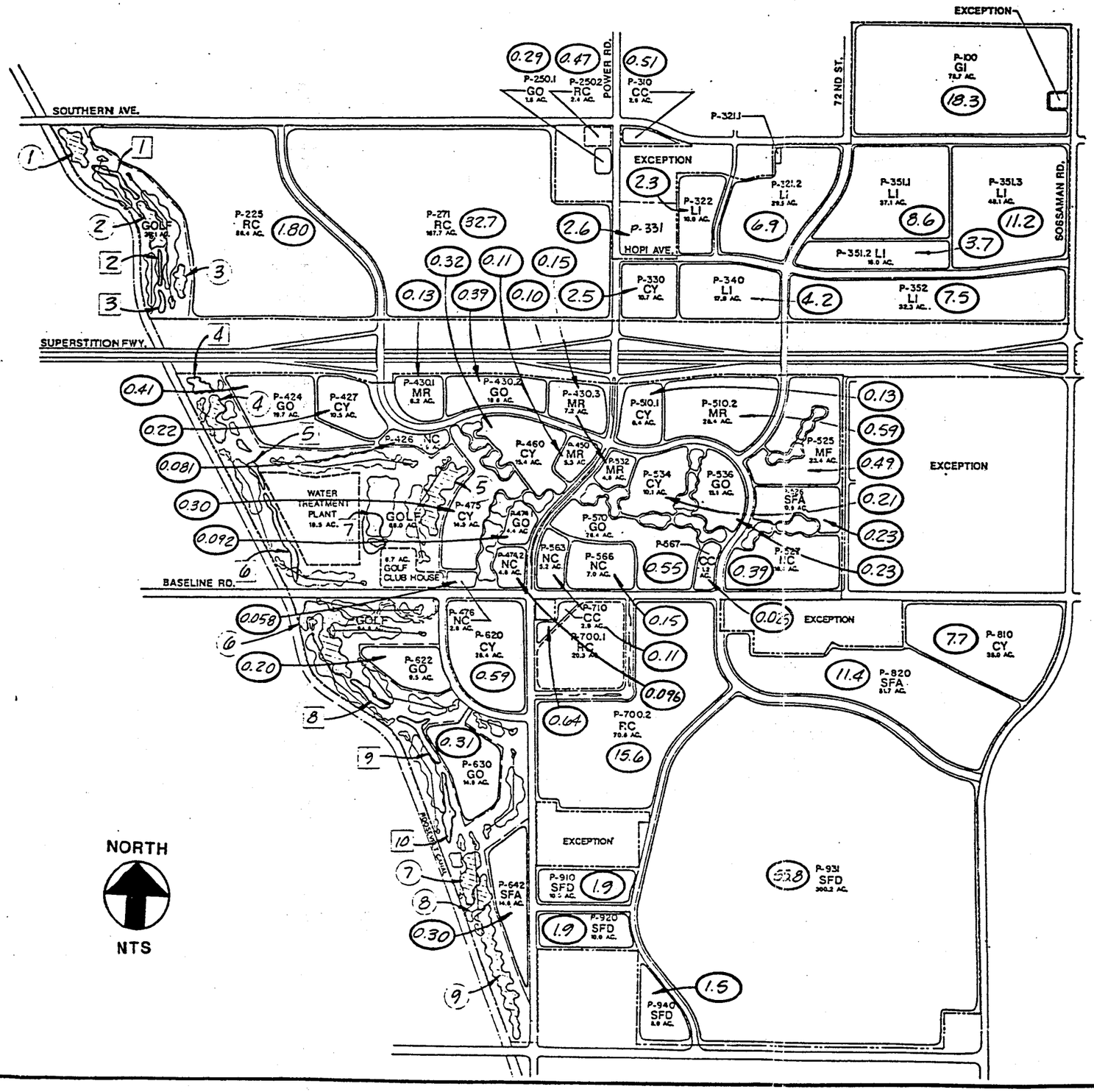
Appendix I

On-Site Retention Map

Note:

This map comes from "Master Drainage Plan for Superstition Springs, Maricopa County, Arizona", by Coe & Van Loo Consulting Engineers, Inc., November, 1987.



LAND USE SUMMARY

MARICOPA COUNTY

LAND USE		GROSS ACRES	TOTAL D.U.	D.U./ACRE
SFA	SINGLE-FAMILY ATTACHED	10.9	153	14.0
MF	MULTIPLE-FAMILY	23.4	421	18.0
NC	NEIGHBORHOOD COMMERCIAL	42.3	—	—
CC	CONVENIENCE COMMERCIAL	1.8	—	—
CY	COMMUNITY COMMERCIAL	48.4	—	—
RC	REGIONAL COMMERCIAL	255.5	—	—
GO	GARDEN OFFICE	62.0	—	—
MR	MID-RISE OFFICE	51.9	—	—

CITY OF MESA

LAND USE		GROSS ACRES	TOTAL D.U.	D.U./ACRE
SFD	SINGLE-FAMILY DETACHED	328.3	1,313	4.0
SFA	SINGLE-FAMILY ATTACHED	51.7	620	12.0
CC	CONVENIENCE COMMERCIAL	5.5	—	—
CY	COMMUNITY COMMERCIAL	58.2	—	—
RC	REGIONAL COMMERCIAL	91.1	—	—
GO	GARDEN OFFICE	19.7	—	—
GI	GARDEN INDUSTRIAL	78.7	—	—
LI	LIGHT INDUSTRIAL	191.9	—	—

TOWN OF GILBERT

LAND USE	GROSS ACRES	TOTAL D.U.	D.U./ACRE
SFA SINGLE-FAMILY ATTACHED	14.5	146	10.0
CY COMMUNITY COMMERCIAL	28.4	—	—
GO GARDEN OFFICE	24.4	—	—

TOTAL ACRES OF DEVELOPMENT

LAND USE	GROSS ACRES
RESIDENTIAL	428.8
COMMERCIAL	826.9
OFFICE	157.0
INDUSTRIAL	269.9
COMMUNITY FACILITIES	*
RECREATIONAL FACILITIES	198.8**
LAKE & PUBLIC OPEN SPACE	38.9
TOTAL	1,819.5

* COMMUNITY FACILITY AND OPEN SPACE IS INCLUDED IN OTHER CATEGORIES

** INCLUDES 191.9 AC. OF GOLF COURSE AND 6.7 AC. OF GOLF CLUB HOUSE

NOTE: THIS GRAPHIC REPRESENTS PROPOSED LAND USES AND ACREAGES WHICH ARE CONCEPTUAL AND SUBJECT TO GOVERNMENTAL APPROVAL

LEGEND

(3) – LAKE

[5] – RETENTION AREA

(0.19) – ON-SITE RETENTION VOLUME (ac-ft)

SUPERSTITION SPRINGS

ON-SITE RETENTION MAP

AUG 87
1089-01

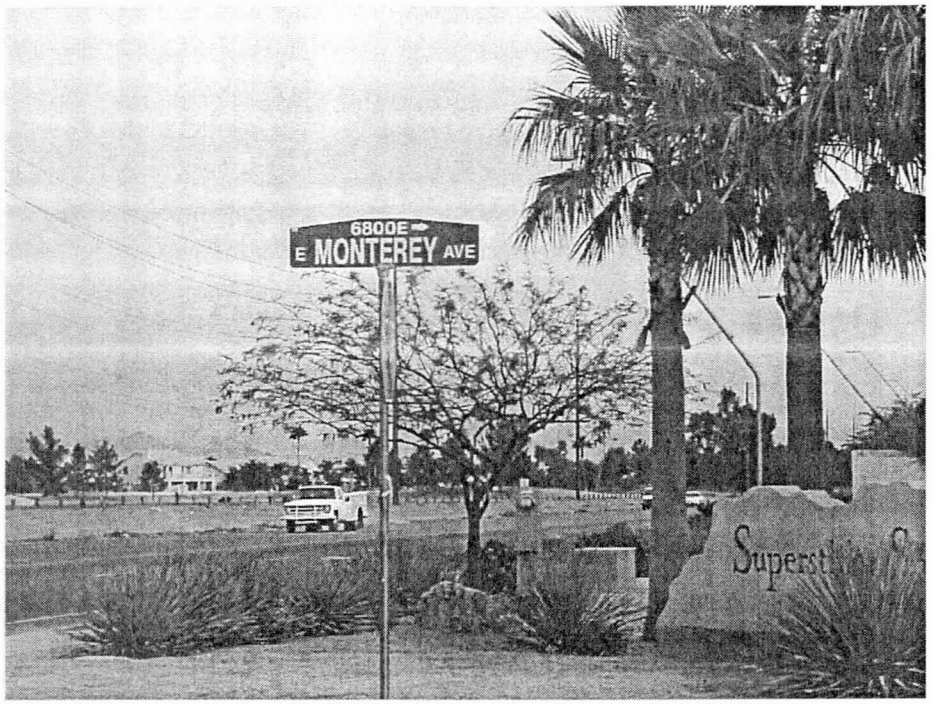
COE & VAN LOO CONSULTING ENGINEERS INC. PHOENIX ARIZONA

FIGURE 5

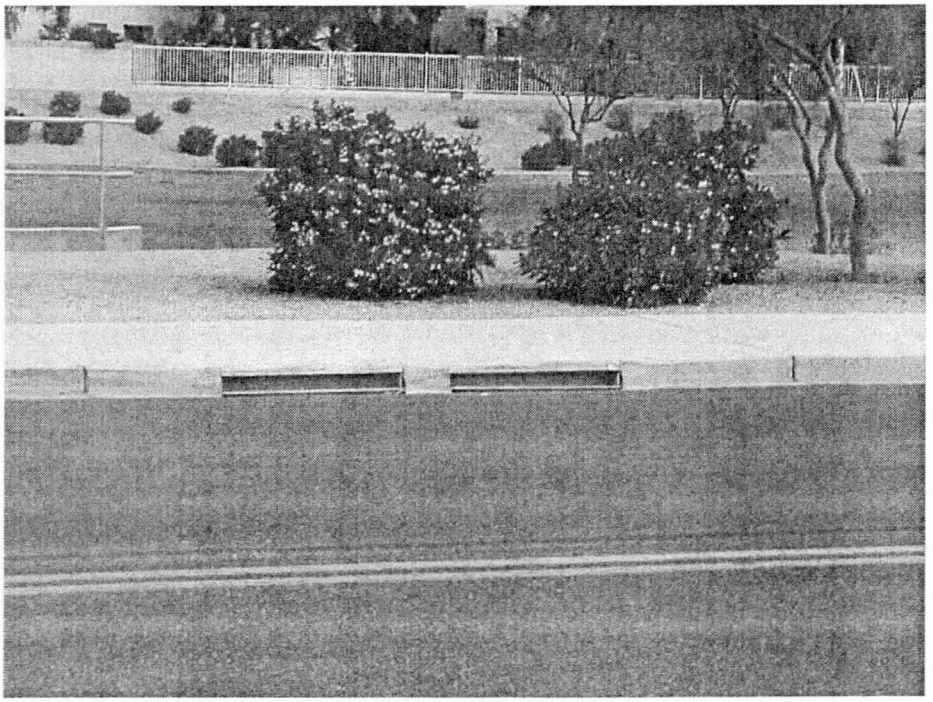
Appendix J

Photographic Documentation

This appendix contains photographs taken during numerous site visits and is related to Section 1.7 "Field Reconnaissance." Stations shown on photographs are for Power Road, and are approximate only.



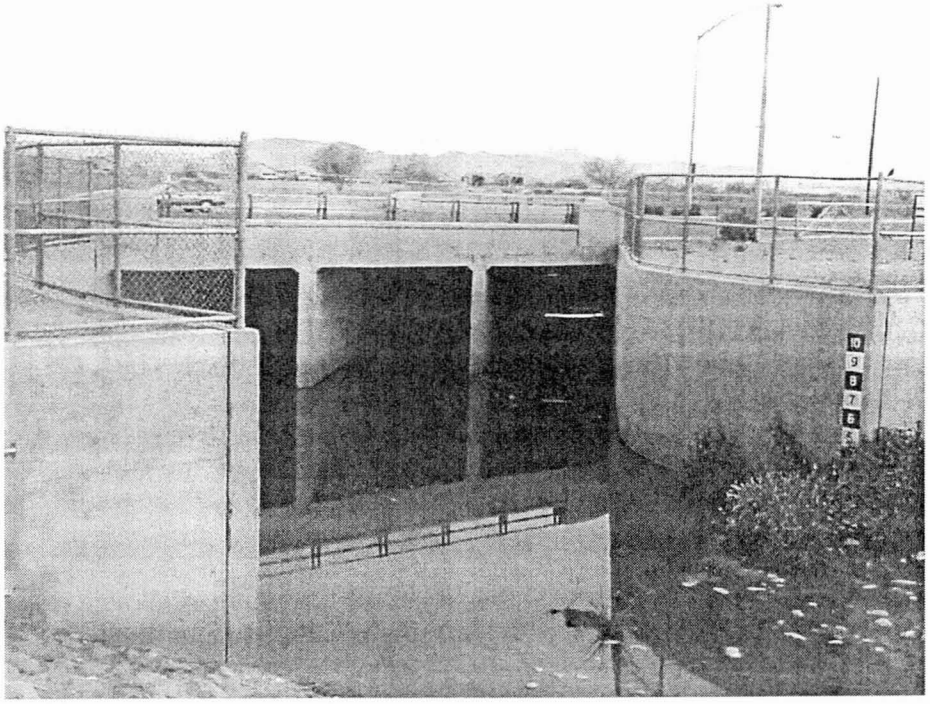
Monterey Avenue, east of Power Road. Sta. 1+380.



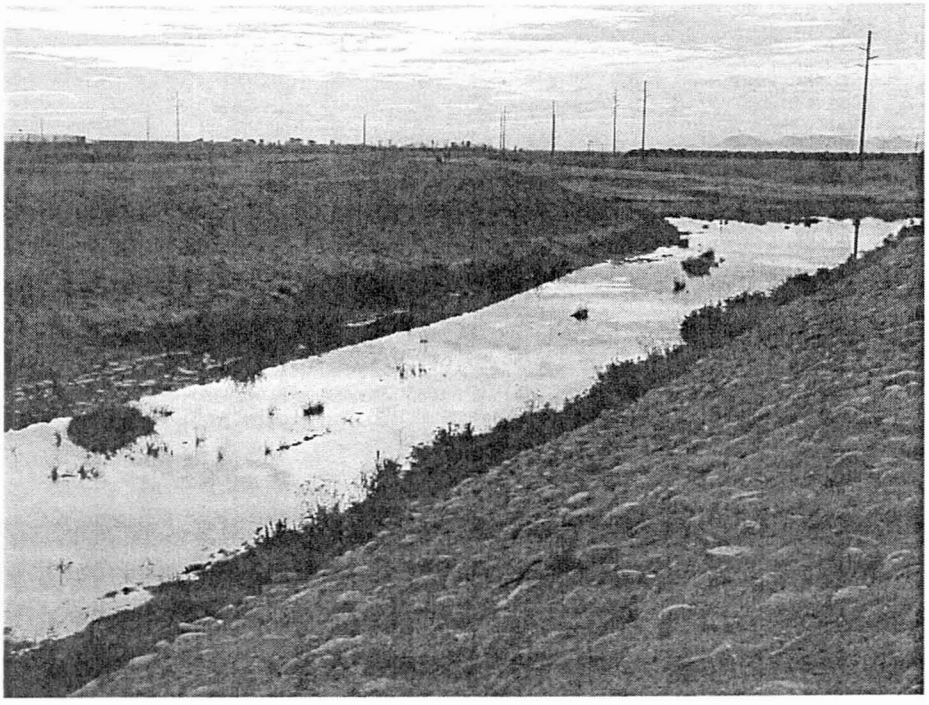
2 catch basins, combined, size:0.3mx 1m (1'x3'), located at Power Rd & Monterey Ave., Northeast corner. There is a retention basin behind the catch basins. Sta. 1+380.

2 catch basins, combined, size:0.3m x 1m (1'x3'), located at Power Rd & Monterey Ave., southeast corner. Sta. 1+380.

460 mm (18") pipe storm drain located at eastside of Power Rd, south of Monterey Ave. Sta. 1+250.

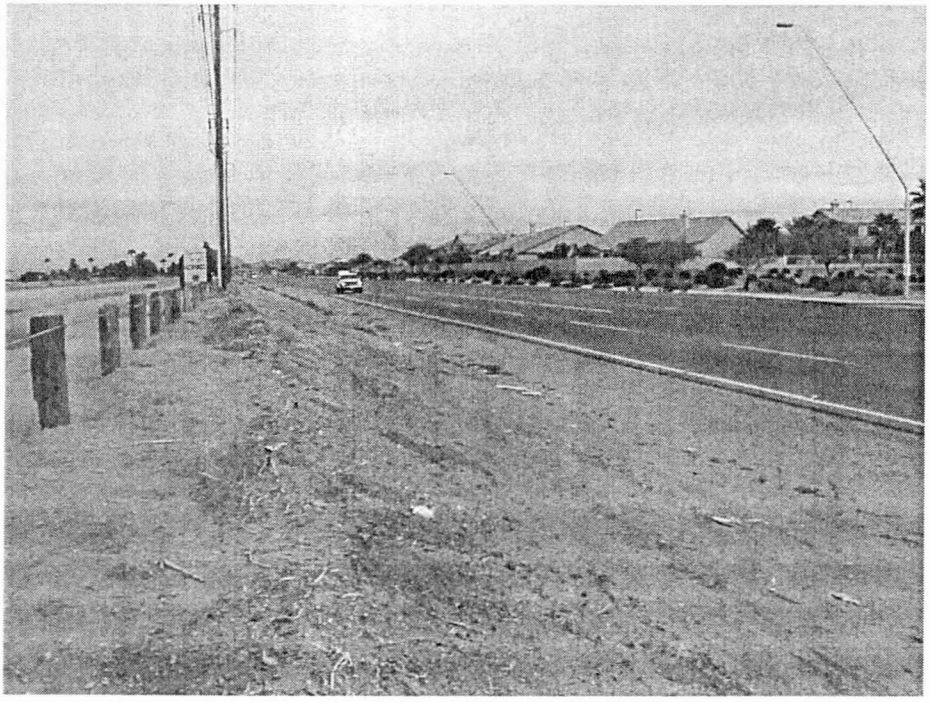


3-3.6m x 3.0m (12'x10') CBC, Guadalupe Rd, east of Power Rd.

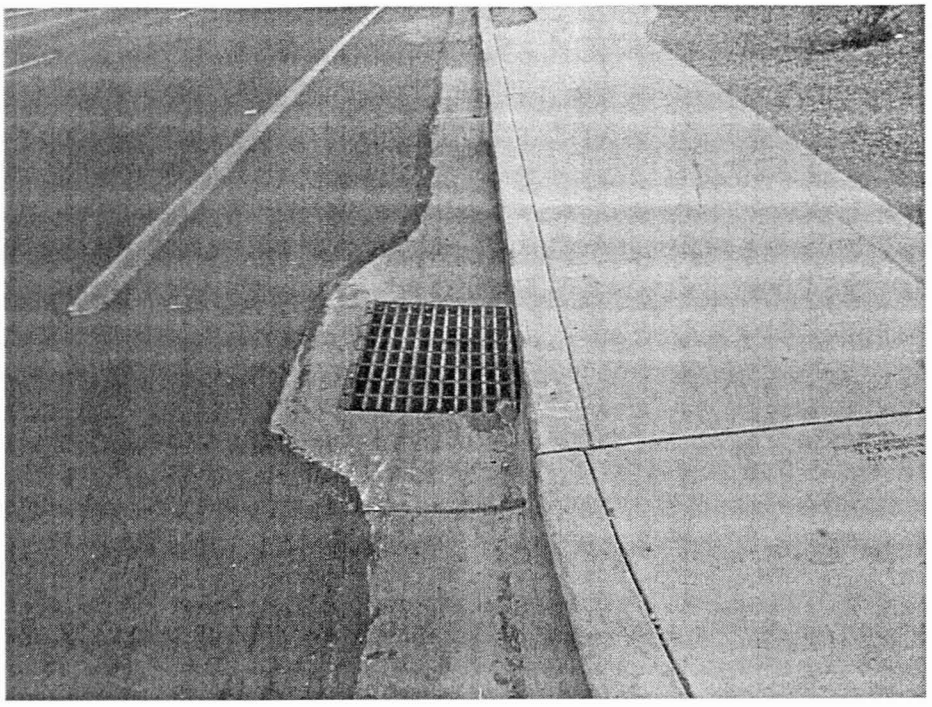


Existing channel, outlet of 3-3.6mx 3.0m (12'x10') CBC.

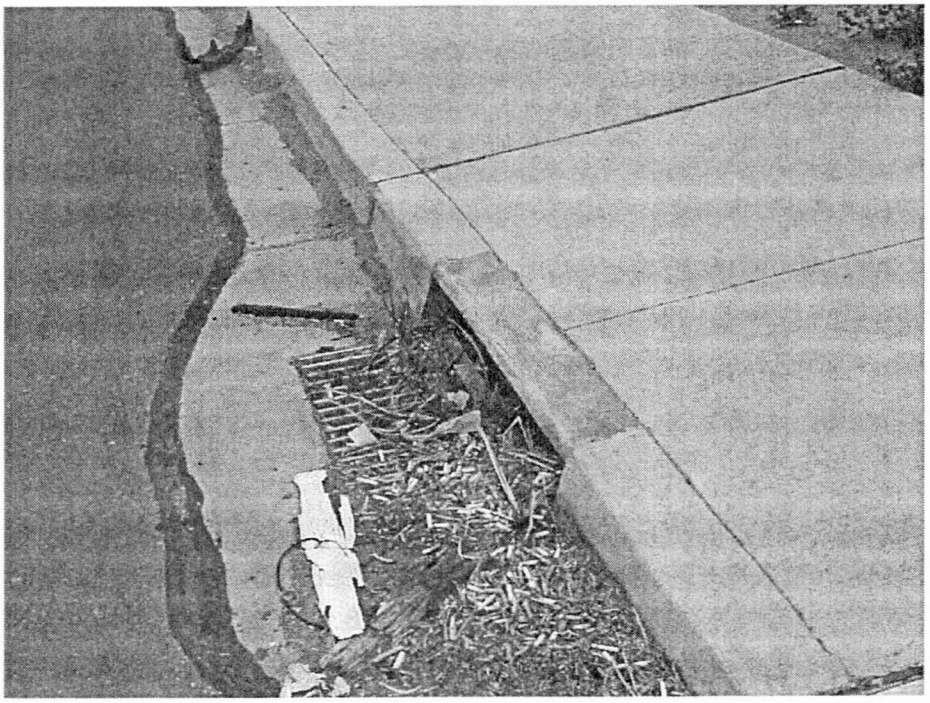
Conc. Scupper,1.83m (6') wide, west of Power Rd, and north of Guadalupe Rd. Sta. 1+100.



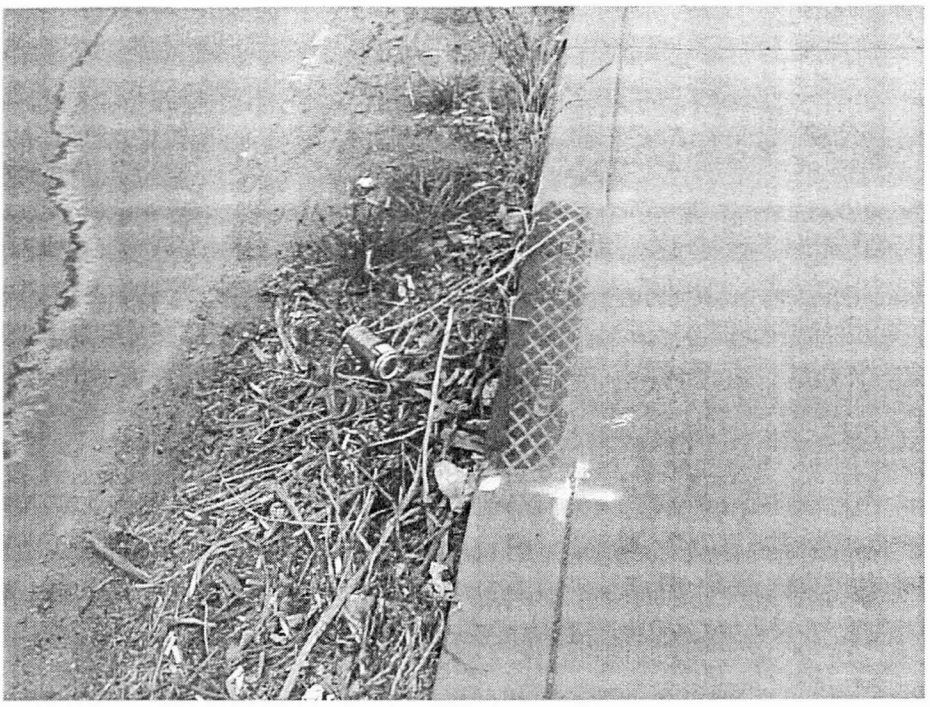
A berm is located west of Power Rd and north of Guadalupe Rd. This berm is about 1.5m high



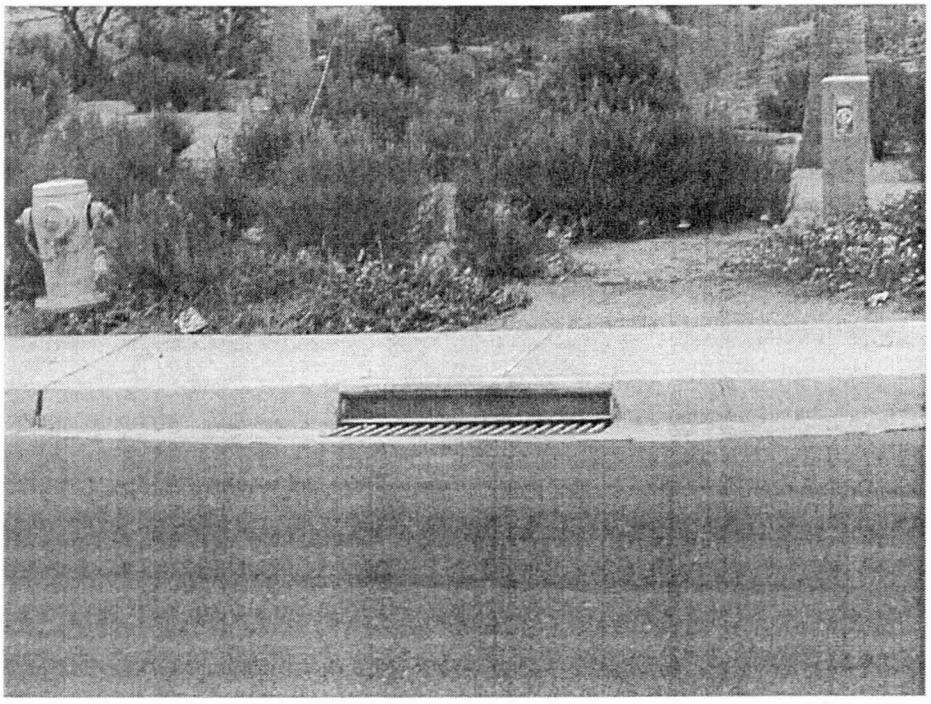
Catch basin, combined, 1mx0.67m (3'x2'), east side of Power Road and north of Monterey Ave.



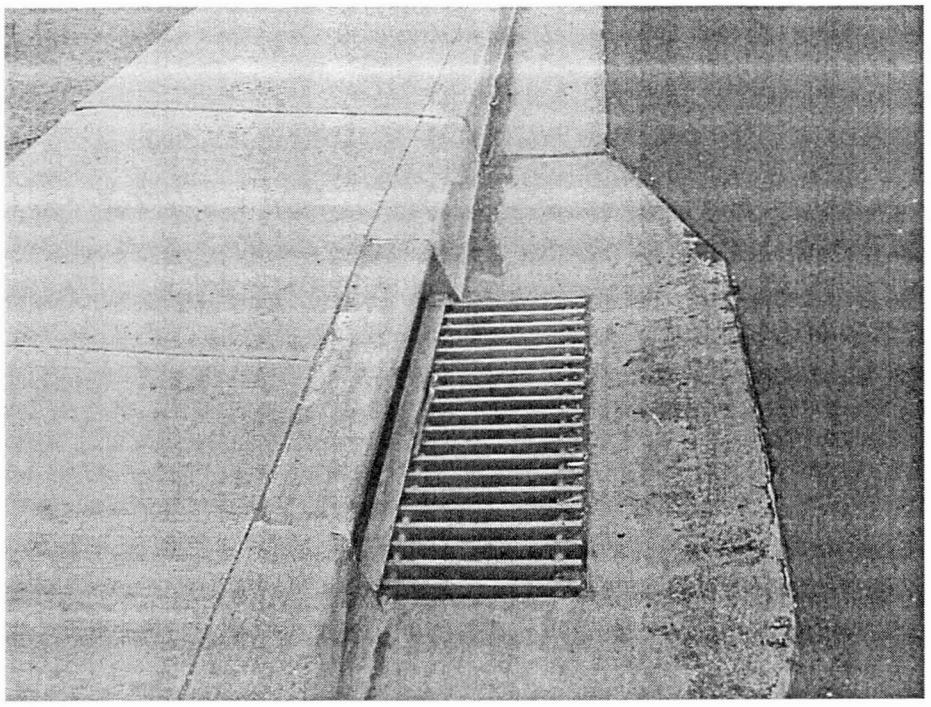
Catch basin, combined, 0.3m x 1m (1'x3'), east side of Power Rd, and south of Madero Ave.This structure appears plugged w/ debris.



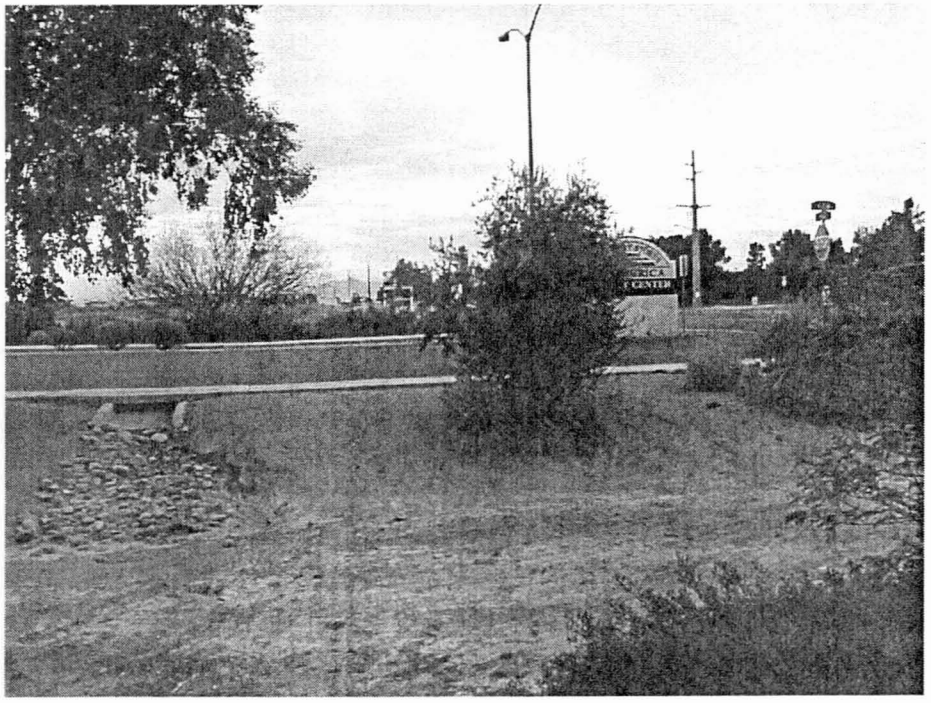
Catch basin, combined, 0.3m x 1m (1'x3'), east side of Power Rd, and south of Madero Ave. This structure appears plugged w/ debris.



Catch basin, northeast corner of Power Rd and Madero Ave., 0.3m x 1m (1'x3'), combined.

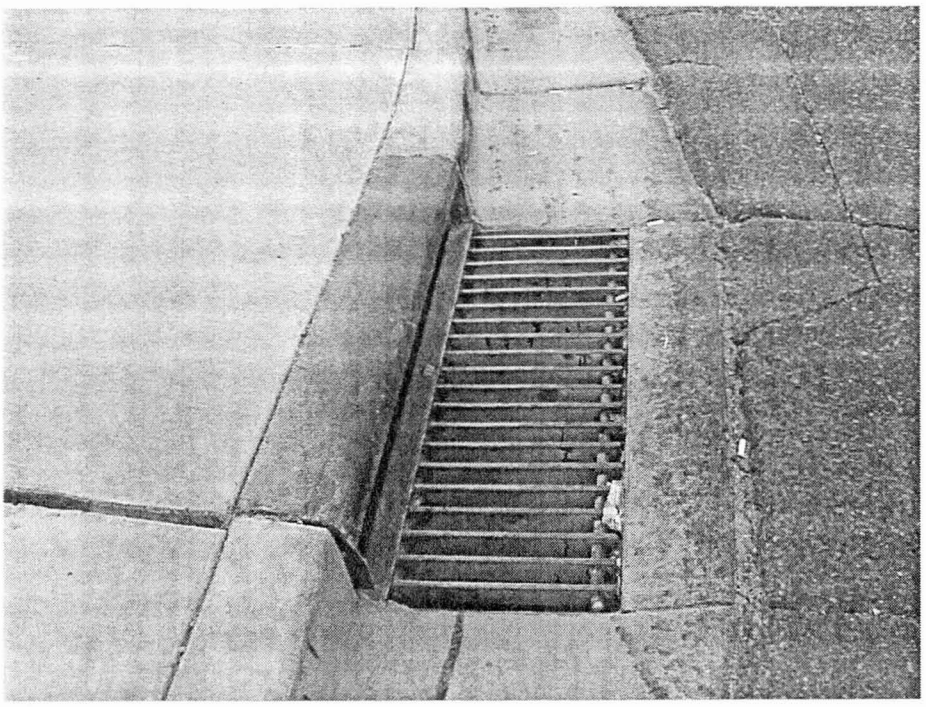


Catch basin, southeast corner of Power Rd and Madero Ave., 0.3m x 1m (1'x3'), combined. Sta. 1+780.



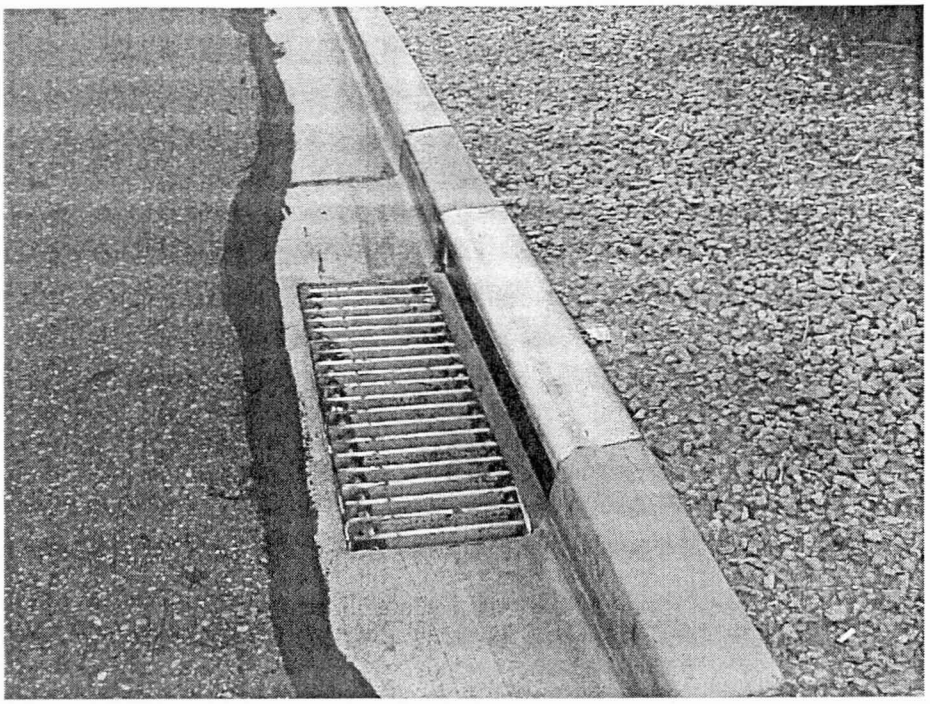
Retention basin, northeast corner of Power Rd and Kiowa Ave.

Sta. 2+280.



Catch basin, combined, 0.3m x 1.3m
(1'x4'), southeast corner of Power Rd and
Baseline Rd. Sta. 2+70.

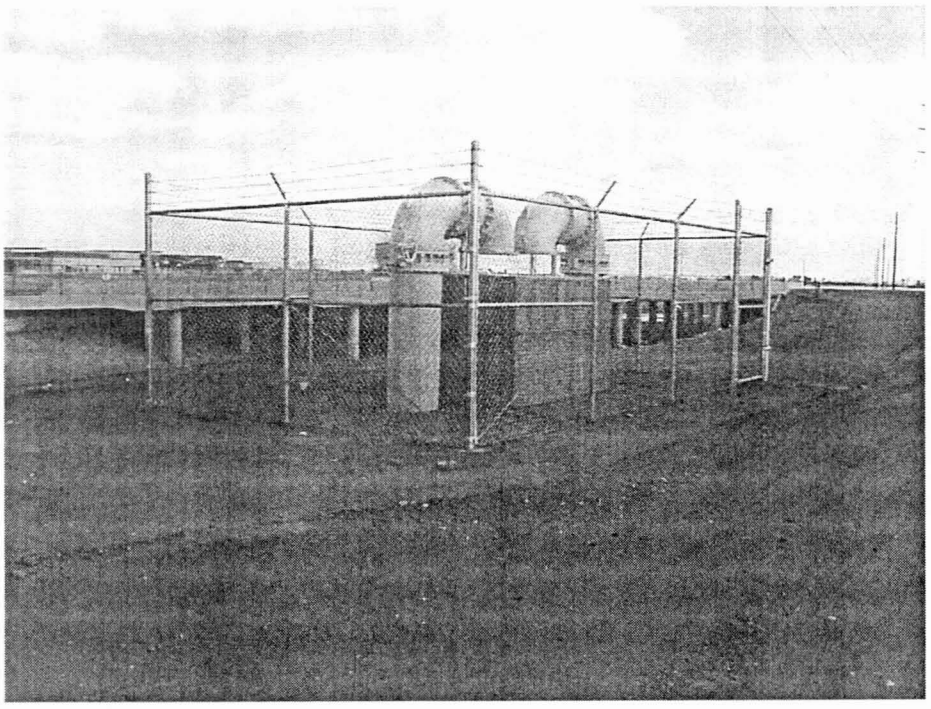
Catch basin, 0.6m x 1.3m (2'x4'), east side of Power Rd. and
north of Baseline Rd. Sta. 2+750.



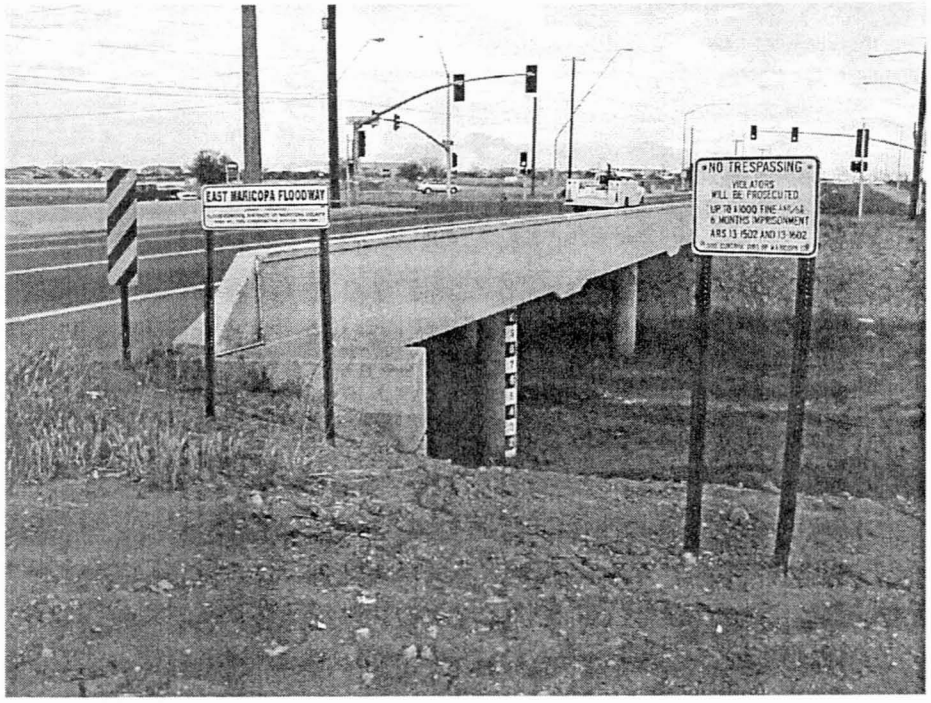
Catch basin, 0.3m x 1.3m (1'x4'), combined, west of median, north of Baseline Rd. Sta. 2+700.

Looking west along north side of
Guadalupe Road at intersection of Power
Road and Guadalupe Road.

Looking northwest at the Power Road Bridge over the East
Maricopa Floodway. View shows underside of bridge, piers, south
abutment, and channel bottom.

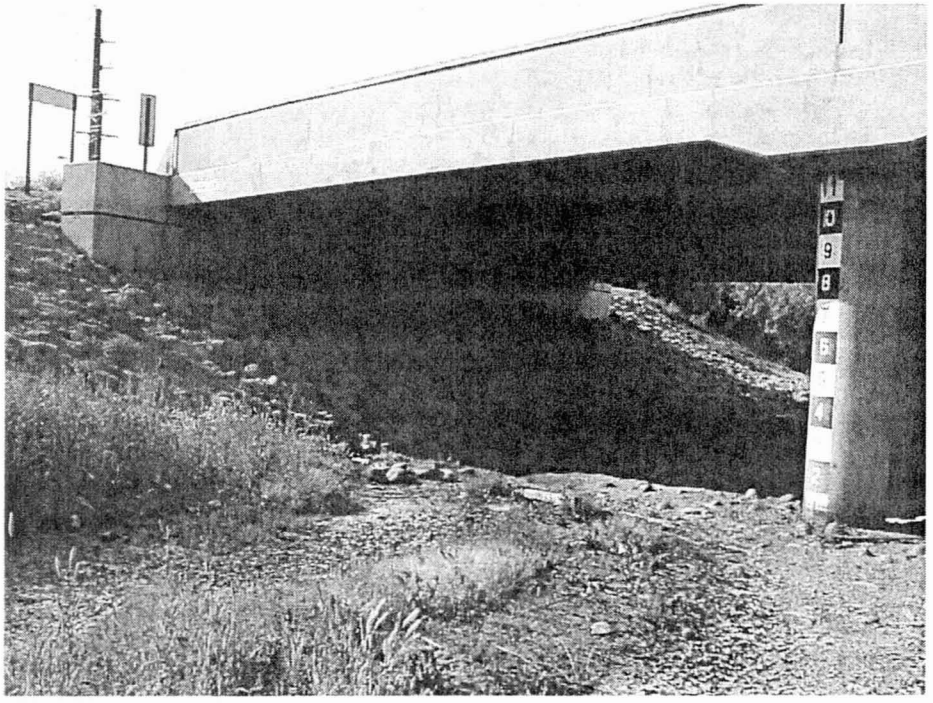


Looking southeast at reclaimed water discharge structure located south of Guadalupe road and west of Power Road

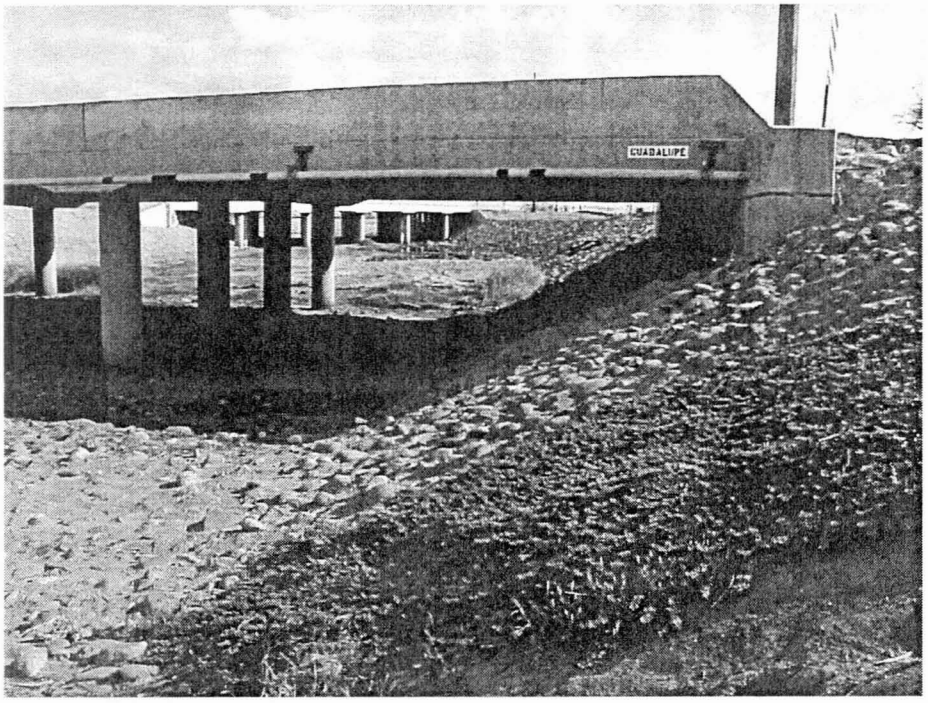


Looking northeast at the Guadalupe Road Bridge over the East Maricopa Floodway

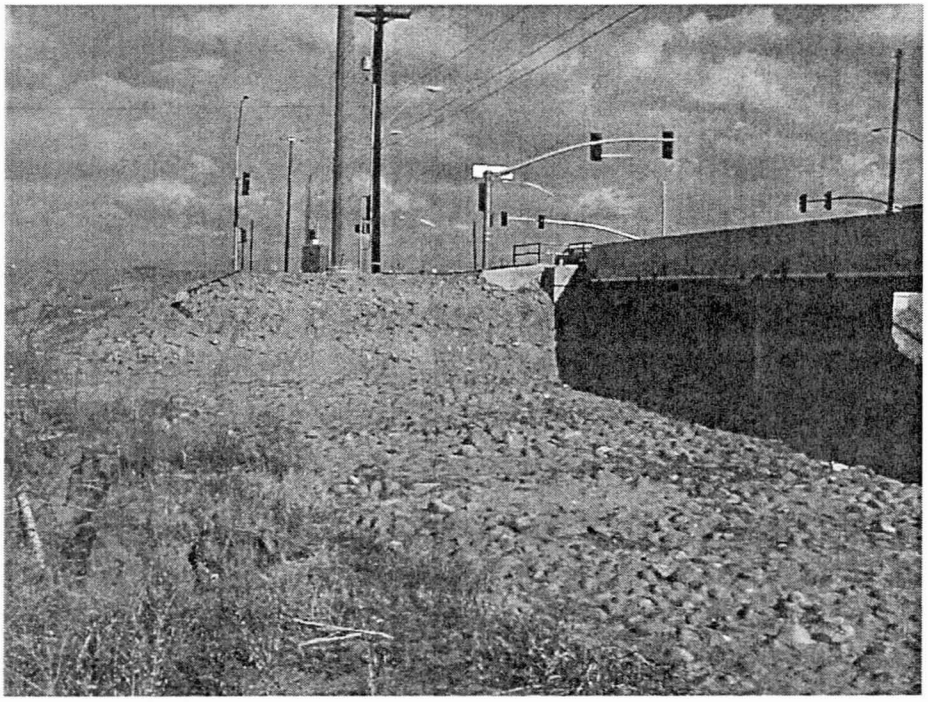
Looking east along the south side of Guadalupe Road from just east of the southeast corner of Guadalupe Road and Blue Jay Avenue



Looking northwest at the Guadalupe Road Bridge over the East Maricopa Floodway. Photo shows the west abutment, underside of deck slab, Jersey barrier, south pier, and grouted riprap

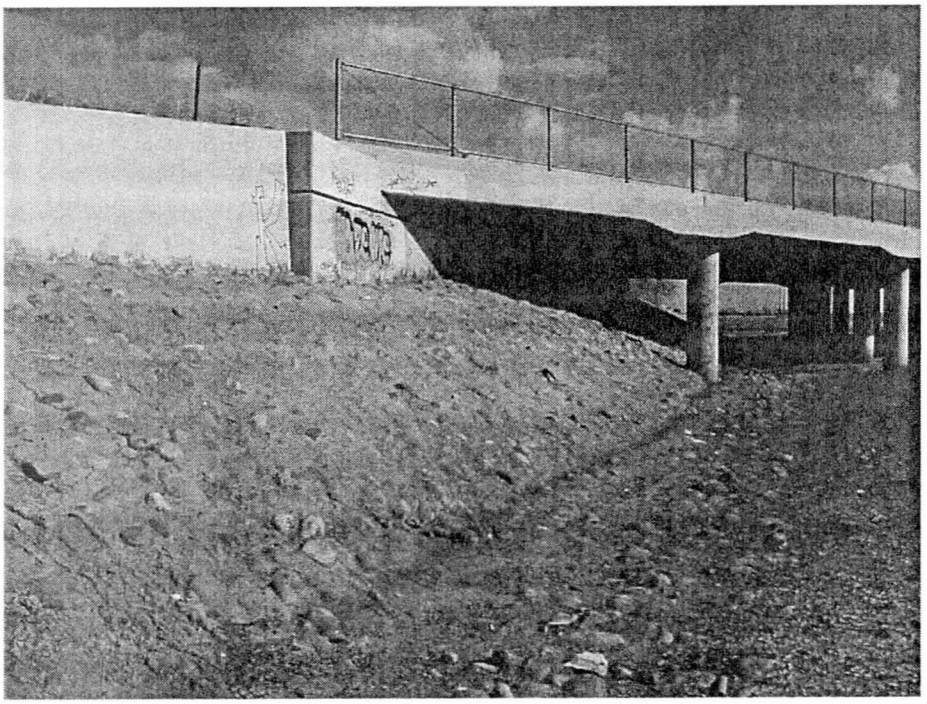


Looking south at the Guadalupe Road Bridge over the East Maricopa Floodway. Photo shows the west abutment, deck slab, Jersey barrier, piers, gas line hung on bridge, and the grouted riprap



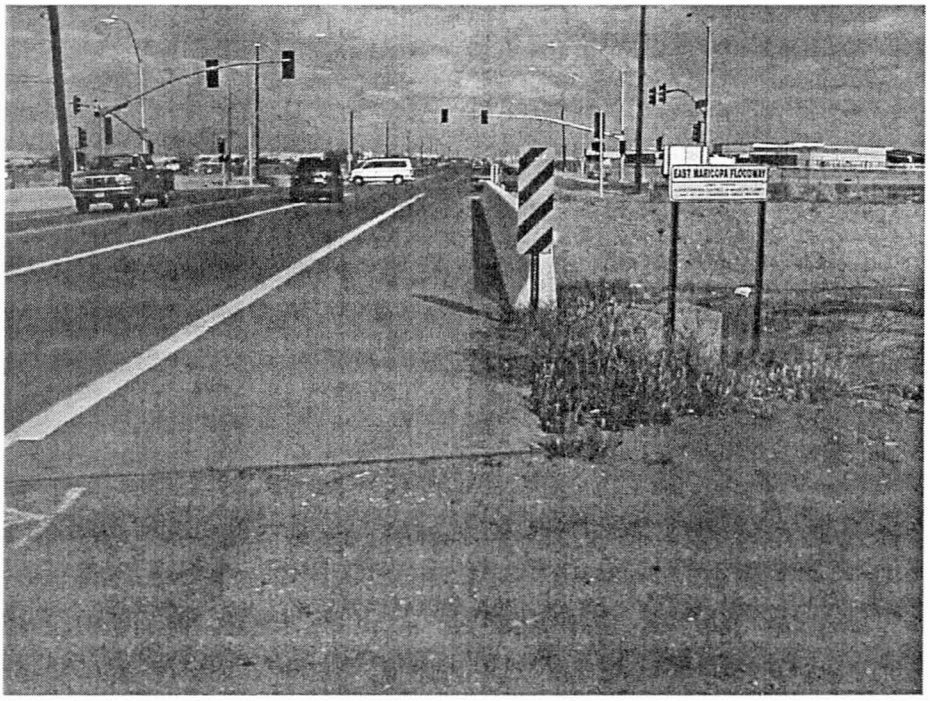
Looking southeast at the Guadalupe Road Bridge over the East Maricopa Floodway. Photo shows the east abutment, deck slab, Jersey barrier, piers, gas line hung on bridge, and the grouted riprap

Looking northwest at reclaimed water discharge structure located south of Guadalupe Road and west of Power Road. Photo shows the outlet structure into the East Maricopa Floodway



Looking east at the northwest abutment corner for the Power Road Bridge over the East Maricopa Floodway. Photo shows the north abutment, deck slab, Jersey barrier, piers, bridge fence, and the grouted riprap

Looking southeast at the Power Road Bridge over the East Maricopa Floodway. Photo shows the south abutment, deck slab, Jersey barrier, piers, bridge fence, and the grouted riprap



Looking east along the south side of Guadalupe Road sighting along the south barrier of the Guadalupe Road Bridge over the East Maricopa Floodway