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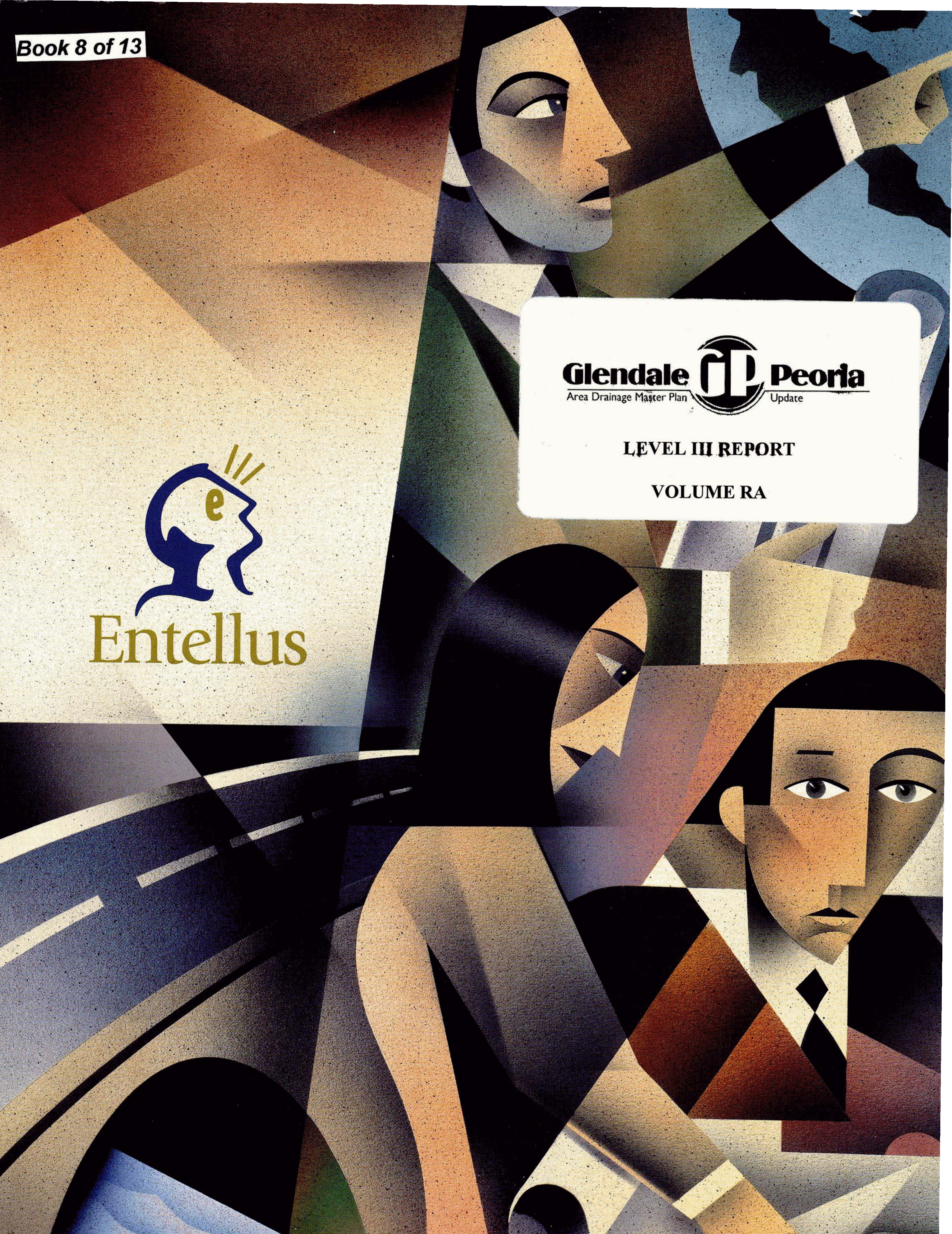

Glendale Peoria
Area Drainage Master Plan Update

LEVEL III REPORT

VOLUME RA

Entellus

Glendale Peoria

Area Drainage Master Plan Update

LEVEL III REPORT

EXECUTIVE SUMMARY

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The Flood Control District
Of Maricopa County
In cooperation with:

CITY OF PEORIA

GLENDALE

Glendale/Peoria Area Drainage Master Plan Update

FCD 99-44

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Glendale/Peoria Area Drainage Master Plan Update
FCD No. 99-44

LEVEL III REPORT

SECTION RA-1: EXECUTIVE SUMMARY

1.1 Introduction

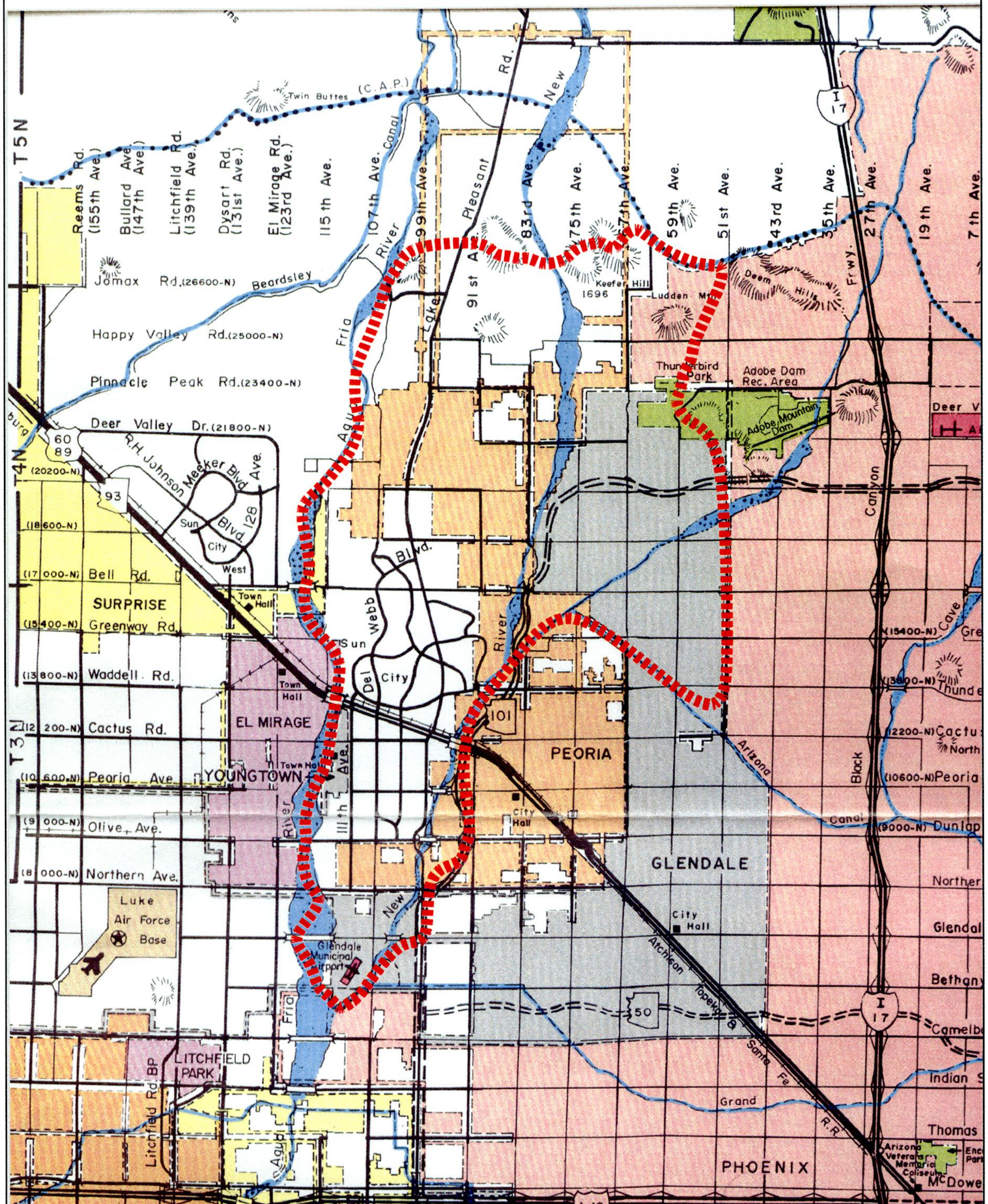
The purpose of this report is to present and summarize the results of the Level III Analysis task for the Glendale/Peoria Area Drainage Master Plan (ADMP) Update. In addition, this report documents the decision process used to arrive at the recommended alternatives and includes the preliminary design concept plans of the recommended alternatives.

1.1.1 Background

The purpose of this overall study is to update a portion of the existing *Glendale/Peoria ADMP* completed in May 1987 (**Reference 1**) by quantifying the extent of flooding problems, developing alternative solutions, selecting the most desirable solutions, and preparing preliminary design concepts for the selected alternatives. The major objectives of this study are to develop a plan to control runoff and prevent flood damage.

1.1.2 Study Areas

The overall study area for the Glendale/Peoria ADMP Update is approximately 80 square miles and includes portions of the cities of Peoria, Glendale, Sun City, Youngtown, Phoenix, and unincorporated portions of Maricopa County. The study area is located between 51st Avenue and the Agua Fria River and between Dynamite Boulevard and Bethany Home Road in northern Maricopa County as shown in **Figure RA-1**.



LEGEND

– STUDY AREA BOUNDARY

N

2 0 2 4

SCALE IN MILES

Entellus

GLENDALE/PEORIA ADMP UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FCD PROJECT NO. 99-44

IN ASSOCIATION WITH:

PENTACORE ARIZONA

LTM Engineering, Inc.
3923 East Thunderbird Road Suite 26-121
Phoenix, Arizona 85032

VICINITY MAP

FIGURE RA-1

The area is traversed or bounded by several major natural watercourses (see **Figure RA-1**), mainly: The Agua Fria River, the New River and Skunk Creek. Additionally, several man-made flow control structures and channels are encountered in the region including the New River Dam, the Arizona Canal Diversion Channel (ACDC), the 91st Avenue channel, the Westbrook Village detention basins and several other channels and detention basins.

The study area consists of several regions in different stages of development. North of Pinnacle Peak Road, the area is mainly undeveloped and is characterized by steep hills draining into flat alluvial valleys. This area contains several washes that have not been significantly affected by development. However, several developments are either under construction or in the planning stage, and the entire area will most likely be completely developed within the next ten years.

Between Pinnacle Peak and Beardsley Roads the area is more heavily developed and all natural drainage paths have been significantly altered. The drainage system in this vicinity is mainly man-made and has been constructed by individual developers. However, there are other inconsistencies in the system such as non-continuous channels and varying capacities throughout the length of the channel.

Between Beardsley Road and Northern Avenue, the area is generally fully developed and includes the Master Planned Communities of Sun City and Youngtown, as well as portions of Glendale and Peoria. For the most part, the drainage infrastructure in this region is already in place. However, the increasing development upstream may increase runoff to the area and overwhelm this system.

South of Northern Avenue, the region is mostly industrial or undeveloped. The entire area is a mile or less from a river outfall and flooding problems are rare.

1.1.3 Purpose and Goals

The purpose of the overall study is to develop alternative solutions for the drainage problems, select the most desirable alternative solutions, and to develop a preliminary concept (15%) design.

The Level III phase of the ADMP Update is to develop the preliminary concept design for the recommended alternative solution. For this study, there are four regions as described in **Subsection 1.2**. The selection of the recommended alternative relied on many factors, including: costs, engineering feasibility, public feedback, future recreation facilities and the flood safety needs for these facilities.

1.1.4 Project Partners

The ADMP Update project team consisted of members from the Flood Control District of Maricopa County (District), the City of Peoria, the City of Glendale, Entellus, and sub-consultants. Additional project partners include the Maricopa County Department of Transportation (MCDOT), private developers, and citizens of the study area. Both MCDOT and future developments will have a key role in partnering with the District, Peoria, and Glendale in implementing this plan.

1.2 Recommended Alternatives

The potential alternatives were grouped into four geographical regions. These geographical regions are the Northwest Region, the 83rd Avenue Region, the Rock Springs Region, and the Pinnacle Peak Road and 67th Avenue Region. **Figure RA-2** shows the Regional areas. A recommended alternative was developed for each

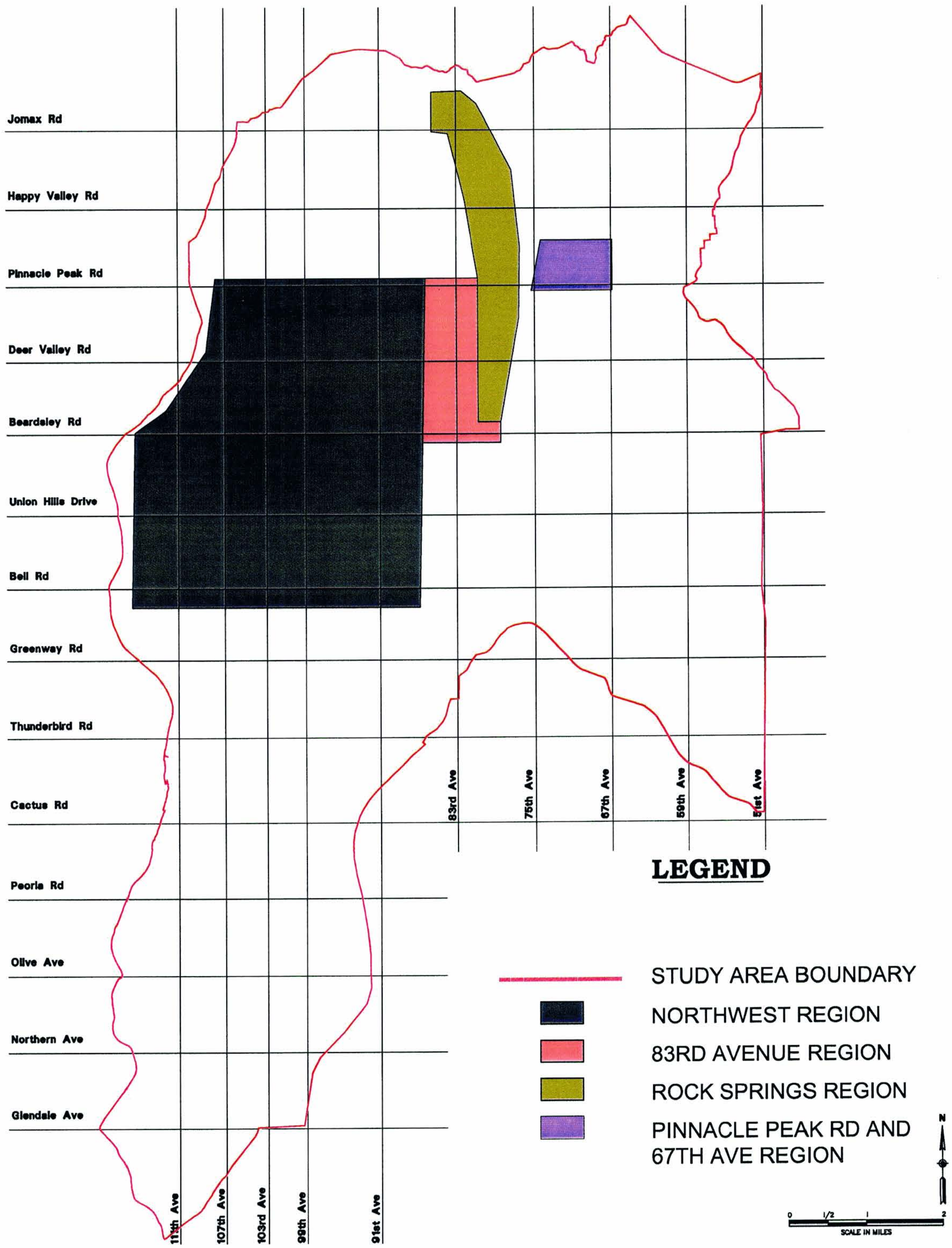


FIGURE RA-2 REGIONAL AREAS

Glendale Peoria
Area Drainage Master Plan

GLENDALE CITY OF PEORIA Flood Control District of Maricopa County Entellus PENTACORE ARIZONA LTM Engineering, Inc. 3923 East Thunderbird Road Suite 26-121 Phoenix, Arizona 85032 LOGAN SIMPSON DESIGN INC.

regional area. If the recommended alternative involved construction of new drainage facilities, the preliminary concept design is included as part of this Level III report.

1.2.1 Process for Recommending Alternatives

To select the most practical option in a logical manner, a three-level analysis was performed. The Level I analysis involved data collection, the creation of the hydrologic model, identification of the screening parameters, and the formulation of initial "seed" ideas. The Level II analysis examined the "seed" ideas for further engineering feasibility and costs and determined which alternatives would go to Level III for preliminary design. The Level III analysis then took these recommended alternatives and provided the 15% preliminary design concept.

1.2.2 Recommended Alternatives Description

The recommended alternatives for the four Regions are described below:
The recommended alternative for the **Northwest Region** is shown in **Figure ES-1.** This recommended alternative consists of three drainage systems including channels, storm drains, culverts, and drop structures located between Beardsley Road and Pinnacle Peak Road that carry the flow to the Agua Fria River.

The first drainage system is mainly along the north side of Pinnacle Peak Road beginning at 95th Avenue flowing west into the Agua Fria River. The recommended channel characteristics for this system are located in **Table RA-1**. The culvert location and sizes is summarized in **Table RA-2**.

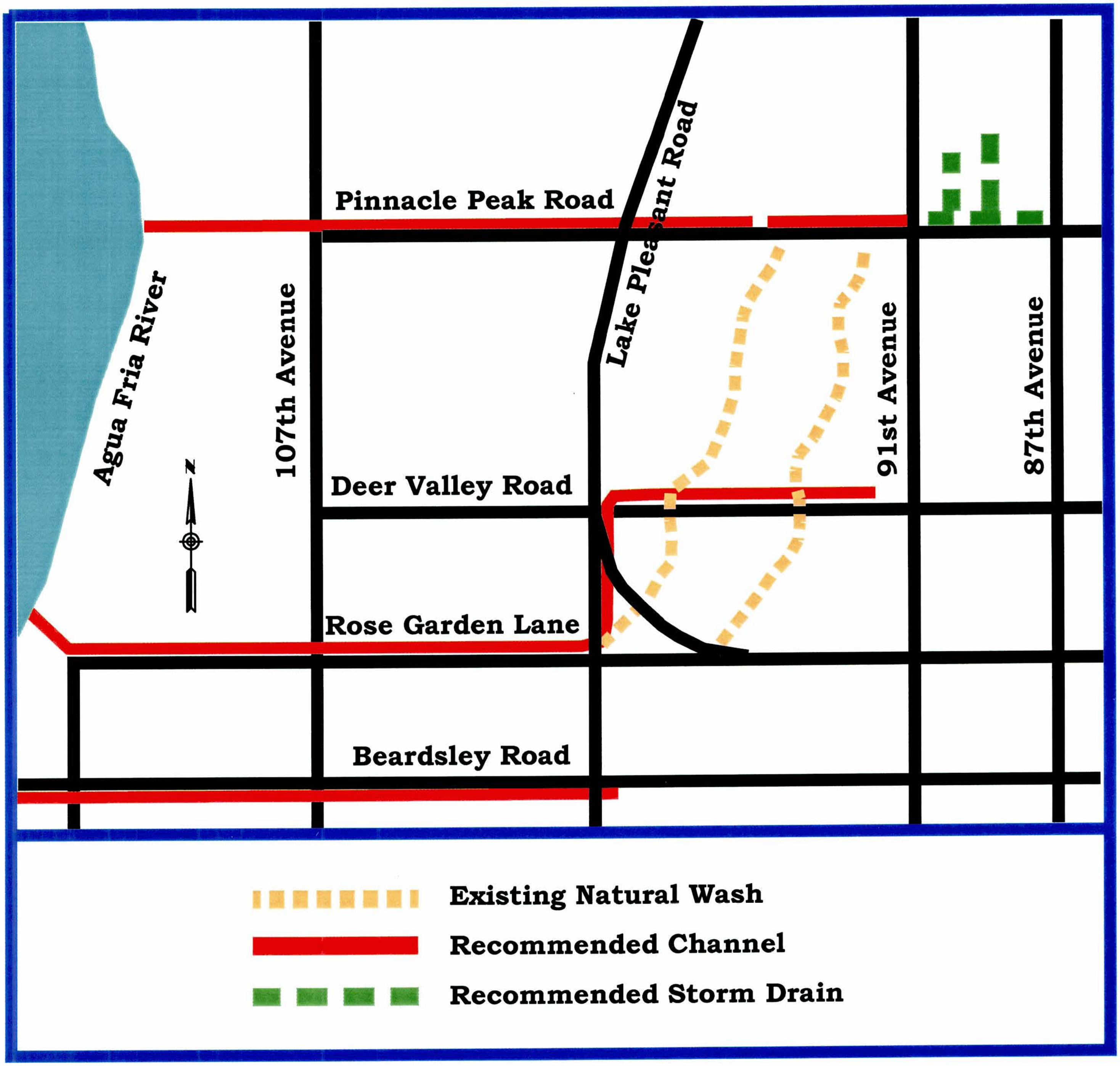


FIGURE ES-1 NORTHWEST REGION

Glendale Peoria Area Drainage Master Plan

GLENDALE · CITY OF PEORIA · Flood Control District of Maricopa County · Entellus · PENTACORE ARIZONA · LOGAN SIMPSON DESIGN INC.

Table RA-1
Channel Characteristics – Northwest Region

Alternative	Drainage System	Channel Location	Top Width	Length
Northwest Region	Pinnacle Peak Rd	95th Ave to 97th Ave	70'	1215'
		97th Ave to 99th Ave	110'	1250'
		99th Ave to Junction Structure	90'	2330'
		Junction Structure to 107th Ave	100'	600'
	Rose Garden Lane	91st to 95th Ave on Pinnacle Peak	67.5' & 50'	1250' & 620'
		91st Ave to Inlet Structure along Deer Valley Rd	80'	1585'
		Inlet Structure to 95th Ave along Deer Valley Rd	120'	975'
		95th Avenue to Lake Pleasant Rd along Deer Valley Rd	140'	4520'
		Deer Valley Rd to Rose Garden Lane along Lake Pleasant Rd	120'	2565'
		Lake Pleasant Road to 107th Ave	140'	1850'
		107th Ave to 109th Ave	110'	1220'
		109th Ave to Agua Fria River	120'	2395'
	Beardsley Road	99th Ave to Agua Fria River	40'	9455'

Table RA-2
Culvert Sizes and Locations – Northwest Region

Alternative	Drainage System	Culvert Location	Size	Length
Northwest Region	Pinnacle Peak Rd	93rd Ave	1- 4' x 3'	49'
		Pinnacle Peak Rd east of 93rd Ave	2 -10' x 5'	97'
		95th Ave	27" x 44"	130'
		97th Ave & 99th Ave	3 - 8' x 4'	70' & 50'
		Lake Pleasant Road	3 - 8' x 4'	105'
		Pinnacle Peak Rd Storm Drain 1800' east of Lake Pleasant Rd	2- 8' x 6'	1650'
		Pinnacle Peak Rd at 107th Ave	3- 8' x 5'	260'
	Rose Garden Lane	91st Ave at Deer Valley Rd	2-27"x 44"	100'
		95th & 99th Ave at Deer Valley Rd	4-10'x 5'	100'
		Deer Valley Rd at Lake Pleasant	4-10'x 5'	287'
		Lake Pleasant Rd	36"	260'
		106th to 107th Ave	3- 10' x 6'	900'
		108th Ave	4- 8' x 6'	92.5'
		109th & 111th Ave	4- 8' x 6'	80' & 80'
	Beardsley Road	99th Ave	2- 8' x 5'	137'
		107th & 109th Ave	2- 8' x 5'	94' & 66'
		111th Ave & 950' east of 111th Ave	2- 8' x 5'	110' & 100'
		Sand and Gravel operation	2- 8' x 5'	100' & 92'

The Rose Garden Lane drainage system begins as a 36" storm drain just west of 87th Avenue. This storm drain transitions into 2 - 4' x 8' box culverts, which empty into a channel west of 91st Avenue. The channel characteristics are presented in **Table RA-1** and the culvert locations and sizes are presented in **Table RA-2**.

The Beardsley Road channel, culverts, and outlet will be improved to increase their capacity as part of this regional alternative. The new channel and culvert dimensions are included in the two previous tables.

The recommended alternative for the **83rd Avenue Region** is shown in **Figure ES-2**. It consists of two detention basins, the first basin is the 83rd Avenue detention basin, which is 58 acre-feet (ac-ft) and is located on the northwest corner of 83rd Avenue and Pinnacle Peak Road. The second basin is the Calle Lejos detention basin, which is18 ac-ft and is located on Calle Lejos just east of 87th Avenue.

The channel characteristics for this recommended alternative are presented in **Table RA-3** and the storm drain and/or culvert locations and sizes are presented in **Table RA-4**.

Table RA-3

Channel Characteristics – 83rd Avenue Region

Alternative	Channel Location	Top Width	Length
83rd Avenue Region	87th Ave to 89th Ave north of Calle Lejos	50'	630'
	83rd Ave from Calle Lejos to Avenida Del Sol	80'	1250'

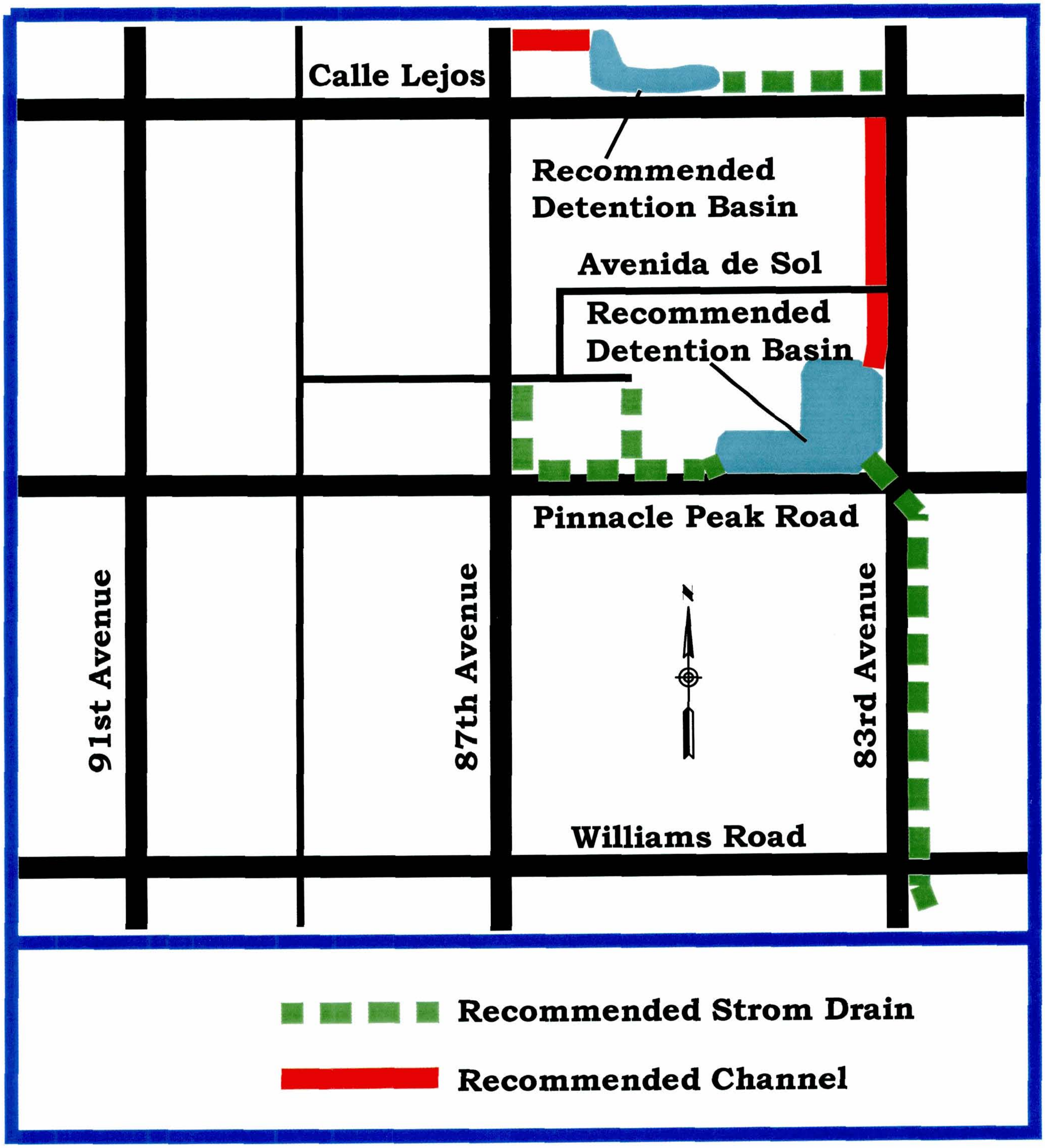


FIGURE ES-2 83rd Ave Region

Table RA-4

Storm Drain / Culvert Sizes and Locations – 83rd Avenue Region

Alternative	Storm Drain or Culvert Location	Size	Length
83rd Avenue Region	87th Ave north of Calle Lejos into basin	1- 6' x 4'	155'
	Calle Lejos from basin to 83rd Ave	36" storm drain	2,053'
	83rd Ave from Avenida Del Sol to basin	2- 10'x 4'	744'
	83rd Ave basin to 83rd Ave channel south of Williams Rd.	48" storm drain	1858'
	87th Avenue to Pinnacle Peak Rd.	1- 10' x 4'	635'
	85th Avenue to Pinnacle Peak Rd.	1- 10' x 4'	637'

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The recommended alternative for the **67th Avenue and Pinnacle Peak Road Region's** is shown in **Figure ES-3**. It consists of three small interceptor basins connected with a series of channels and storm drains. The first interceptor basin is 0.5 ac-ft and is located on the southwest corner of Hatfield Road and 67th Avenue. The second interceptor basin is 4 ac-ft and is positioned just south of Calle Lejos on the east side of the road. The third interceptor basin is approximately 4.5 ac-ft located east of Pinnacle Peak Road and 67th Avenue. The channel characteristics for this recommended alternative are presented in **Table RA-5** and the storm drain and/or culvert locations and sizes are presented in **Table RA-6**.

Table RA-5

Channel Characteristics – 67th Avenue Region

Alternative	Storm Drain or Culvert Location	Top Width	Length
67th Avenue Region	67th Ave south of Softwind Dr to Pinnacle Peak Rd	63'	1260'
	69th Drive along north side of Pinnacle Peak Rd to Agua Fria River	60'	3290'

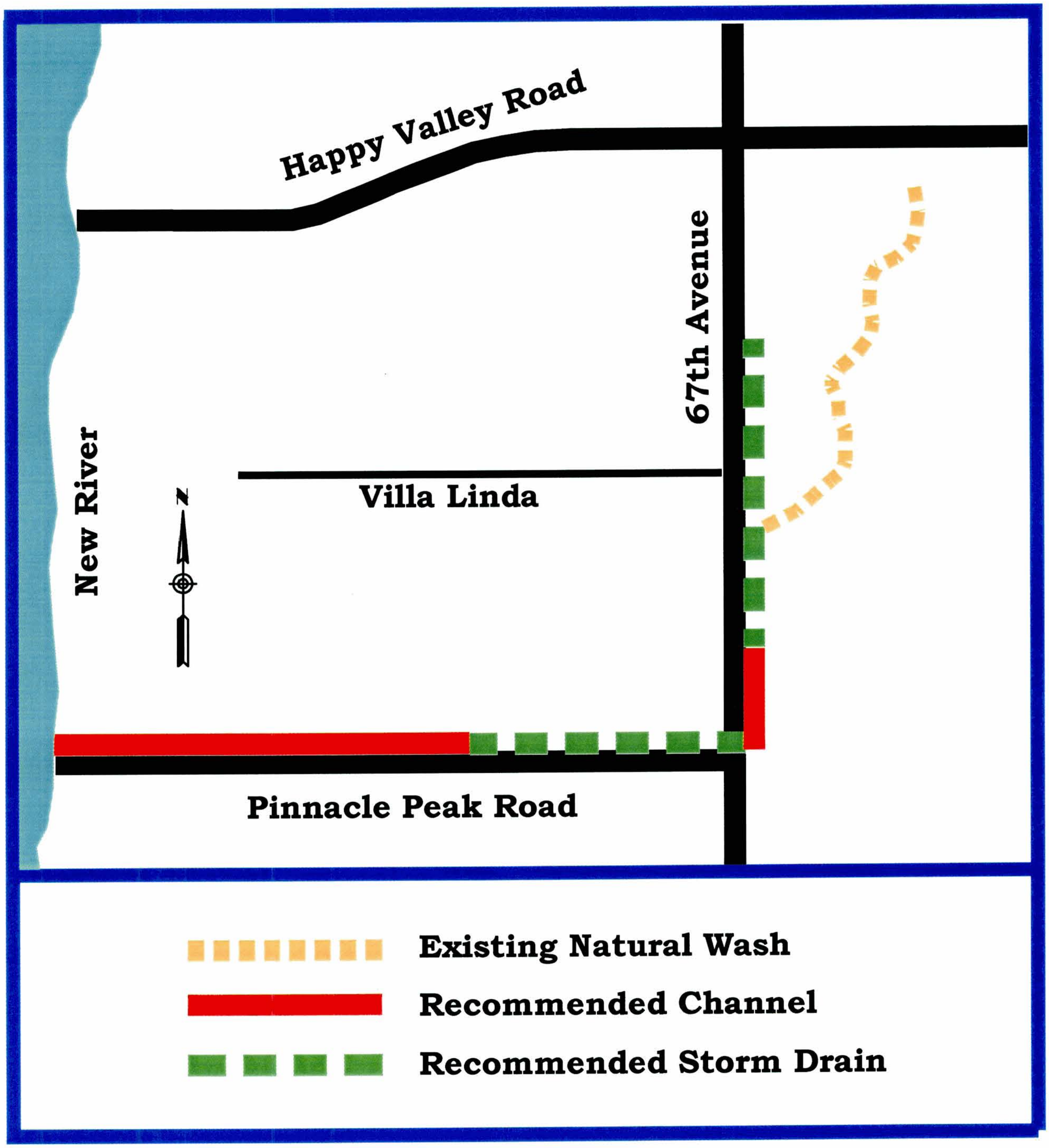


FIGURE ES-3 67th Ave Region

Table RA-6

Storm Drain / Culvert Sizes and Locations – 67th Avenue Region

Alternative	Storm Drain or Culvert Location	Size	Length
67th Avenue Region	South of Hatfield Road to second interceptor basin on east side of 67th Ave	42" RCP	1478'
	Second Interceptor Basin to south of Softwind Dr. on east side of 67th Ave	4' x 10' RCB	1000'
	Culvert south of Camino de Oro on east side of 67th Ave	4' x 10' RCB	50'
	Third Interceptor Basin to 69th Drive on north side of Pinnacle Peak Road	4' x 10' RCB	410'
	Culvert for 71st Avenue north of Pinnacle Peak Rd	2 - 4' x 10' RCB	50'
	Culvert for 73rd Avenue north of Pinnacle Peak Rd	2 - 4' x 10' RCB	50'

The **Rock Springs Region's** recommended alternative is to regulate and enforce the floodplain/floodway delineations recently approved by FEMA for Rock Springs Creek (**Reference 2**).

1.2.3 Recommended Alternatives Cost

The total cost for the recommended alternatives for each region is summarized in **Table RA-7.**

TABLE RA-7
LEVEL III RECOMMENDED ALTERNATIVES
COST ESTIMATES

Description	Year 2001 Construction Cost
Northwest Region	$21,400,000
83rd Avenue Region	$ 9,900,000
Pinnacle Peak and 67th Avenue Region	$ 4,300,000
Rock Springs Creek Region	$ 0 (Do Nothing)

The costs are further broken down into phasing based on their priority in the next section.

1.3 Implementation Plan

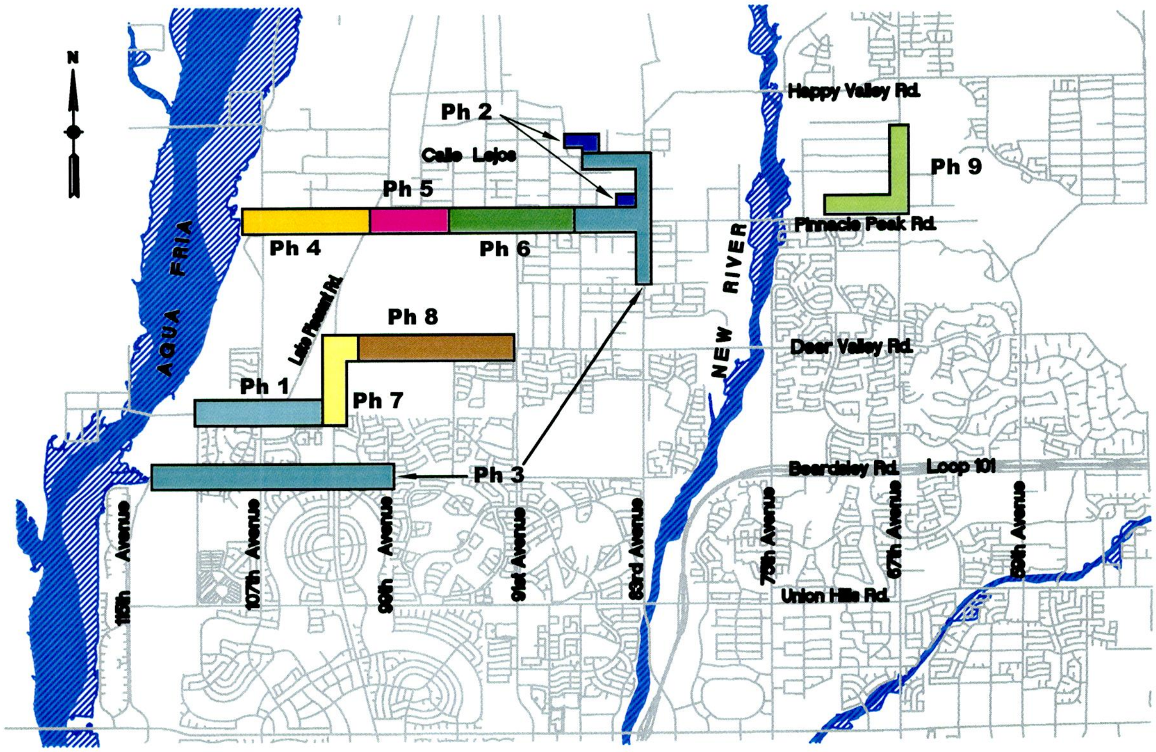
The recommended alternatives need to be phased based on their priority and costs so that they can be placed into the Capital Improvement Programs for both the City of Peoria and the District. A recommended phasing plan with the associated costs, based upon results of the ADMP Update and discussions with the City of Peoria and the District staff, is shown on **Figure RA-3**.

1.3.1 Feature Prioritization

The regions were prioritized so that the funding could be made available for the improvements on a Capital Improvements Projects (C.I.P.) basis.

The 83rd Avenue Region was originally the highest priority because the region is already mostly developed and the land available for the detention basin is limited. The purchase of the land for the detention basin is a key component of the recommended alternative. However, based on input from the public, the channel along Rose Garden Lane is the highest priority due to recent flooding. The Rose Garden channel is a component of the Northwest Region, which is the second priority. The Rose Garden Channel will be the first priority followed by the 83rd Avenue Region. After the 83rd Avenue Region is constructed, the next phase of the Northwest Region will be constructed. The Northwest region is developing quickly, and many of the recommended alternatives will either be constructed or accounted for in the new developments in the area. The last region with the lowest priority is the 67th Avenue and Pinnacle Peak Road region. This region only affects a small percentage of residents, and the improvements are not as high a priority as the other two regions mentioned above. The Rock Springs region was not prioritized because the recommended alternative is complete.

Overall Cost and Recommended Phasing



Planned Cost and Recommended Phasing w/ Partner Participation

Description	Total Cost	Peoria	FCDMC	Other
Phase 1	$3.7 M	$1.5 M	$1.5 M	$0.7 M
Phase 2	$4.8 M	$2.4 M	$2.4 M	$0.0 M
Phase 3	$6.1 M	$2.8 M	$2.7 M	$0.6 M
Phase 4	$3.3 M	$1.1 M	$1.1 M	$1.1 M
Phase 5	$3.2 M	$1.2 M	$1.2 M	$0.8 M
Phase 6	$3.4 M	$1.4 M	$1.4 M	$0.6 M
Phase 7	$2.2 M	$0.5 M	$0.5 M	$1.2 M
Phase 8	$4.5 M	$1.1 M	$1.1 M	$2.3 M
Phase 9	$4.3 M	$0.8 M	$2.1 M	$1.4 M
TOTAL	**$35.5 M**	**$12.8 M**	**$14.0 M**	**$8.7 M**

Note: All amounts are based on year 2001 costs

FIGURE RA-3 IMPLEMENTATION PLAN

Glendale Peoria
Area Drainage Master Plan

GLENDALE · City of Peoria · Flood Control District of Maricopa County · Entellus · PENTACORE ARIZONA · LTM Engineering, Inc. · LOGAN SIMPSON DESIGN INC.

1.3.2 Local Adoption Process

All three regions brought to the Level III analysis are located within the City of Peoria. The 67th Avenue Region also lies within the Cities of Phoenix and Glendale. It was essential to have the Peoria City Council adopt this Glendale/Peoria ADMP Update area. Based upon a presentation of the recommended plan and phasing to the City Council, the Peoria Council adopted this ADMP on July 10, 2001 and has authorized the purchase of some of the right-of-way.

1.3.3 Recommended Partners

It is recommended that the City of Peoria team with the District, MCDOT, and future developments on all the improvements. A prioritization request for the 83rd Avenue Region has been submitted by the City of Peoria to the District. The prioritization request is the first step in having the District sponsor an Inter-Governmental Agreement (I.G.A.) with the City of Peoria.

The 67th Avenue and Pinnacle Peak Road region affects three different municipalities. These municipalities are the City of Phoenix, the City of Glendale, and the City of Peoria. It is recommended that these three municipalities partner on the recommended improvements with the District.

1.3.4 Recommended Funding Sources

The recommended funding source from both the City of Peoria and the District lies in the adoption of the suggested phasing for each recommended alternative within each agency's C.I.P.

1.4 Conclusions

There are three regions that require drainage and flood protection improvements in order to mitigate current and future drainage problems within the Glendale/Peoria ADMP Update's project area. These improvements are designed to aid any existing and/or future development in the study area. If these improvements are not implemented, the drainage problems will only increase in the future.

These improvements can be implemented through cooperation between the Peoria City Council and the Board of Supervisors Maricopa County through the creation of an I.G.A. Both Agencies will need to rank each proposed phase of improvements in their respective prioritization process for C.I.P. improvements. A third critical partner is existing and future developments in the study area. By placing retention and open space areas in strategic locations that would support the development of improvements called for in this study, a tremendous cost savings will be achieved based solely upon planning and cooperation.

Implementation of this ADMP will result in facilities that will provide protection of property and lives from a 100-year storm for the entire study area. The facilities proposed have been developed using a logical process with input from the public. This plan, when implemented, will provide all the stakeholders with sustainable flood protection infrastructure, which is of the highest value and effectiveness for its users.

1.5 Agency Information

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January 29, 2001

VOLUME DESIGNATION

VOLUME ID	Volume Name	Number
DC	Data Collection	1
HY	Hydrology	2
PA	Potential Alternatives	3
AA	Alternative Analysis (Level II)	4
RA	Recommended Alternatives (Level III)	5
ZA	Zone A Floodplain Delineation	6
DS	Detailed (Section 15)	7
AL	Arrowhead Lakes Hydrology	8
AR	Administrative Report (Correspondence)	9

Note: Volume ID will be used for Section, Plate, Figure, and Table identifiers.

Flood Control District of Maricopa County

GLENDALE

CITY OF PEORIA

Glendale Peoria
Area Drainage Master Plan Update

LEVEL III REPORT

VOLUME RA

Contract FCD 99-44

December 2001

Prepared by:

Intelligent Engineering

Environmental *Solutions*

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LTM Engineering, Inc.

Glendale/Peoria Area Drainage Master Plan Update

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SECTION RA-2: INTRODUCTION

2.1 Project Purpose and Goals

The purpose of this study was to update the Glendale-Peoria Area Drainage Master Plan that was completed in May 1987 (**Reference 1**), by quantifying the extent of flooding problems and developing alternative solutions. The major objectives of the study were to qualify the selected drainage problems and to develop a plan to control runoff to prevent flood damage. This was done by quantifying the extent of flooding problems, developing alternative solutions, selecting the most desirable alternative solutions, and preparing preliminary concept designs for the selected alternatives.

2.2 Scope of Work

The Scope of Work for the Glendale/Peoria Area Drainage Master Plan Update is included in Appendix B of the *Glendale/Peoria Area Drainage Master Plan - Data Collection – Volume DC.*

2.3 Previous Studies

Flooding within the study area was documented as early as 1963, when the U.S. Army Corps of Engineers (COE) documented, in detail, the storm and flood event of August 16, 1963 (**Reference 3**). The COE documented flooding in the northern areas of Glendale, portions of which fall within the study area.

The Flood Control District of Maricopa County (District) prepared reports on flooding in the early 1960s as well. These two reports were the *Flood Control Survey Report* (**Reference 4**) and the *Comprehensive Flood Control Program Report* (**Reference 5**). These reports identified flood hazards along Grand Avenue. The second report also documented plans for a number of flood control facilities, including the ACDC and New River Dam. Several of these regional flood control facilities, documented in that report, were built in the last thirty years.

The District sponsored two studies within the project area in 1987; the first study was the *Glendale/Peoria Area Drainage Master Plan* **(Reference 1).** This study documented flooding hazards and flood control alternatives for a large portion of the study area. The flood control alternatives evaluated in that study were mainly networks of storm drain systems. The second study was the *Bell Road Project Drainage Study* **(Reference 6),** which was a storm water/floodwater management plan for the expansion of Bell Road.

In the 1990's, the District has prepared three notable reports within the project area. The first was the *Hydrology for Beardsley Channel Extension* **(Reference 7).** This report was used for the extension of the Beardsley Road channel from 111th Avenue to the Agua Fria River. The second study was the *Sun City Area Hydrologic Study* **(Reference 8)**. This study was performed to estimate peak flows at concentration points within the Sun City Area. The third study was the *91st Avenue Drain Hydrology Update* **(Reference 9)**. This study was performed to analyze the effects of upstream urbanization on the 91st Avenue Channel in the City of Peoria.

The District also sponsored three major projects within the project area in the 1990's. The first project was the *Final Design Report Skunk Creek Channel Improvements* **(Reference 10)**. The findings were used to construct bank protection and a drop structure in Skunk Creek. The second project was the *Middle New River Watercourse Master Plan* **(Reference 11)**. This watercourse master plan updated the hydrology and floodplains for the New River from the New River Dam to the confluence with Skunk Creek. The third project was the *Floodplain and Floodway Delineation for Rock Springs Creek* **(Reference 2)**. This study delineated the floodplain and floodway of Rock Springs Creek.

2.4 Study Area

The overall study area for the Glendale/Peoria ADMP Update is approximately 80 square miles in size and includes portions of the cities of Peoria, Glendale, Sun City, Youngtown, Phoenix, and unincorporated Maricopa County. The study area is located between 51st Avenue and the Agua Fria River and between Dynamite Boulevard and Bethany Home Road in northern Maricopa County as shown in **Figure RA-1 (See Executive Summary).**

The study area consists of several regions in different stages of development. North of Pinnacle Peak Road, the area is mainly undeveloped and is characterized by steep hills draining into flat valleys. This area contains several washes that have not been significantly affected by development. However, several developments are either under construction or in the planning stage, and the entire area will most likely be completely developed within the next ten years.

Between Pinnacle Peak and Beardsley Roads, the area is more heavily developed and all natural drainage paths have been significantly altered. The drainage system in this part is mainly man-made and has been constructed by individual developers. Consequently, there are non-continuous channels and inconsistencies in the system.

Between Beardsley Road and Northern Avenue, the area is mostly fully developed and includes the Master Planned Communities of Sun City and Youngtown, as well as portions of Glendale and Peoria. For the most part, the drainage infrastructure in this region is already in place. However, the increasing development upstream may increase runoff to the area and overwhelm this system.

South of Northern Avenue, the region is mostly industrial or undeveloped. This district is located between the Agua Fria River and the New River. The entire area is a mile or less from a river outfall and flooding problems are rare.

2.5 Study Approach

The study encompasses a significant geographical area. Additionally, the drainage problem areas are spread throughout the study area. This resulted in numerous options or a combination of options that were possible to alleviate drainage problems. To select the most practical option in an opportune manner, a three-level analysis was performed as follows:

Level I: The alternatives formulation included an initial stage of research, which identified focus areas where historic drainage problems have been identified by the District or client agencies. The historic drainage problem focus areas were combined with data collected on existing facilities and environmental, social, and cultural resources in the study area. In addition, the alternatives formulation included the development of a hydrologic model, identification of screening parameters, and identification of initial "seed" alternative solutions for each focus area.

Level II: The alternative solutions selected in the Level I analysis were further evaluated in Level II. This detailed evaluation included hydraulic analysis, estimates of costs, and identification of conflicts with existing major utilities. The results of the Level II analysis were used to select alternatives to take to the Level III analysis.

Level III: The recommended alternative solutions from the Level II analysis are evaluated in more detail in the Level III analysis. The results from the Level III analysis are presented in this report.

2.6 Drainage Problem Areas

A detailed hydrologic analysis for the study area has been performed in the Hydrology Task of this ADMP, and is documented in the *Glendale/Peoria Area Drainage Master Plan – Hydrology –Volume HY.*

As shown in the *Glendale/Peoria Area Drainage Master Plan – Potential Alternatives - Volume PA*, eleven drainage problem areas or "focus areas" were identified. These focus areas are shown in **Figure RA-2 (See Executive Summary)** and are listed below:

1. North Side of the Arizona Canal Diversion Channel (ACDC).
2. 91st Avenue and Greenway Alignment Channel.
3. 91st Avenue to the Agua Fria River along Beardsley Road, and 115th Avenue to Bell Road.
4. 83rd Avenue to the New River north of Beardsley Road.
5. Rock Springs Creek.
6. Channel along north side of Grand Avenue.
7. Drainage along 99th Avenue and Bell Road to the Agua Fria River.
8. Lake Systems North of Beardsley Road (Ventana Lakes).
9. Pinnacle Peak Road and 67th Avenue.
10. Weir Wash.
11. Williams Road from 91st Avenue to 83rd Avenue.

The detailed description of these areas is located in Subsection 2.4 of the *Glendale/Peoria Area Drainage Master Plan - Data Collection – Volume DC.*

2.7 Report Objectives

The purpose of the Level III phase of the ADMP Update is to evaluate the regional solutions from the *Glendale/Peoria Area Drainage Master Plan - Alternative Analysis – Volume AA* and to prepare preliminarily designs and cost estimates for the recommended regional solutions. The ADMP Update team reviewed the alternatives in the Level II analysis to decide which alternatives to bring to the Level III preliminary design. The Level II evaluation depended on many factors, including: costs, engineering feasibility, future recreation facilities, and the flood safety needs for these facilities.

SECTION RA-3: EXISTING CONDITIONS

As part of the alternatives evaluation, a tremendous amount of data was collected in order to identify and characterize the existing drainage facilities in the project study area. These facilities, identified from previous drainage reports, studies, and field visits, were documented and entered into the project database, and used to develop an existing facilities exhibit. The existing facilities exhibits are included in the Glendale/Peoria Area Drainage Master Plan – *Data Collection – Volume DC.*

The Environmental Overview, the Ecological Assessment, and the Cultural Resource Survey were included as appendices to the *Glendale/Peoria Area Drainage Master Plan - Data Collection – Volume DC-A, DC-B, and DC-C* respectively.

SECTION RA-4: HYDROLOGY

A detailed hydrologic model was prepared by Entellus as part of this study, which was based on the Kaminski-Hubbard model prepared in 1995 as part of the ACDC ADMP **(Reference 12)**. Reference was also made to the hydrologic model prepared for the Sun City area by Flood Control District **(Reference 8)**. Both models were completely redone and updated to the Flood Control District's latest design and analysis criteria as part of this study. The detailed report for the hydrology task of this project was completed in October 2000.

A separate hydrologic model was prepared that includes the effects of the facilities and drainage improvements that are recommended in this report. This model includes the proposed C.I.P. into the existing state of development (existing conditions) 100-year, 6-hour storm hydrology model. The output and complete details of this model are included in **Appendix G.**

4.1 Study Area Hydrologic Boundaries

As part of the development of the new hydrologic model for the study area, a detailed review of as-built information, field data, mapping, and field investigation was made in order to determine new sub-regional watershed limits. It was important to determine these sub-regional watershed limits to establish the hydrologic connectivity of individual alternative solutions. By determining these watershed boundaries, the study team was able to ascertain if an upstream alternative solution may have a beneficial affect on drainage problems that were occurring downstream.

Figure RA-4 illustrates the final hydrologic boundaries that were used in the development of the hydrologic model for the Recommended Alternatives contained in this report.

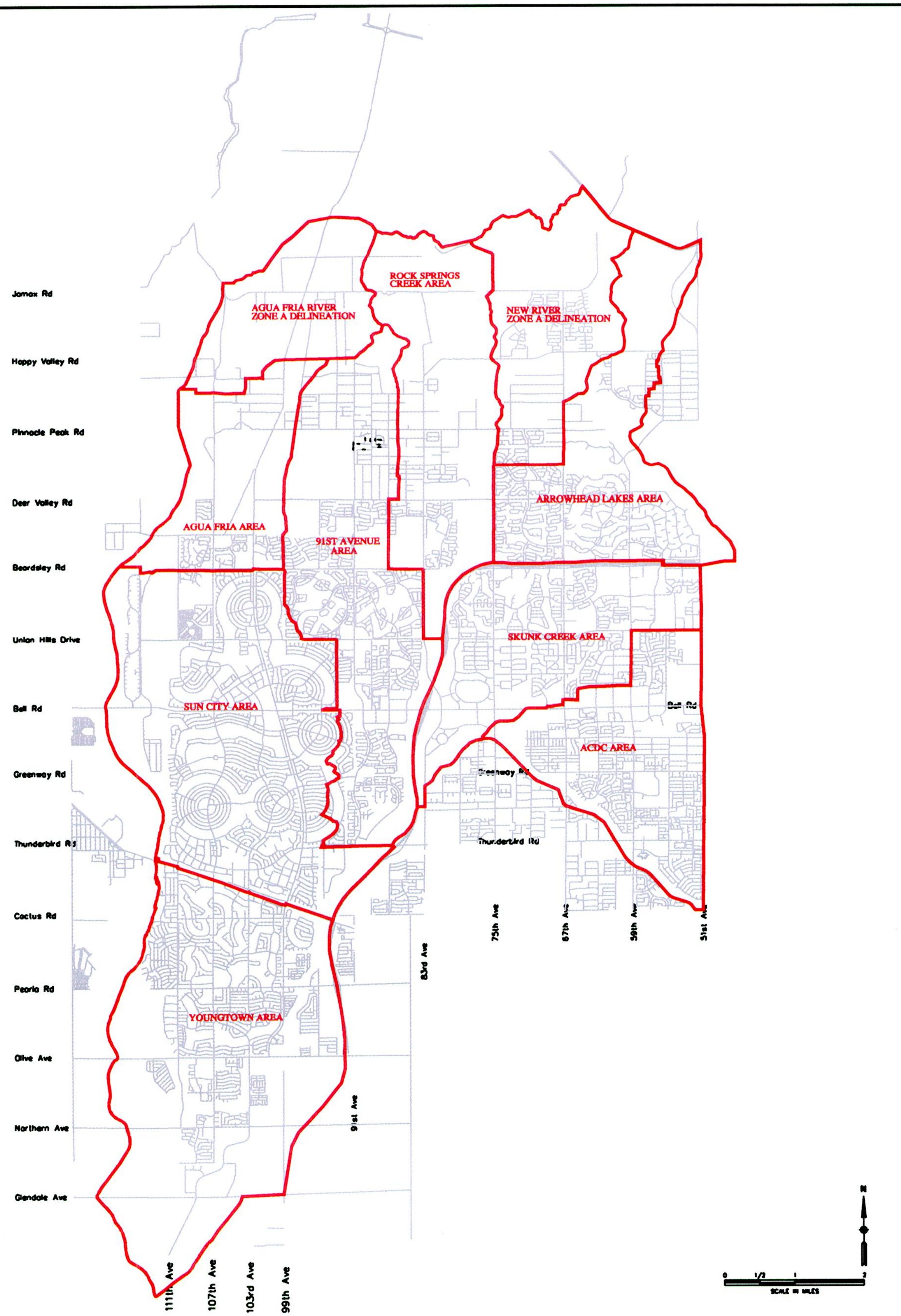

FIGURE RA-4 HYDROLOGIC BOUNDARIES

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4.2 Summary of Key Flows

A specific list of peak flows at key locations was developed to facilitate the evaluation of drainage problems in focus areas. **Table RA-8** shows a summary of key flows for the 100 year/6-hour storm event. **Table RA-9** shows the channel capacities based on Manning's normal depth calculations.

A summary of the Level III HEC-1 design flows is shown graphically on **Figure RA-10** in the Flow Summary Section of Appendix G.

TABLE RA-8

Channel Capacity Data for the 100-Year 6-Hour Storm

Conveyance Location	Routing ID	HEC-1 Peak Flow Existing Conditions (cfs)	HEC-1 Peak Flow Future Conditions (cfs)	HEC-1 Peak Flow Existing Conditions with C.I.P. (cfs)	Calculated Capacity (Channel Only) (cfs)	Capacity per Previous Drainage Reports (cfs)
Channel along 67th Avenue	CN25D	455	460	455	***50* *(1)**	
115th Avenue *(2)	CA08B	750	510	245	***510* *(1)**	
Channel along 115th Avenue	CA08B *(3)	750	510	245	***30* *(1)**	
Channel along Rose Garden Lane	CX10 *(3)	570	520	1460	670	620
Channel along 111th Avenue	RX11S	465	420	0	680	620
Channel in 99th Avenue	CS30B *(4)	595	585	755	***320* *(1)**	
99th Avenue *(2)	CS10S *(4)	695	690	885	***660* *(1)**	
Channel in Del Webb Blvd	CS30A	990	995	1085	***510* *(1)**	
Channel in 99th Avenue	CS10D *(5)	2910	2650	2740	***935* *(1)**	
Channel in 99th Avenue	CS10D	2360	2100	2190	***810* *(1)**	
Channel along Grand Avenue	CS10C	3330	3070	3285	***320* *(1)**	
Channel along Grand Avenue	CS10C	3330	3070	3285	***285* *(1)**	
Channel along Grand Avenue	CS10 *(4)	3380	3110	3335	***2340* *(1)**	
Greenway Channel	CN09*	1370	1185	1430	3730	
91st Avenue Channel	CN10	1270	1280	1380	1430	750
Channel along Beardsley Road	CA09C*	885	630	425	1075	
Channel along Beardsley Road	CA09C	885	635	435	980	
Channel along Beardsley Road	CA09A	900	650	530	***805* *(1)**	
Channel along 83rd Avenue	CN21F	770	830	210	***150* *(1)**	
Channel along 83rd Avenue	CN21E	825	890	365	***505* *(1)**	520
Channel along 83rd Avenue	CN21E *(3)	825	890	365	1145	970
Channel along 83rd Avenue	CN21C	1070	1150	860	***460* *(1)**	970

Notes: **(1)** Calculated peak flow exceeds channel capacity.

(2) Route capacity is the entire right-of-way for the street.

(3) The upstream concentration point was used to determine the flow in the reach because flow decreases downstream due to an increase in area, which creates a larger aerial reduction.

(4) This concentration point is not available from the HEC-1 model. Temporary modifications were made in order to obtain flow for this reach.

(5) The diverted hydrograph was added to the downstream concentration point to get the flow in this reach.

TABLE RA-9

Existing Channel Characteristics

Conveyance Location	Routing ID	Manning's Coefficient	Channel Bottom Width (ft)	Slope (ft/ft)	Side Slopes	Depth (ft)	Flow (ft/s) *(1)
Channel along 67th Avenue	CN25D	0.035	2	0.0050	3	2.0	50
115th Avenue	CA08B	0.020	2 *(2)	0.0030	10	2	510
Channel along 115th Avenue	CA08B	0.035	4	0.0010	3	2.0	30
Channel along Rose Garden Lane	CX10	0.020	7	0.0039	1	5.5	670
Channel along 111th Avenue	RX11S	0.020	7	0.0040	1	5.5	680
Channel in 99th Avenue	CS30B	0.020	10	0.0023	3	3.0	320
99th Avenue	CS10S	0.020	2 *(2)	0.0018	10	1.7	660
Channel in Del Webb Blvd	CS30A	0.020	16	0.0008	1	5.0	510
Channel in 99th Avenue	CS10D	0.020	18	0.0028	3	4.0	935
Channel in 99th Avenue	CS10D	0.020	18	0.0021	3	4.0	810
Channel along Grand Avenue	CS10C	0.020	10	0.0016	1	4.0	320
Channel along Grand Avenue	CS10C	0.020	10	0.0013	1	4.0	285
Channel along Grand Avenue	CS10	0.020	20	0.0045	1	6.5	2340
Greenway Channel	CN09*	0.020	25	0.0041	2	7.0	3730
91st Avenue Channel	CN10	0.020	14	0.0036	2	5.5	1430
Channel along Beardsley Road	CA09C*	0.020	11	0.0041	2	5	1075
Channel along Beardsley Road	CA09C	0.025	12	0.0083	3	4	980
Channel along Beardsley Road	CA09A	0.025	12	0.0056	3	4	805
Channel along 83rd Avenue	CN21F	0.035	2	0.0063	3	3	150
Channel along 83rd Avenue	CN21E	0.035	25	0.0039	4	3	505
Channel along 83rd Avenue	CN21E	0.035	30	0.0051	4	4	1145
Channel along 83rd Avenue	CN21C	0.035	20	0.0046	4	3	460

Notes: (1) Flow is calculated using Manning's Formula. ($Q = 1.49/n * S^{1/2} * R^{2/3} * A$)

(2) Route capacity uses the entire right-of-way for the street.

SECTION RA-5: EVALUATION CRITERIA

As part of the Level II Alternatives Evaluation meeting, the original evaluation criteria used in the *Glendale/Peoria Area Drainage Master Plan – Potential Alternatives – Volume PA* was reviewed as well as the summary of the public comments and the Level II cost estimates. The areas were then evaluated individually and alternatives were selected for examination in this Level III Report. The discussion and decisions are presented in the next section. The criteria taken from the potential alternative analysis is listed below:

<u>Traditional Criteria</u>

1. Implementation Cost – Construction Cost, Right-of-Way Cost
2. O & M cost – Initial and long term efforts and maintenance costs willing to be accepted by an organization capable of providing the maintenance needed
3. Safety – Safety in design elements. Need for Flood warning system
4. Impact on traffic during and after construction
5. Politically consistent with ordinances and promises
6. Sound Design – Design is based on tested and economical engineering practices

<u>Sustainability Criteria</u>

6. Aesthetics – Will the improvements blend in and even enhance the visual character of the area?
7. Environmental considerations – Visual, biological, cultural, ecological
8. Multi-Use opportunity – Is this going to be a useable amenity?
9. Public Acceptance – Does the neighborhood want this solution?

The cost estimates used in this analysis are located in **APPENDIX B**, and the public comments are summarized in **APPENDIX E.**

SECTION RA-6: DESCRIPTION AND REFINEMENT OF ALTERNATIVES

As discussed in the *Glendale/Peoria Area Drainage Master Plan – Potential Alternatives Report – Volume PA*, the potential alternatives were grouped into four geographical regions. These geographical regions are the Northwest Region, the 83rd Avenue Region, the Rock Springs Region, and the Pinnacle Peak Road and 67th Avenue Region. **Figure RA-5** shows the regional areas in relation to the focus areas described in that report. Focus areas that are not located within a regional area were analyzed individually.

6.1 Northwest Region

The Northwest Region includes Focus Areas 3, 8, and 11 shown in **Figure RA-5**. These focus areas are located in the northwest portion of the watershed. Focus Area 3 is the Beardsley Road channel from 91st Avenue to the Agua Fria River, and 115th Avenue from Beardsley Road to Bell Road. Focus Area 8 is the lake systems north of Beardsley Road located in the Ventana Lakes development. Focus Area 11 is Williams Drive from 91st Avenue to 83rd Avenue.

The problem in Focus Area 11 is that water ponds upstream of an old irrigation ditch along the Williams Drive alignment. During large storm events, water ponds until it is high enough to overflow the low spot and flow down 87th and 89th Avenues. The goal of the selected alternative is to eliminate ponding in the 87th Avenue and Williams Drive area. Storm runoff flows from north to south in this area. The flow line of the New River is approximately three to four feet lower than the ground at Deer Valley Road and 87th Avenue. However, the invert of the Agua Fria River is 80 feet lower at the same location. Therefore, an outlet to the Agua Fria is more feasible because it is much easier to construct.

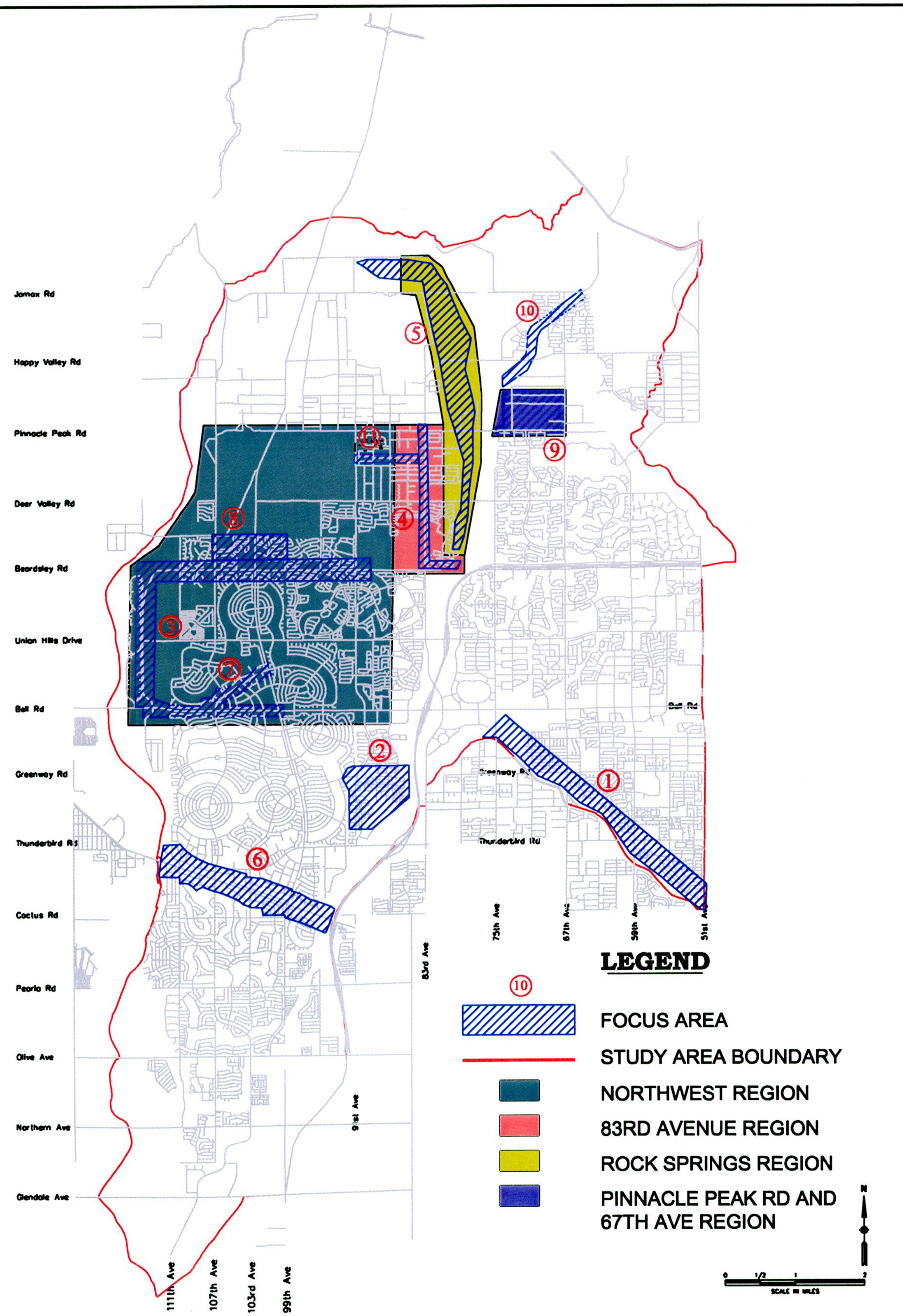

FIGURE RA-5 REGIONAL AREAS

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The problem in Focus Area 3 is that the Beardsley Road channel does not have enough capacity and needs maintenance and repair in order to carry the contributing flows to or near the Agua Fria River. The entrance into a golf course at 115th Avenue constricts the flow, and the excess flow overtops the banks of the channel and flows south down 115th Avenue. The treatment facilities west of 111th Avenue need to be protected from channel overflows. The channel at Rose Garden Lane makes a ninety-degree turn south onto 111th Avenue, and flow overtops the channel during significant rainfall events. The goal of the selected alternative is to carry the flows to the Agua Fria River with no overflow or ponding and to reduce maintenance costs.

The problem in Focus Area 8 is that runoff from inside Ventana Lakes development flows through the Ventana lakes' system into the Beardsley Road Channel. It is unclear how the lakes perform and what kind of storage can be expected given the existing operation procedures. The water quality in the lakes may be undesirable to combine with storm water runoff in the Beardsley Road channel and the Agua Fria River. The lakes on the south side of Beardsley Road have no true outlet, and their performance needs to be evaluated during 100-year storm events.

Table RA-10 shows the elements of potential alternative solutions brought to the Level II analysis located within the Northwest Region. Element D of Focus Area 11 was eliminated in the Level II analysis. The reason the alternative was eliminated was that the land at this location is already developed, so any basin would have to be retrofitted. The cost would greatly outweigh the benefits at this location.

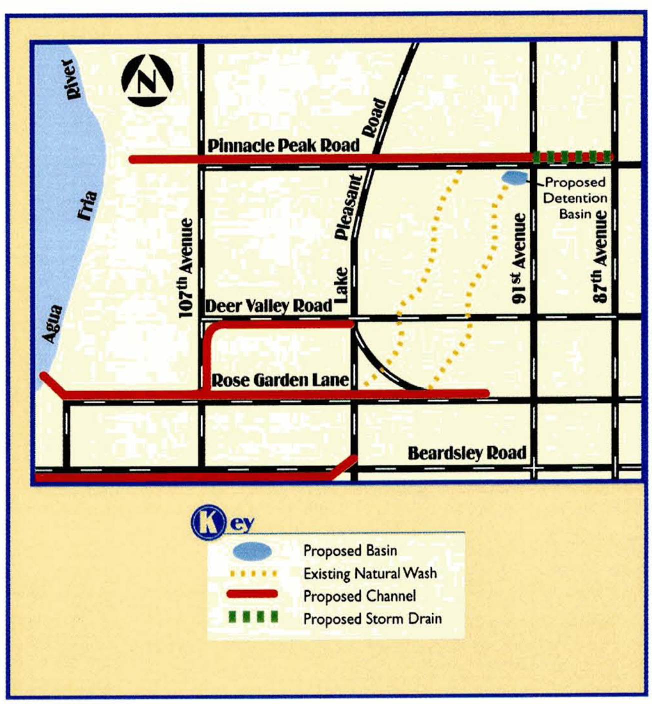
TABLE RA-10

Northwest Region – Elements of Level II Alternatives

Focus Area	Elements	Element Description
11	B	Relief channel or conduit along Pinnacle Peak Rd. to the Agua Fria River.
	E, F, & G	Detention basin near 91st Avenue and Pinnacle Peak Rd. and an ordinance requiring development to maintain sheet flow.
	D	A regional detention basin near 83rd Avenue and Williams Dr.
3	A	Channel along Deer Valley Road from Lake Pleasant Rd. to the Agua Fria River.
	B & C	Improve the Beardsley channel to carry existing flows and improve the outlet of the Beardsley channel into the golf course at 115th Ave.
	E	Channel along Rose Garden alignment from Lake Pleasant Rd. to the Agua Fria River.

6.2 Northwest Region Alternatives

6.2.1 Northwest Regional Alternative One



The first regional alternative for the Northwest Region is a combination of many of the elements in **Table RA-10** as shown in the previous picture. This regional plan consists of many components. The first component is a Pinnacle Peak Road storm drain and channel from 87th Avenue to the Agua Fria River, which is Element B for Focus Area 11. This element follows the City of Peoria's Trail Master Plan **(Reference 13)**, which calls for an equestrian trail along Pinnacle Peak Road from the New River to the Agua Fria River. The proposed channel can be incorporated into an equestrian trail. The second element is a Deer Valley Road channel from Lake Pleasant Road to 107th Avenue and then south to Rose Garden Lane, which is a slightly modified version of Element A in Focus Area 3. The modification to Element A is that the channel would turn south along 107th Avenue to Rose Garden Lane. This regional alternative will also incorporate a Rose Garden Lane channel from the existing natural wash near the 95th Avenue alignment to the Agua Fria River; this is Element E of Focus Area 3. The next component of this regional alternative is to improve the Beardsley Road channel, including the outlet into the golf course. The final piece of the regional alternative is the preservation of the existing natural washes between Deer Valley Road and Pinnacle Peak Road. This preservation will be accomplished by performing a Zone A delineation on two washes.

6.2.2 Northwest Regional Alternative Two

The second regional alternative for the Northwest Region is the same as alternative one with the addition of a regional detention basin located near Pinnacle Peak Road and 91st Avenue (see previous picture). The intent would be to decrease the downstream flow, which would result in smaller downstream channels.

6.2.3 Northwest Regional Alternative Three

The third regional alternative for the Northwest Region is a different combination of the routes mentioned in **Table RA-10** and is shown on the following picture. The first component of this regional alternative

is the same channel and storm drain along Pinnacle Peak Road used in the first two regional alternatives. The improvements to the Beardsley Road channel and outlet are also included in this regional alternative. The channel along Deer Valley Road extends east and connects to the natural washes west of 91st Avenue. It follows the same alignment as in the first two regional alternatives, turning south along 107th Avenue and joining the Rose Garden Channel into the Agua Fria River. Under this alternative, the Rose Garden Channel begins at the intersection of 107th Avenue and Deer Valley Road and drains into the Agua Fria River.

6.2.4 Northwest Regional Alternative Four

The fourth alternative for the Northwest Region is exactly the same as the third alternative with the addition of the regional detention basin located in the vicinity of Pinnacle Peak Road and 91st Avenue (see previous picture).

6.2.5 Northwest Regional Alternative Five

The fifth alternative for the Northwest Region is to do nothing. This is not a feasible option because the flooding that occurs in the existing conditions is not corrected and will be compounded with further development.

6.2.6 Additional Northwest Region Alternatives

The public feedback towards the initial Recommended Alternative presented in May 2001 was negative because of the need to purchase residences along the north side of Pinnacle Peak Road and on the west side of 83rd Avenue. The ADMP team re-evaluated this area along with portions of the 83rd Avenue region to find a solution to the drainage problems that would not displace any residents. The costs of all the new alternatives were higher because they included storm drains/box culverts instead of open channels to convey the runoff.

There were four new solutions that were developed to solve the drainage problems without removing any residences. These four solutions incorporated portions of the Northwest Region as well as the 83rd Avenue Region. They are shown on **Figures RA-6** to **RA-9**. These four solutions were presented to the public and their feedback was received in the form of ranking the alternatives. The results of the ranking of alternatives are contained in Appendix E and show that the

Alternative No.4

83rd AVENUE & PINNACLE PEAK ROAD REGION

(Design and construction estimated for 2002 through 2003)

Regional detention basins near Pinnacle Peak Road and 83rd Avenue (south) and Calle Lejos and 87th Avenue (north).

Storm drain with 85th and 87th Avenue laterals, from 87th Avenue along Pinnacle Peak Road, to south basin.

Open channel collector along the Hatfield Road and 89th Avenue alignment to north basin.

Storm drain outlet from north basin along Calle Lejos to open channel at 83rd Avenue.

Open channel collector and storm drain system along 83rd Avenue to south basin.

Storm drain outlet from basin down 83rd Avenue to open channel south of Williams Road.

NORTHWEST REGION

(Design and construction estimated for 2010)

Storm Drain collector from 87th Avenue to 91st Avenue along Pinnacle Peak Road.

Open Channel Collector from 91st Avenue along Pinnicle Peak Road to 93rd Avenue.

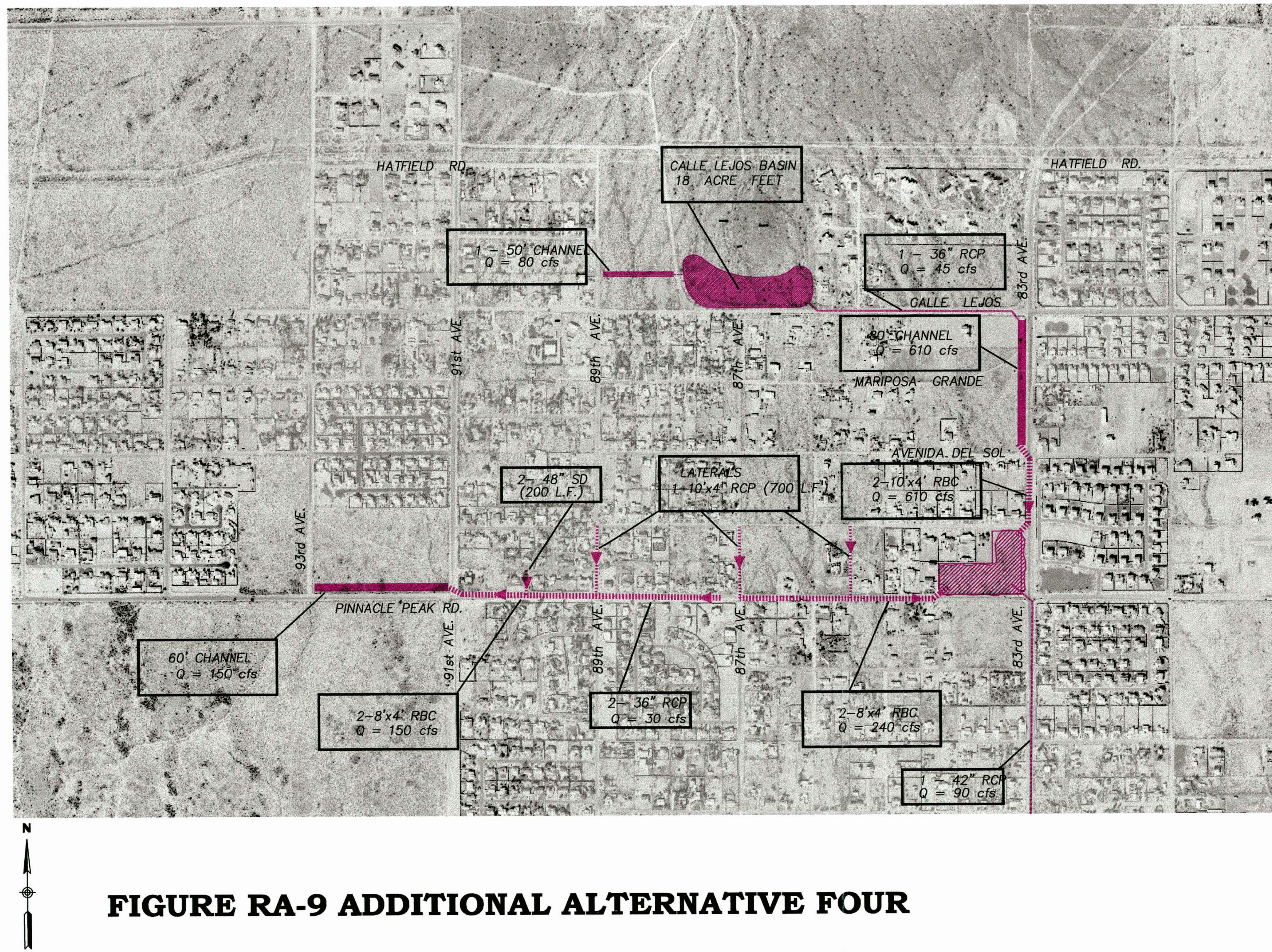


FIGURE RA-9 ADDITIONAL ALTERNATIVE FOUR

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Alternative No.2

83rd AVENUE & PINNACLE PEAK ROAD REGION

(Design and construction estimated for 2002 through 2003)

Regional detention basin near Pinnacle Peak Road and 83rd Avenue.

Storm drain with 85th Avenue lateral, from 87th Avenue along Pinnacle Peak Road to basin.

Open channel collector and storm drain system along 83rd Avenue to basin.

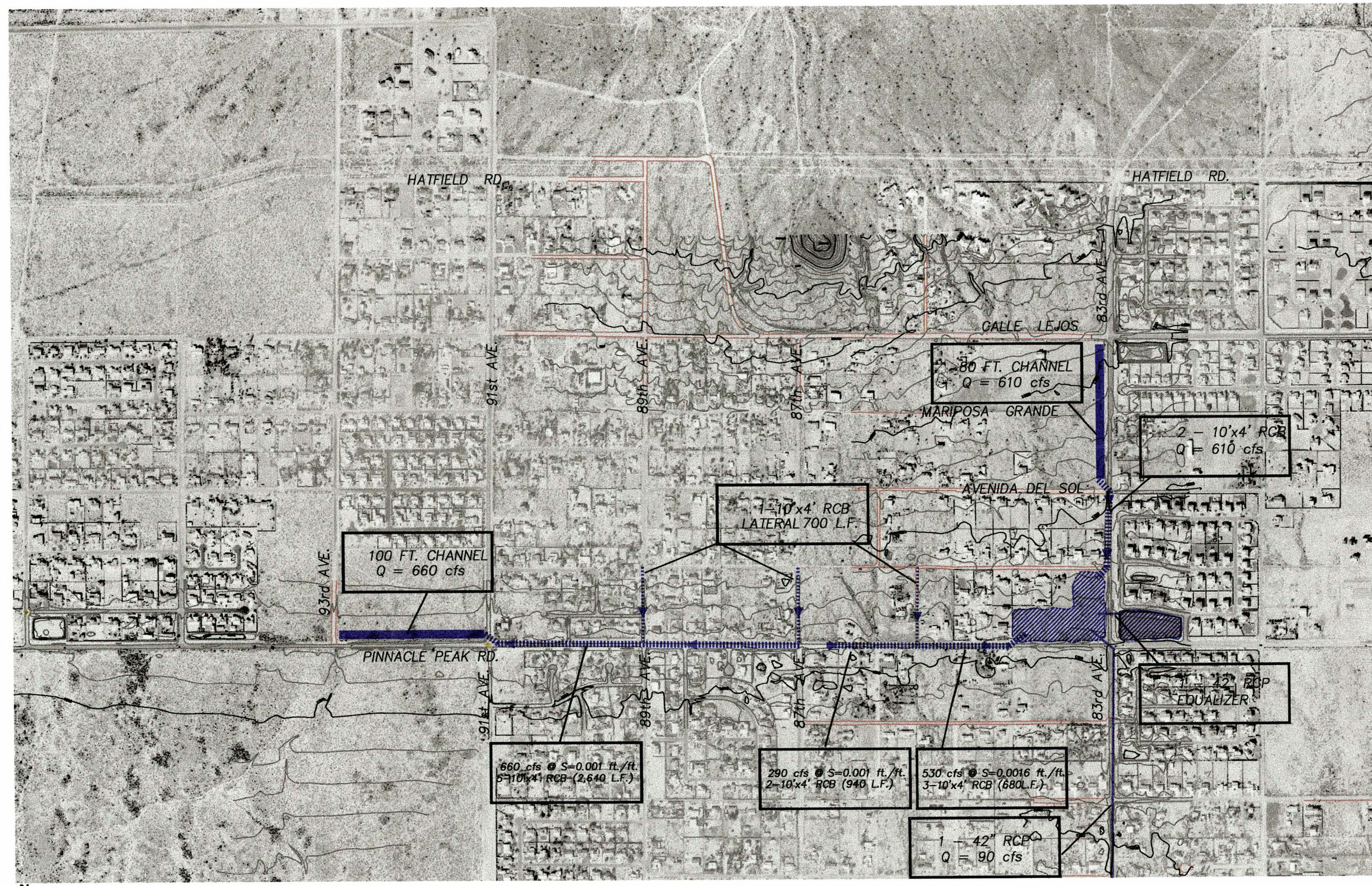
Storm drain outlet from basin down 83rd Avenue to open channel south of Williams Road.

NORTHWEST REGION

(Design and construction estimated for 2010)

Storm drain with 87th Avenue and 89th Avenue laterals, from 87th Avenue to 91st Avenue along Pinnacle Peak Road to open channel.

Open channel collector from 91st Avenue to 93rd Avenue along Pinnacle Peak Road.



N

0 1/4 1/2

SCALE IN MILES

FIGURE RA-7 ADDITIONAL ALTERNATIVE TWO

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Alternative No.3

83rd AVENUE & PINNACLE PEAK ROAD REGION

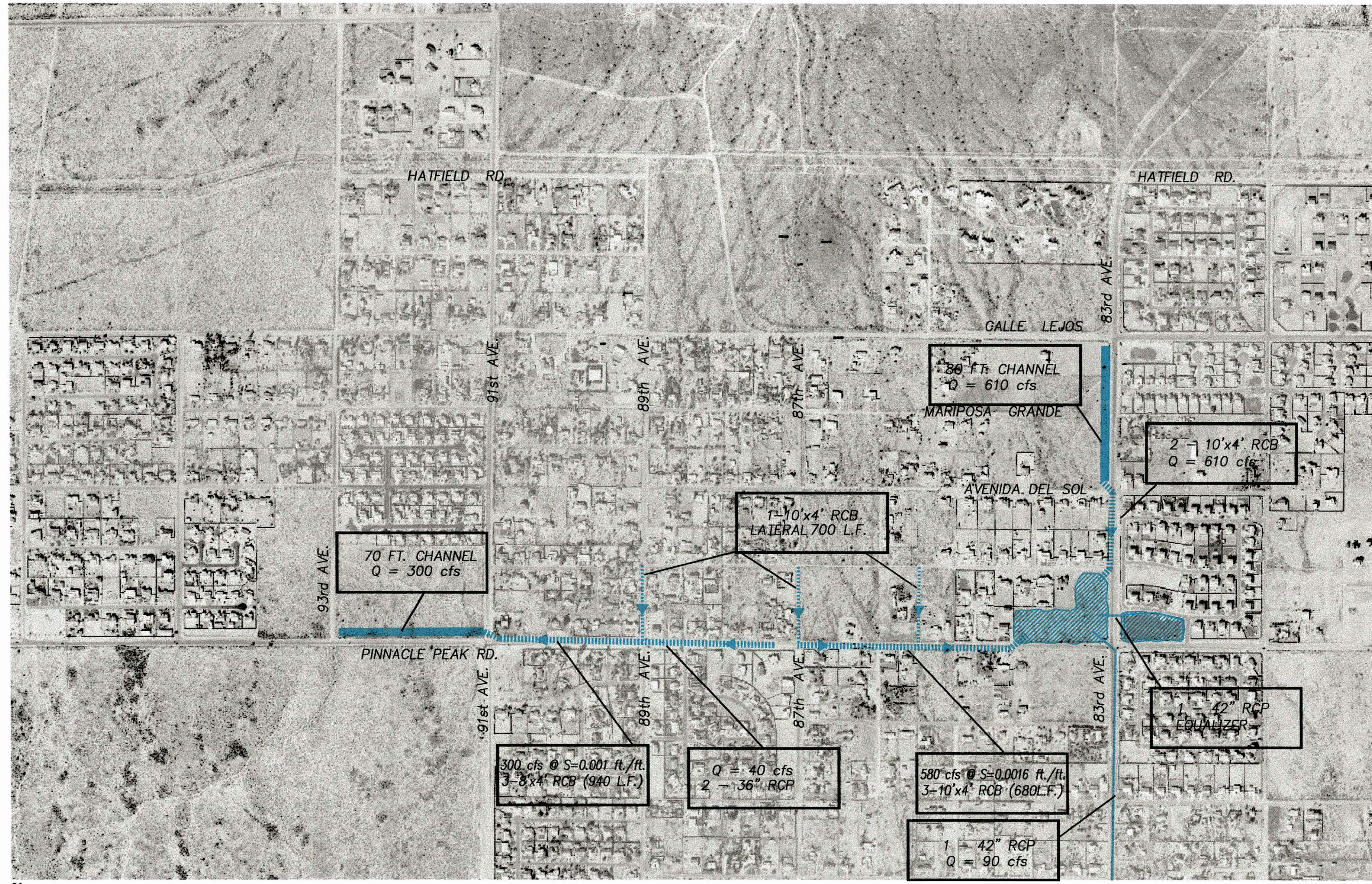
(Design and construction estimated for 2002 through 2003)

- Regional detention basin near Pinnacle Peak Road and 83rd Avenue.
- Storm drain with 85th & 87th Avenue laterals from 87th Avenue along Pinnacle Peak Road to basin.
- Open channel collector and storm drain system along 83rd Avenue to basin.
- Storm drain outlet from basin down 83rd Avenue to open channel south of Williams Road.

NORTHWEST REGION

(Design and construction estimated for 2010)

- Storm drain with 89th Avenue lateral from 89th Avenue along Pinnacle Peak Road to open channel.
- Open channel collector from 91st Avenue to 93rd Avenue along Pinnacle Peak Road.



N

0 1/4 1/2
SCALE IN MILES

FIGURE RA-8 ADDITIONAL ALTERNATIVE THREE

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Alternative No.1

83rd AVENUE & PINNACLE PEAK ROAD REGION

(Design and construction estimated for 2002 through 2003)

Regional detention basin near Pinnacle Peak Road and 83rd Avenue.

Open channel collector from 87th Avenue along Pinnacle Peak Road to basin.

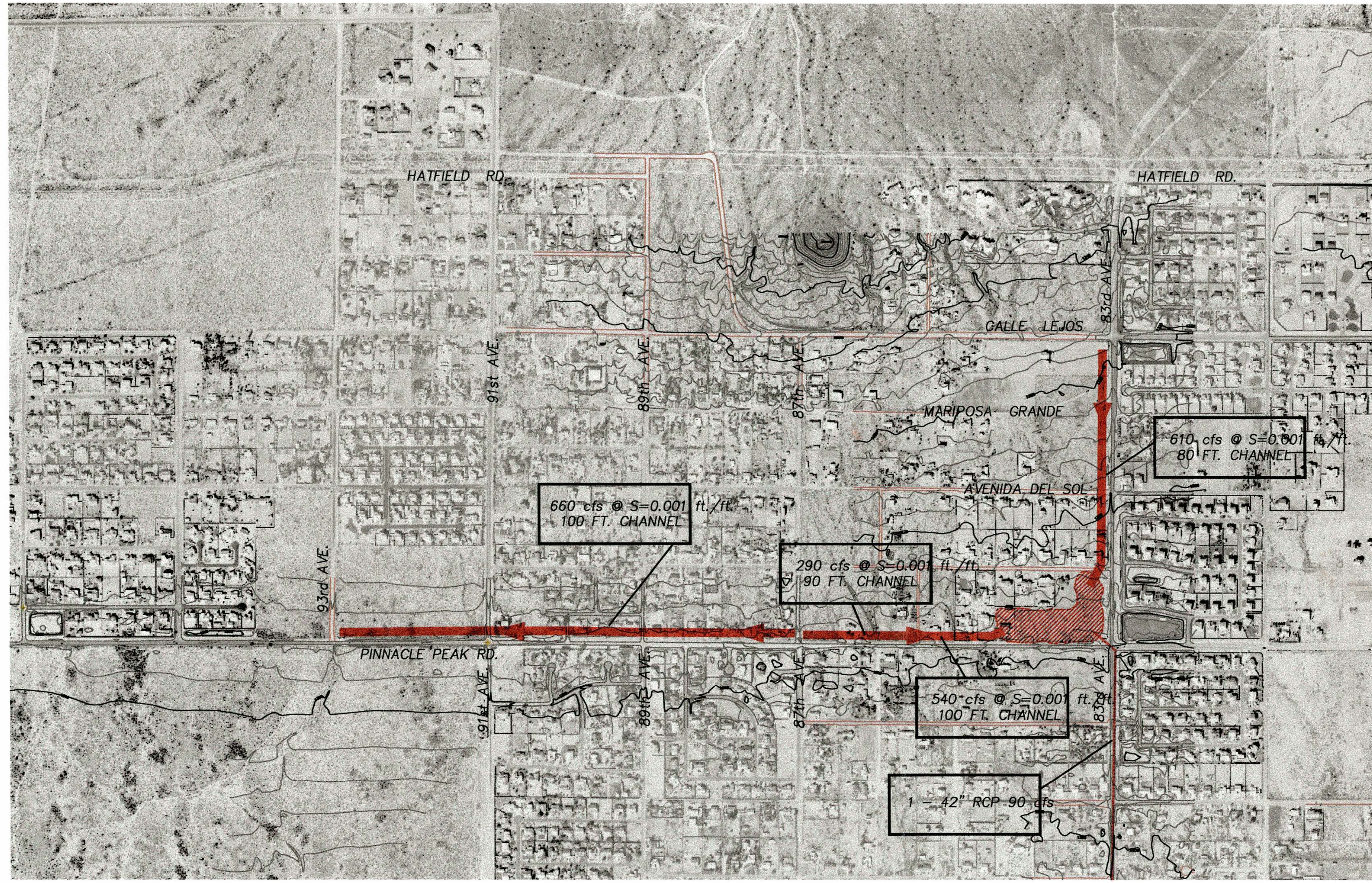
Open channel collector from Calle Lejos along 83rd Avenue to basin.

Storm drain outlet from basin down 83rd Avenue to open channel south of Williams Road.

NORTHWEST REGION

(Design and construction estimated for 2010)

Open channel collector from 87th Avenue along Pinnacle Peak Road to 93rd Avenue.



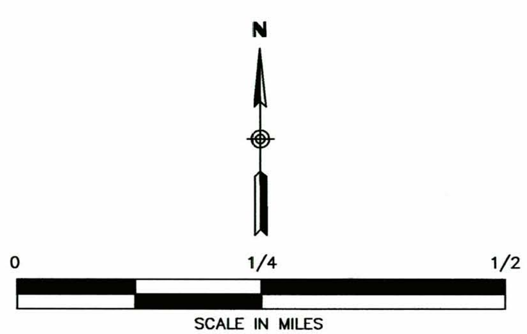


FIGURE RA-6 ALTERNATIVE ONE

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highest preferred alternative was Alternative Four. As a result, the recommended solution for this study incorporates the components shown in Alternative Four including a retention basin, channel, and storm drain on Calle Lejos.

6.3 Rock Springs Region

The Rock Springs Region is Focus Area 5 in **Figure RA-5**. The problem in the Rock Springs Region is that water runs down Rock Springs Creek and floods homes that are near or encroaching into the floodplain along the creek. Rock Springs Creek has been impinged and ends at a sand and gravel operation north of its original outfall into New River. One consideration of the alternatives is that the homes were built in the creek floodplain limits. Another consideration is that the water surface elevation at New River would have to be checked against the water surface elevation of any outfall channel. Stantec Consulting recently completed the *Floodplain and Floodway Delineation for Rock Springs Creek* **(Reference 2).** The goal of the selected alternative is to prevent flooding and damage to existing structures from Rock Springs Creek, and to provide a suitable outlet into the New River.

Table RA-11 shows elements of the potential alternative solutions brought to the Level II analysis located within the Rock Springs Region.

TABLE RA-11

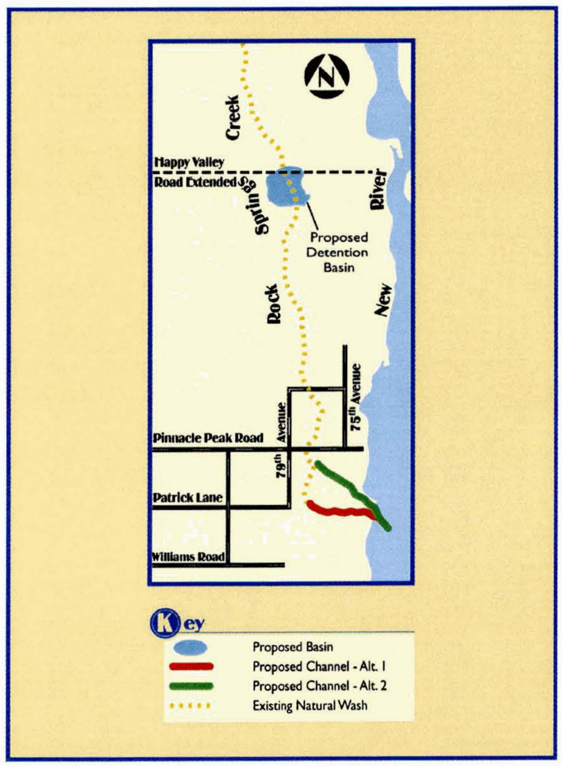
Rock Springs Region – Elements of Level II Alternatives

Focus Area	Element	Element Description
5	A & C	Channel along Pinnacle Peak Rd. or Patrick Lane east to the New River. Improve Rock Springs Creek in combination with mutli-use opportunities.
	D	Detention basin located near Happy Valley Road.
	E	Enforce the Floodplain and Floodway delineation of Rock Springs Creek.

Appendix D contains the flier that was distributed in the Level II public meetings which shows the five regional alternatives that were analyzed in the Rock Springs Region.

6.4 Rock Springs Region Alternatives

6.4.1 Rock Springs Regional Alternative One



The first alternative for the Rock Springs Region is a relief channel into the New River along Patrick Lane as shown in the previous picture. This alternative is a subset of Element A in Focus Area 5. The Patrick Lane alignment is just north of the sand and gravel operation.

6.4.2 Rock Springs Regional Alternative Two

The second alternative expands on the first alternative with the addition of a detention basin at the Happy Valley Road alignment (see picture). The detention basin is Element D for Focus Area 5.

6.4.3 Rock Springs Regional Alternative Three

The third regional alternative for the Rock Springs Region is a relief channel into the New River at Pinnacle Peak Road. This regional alternative is the second option of Element A in Focus Area 5. The relief channel would make a smooth transition from Rock Springs Creek to avoid a sharp bend (see picture).

6.4.4 Rock Springs Regional Alternative Four

The difference between the third and fourth alternative is the addition of a detention basin located at Happy Valley Road (see picture). This basin could have recreational possibilities.

6.4.5 Rock Springs Regional Alternative Five

The fifth alternative is the do-nothing option. This alternative has been modified into enforcing the floodplain/floodway delineations performed by Stantec Consulting.

6.5 83rd Avenue Region

The 83rd Avenue region is Focus Area 4 in **Figure RA-5**. The dilemma in this region is that development has routed flow along 83rd Avenue and created a default regional drainage corridor. The channel along 83rd Avenue was constructed in pieces and is discontinuous. The design requirements stipulate that the existing channel in conjunction with the roadway carries the 100-year flow. The solution to this focus area is to carry flow to the New River and to maintain accessibility to 83rd Avenue. A detailed hydraulic analysis was performed on the

83rd Avenue channel. This analysis showed that the channel is currently undersized.

Table RA-12 shows the elements of potential alternative solutions brought to the Level II analysis located within the 83rd Avenue Region.

TABLE RA-12

83rd Avenue Region – Elements of Level II Alternatives

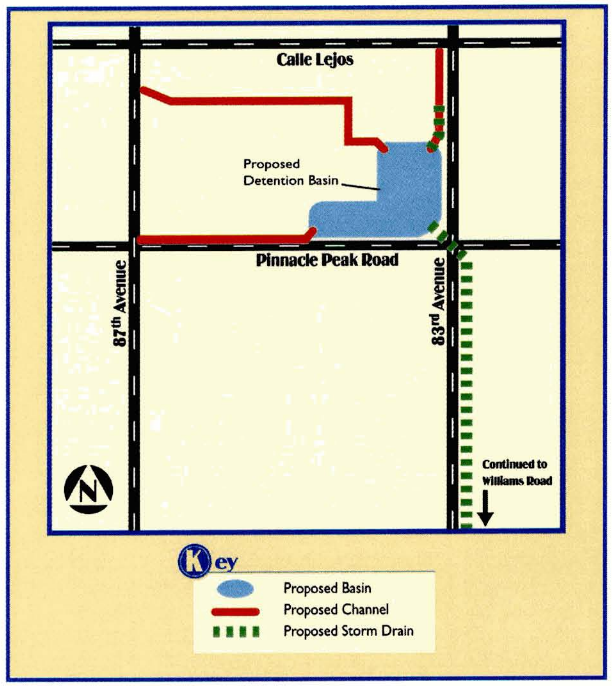
Focus Area	Element	Element Description
4	A	Increase the size of the channel to convey the existing flow and construct a channel where does not exist currently.
4	B	Detention basin located one mile north of Pinnacle Peak Rd. or at Deer Valley Rd.
4	C	Straighten the bends within the existing channel.

Element C was eliminated in the Level II analysis because the channel was still undersized for the 100-year flow even if the bends were removed.

6.6 83rd Avenue Region Alternatives

6.6.1 83rd Avenue Regional Alternative One

The first alternative of the 83rd Avenue region is a modified version of Elements A and B. There are right-of-way conflicts in this region that limited the alternative plan. The detention basin's location was changed to Pinnacle Peak Road and 83rd Avenue (see following picture). This regional basin decreases the downstream flow and the 83rd Avenue channel becomes adequate. Two channels from the west route flow into the basin. The first channel is along the Pinnacle Peak Road alignment and begins at 87th Avenue. The second channel also begins at 87th Avenue, just south of Calle Lejos, and flows southeast



into the basin. A third contributing channel begins at Calle Lejos and follows the 83rd Avenue alignment into the regional basin. A storm drain outlet that drains the basin flows southerly along 83rd Avenue and empties into the existing 83rd Avenue channel just south of Williams Drive.

6.6.2 83rd Avenue Regional Alternative Two

The second alternative for the 83rd Avenue Region is essentially the same concept as the first alternative, except that the channel, which drains into the basin along 83rd Avenue, is replaced by a combination of channel and storm drain (see picture). The storm drain was proposed due to a conflict with existing right-of-way just north of the basin.

6.6.3 83rd Avenue Regional Alternative Three

The third alternative for the 83rd Avenue Region is to do nothing. This alternative is not desirable because the existing drainage problems would not be solved.

6.6.4 Additional 83rd Avenue Region Alternatives

The public feedback towards these alternatives was negative because of the removal of existing residences. Therefore, portions of this area were combined with the Northwest Region and re-evaluated to find a solution that would solve the drainage problems without removing any existing residences. These new additional alternatives are discussed in Subsection 6.2.6.

6.7 Pinnacle Peak Road and 67th Avenue Region

The Pinnacle Peak Road and 67th Avenue region is Focus Area 9 in **Figure RA-5**. The problem in this region is that significant offsite flows enter into the existing subdivision south of Pinnacle Peak Road at various locations. Ponding depths of one foot or more are expected for large storms. Any mitigation for this problem area should be done north of Pinnacle Peak Road because the area to the south is much more developed. The goal of the selected alternative is to minimize the amount of offsite flows entering the subdivision.

Table RA-13 shows the elements of potential alternative solutions brought to the Level II analysis that are located within the Pinnacle Peak Road and 67th Avenue Region.

TABLE RA-13

Pinnacle Peak Road and 67th Avenue Region

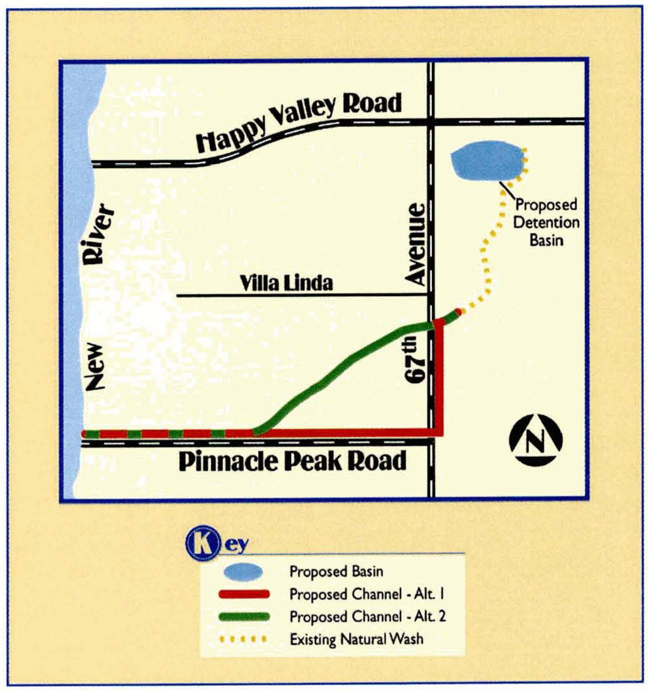
Elements of Level II Alternatives

Focus Area	Element	Element Description
9	A	Channel or storm drain along Pinnacle Peak Rd. to New River.
	B	Offline detention basin in combination with a smaller channel along Pinnacle Peak Rd. to the New River.
	C	Natural channel through property northwest of Pinnacle Peak Rd. and 67th Ave. in a southwesterly alignment.

6.8 Pinnacle Peak Road and 67th Avenue Alternatives

6.8.1 Pinnacle Peak Road and 67th Avenue Alternative One

The first alternative for this region is a channel along 67th Avenue that transitions into a channel along the north side of Pinnacle Peak Road that drains into the New River (see picture). The transition is done



through a small interceptor basin located at the northeast corner of 67th Avenue and Parkside Lane. An additional benefit of this basin is that it captures local storm water runoff flowing west on Parkside Lane. This is an expanded version of Element A, the channel segment now begins along 67th just south of West Wind Drive. The channel will then cross under 67th Avenue and continue along the north side Pinnacle Peak Road.

6.8.2 Pinnacle Peak Road and 67th Avenue Alternative Two

The second alternative for this region is the same as the first alternative, with the addition of a regional off-line detention basin located southeast of the intersection of Happy Valley Road and 67th Avenue (see picture). This basin would reduce the downstream flow, which decreases the size of the downstream channels and culverts. The basin could provide recreational opportunities such as a soccer field.

6.8.3 Pinnacle Peak Road and 67th Avenue Alternative Three

The third alternative for the region is a natural appearing channel along the existing wash alignment from 67th Avenue to Pinnacle Peak Road then west along Pinnacle Peak road into the New River (see picture). This is Element C for the focus area.

6.8.4 Pinnacle Peak Road and 67th Avenue Alternative Four

The fourth alternative for this region expands on the third alternative with the addition of a regional off-line detention basin located southeast of the intersection of Happy Valley Road and 67th Avenue (see picture). This basin would reduce the downstream flow, which in turn would decrease the size of the downstream natural channel.

6.8.5 Pinnacle Peak Road and 67th Avenue Alternative Five

The last alternative for this region is the do-nothing alternative. This alternative will not be considered because the downstream flooding concerns are not addressed.

6.9 ACDC Region

The ACDC Region's drainage problems are local in nature and this Region was not taken to the Level III analysis per the City of Glendale's request. However, the drainage solutions studied in the Level II analysis are presented here.

The ACDC region is Focus Area 1 in **Figure RA-5**. The problem in this area is that no provisions were made to convey storm water from subdivisions adjacent to the ACDC to the canal itself. This focus area was further subdivided into five sub-areas: 1) 59th Avenue and the ACDC, 2) 61st Avenue and Heard Road, 3) 63rd Avenue and Coral Gables Drive, 4) cul-de-sac at Maui Lane and the ACDC, and 5) Greenway Road and 70th Avenue.

The problem in Focus Area 1-1 is that runoff exceeding the 10-year event is beyond the capacity of the storm drain systems. Excessive ponding occurs at the sag at 59th Avenue approximately 500 feet north of the ACDC. Runoff flows overland through a nursery on the west side of the street. This area is highly developed, and the solution to this problem needs to be linear or nonstructural. The existing utilities in the area could be in conflict with any storm drain design. The goal of the selected alternative is to alleviate the flooding impact to the nursery and to ACDC recreational facilities that lie in the path of the overland flow.

The problem in Focus Area 1-2 is the undersized catch basins and storm drain. Ponding is anticipated for most events and excessive ponding could result from larger magnitude flows. Flows exceeding the capacity of the sump will spill overland back to Hearn Road and then into the ACDC. The area is fully developed with no solution except linear or nonstructural. There could be utility conflicts in the area. The goal of the selected alternative is to alleviate potential flooding impacts to the homes adjacent to the sump.

The problem with Focus Area 1-3 is that flows greater than the 10-year event would exceed the capacity of the storm drain system and excessive ponding occurs at the sag located at 63rd Avenue and Coral Gables Drive. The excess flow spills southeasterly within 63rd Avenue, or southwesterly through the recreational fields of Pioneer Elementary School. This area is also highly developed and an alternative solution needs to be linear or nonstructural. In consideration of Pioneer Elementary, a detention basin or excessive overland flows would not be desirable if they take away too much play area. The goal of the selected alternative is to alleviate flooding in this area and reduce the ponding.

The problem with Focus Area 1-4 is that the capacity of the scupper and the sag at the cul-de-sac spill over the curb directly to the ACDC. The spillway is being eroded by runoff flowing parallel to it. The area is fully developed with no solutions except linear. The goal of the selected alternative is to minimize the erosion along the spillway.

The problem with Focus Area 1-5 is that flows are concentrated at the intersection. The existing catch basins are undersized and seem to be filled with sediment. The flow at this location exceeds the capacity of the catch basins and flows overland to the ACDC. There is a large storm drain in the area, but it has insufficient capacity. The area is highly developed leaving little opportunity for solutions except linear and nonstructural. Utility conflicts will be likely with any storm drain design. The City of Glendale is planning on improving 67th Avenue from Union Hills Drive to the ACDC, which should reduce the runoff reaching Greenway Road and 70th Avenue. The goal of the selected alternative is to alleviate the flooding of the mobile homes adjacent to the sumped area. The City of Glendale is planning to improve Greenway Road from 67th Avenue to 71st Avenue.

Table RA-14 shows the potential alternative solutions brought to the Level II analysis located within the ACDC Region.

TABLE RA-14

ACDC Region – Elements of Level II Alternatives

Focus Area	Element	Element Description
1-1	B	Purchase the Nursery property and make it a parking lot for Thunderbird Park.
	C	Purchase a drainage easement thru the Nursery and construct a drainage path for excess flow to the east.
	D	Re-grade Eugie Ave. to carry flow south thru an easement in the parking lot.
1-2	C	Purchase a 20-foot easement through the residences to provide an outfall to the ACDC.
	D	Re-grade the street to remove sump and carry the flow north to the ACDC.
1-3	A	Replace storm drain with larger storm drain that minimizes the flooding.
	B	Construct an overland flow channel with a collection system that will remove the flooding from the street.
1-4	B	Armor the areas adjacent to the spillway, mitigate the erosion, and increase size of the scupper.
1-5	D	Perform a design analysis on 100-year flows and incorporate alternatives A, B, and C for this area.

6.10 ACDC Region Alternatives

At the request of the City of Glendale, the alternatives for the ACDC were brought forward to the Level III analysis.

6.11 Cost Estimates

This section includes cost estimates for the alternatives that were evaluated as part of the Level II alternative analysis as well as refined cost estimates for the Level III recommended alternatives. The Level II costs are included for reference. The Level II cost estimates summary is presented in **Table RA-15** and the Level III cost estimate Summary is included in **Table RA-16**. The detailed cost estimates for both Level II and Level III is included in **Appendix B.**

TABLE RA-15
LEVEL II COST ESTIMATE SUMMARY

Region	Alternative	Year 2001 Construction Cost
Northwest	1	\$39,300,000
Northwest	2	\$44,060,000
Northwest	3	\$36,900,000
Northwest	4	\$44,420,000
83rd Avenue	1	\$8,100,000
83rd Avenue	2	\$9,310,000
Pinnacle Peak Rd & 67th Avenue	1	\$6,370,000
Pinnacle Peak Rd & 67th Avenue	2	\$11,090,000
Pinnacle Peak Rd & 67th Avenue	3	\$5,160,000
Pinnacle Peak Rd & 67th Avenue	4	\$11,410,000
Rock Springs	1	\$1,900,000
Rock Springs	2	\$5,920,000
Rock Springs	3	\$1,380,000
Rock Springs	4	\$5,400,000

TABLE RA-16
LEVEL III RECOMMENDED ALTERNATIVES – COST ESTIMATES

Description	Year 2001 Construction Cost
Northwest Region	\$21,400,000
83rd Avenue Region	\$ 9,900,000
Pinnacle Peak and 67th Avenue Region	\$ 4,300,000
Rock Springs Creek Region	\$ 0 (Do Nothing)

6.12 Miscellaneous Focus Areas

There were four focus areas that were not included in the regional plans discussed in the previous sections. These four areas are the Greenway Channel, the 99th Avenue Channel, the Grand Avenue Channel, and Weir Wash. These focus areas were analyzed hydraulically to assess their performance in a 100-year event. Typical cross sections and most of the culverts for the drainage ways were surveyed. The survey notes from these focus areas are included in the *Glendale/Peoria Area Drainage Master Plan – Data Collection Report – Volume*

DC. Field trips were made to the area and any as-built information available was collected. The 100-year/6-hour flow for these channels was used in the hydraulic analysis. This flow was presented in the *Glendale/Peoria Area Drainage Master Plan – Hydrology Report – Volume HY.* The hydraulic analysis summary for significant locations in these four areas is shown in **Table RA-17.**

TABLE RA-17

Hydraulic Analysis Summary Table

Focus Area Description	Channel Segment Analysis Location	HEC-1 Peak Flow 100-year/6-hour Existing Conditions (cfs)	Computed WSEL (ft)	Maximum WSEL (ft)
99th Avenue Channel	Upstream of Bell Road	660	1205.8	1207.0
	Upstream of Grand Avenue	2540	1146.6	1148.0
91st Avenue and Greenway Alignment Channel	Upstream of box culverts under 91st Avenue	1360	1175.6	1177.0
	Downstream of box culverts under 91st Avenue	1360	1176.8	1178.8
Grand Avenue Channel	Upstream of 99th Avenue	1380	1142.6	1143
	Downstream of 99th Avenue	3050	1140.2	1141
Weir Wash	Upstream of Terramar Blvd	1020	1357.3	1360.0
	Upstream of Moon Way Drive	1015	1409.6	1411.5

6.12.1 99th Avenue Channel

The 99th Avenue channel is located in the median of 99th Avenue, between Beardsley Road on the north and Grand Avenue on the south. In this portion of 99th Avenue, the road is an inverted crown sloped to the channel and therefore acts as the over-bank for the channel during severe rainfall events. There are many street crossings (culverts) along the course of the channel.

The water surface elevation in this channel was estimated using the Manning's Formula and the culverts were analyzed using the *Federal Highway Administration's (FHA) HY8* software, version 6.0 (**Reference 14**).

The hydraulic analysis for the 99th Avenue shows that the water surface stays within the right-of-way during a 100-year/6 hour storm. However, the depth of flow along the roadway would be approximately one and a half feet deep. This depth of water would cause 99th Avenue to be closed and restrict access for emergency vehicles on this road. The detailed hydraulic calculations, figures, and cross section plots are included in **Appendix C.**

6.12.2 91st Avenue and Greenway Alignment Channel

The 91st Avenue and Greenway Alignment Channel begins just south of Bell Road west of 91st Avenue and flows directly south. The channel crosses under 91st Avenue at the Greenway Road alignment. This channel segment conveys flow from the 91st Avenue Channel into the New River. The 91st Avenue Channel is connected to the Greenway channel by means of a box culvert under the roadway in 91st Avenue. The District furnished the as-built information for this culvert. Topographic information for this area was obtained from the new mapping developed by DTM, Inc. for this project under a separate contract with the District. Typical cross-sections and slope of the channel were acquired through field investigation and from the mapping mentioned above.

A hydraulic analysis of the channel was prepared using the *Boss River Modeling System* (RMS) program (**Reference 15**). The hydraulic analysis indicates that the 100-year peak flow appears to be adequately conveyed through the existing hydraulic structures. For the most part it appears that the channel capacity is adequate. However, the backwater affect of the box culvert under 91st Avenue would cause the flow to overtop and spill into an adjacent detention basin. In addition, immediately downstream from the culvert, the flow would overtop the south bank of the channel and spill into a vacant lot. Although not evidenced by analysis, flow may continue down 91st Avenue and eventually flow into the lakes constructed as part of the Desert Harbor Subdivision. In the unlikely event that runoff flows south of the Greenway Road alignment on 91st Avenue, it does not appear that it would be significant enough to flood any homes. The detailed hydraulic calculations, figures, and cross section plots are included in **Appendix C.**

6.12.3 Grand Avenue Channel

The Grand Avenue channel is located at the south end of Sun City on the north side of Grand Avenue and flows to both the Agua Fria River and the New River. The Southern Pacific railroad separates the channel from Grand Avenue to the south, and the Sun City perimeter wall bounds the channel to the north. The channel flows west into the Agua Fria River from 107th Avenue, and flows east into the New River from the 105th Avenue alignment.

The topographic information for this area was also obtained from the new mapping developed by DTM, Inc. for this project. Typical cross-sections and slopes of the channel were acquired through field investigation and survey.

The water surface elevation in this channel was calculated using the Manning's Formula and the culverts were analyzed with the *Federal*

Highway Administration's (FHA) HY8 software, version 6.0 (**Reference 14**).

The initial hydraulic analysis reveals that the channel itself is undersized. However, the over-bank area between the railroad and Sun City's perimeter wall combined with the channel appear to have enough capacity to convey the 100-year flows. Notwithstanding, every culvert within the channel produces a significant backwater effect. The water at these locations would overtop the crossing roadway surfaces, creating significant roadway flooding. In spite of this, the railroad tracks would not be overtopped, and the analysis shows the flow returns to the channel downstream, with one exception at the culvert located underneath 99th Avenue. The backwater analysis at this location shows that approximately 150 cfs of flow may overtop the railroad track and spill into Grand Avenue. However, it is a possibility that this flow may eventually flow north into the 99th Avenue channel, because the 99th Avenue channel intersects the Grand Avenue channel at a location downstream of this culvert. The detailed hydraulic calculations, figures, and cross section plots are included in **Appendix C.**

6.12.4 Weir Wash

A man-made channel from Jomax Road to Terramar Boulevard replaced the natural Weir Wash through the Terramar development. This man-made channel is lined with concrete in some sections and riprap in other sections with multiple culverts throughout its length.

The water surface elevation in this channel was calculated using the Manning's Formula and the culverts were analyzed with the *Federal Highway Administration's (FHA) HY8* software, version 6.0 (**Reference 14**). The hydraulic analysis shows that the channel appears to have enough capacity to convey the 100-year flow. The detailed hydraulic calculations, figures, and cross section plots are included in **Appendix C.**

SECTION RA-7: RECOMMENDED ALTERNATIVES

As part of the scope of work for this project, preliminary (15%) design concept plans were prepared. The half-sized preliminary design concept plans for each region taken to this Level III analysis, as well as the half-sized landscaping concept plans, can be found in **Appendix A.** The full-size preliminary construction design concept plans are included as a separate attachment.

7.1 Northwest Region

7.1.1 General Description

As discussed in the previous section, the new Alternative 4 was taken to the Level III design for the Northwest Region (see **Figure ES-1**). This recommended alternative consists of three drainage systems including channels, storm drains, culverts, and drop structures located between Beardsley Road and Pinnacle Peak Road that carry the flow to the Agua Fria River.

The first drainage system is mainly along the north side of Pinnacle Peak Road beginning at 95th Avenue flowing west into the Agua Fria River. The recommended channel characteristics for this system are located in **Table RA-1**. The culvert location and sizes is summarized in **Table RA-2**.

The Rose Garden Lane drainage system begins as a 36" storm drain just west of 87th Avenue. This storm drain transitions into 2 - 4' x 8' box culverts, which empty into a channel west of 91st Avenue. The channel characteristics are presented in **Table RA-1** and the culvert locations and sizes are presented in **Table RA-2**.

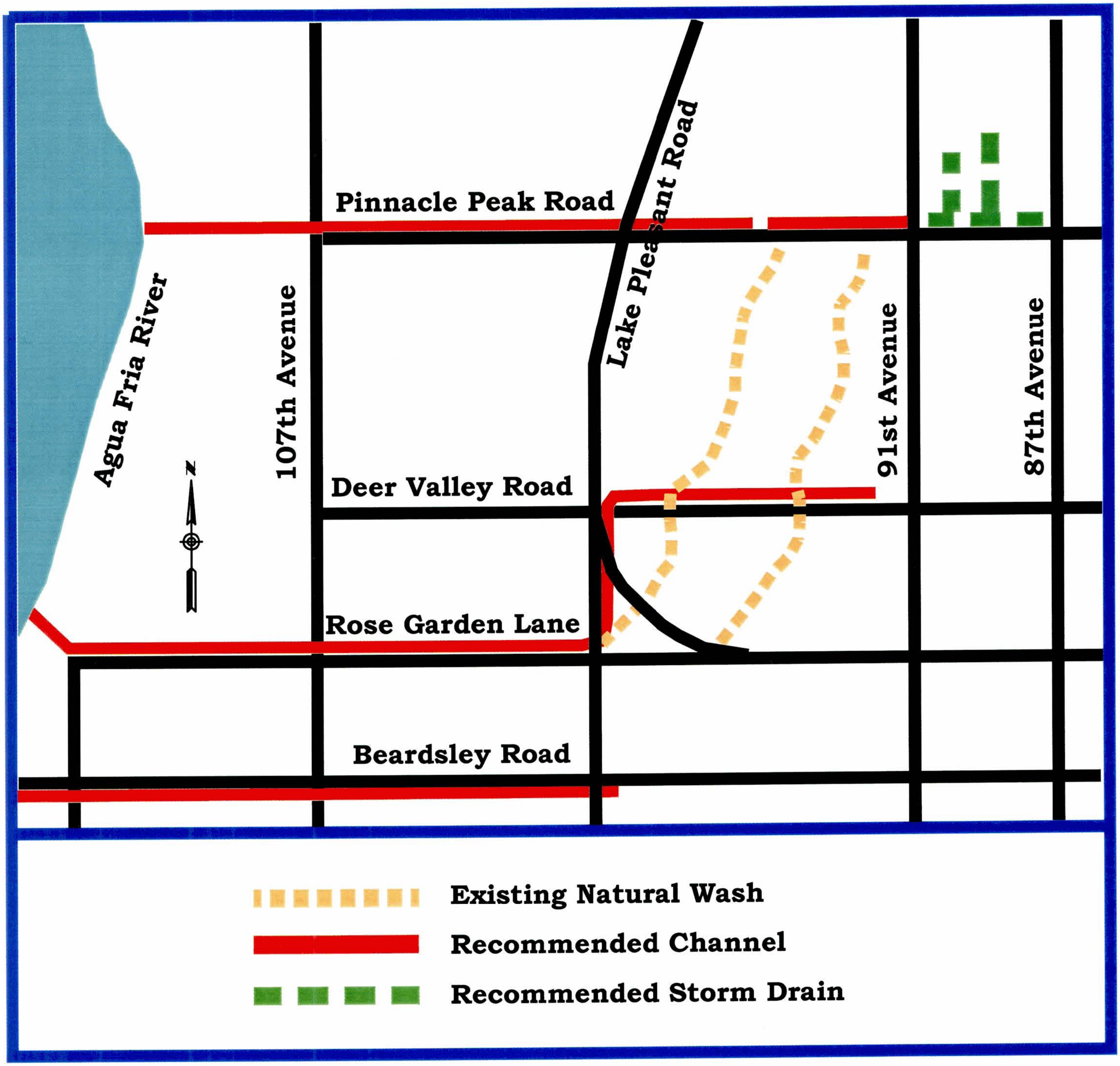


FIGURE ES-1 NORTHWEST REGION

Glendale GP Peoria
Area Drainage Master Plan

GLENDALE | CITY OF PEORIA | Flood Control District of Maricopa County | Entellus | PENTACORE ARIZONA | LOGAN SIMPSON DESIGN INC.

Table RA-1
Channel Characteristics – Northwest Region

Alternative	Drainage System	Channel Location	Top Width	Length
Northwest Region	Pinnacle Peak Rd	95th Ave to 97th Ave	70'	1215'
		97th Ave to 99th Ave	110'	1250'
		99th Ave to Junction Structure	90'	2330'
		Junction Structure to 107th Ave	100'	600'
	Rose Garden Lane	91st to 95th Ave on Pinnacle Peak	67.5' & 50'	1250' & 620'
		91st Ave to Inlet Structure along Deer Valley Rd	80'	1585'
		Inlet Structure to 95th Ave along Deer Valley Rd	120'	975'
		95th Avenue to Lake Pleasant Rd along Deer Valley Rd	140'	4520'
		Deer Valley Rd to Rose Garden Lane along Lake Pleasant Rd	120'	2565'
		Lake Pleasant Road to 107th Ave	140'	1850'
		107th Ave to 109th Ave	110'	1220'
		109th Ave to Agua Fria River	120'	2395'
	Beardsley Road	99th Ave to Agua Fria River	40'	9455'

Table RA-2
Culvert Sizes and Locations – Northwest Region

Alternative	Drainage System	Culvert Location	Size	Length
Northwest Region	Pinnacle Peak Rd	93rd Ave	1- 4' x 3'	49'
		Pinnacle Peak Rd east of 93rd Ave	2 -10' x 5'	97'
		95th Ave	27" x 44"	130'
		97th Ave & 99th Ave	3 - 8' x 4'	70' & 50'
		Lake Pleasant Road	3 - 8' x 4'	105'
		Pinnacle Peak Rd Storm Drain 1800' east of Lake Pleasant Rd	2- 8' x 6'	1650'
		Pinnacle Peak Rd at 107th Ave	3- 8' x 5'	260'
	Rose Garden Lane	91st Ave at Deer Valley Rd	2-27"x 44"	100'
		95th & 99th Ave at Deer Valley Rd	4-10'x 5'	100'
		Deer Valley Rd at Lake Pleasant	4-10'x 5'	287'
		Lake Pleasant Rd	36"	260'
		106th to 107th Ave	3- 10' x 6'	900'
		108th Ave	4- 8' x 6'	92.5'
		109th & 111th Ave	4- 8' x 6'	80' & 80'
	Beardsley Road	99th Ave	2- 8' x 5'	137'
		107th & 109th Ave	2- 8' x 5'	94' & 66'
		111th Ave & 950' east of 111th Ave	2- 8' x 5'	110' & 100'
		Sand and Gravel operation	2- 8' x 5'	100' & 92'

The Beardsley Road channel, culverts, and outlet will be improved to increase their capacity as part of this regional alternative. The new channel and culvert dimensions are included in the two previous tables.

7.1.2 Environmental, Visual, Cultural, and Multi-Use

This location is situated within a residential planned area development (P.A.D.). The P.A.D. has a uniform appearance due to the similar architectural elements, narrow lots, mixed ornamental and desert landscaping, masonry perimeter walls, and streetlights typical of a suburban neighborhood. Existing plant materials are a mixture of ornamental and native species, and the existing landscaping tends to be manicured.

The proposed drainage improvement within this area is an earthen-lined, open channel, except west of 107th Avenue where a 1,200' portion of the channel has been placed underground in a box culvert. The landscape concept for this area is to integrate the proposed drainage facilities as an extension of the existing P.A.D. character and to utilize native seeding to re-vegetate the underground portions. The landscaping approach and materials used to implement this design response include:

- planting of native trees, shrubs, and grasses - no turf;
- installing native seeding over areas disturbed by the box culvert construction;
- maintaining open views to the surrounding area;
- utilizing native material for pathways and trails such as stabilized decomposed granite; and
- creating an irregular, organic pattern of elements.

The use of native trees and shrubs, as proposed, will blend the drainage facilities into the surrounding native landscape. Use of native seeding at the underground section will further restore portions of the disturbed area to a natural appearance similar to pre-construction conditions. This alternative provides an opportunity to build a section of multi-use/equestrian trail along portions of Pinnacle Peak Road, which has been identified in the City of Peoria Trails Master Plan. Views to off-site landforms to the north and west will be maintained. Installing the drainage facilities along existing roads and streets will limit potential impacts to identified cultural resources in the project vicinity.

7.1.3 Safety Issues

The recommended alternative for the Northwest Region incorporates a pedestrian and equestrian trail within a natural-appearing drainage channel along Pinnacle Peak Road from 91st Avenue to the Agua Fria River. Because the channel alignment is largely along commercial and residential corridors, interference with commercial traffic will be a safety consideration.

Multi-use opportunities by definition carry special safety considerations because people are encouraged to enter areas that may be flooded during large storms. Further, long drainage-ways may exhibit "sunny day" scenarios where downstream reaches may not be subject to heavy rainfall but could still flood due to precipitation in the watershed upstream. To offset the safety concerns of outdoor recreation within drainage-ways, the following elements should be included in the multi-use channel along Pinnacle Peak Road:

- Signage at the top and bottom ends of the drainage-way, as well as intermittently along the channel. In particular, primary access points such as 91st Avenue, 107th Avenue, and Lake Pleasant Road should include signs warning users not to enter the channel when flooded. Traffic signals should be added at these arterial crossings for safer pedestrian and equestrian crossings.

- Signage at driveways and cross streets should be installed warning motorists of pedestrian and equestrian crossings.
- Where possible, pedestrian and equestrian crossings should be below grade.

- Channel side slopes should not exceed 4(h):1(v); preferably, side slopes should not exceed 6(h):1(v).

- A precipitation and/or stage gage could be installed upstream to activate flashing lights at pre-set thresholds on the warning signs along the channel. The gage(s) would be incorporated into the District's existing automated flood detection network. However, available lead-time would need to be evaluated to determine if the system could effectively warn trail users downstream. Additionally, the height of any proposed lights would need to be set to minimize adverse impacts to equestrian use.

- As the areas along the proposed channel continue to develop, safe pedestrian and equestrian crossings will need to be re-evaluated.

The remaining proposed channels within the Northwest Region are not planned for multi-use. However, even in these channels, side slopes should not exceed 6(h):1(v). For the Beardsley Road Channel, this recommendation could be problematic because the existing channel has much steeper side slopes. Decreasing the side slopes would reduce the capacity of the channel. One alternative would be to modify the far side of the channel to create a vertical wall and add architectural treatments. The remaining side slope adjacent to Beardsley Road could then be flattened significantly. This scenario would allow a safer exit for any pedestrians in the channel. It would also enhance the safety of adjacent traffic that may leave the roadway. Alternatively, if the existing channel is repaired and cannot be modified in this manner, fencing or barriers should be considered to discourage pedestrian access and vehicular entry.

7.1.3.1 Benefits

There are several benefits to the Northwest Regional Alternative. The most important benefit is that the overall system will provide protection from a 100-year storm. This alternative was one of the lower cost alternatives developed in this region. The system will be designed for relatively low maintenance cost by including natural desert landscaping. This solution provides an opportunity to construct a multi-use pathway/equestrian trail linking the Agua Fria River to the New River along Pinnacle Peak Road. This has been identified previously in the Peoria Trail Master Plan **(Reference 13)**.

The preservation of natural washes until they can be incorporated into the development ensures that adequate drainage will be maintained from now until the development of the State Land. The majority of the recommended improvements are located away from existing development in the northwest region drainage area, minimizing impacts to existing developments, and maximizing the potential for the improvements to be incorporated into future development. This would result in an aesthetic amenity as each portion of the natural looking drainage facility is integrated with the next. The recommended improvements are outside any cultural resource sites and would be landscaped to match the visual character of the adjacent areas. The last benefit is that the recommended channel locations take advantage of existing retention facilities along Deer Valley Road and Rose Garden Lane.

7.1.4 Cost of Recommended Alternative

The total cost of the recommended alternative for the Northwest Region (including design and contingencies) is $21.8 million. The drainage improvement cost is $13.6 million, the landscape improvement cost is $1.9 million, and the right-of-way cost is $5.9 million.

7.2 83rd Avenue Region

7.2.1 General Description

As discussed in the previous section, the new Alternative 4 was carried to the Level III analysis for this region (see **Figure ES-2**). It consists of two detention basins, the first basin is the 83rd Avenue detention basin, which is 58 acre-feet (ac-ft) and is located on the northwest corner of 83rd Avenue and Pinnacle Peak Road. The second basin is the Calle Lejos detention basin, which is18 ac-ft and is located on Calle Lejos just east of 87th Avenue.

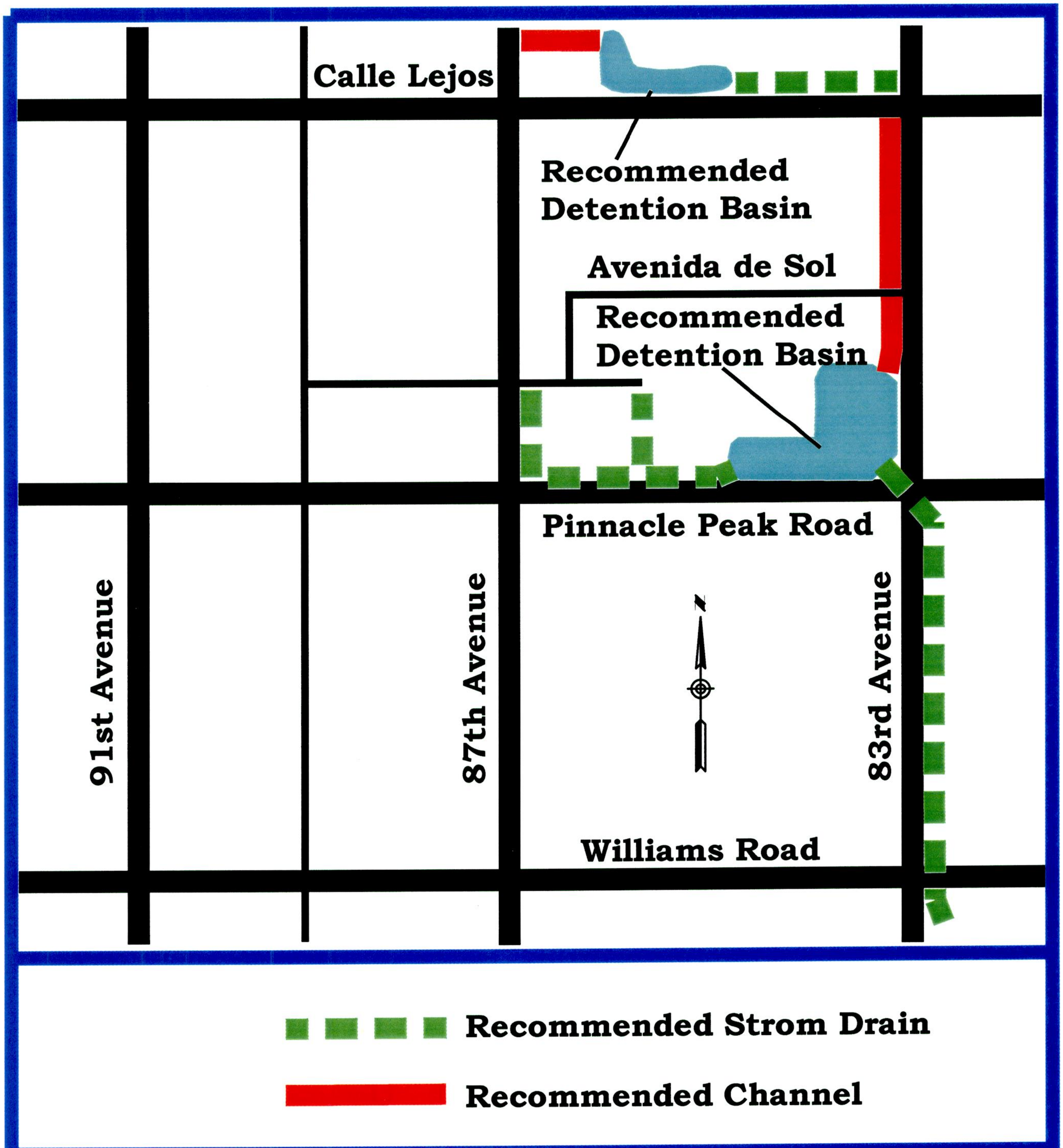


FIGURE ES-2 83rd Ave Region

The channel characteristics for this recommended alternative are presented in **Table RA-3** and the storm drain and/or culvert locations and sizes are presented in **Table RA-4**.

Table RA-3

Channel Characteristics – 83rd Avenue Region

Alternative	Channel Location	Top Width	Length
83rd Avenue Region	87th Ave to 89th Ave north of Calle Lejos	50'	630'
	83rd Ave from Calle Lejos to Avenida Del Sol	80'	1250'

Table RA-4

Storm Drain / Culvert Sizes and Locations – 83rd Avenue Region

Alternative	Storm Drain or Culvert Location	Size	Length
83rd Avenue Region	87th Ave north of Calle Lejos into basin	1- 6' x 4'	155'
	Calle Lejos from basin to 83rd Ave	36" storm drain	2,053'
	83rd Ave from Avenida Del Sol to basin	2- 10'x 4'	744'
	83rd Ave basin to 83rd Ave channel south of Williams Rd.	48" storm drain	1858'
	87th Avenue to Pinnacle Peak Rd.	1- 10' x 4'	635'
	85th Avenue to Pinnacle Peak Rd.	1- 10' x 4'	637'

7.2.2 Environmental, Visual, Cultural, and Multi-Use

This alternative's location is within a transitioning residential area going from rural neighborhoods to newer, planned area developments (P.A.D.). The rural neighborhoods consist of relatively large (1/2 acre) lots with relatively mature vegetation. Ornamental tree species bordering yards include eucalyptus, cottonwood, and pine. Block walls are seldom used to delineate property boundaries; instead vegetation, wood, or chain-link fencing is used. The vegetation and building structures are prominent in the setting. Conversely, the planned area developments have a more uniform appearance due to the similar architectural elements, narrow lots, mixed ornamental and desert landscaping, masonry perimeter walls, and street lights typical of a suburban neighborhood.

The proposed drainage features within this alternative include an off-line detention basin and earthen, open channel. The proposed landscape concept is to integrate the proposed drainage facilities as an extension of the increasing P.A.D.-type development. The landscaping materials and approaches proposed to develop this design include:

- planting specimen exotic and native trees, installation of shrubs, and introducing turf in all or portions of the basin bottom;
- repeating the adjacent hardscape elements utilizing small walls and concrete pathways;
- incorporating stucco and tile materials and colors associated with adjacent development;
- integrating the existing concrete block walls as art elements to add interest and identity to individual subdivisions; and
- creating a well-organized, repetitive pattern of elements.

The use of exotic trees and shrubs and decomposed granite in the basin bottom will blend the drainage facilities into the surrounding ornamental landscape. Installing grass in the basin bottom would enhance the multi-use recreation opportunities for field games such as soccer, softball, football, and other uses, particularly if augmented with ramadas or other comfort facilities. A grassed basin would create additional open space in a rapidly expanding portion of the City. This alternative provides an opportunity to continue to 83rd Avenue a section of the multi-use/equestrian trail planned along Pinnacle Peak Road by the City of Peoria.

7.2.3 Safety Issues

The recommended alternative for 83rd Avenue Region incorporates a continuation of a planned pedestrian/equestrian trail along Pinnacle Peak Road. Therefore, safety considerations for this element are similar to that identified for the Pinnacle Peak Road Channel in the Northwest Region. Additionally, a detention basin is proposed that would require special safety considerations:

- Signage at the top and bottom ends of each drainage-way, as well as intermittently along each channel. Additionally, the proposed detention basin at Pinnacle Peak Road and 83rd Avenue should include signs warning users not to enter the basin when flooded.

- Signage at driveways and cross streets should be installed warning motorists of pedestrian and equestrian crossings. Driveway and street crossings for business and residence access should be minimized through the use of a frontage road or similar concept.

- If the detention basin is used as an equestrian staging area and/or local park, vehicular parking should be at grade and access for emergency vehicles should be accommodated. A traffic signal should be added for safer pedestrian and equestrian crossing of any arterial streets (e.g., 83rd Avenue).

- Basin and channel side-slopes should not exceed 4(h):1(v); preferably, side-slopes should not exceed 6(h):1(v).

- A precipitation and/or stage gage installed upstream to activate flashing lights at pre-set thresholds would not likely be effective at this location because the length of flow path and corresponding lead time are very short. However, it could be a benefit to users in the Northwest Region along the Pinnacle Peak Road Channel.

As the areas along the proposed channel continue to develop, safe pedestrian and equestrian crossings will need to be re-evaluated.

7.2.4 Benefits

The main benefit of this recommended alternative is that it solves the drainage problems on 83rd Avenue and Pinnacle Peak Road and provides 100-year protection. The detention basins offer some recreational possibilities as well. The storm drain outlet to the detention basins can be constructed in the existing rights-of-way, which is another benefit.

7.2.5 Cost of Recommended Alternative

The total cost of the 83rd Avenue Region alternative (including design and contingencies) is $9.9 million. The drainage improvement cost is $6.4 million, the landscape improvement is $1.6 million, and the right-of-way cost is $1.9 million.

7.3 Pinnacle Peak Road and 67th Avenue Region

7.3.1 General Description

As decided in the Level II report, Alternative 1 was brought to the Level III analysis for this region (see **Figure ES-3**). It consists of three small interceptor basins connected with a series of channels and storm drains.

The first interceptor basin is 0.5 ac-ft and is located on the southwest corner of Hatfield Road and 67th Avenue. The second interceptor basin

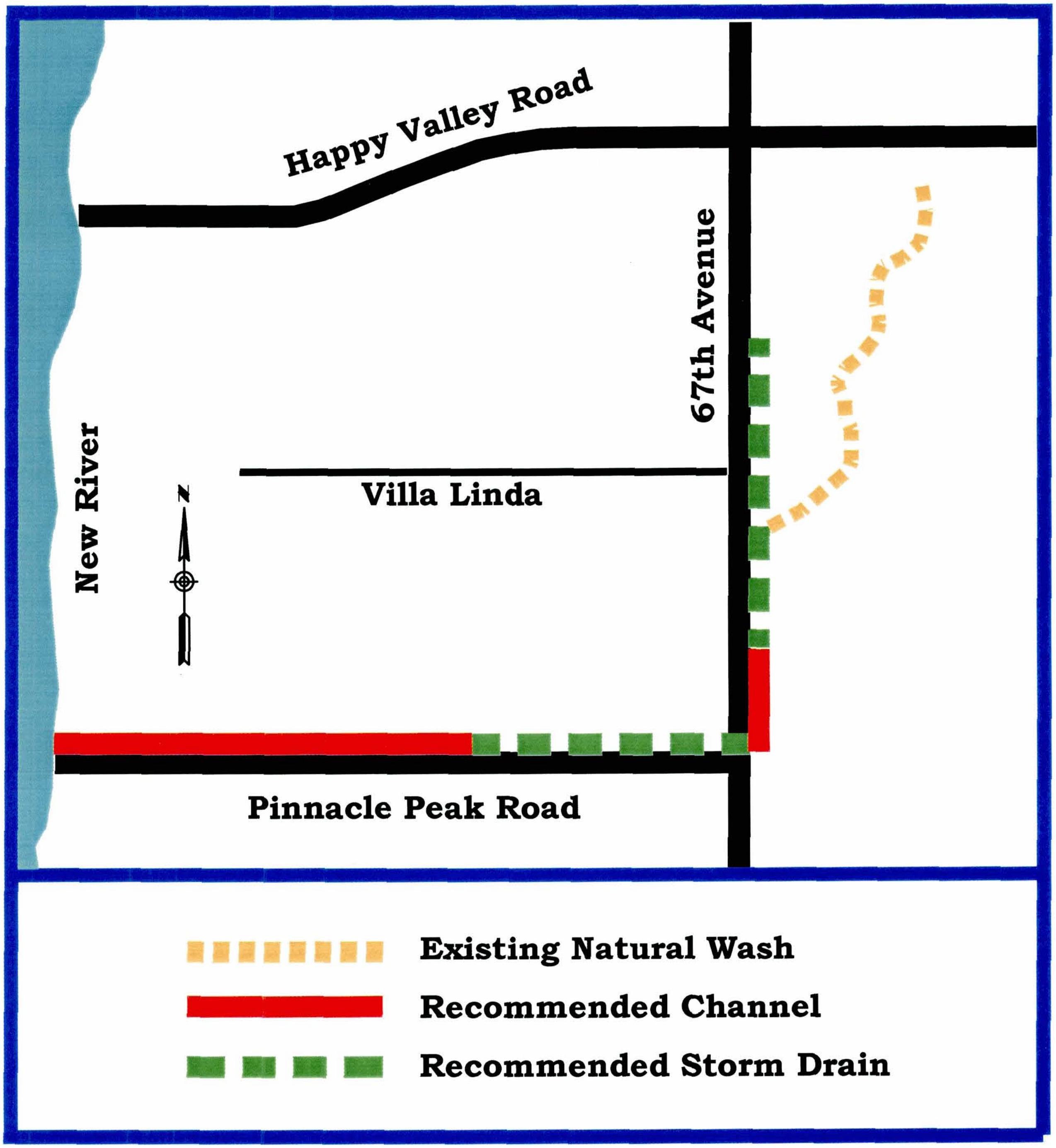


FIGURE ES-3 67th Ave Region

is 4 ac-ft and is positioned just south of Calle Lejos on the east side of the road. The third interceptor basin is approximately 4.5 ac-ft located east of Pinnacle Peak Road and 67th Avenue. The channel characteristics for this recommended alternative are presented in **Table RA-5** and the storm drain and/or culvert locations and sizes are presented in **Table RA-6**.

Table RA-5

Channel Characteristics – 67th Avenue Region

Alternative	Storm Drain or Culvert Location	Top Width	Length
67th Avenue Region	67th Ave south of Softwind Dr to Pinnacle Peak Rd	63'	1260'
	69th Drive along north side of Pinnacle Peak Rd to Agua Fria River	60'	3290'

Table RA-6

Storm Drain / Culvert Sizes and Locations – 67th Avenue Region

Alternative	Storm Drain or Culvert Location	Size	Length
67th Avenue Region	South of Hatfield Road to second interceptor basin on east side of 67th Ave	42" RCP	1478'
	Second Interceptor Basin to south of Softwind Dr. on east side of 67th Ave	4' x 10' RCB	1000'
	Culvert south of Camino de Oro on east side of 67th Ave	4' x 10' RCB	50'
	Third Interceptor Basin to 69th Drive on north side of Pinnacle Peak Road	4' x 10' RCB	410'
	Culvert for 71st Avenue north of Pinnacle Peak Rd	2 - 4' x 10' RCB	50'
	Culvert for 73rd Avenue north of Pinnacle Peak Rd	2 - 4' x 10' RCB	50'

7.3.2 Environmental, Visual, Cultural, and Multi-Use

This Alternative's location is within the transition area of undeveloped desert into interspersed, rural development. The relatively undisturbed native desert is relatively flat, and the irregularity and color of native vegetation makes it distinguishable from encroaching development to the east. Mature mesquite trees, creosotebush, and desert broom are prevalent and dominate the natural setting. Interspersed rural development within the undeveloped desert consists of various architectural types and colors. Few overhead utilities exist, and arterial roadways are rural in character (i.e. without developed shoulders). Vegetation, wood, or chain-link fencing is used for delineating property boundaries. The vegetation and building structures are prominent in this setting.

The proposed drainage improvement within this area is an earthen-lined, open channel. The landscape response to the existing and projected development of the area is to integrate the proposed drainage facility as an extension of the natural, desert biotic community. The landscaping approach and materials used to develop this design response include:

- planting of native trees, shrubs, and grasses - no turf;
- maintaining open views to the surrounding area;
- utilizing native material for pathways and trails such as stabilized decomposed granite; and
- creating an irregular, organic pattern of elements.

The use of native trees, shrubs, and earthen materials will blend the drainage facility into the surrounding native landscape. The potential incorporation of the drainage channel with the future Pinnacle Peak Road improvements will create an integrated aesthetic for these side-by-side facilities. This alternative provides an opportunity to extend the multi-use/equestrian trail along Pinnacle Peak Road between New River and 67th Avenue. Installing the drainage facility along existing roads and streets will limit potential impacts to identified cultural resources in the project vicinity.

7.3.3 Safety Issues

The recommended alternative for Pinnacle Peak Road and 67th Avenue Region incorporates a pedestrian and equestrian trail within a natural-appearing drainage channel. Because the channel alignment is largely along residential and undeveloped corridors, interference with commercial traffic is reduced. To offset the safety concerns of outdoor recreation within drainage-ways, the following elements should be included in the multi-use channel:

- Signage at the top and bottom ends of the drainage-way, as well as intermittently along the channel. In particular, primary access points such as Pinnacle Peak Road and 67th Avenue should include signs warning users not to enter the channel when flooded.

- A traffic signal should be added for safer pedestrian and equestrian crossing of 67th Avenue.

- Channel side slopes should not exceed 4(h):1(v); preferably, side slopes should not exceed 6(h):1(v).

- A precipitation and/or stage gage could be installed upstream to activate flashing lights at pre-set thresholds on the warning signs along the channel. The gage(s) would be incorporated into the District's existing automated flood detection network. However, the length of flow path from the source of runoff for the Pinnacle Peak and 67th Avenue region is relatively short. Therefore, available lead-time would need to be evaluated to determine if the system could effectively warn trail users. Additionally, the height of any proposed lights would need to be set to minimize adverse impacts to equestrian use.

- As the areas along the proposed channel continue to develop, safe pedestrian and equestrian crossings will need to be re-evaluated.

7.3.4 Benefits

There are many benefits to this regional alternative. The first is that the proposed system provides protection from a 100-year storm for areas both upstream and downstream of the improvements. This alternative is one of the lower cost alternatives developed for this region. The proposed system will be designed for relatively low maintenance cost by including natural desert landscaping. This proposed solution provides an opportunity to extend the multi-use pathway/equestrian trail on Pinnacle Peak Road. The proposed improvements can be incorporated into future roadway development, which will result in an integrated natural looking drainage facility that can be considered an aesthetic amenity. Finally, this regional alternative avoids cultural resource sites and will be landscaped to match the visual character of the adjacent areas.

7.3.5 Cost of Recommended Alternative

The total cost of the Pinnacle Peak Road and 67th Avenue region (including design and discrepancies) is \$4.3 million. The drainage improvement cost is \$2.4 million, the landscape improvement cost is \$0.5 million, and the right-of-way cost is \$1.4 million.

7.4 Rock Springs Region

7.4.1 Description

Alternative 5 was the selected alternative and a Level III analysis is not required. This alternative is to enforce the floodway/floodplain that has been recently delineated.

7.4.2 Environmental, Visual, Cultural, and Multi-Use

This alternative's location is within the transition area of undeveloped desert into interspersed, rural development. The relatively undisturbed native desert is relatively flat, and the irregularity and color of native vegetation makes it distinguishable from encroaching development surrounding Rock Springs Creek. Mature mesquite trees, creosotebush, and desert broom are prevalent and dominate the natural setting. Interspersed rural development within the undeveloped desert consists of various architectural types and colors. Large overhead utilities exist along the general Happy Valley Road alignment, and arterial roadways are rural in character (i.e. without developed shoulders). Vegetation, wood, or chain-link fencing is used for delineating property boundaries. The vegetation and building structures are prominent in this setting.

There are no proposed drainage improvements under this alternative, therefore, there will be no construction impacts associated with this drainage solution that need to be mitigated. If development is retained outside the floodplain limits by the City of Peoria, this will maintain the existing openness of the lands surrounding the Creek. Vegetation density and improved wildlife habitat may occur as a result. Opportunities for dispersed recreation use such as hiking, jogging and bird watching will also increase.

7.4.3 Safety Issues

The recommended alternative for the Rock Springs Region is a non-structural solution limited to enforcing limitations on development within the recently-delineated floodplain. Safety considerations could include signs along Rock Springs Creek warning pedestrians and motorists not to enter when flooded. Staff gages could be installed at paved dip crossings to inform motorists of the depth of water at these crossings.

7.4.4 Benefits

There are three main benefits for this regional alternative. The first benefit is that delineation of the floodplain allows the City of Peoria to regulate development in the area ensuring residences are safe from flood hazards. Another benefit is that this non-structural solution is the lowest cost alternative. Finally, this regional alternative results in no adverse impacts to the existing biological and cultural resources, and it provides an opportunity to use the natural wash for recreation.

7.4.5 Cost of Recommended Alternative

There are no anticipated costs for this regional alternative.

SECTION RA-8: MAINTENANCE PLAN

There will be three principal entities that are responsible for maintenance depending on the location of the drainage improvement. All three regions that have construction of drainage improvements are located with the City of Peoria. Typically, the City of Peoria will maintain the drainage infrastructure located in their right-of-way, this will include culverts, detention basins, and channels. The District will typically maintain the outfall structures into the Agua Fria and New River. Individual homeowners associations, (HOA), in residential developments will maintain any infrastructure located within their property.

8.1 General Maintenance & Operation Guidelines

There are two types of maintenance that are required for the recommended alternatives. The first type of maintenance can be called "soft" maintenance and the second type is "hard" maintenance. Soft maintenance is the regular maintenance required for these improvements, the "hard" maintenance is the less frequent, intense type of maintenance.

Landscape maintenance would involve a number of diverse tasks, most of which are considered "soft" maintenance activities. Routine tasks would include grass mowing; vegetative trimming; weed control in inert surface (decomposed granite) areas and around drainage inlets/outlets; irrigation system repairs/replacement; recreation structures maintenance such as painting and vandalism repairs (if structures such as ramadas, benches or restrooms are included in the facility); sweeping/cleaning of recreation structures and paved surfaces; and trash collection. Activities that would be required on an annual or occasional basis include pest/disease control; replanting of dead plants; replenishment of decomposed granite areas; erosion repair (in turf or granite areas); landscape modifications due to overuse, unplanned use or special uses; removal of debris around drainage inlets/outlets; and repairs/replacement of structure components, site signage, pedestrian lighting, multi-use trails, and/or sidewalks.

The frequency of soft maintenance depends on the frequency of flooding events, the amount of debris left in the area, siltation from upstream areas, and the vitality of the vegetation and landscaping.

The "hard" periodic maintenance required for these improvements includes the removal of extreme amounts of sediment that may build up in improvements, damage to structures or slopes, and any erosion damage that may take place. Additional maintenance that may be required would be the replacement of any structures that become severely damaged such as a culvert being washed out. It is assumed the structures will have a design life of between 50 and 75 years, so their replacement is not included in the maintenance cost estimate.

8.2 Maintenance Requirements & Costs

The specific responsibility for maintenance will be determined as part of an intergovernmental agreement (I.G.A.) established at he beginning of each project. The City of Peoria has maintenance crews that are responsible for the regular maintenance of structures throughout the city. These maintenance crews are typically responsible for the drainage improvements within the City of Peoria's right-of-way. The individual H.O.A.'s will have maintenance responsibility for the improvements located within their development. The District typically maintains the outfall structures into their major watercourses and is often responsible for heavy or hard maintenance.

Developing accurate costs for landscape maintenance for the recommended alternatives is challenging, since many times this work is contracted to private firms on a competitive bid basis. We have contacted representatives of the District and other Valley cities to obtain representative costs for these types of maintenance activities. The estimates of costs for landscape maintenance are for planning purposes only and are based on the data gathered for this project and the types of facilities being proposed.

Based on information obtained from the District's Maintenance Database (ACDC Reach 3), the following **Table RA-18** estimates the annual landscape maintenance costs, which could be anticipated for the various regions of the project.

TABLE RA-18

ESTIMATED ANNUAL LANDSCAPE MAINTENANCE COSTS

Region	Maintenance Cost (per year)	Total Cost (50 years)
83rd Avenue Region	$275,000	$13.75 million
Northwest Region	$450,000	$22.50 million
Pinnacle Peak Region	$75,000	$3.75 million

SECTION RA-9: FEATURE PRIORITIZATION

9.1 Rationale for Phasing

The regional improvements were prioritized based upon benefit, need, cost, and time of anticipated development. The need to construct from downstream to upstream played a major part in the prioritization as well. The regional improvements were also segmented into phases with construction costs ranging from $3 million to $6 million. Breaking down the projects into the $3 million to $6 million size was done to facilitate their placement into the City or County annual C.I.P.

9.2 Priority of Regional Alternatives

The segment of the proposed improvements with the highest priority is Rose Garden Lane from 102nd Avenue to the Agua Fria River. It is the key facility that will relieve a high potential for downstream flooding in existing developments. This reach is located in the Northwest Region.

However, as a region, the 83rd Avenue Regional Plan has the highest priority. This region is already very developed and the land available for a detention basin is limited and at an extremely high potential for being developed. The purchase of the land for the detention basin is a key component of the recommended alternative and is listed as the second phase of improvements with basin construction being the third phase.

The next priority is the Northwest Region. This region is developing quickly, and many of the recommended alternatives will either be constructed or accounted for in the new developments in the area. This region must be built before development occurs to achieve the maximum benefit to cost ratio. If development occurs without these proposed improvements, it will be much more costly to try to fit improvements into the land later after it is already developed. As a result, phases four through eight are sequential facilities that will complete the 100-year flood protection system for the Northwest Region. These are sequenced so they can be built from downstream to upstream and would be self-draining.

The regional plan with the lowest priority is the 67th Avenue and Pinnacle Peak Road region. This solution in this region only affects a small percentage of residents, and the improvements will most likely require a 4-way I.G.A. between Phoenix, Glendale, Peoria and the District. The Rock Springs region was not prioritized because the recommended alternative does not require construction of capital improvements.

9.3 Recommended Phasing and Cost for each Regional Alternative

The recommended improvements and phasing are shown graphically in **Figure RA-3**. The total cost and the phasing breakdown is shown in **Figure RA-3** and **Table RA-16**. The total estimated time to construct all improvements will depend upon the availability of funding; therefore it was not estimated as part of this study. The shortest time frame that these improvements could be anticipated to be constructed is over a nine to twelve year period.

TABLE RA-16
LEVEL III RECOMMENDED ALTERNATIVES – COST ESTIMATES

Description	Year 2001 Construction Cost
Northwest Region	$21,800,000
83rd Avenue Region	$ 6,200,000
Pinnacle Peak and 67th Avenue Region	$ 4,300,000
Rock Springs Creek Region	$ 0 (Do Nothing)

SECTION RA-10: IMPLEMENTATION PLAN

The Glendale/Peoria ADMP Update was developed as a vehicle to improve current drainage problems in the study area. It is vital that the local municipalities adopt this plan so that it can be used as a tool to guide the new developments in the area.

10.1 Local Adoption Process

As stated earlier, the study area includes several municipalities. The regions that require drainage improvement infrastructure are mainly located in the City of Peoria and County. The 67th Avenue and Pinnacle Peak Road region also affects the City of Glendale and the City of Phoenix, so their ordinances and guidelines need to be discussed in this section as well.

10.1.1 Existing Ordinances and Regulations

Although it was used for planning, The City of Peoria never officially adopted the original *Glendale/Peoria ADMP* study completed in May 1987 (**Reference 1**). The drainage improvements were not always implemented in cooperation with the developers, which resulted in a discontinuous infrastructure.

The City of Peoria has an ordinance that any new development detains the 100-year/2-hour onsite flow and another that requires new developments to incorporate open space in their development. These ordinances reduce the future flows in any undeveloped area, so it is essential that they be enforced.

10.1.2 Proposed Ordinances and Regulations

It is recommended that the Glendale and Peoria City Councils adopt this ADMP. By adopting this plan, Peoria would be able to uniformly implement a drainage infrastructure as the city continues to develop.

Other recommended actions include the adoption of new floodplains along Rock Springs Creek and Zone A floodplains along various washes in Peoria. This allows the City to regulate development and ensure that development does not adversely affect the drainage-ways.

10.2 Technical Issues

10.2.1 Utility Coordination

As part of the scope of work for this project, the impact of the recommended plan on both existing and planned utilities was evaluated. Existing utility information was obtained as part of the data collection effort (refer to Volume DC). This included utility quarter section maps (in Glendale only), as-builts, franchised utility records, field observations and other various sources. Existing utility information that was obtained is shown on the conceptual Design Plans contained in **Appendix A**.

Based on the information obtained, there are no significant utility conflicts with the recommended plan. Some waterline relocations, electric, TV and telephone cables will need to be relocated; however no major lines appear to be in conflict. Additionally, the channel and box culverts are designed to be shallow (maximum of 6' deep), which should not be in conflict with the new sanitary sewer planned for Lake Pleasant Road. A search and review of master planned utilities was also made as part of this study. The City of Peoria was updating its

Master Plans for sewer, water and effluent re-use concurrently with the preparation of this report, so final recommended utilities were not available. Based upon discussions with City staff, major utility lines are planned for Lake Pleasant Parkway. The design of the flood protection improvements recommended herein, especially at the crossing with Pinnacle Peak Road, should be coordinated with Peoria's plans for future water and sewer improvements.

10.2.2 Permitting Requirements

In order to accurately determine the Section 404 permit needs within the various regions, completion of formal Jurisdictional Delineations (J.D.) would be a requisite task. No J.D.'s were completed during this study. The permitting requirements can only be determined after the J.D. is completed, a substantial level of design is completed, and a detailed calculation of impacts to waters of the U.S. is made. It is expected that these activities will be completed during the design/implementation phase of each project.

The discussion herein on the permitting requirements should be viewed with the understanding that the permitting needs of each project will be determined by the regulations in place at the time of implementation. In June 2000, substantial changes were made in the Section 404 regulations; future changes are inevitable and could significantly modify the permitting needs from those noted in this report. As currently envisioned, the drainage improvements could utilize Nationwide (#43) or Individual Permits to authorize work within waters of the U.S. The specific type of permit needed for each project will be determined and obtained prior to ground disturbance.

Additional environmental studies will be necessary to obtain the Section 404 permits. As part of the Level I activities, an environmental review was completed for the Ecological Assessment. The Assessment involved a cursory overview of biological and cultural resources within the entire ADMP area. At the time of obtaining the permits, additional biological studies (i.e., a biological evaluation, particularly for construction near the major watercourses) and additional cultural investigations (i.e., Class III surveys) will be required for each project or group of projects.

Based on the Level III Recommended Alternative, the following permitting conditions could apply.

10.2.2.1 83rd Avenue Region:

Based on a review of the characteristics of the project area, no Section 404 permits will be needed. There are no apparent waters of the U.S. within the project area.

10.2.2.2 Rock Springs Region:

Since the proposed action will not involve the disturbance of the existing wash, no permits or authorizations will be needed. Construction of multi-use trails within the jurisdictional water of Rock Springs (by any agency or entity) will require acquisition of a Section 404 Permit (Nationwide #14 or 42).

10.2.2.3 Northwest Region:

The Pinnacle Peak Road channel will likely require a Section 404 permit since it interrupts and/or affects drainages that are typically considered waters of the U.S.

The Beardsley Road channel may require a Section 404 permit since it interrupts and/or affects drainages that could be considered waters of the U.S.

10.2.2.4 Pinnacle Peak Region:

The Pinnacle Peak Road/67th Avenue channels will likely require a Section 404 permit since they interrupt and/or affect drainages that are typically considered waters of the U.S.

10.3 Potential Project Partners

There are four main Regional Solutions recommended in **Section RA-9** of this report. The District, the City of Peoria, and the development community are potential partners for funding design, construction, and maintenance of all four of these regional plans.

Additionally, the cities of Glendale and Phoenix have jurisdictional boundaries within the watershed for the 67th Avenue and Pinnacle Peak Region; therefore, they represent a potential project partner. The Maricopa County Department of Transportation (MCDOT) owns and operates most of the roads adjacent to the proposed improvements, and any improvements placed on or adjacent to county right-of-way will need to be coordinated with the MCDOT. Since MCDOT has an interest in developing some of these roads and turning them over to local communities like Peoria, it represents a potential project partner.

10.4 Potential Funding

10.4.1 Flood Control District of Maricopa County

10.4.1.1 District's Cost Share Policy

The District has a policy of cost sharing up to 50 (fifty) percent on prioritized and qualified flood control projects. The projects recommended in this report qualify as projects that are Regional Flood Control Facilities that have benefits regardless of jurisdictional boundaries. The specific process needed for any project to be funded by the District is called the C.I.P. Prioritization Procedure, which is further described below. Once a project has the priority and is accepted into the District's C.I.P. process, the partnering agency or agencies must enter into an I.G.A. with the District.

10.4.1.2 Prioritization Request

The C.I.P. Prioritization procedure is an annual process conducted by the District. The current contact is Mr. Richard Perreault (602) 506-4774. A copy of the C.I.P. Prioritization Procedure is included in **Appendix H**. Current status and applications for the C.I.P. process can be obtained on the Internet at the website www.maricopa.gov. A completed C.I.P. Prioritization request for the highest priority projects for Peoria is also included in **Appendix H**. The annual request process requires that requests be filed in July of each year. The due date in the year of this study was July 20, 2001.

10.4.2 City of Peoria Funding Process

The City of Peoria currently does not have a continual commitment of funding or a revenue source for funding drainage improvements. Based on discussions with staff, the most immediate method for funding will be through its C.I.P., supported by its approved bonding capacity. The contact for the details regarding the City of Peoria's Capital improvement Program process and I.G.A. preparation is the Public Works Director, currently Mr. Dave Moody, P.E. phone: (623) 773-7217. The City of Peoria has already allocated $2.6 million (FY 2001/2002) and $0.9 million (FY 2002/2003) for the drainage improvements identified in the 83rd Avenue Region. Additional future funding for other drainage improvements has been discussed by city staff but has not been finalized at the time this report was being prepared.

10.4.3 City of Glendale Funding Process

The City of Glendale has an annual C.I.P. budgeting and appropriation process. It currently has allocated most of its funding for the Bethany Home Road outfall channel as part of its cost share under I.G.A. with the district. In discussions with Mr. Dan Sherwood of Glendale, there does not appear to be availability of funding for cost share from Glendale for a few years due to the current C.I.P allocations. Questions regarding funding ad the C.I.P. in Glendale should be directed to the city of Glendale Engineer, currently Larry Broyles, P.E., phone: (623) 930-3630.

10.4.4 City of Phoenix Funding Process

The City of Phoenix has several processes it uses for funding of projects, many of which are used to determine the projects placed into the Phoenix 5-year and 1-year C.I.P. Storm drainage improvements are prioritized and placed into the Street Transportation Department Capital Improvement Program. The specific priority and need for the improvements identified in the 67th Avenue and Pinnacle Peak Region, which is the region whose watershed lies partly in the City of Phoenix jurisdictional boundary, was not determined at the time this report was prepared. The initial contact for discussing priority and funding for drainage improvements in the city of Phoenix is Mr. Ray Dovolina, phone: (602) 262-7254.

10.4.5 Maricopa County Department of Transportation Funding

MCDOT currently has several projects in both Glendale and Peoria that are being completed as part of an I.G.A. with the cities. MCDOT is currently working on projects in 83rd Avenue, Pinnacle Peak Road, Deer Valley Road, and other locations along alignments identified for improvements in this study. The specific contact regarding the C.I.P. at MCDOT is the Division Manager, currently Mr. Greg Halverson, P.E., phone: (602) 506-8744.

10.4.6 Other Potential Funding Participants

The recommended improvements were developed in consideration of their implementation, benefit to the community, and potential for multiple uses. Accordingly, many of the improvements must be completed in partnership with future development.

Although developers will not be directly paying for these drainage improvements, they would be asked to place their currently required retention areas and open space in locations that will allow the Recommended Regional Drainage Improvements to be built. This would reduce the cost of the regional drainage improvements at no additional cost to developments. In effect, the cost savings is simply due to coordination between all parties in implementing the regional drainage solution.

10.4.7 Possible Funding Scenario

A potential funding scenario is included in the table shown in **Figure RA-3.** This funding scenario is based on many assumptions and is provided to show the relative order of magnitude of the cost of improvements, the potential participants, and the feasibility of implementing the Regional Drainage Solutions shown in this report.

This funding scenario was presented to members of the Peoria City Council on May 22, 2001. Although there was much discussion, the Council Members were favorable to the plan and adopted the plan at the July 10, 2001, council session.

SECTION RA-11: CONCLUSIONS AND RECOMMENDATIONS

The ADMP Update was developed over a twenty-month period beginning with some simple goals. The Study Goals for this ADMP were to identify and evaluate existing regional and neighborhood drainage problems within the study area and to develop cost-effective solutions. These solutions needed to be sensitive to the natural and cultural resources, an enhancement of the neighborhood's character, and acceptable to the public.

The regional solutions contained in this report meet these original goals. They were developed with a multi-disciplined team with participation from all key stakeholders and verification at public meetings. The end result is an acceptable economic solution for regional drainage and flooding problems.

The next key steps are to adopt and implement the plan. The City of Peoria Council has already adopted this ADMP Update and staff can now regulate its implementation when reviewing development plans and begin the inclusion of improvements in the C.I.P. The District will review the plan at its September Flood Control Advisory Board meeting and consider its adoption. Also, the District should review the C.I.P. request and if high enough priority, enter into an I.G.A. with interested project partners to begin design and construction immediately.

By implementing this plan, all affected parties will take advantage of a golden opportunity to develop a drainage infrastructure that achieves a tremendous cost savings due solely sharing a common vision and coordinating its implementation for mutual benefit.

SECTION RA-12: REFERENCES

12.1 Data Collection Summary

The following **Table RA-19** summarizes the data collected as part of this study.

12.2 Reference Documents

1. CDM INC. and JM Montgomery Inc., *Glendale - Peoria Area Drainage Master Plan*, May 1987
2. Stantec Consulting, Inc., Floodplain and Floodway Delineation for Rock Springs Creek, March 2000.
3. U.S. Army Corps of Engineers, *Gila River and Tributaries in Arizona and New Mexico – Flood Damage Report Storm and Flood of August 16-17, 1963*, June 1964.
4. Flood Control District of Maricopa County, *Flood Control Survey Report,* 1962.
5. Flood Control District of Maricopa County, *Comprehensive Flood Control Program Report,* 1963.
6. Greiner Engineering Sciences, Inc. *Bell Road Project Drainage Study – Volume IV – Selected Stormwater/Floodwater Management Plans*, October 1987.
7. Flood Control District of Maricopa County, *Hydrology for Beardsley Channel Extension*, December 1990.
8. Flood Control District of Maricopa County, *Sun City Area Hydrologic Study*, November 1997.
9. Flood Control District of Maricopa County, *91st Avenue Drain Hydrology Update*, October 1994.
10. Simons, Li & Associates, Inc. *Final Design Report Skunk Creek Channel Improvements*, June 1998.

11 Stantec Consulting, Inc., *Middle New River Watercourse Master Plan*, June 1999.

12 Kaminski-Hubbard Engineering, Inc. *Arizona Canal Diversion Channel Area Drainage Master Study*, Volumes 1.2, 1.3, & 1.5, May 1995.

13 Cella Barr Associates Inc., *Trails Master Plan – City of Peoria*, January 1999.

14 Federal Highway Administration (FHA) HYB Software, Version 6.0.

15 HEC-River Modeling System (RMS) by Boss, Version 3.5, 1999.

12.3 Agency Information

1. Flood Control District of Maricopa County
   2801 West Durango Street
   Phoenix, AZ 85009
   (602) 506-1501
   For information contact: Marilyn DeRosa

2. City of Peoria
   8401 West Munroe Street
   Peoria, AZ 85345
   (623) 773-7210
   For information contact: Burton Charron

3. City of Glendale
   5850 West Glendale Avenue
   Glendale, AZ 85301
   (623) 930-3630
   For information contact: Dan Sherwood

TABLE RA-19
DATA COLLECTION SUMMARY

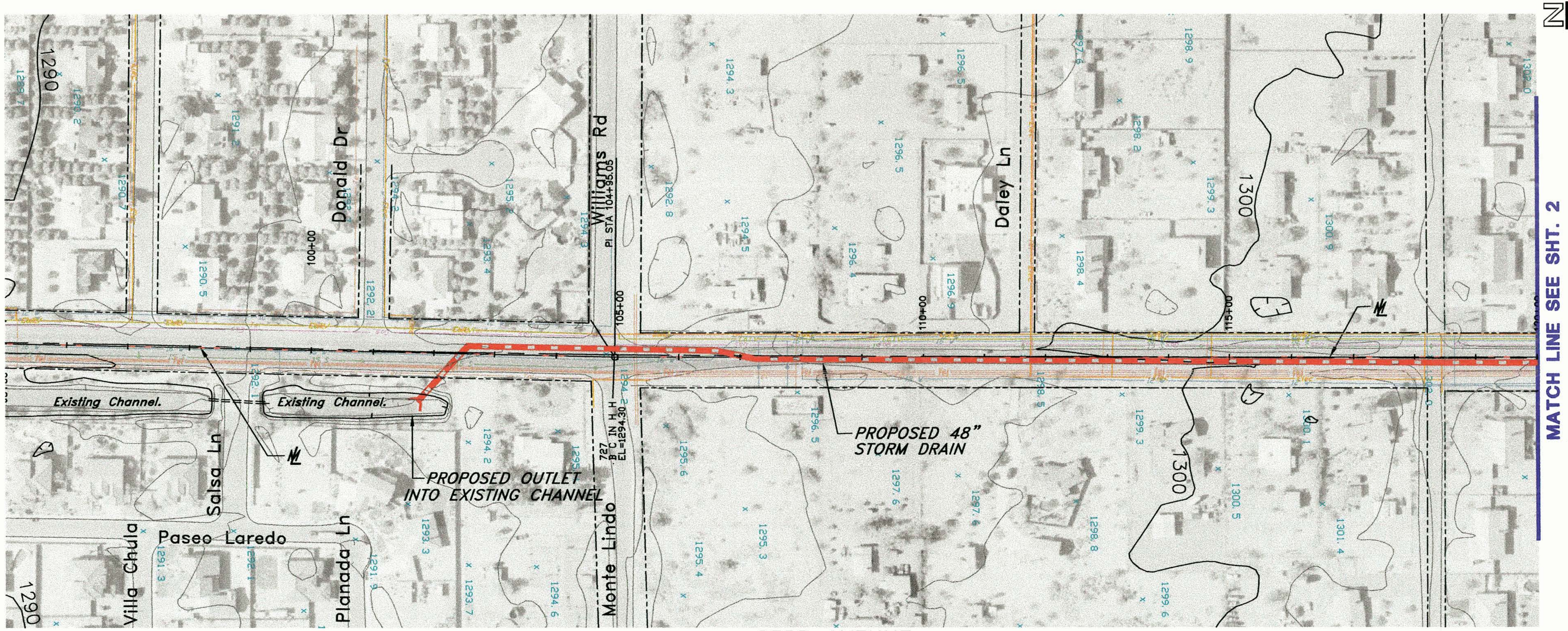
Data Number	Data Description	Prepared by	Date
1	Hydrology Update on Glendale-Peoria Area Drainage Master Study	Maximo R. De Vera (FCDMC)	Jan. 1993
2	Master Grading and Drainage Plan	Carter Associates ,INC.	May 1989
3	Glendale-Peoria Area Drainage Master Plan	CDM INC. and JM Montgomery Inc.	May 1987
4	Concept/Routing study	Wood, Patel and Assoc. Inc.	March 1996
5	Orangewood Storm Drain Location Study	Wood, Patel and Assoc. Inc.	March 1996
6	Preliminary Drainage Report	Coe and Van Loo Consultants Inc.	April 1994
7	Glendale-Peoria-Sun City Drainage Area no.1	Hydrology Branch Engineering Div.	Jan. 1995
8	Drainage Report on Union Hills Dr.	Erikson and Salmon, Inc.	August 1987
9	Flood Damage Report on storm and flood of Aug. 16-17 1963	U.S. Army Corps of Engineers	June 1964
10	Cactus Road Storm Drain	Stanley Franzoy Corey	Nov. 1992
11	Westbrook Village East Drainage Study	Goldman, Toy and Assoc. Inc.	Oct. 1998
12	91st Ave. Drain Hydrology Update	Maximo R. De Vera (FCDMC)	Oct. 1994
13	Desert Amethyst Drainage Project - 60% Plans	Wood, Patel and Assoc. Inc.	May 1999
14	Glendale-Peoria-Sun City Drainage Area no. 2	Hydrology Branch Engineering Div.	Jan. 1995
15	Arrowhead Ranch - Specific Area Plan and Storm Drainage Plan	Dibble and Associates	April 1992
16	Storm Water Master Plan - City of Peoria	JM Montgomery Inc.	April 1985
17	Desert Amethyst Drainage Master Plan	Montgomery Watson	July 1997
18	Preliminary Drainage Report for Intersection Improvements	Hendrich, Eberhart and Assoc., Inc	August 1995
19	500' Swath/Intersection Drainage Plan	Kaminski Hubbard Engineering Co.	July 1993
20	Storm Water Management Plan	Camp Dresser and McKee Inc.	Jan. 1986
21	Glendale General Plan	City of Glendale	Sept. 1987
22	City of Peoria Master Plan of Storm Drainage - Executive Summary	J.M. Montgomery Inc.	April 1988
23	Storm Water Management Plan Capitol Improvement Sum.	Camp Dresser and McKee Inc.	Jan. 1986
24	Storm Drain along Cactus Road - Proposal	Steve Corrales Engineering Co.	Sept. 1990
25	Concept/Routing study (43rd to 99th Ave and Glendale to Olive Ave)	Wood, Patel and Assoc. Inc.	March 1996
26	Final Drainage Report for Eagle Canyon	American Engineering Co.	Jan. 1998
27	Lake Pleasant Road Corridor Study	Kirkham Michael Engineers	May 1999
28	Glendale-Peoria area Drainage Master Plan	CDM INC. and JM Montgomery Inc.	May 1987
29	Revisions to Final Drainage Report Deer Village Unit 1	Coe and Van Loo Consultants Inc.	March 1997
30	Silverton Beazer Homes HEC-RAS and HEC-FDA summary	Sage Engineering Corporation	August 1997
31	Fletcher Heights - Final Drainage Plan	CMX Group Inc.	June 1996
32	Deer Village Units 5&6 - Final Drainage Report	CVL Consultants, Inc	Dec. 1996
33	Dove Valley Ranch - Final Drainage Report Parcels 2,3,5	Neil/McGill Consultants,Inc.	Oct. 1998
34	Deer Village Final Drainage Report Units 1,2,3,4	CVL Consultants, Inc	Dec. 1996
35	Alta Vista Estates - Drainage Report, Units 3 and 4	CMX Group Inc.	Jan. 1998
36	Orangewood Alignment Concept/Routing Study	Wood, Patel and Assoc. Inc.	Nov. 1995
37	Addendum to Glendale-Peoria area Drainage Master Plan	CDM INC. and JM Montgomery Inc.	May 1987
38	Marinette heading canal Floodplain Removal	Coe and Van Loo Consultants Inc.	Sept. 1995
39	Gila River Basin New River and Phoenix City Streams	U.S. Army Corps of Engineers	1982
40	Final Drainage Report for Parkridge at 95th Ave and Beardsley	Coe and Van Loo Consultants Inc.	Jan. 1994
41	Marinette Heading Canal floodplain removal Request for revision	Coe and Van Loo Consultants Inc.	March 1995
42	Drainage Report For Alta Vista Estates, Units 1 and 2	CMX Group Inc.	June 1995
43	Ironwood Final Drainage Plan	CMX Group Inc.	Oct. 1998
44	Peoria Desert Lands Conservation Master Plan	Dames & Moore	Aug 1999
45	City of Peoria Parks Master Plan	Planners Ink	Feb 1996
46	Rivers Master Plan - Executive Summary	Cella Barr Associates Inc.	March 1999
47	Rivers Master Plan	Cella Barr Associates Inc.	Jan 1999
48	Trails Master Plan - Executive Summary	Cella Barr Associates Inc.	March 1999
49	Trails Master Plan	Cella Barr Associates Inc.	Jan 1999
50	Sun City Hydrologic Study	FCDMC	Nov. 1997
51	Silverton Drainage Report	Sage Engineering Corporation	Aug. 1997
52	Fletcher Heights - Preliminary Drainage Plan, Phase III	CMX Group Inc.	June 1996
53	Deer Valley Estates Drainage Plan	CMX Group Inc.	Aug. 1996
54	Fletcher Heights - Preliminary Drainage Plan, Phase II	CMX Group Inc.	July 1996
55	Fletcher Heights - Preliminary Drainage Plan Concept Overview	CMX Group Inc.	June 1993
56	Drainage Report for Calbrisa	CVL Consultants, Inc	July 1993
57	Drainage Report for Calle Lejos Estates	CMX Group Inc.	Nov. 1994
58	Drainage Report for Parcel XI at Arizona Traditions	CVL Consultants, Inc	Oct. 1998
59	Drainage Report for Parcel VIII, IX, and X at Arizona Traditions	CVL Consultants, Inc	June 1998
60	Fletcher Heights - Preliminary Drainage Plan, Phase I Volume I of 2	CMX Group Inc.	June 1996
61	Fletcher Heights - Phase III - Evaluation of Offsite Drainage	CMX Group Inc.	Sept. 1996
62	Drainage Report for La Caille	CMX Group Inc.	Dec 1994
63	Boardwalk/Peoria Units 1&2 Preliminary Drainage Report	Erie and Associates	April 1994
64	Deer Village Final Drainage Report Units 1,2,3,4 PLATE	CVL Consultants, Inc	Dec. 1996
65	Deer Village Final Drainage Report Units 1 Revisions to Final Drainage Report	CVL Consultants, Inc	Dec. 1996
66	Final Drainage Report for Pinnacle Ranch	American Engineering Co.	Oct. 1994

TABLE RA-19
DATA COLLECTION SUMMARY

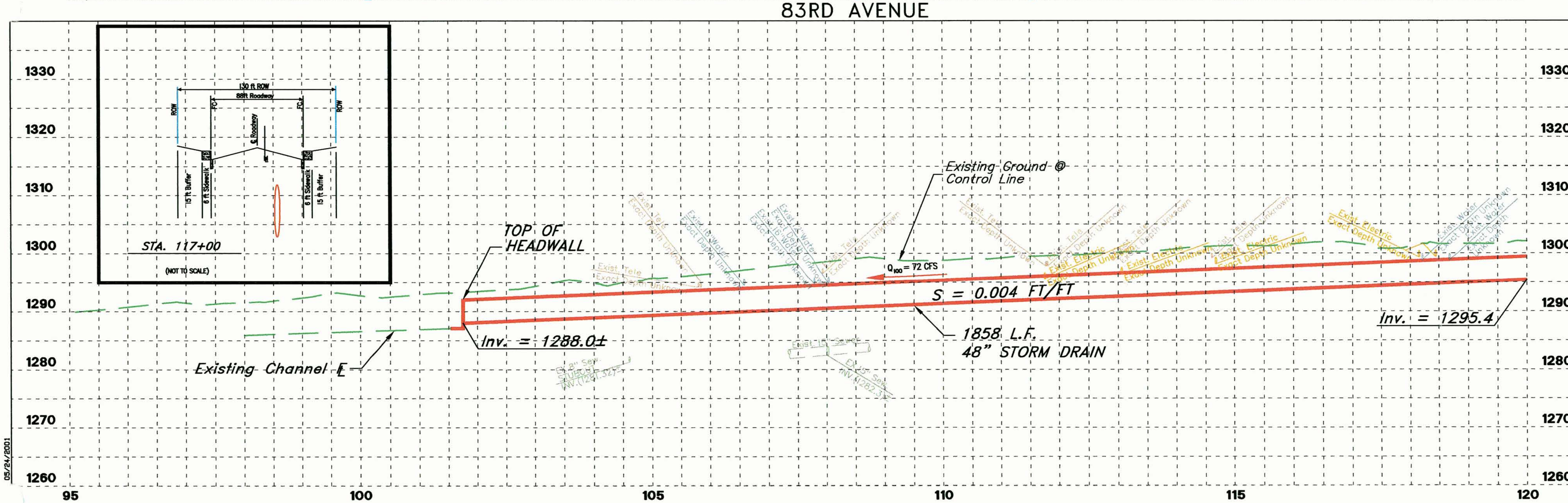
Data Number	Data Description	Prepared by	Date
68	Arrowhead Cove & Arrowhead Business Park Preliminary Drainage Report	Erie and Associates	July 1993
69	Ventana Lakes Final Drainage Report	Collar, Williams & White Engineering	
70	Bell Road Project Drainage Study Volume IV	Greiner Engineering Sciences	Oct 1987
73	New River Watercourse Master Plan-Report & Tech. Notebook	Stantech (draft)	June, 1999
74	Patrick Ranch - Final Drainage Report	Sage Engineering Corporation	March, 1994
75	Hillcrest Ranch - Master Drainage Report	Wood Patel & Associates, Inc.	August, 1991
76	Hillcrest Ranch - Phase 2 Drainage Improvements	Wood Patel & Associates, Inc.	August, 1992
77	Final Drainage for Fletcher Hts Phase 2a	CMX Group Inc.	Dec. 1997
78	Drainage Report for Arrowhead Horizons	DEA	May 1995
79	Drainage Report for Boardwalk	DEA	June, 1995
80	91st Channel plans	Dibble and Associates	Dec. 1998
81	Union Hills paving plans	Carter Associates ,INC.	1990
82	Walgreen Plans	Pasterneck	
83	Bell Rd Plans		
84	Desert Amethyst Drainage Project - 95% Plans	Wood, Patel and Assoc. Inc.	May 1999
85	Westbrook Village East Drainage Study	IMC Consultants	May 1993
86	Smith's Drainage Report	CBA	March 1998
87	Drainage Report for Hunter Ridge	DEA	Aug 1995
90	Hydrologic Analysis of Beardsley Channel extension project	FCDMC	Dec. 1990
91	Master Drainage Report for Terramar	CVL Consultants, Inc	Oct, 1996
93	West Valley Recreation Corridor Pasajes Del Rio Design Concept Report	Carter -Burgess	June, 1999
94	City of Glendale - Existing Structures Map	Unknown	**Current**
95	City of Glendale - General Plan	Glendale Planning Department	**Current**
96	87th Avenue Design Concept Report	Kimley-Horn and Assoc.	Oct 1999
97	Preliminary Drainage Report for Intersection Improvements		
98	Skunk Creek Channel Improvements - FEMA forms	FCDMC	Aug 1993
99	Final Design Report for Skunk Creek Channel Improvements	Simons, Li & Associates	June, 1998
100	ACDC / ADMS PHASE I - VOLUME 1.2	Kaminski Hubbard Engineering Co.	May 1995
101	ACDC / ADMS PHASE I - VOLUME 1.3	Kaminski Hubbard Engineering Co.	Feb. 1995
102	ACDC / ADMS PHASE I - VOLUME 1.5	Kaminski Hubbard Engineering Co.	March 1995
103	Hydrology Worksheets for Area between Skunk Creek and the ACDC	Kaminski Hubbard Engineering Co.	March 1995
104	Skunk Creek Hydrology Report	Coe and Van Loo Consultants Inc.	Nov. 1990
105	Drainage Infrastructure Report for Terramar	Coe and Van Loo Consultants Inc.	Nov. 1996
106	Area Drainage Master Study Little Deer Valley	Collar, Williams & White Engineering	July 1990
107	Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects	FCDMC	Dec. 1992
108	Final Drainage Report for Hunter Field Estates	Tobar	Feb 2000
109	Preliminary Drainage Report for Summit at Sunrise Mountain	American Engineering Co.	5-2000
110	Durango ADMP -Potential Alternatives Submittal	Dibble and Associates	3-31-2000
111	Lake Pleasant Parkway Detention Basin	Goldman, Toy and Assoc. Inc.	1-2000
112	Lake Pleasant Parkway Detention Basin - Plans and bid Documents	Goldman, Toy and Assoc. Inc.	1-2000
113	Lake Pleasant Parkway Detention Basin - Addendum #5	Goldman, Toy and Assoc. Inc.	1-2000
114	Floodplain and Floodway Delineation for Rock Springs Creek	Stantec Consulting	March 2000
115	Camino A Lago Specific Plan	Urban Lands Development	Feb 1997
116	87th Avenue Final Canidate Assesment Report	DMJM	Feb 1998
117	Pinnacle Peak Road Final Canidate Assesment Report	Entranco	Oct 1999
150	101 As-Built Information	Franzoy-Corey	1991
200	Kaminski Hubbard Drainage Basins	Kaminski Hubbard Engineering Co.	
201	MAG Landuse	FCDMC	
202	SOILS	FCDMC	
203	USGS Mapping	USGS	
204	1999 Aerials	FCDMC	
300	Peoria Zoning Map	City of Peoria	12-06-99

APPENDIX A. PRELIMINARY CONSTRUCTION DRAWINGS

FULL SIZE DRAWINGS ARE ATTACHED SEPARATELY



83RD AVENUE



LEGEND

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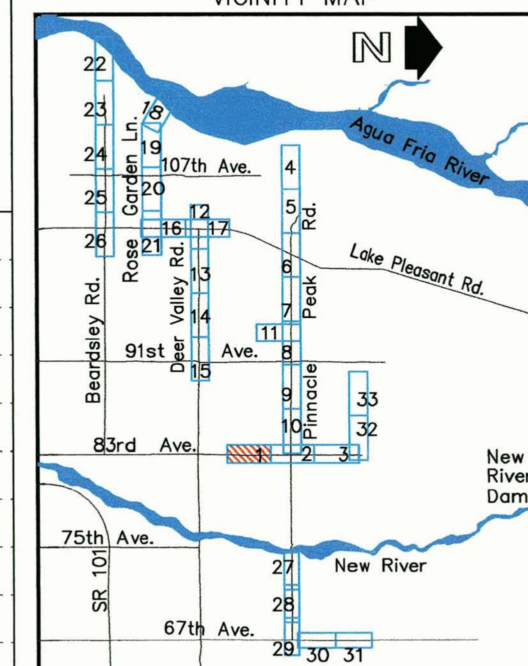
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



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SCALE: 1"= 100'

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer, Certificate No. 29737, HERNAN A. ARISTIZABAL, ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

83RD AVENUE
STA. 95+00 TO 120+00

SHEET 1 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

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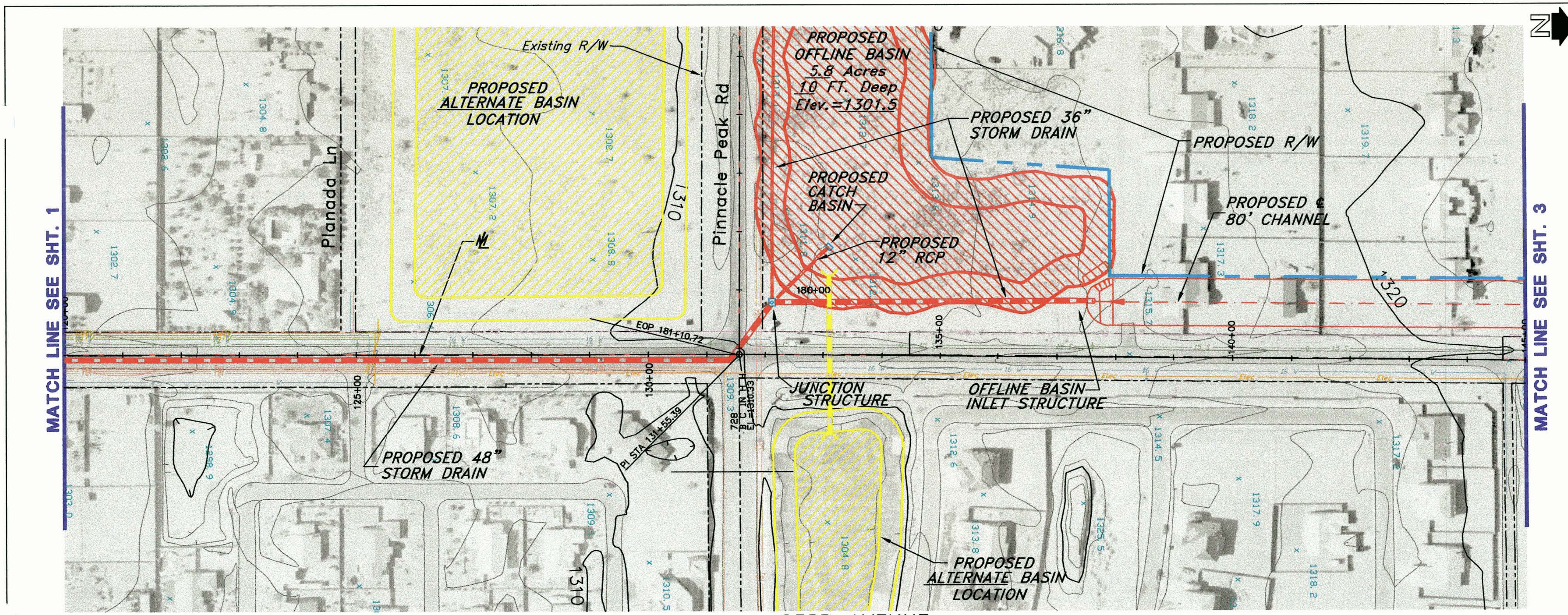

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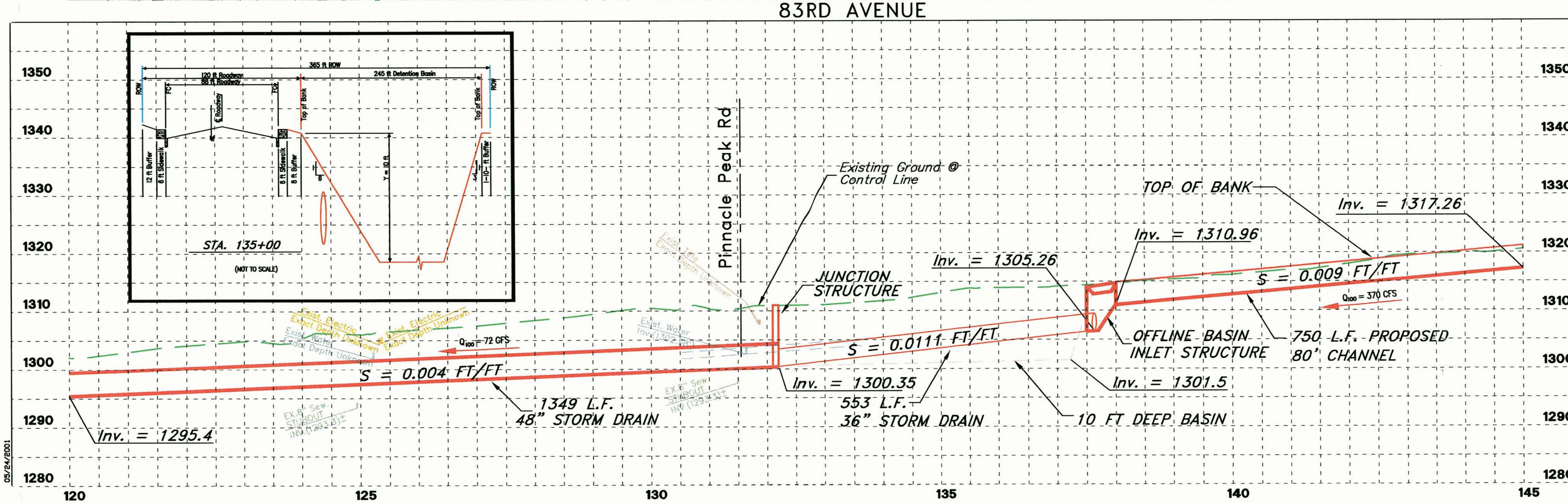

05/24/2001

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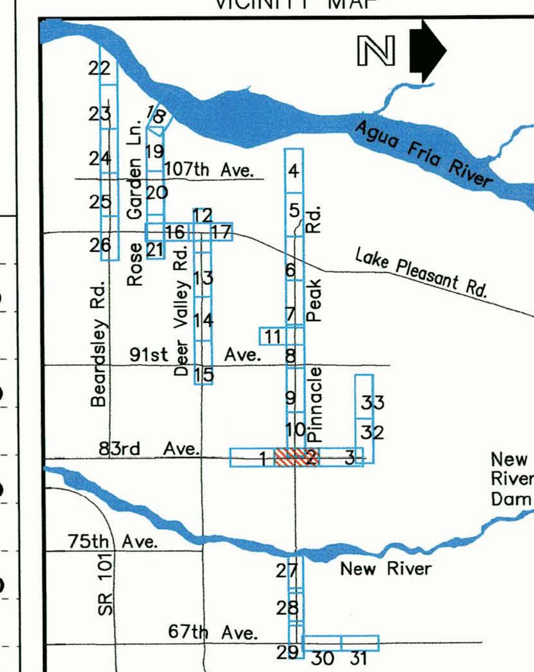
BY PENTACORE ARIZONA, INC.

LEGEND

EXISTING RIGHT-OF-WAY
EXISTING TELEPHONE LINE
EXISTING SEWER LINE
EXISTING GAS LINE
EXISTING WATER LINE
EXISTING ELECTRIC LINE
EXISTING CABLE TV LINE
PROPOSED RIGHT-OF-WAY
PROPOSED BASIN
ALTERNATE FACILITIES
PROPOSED STORM DRAIN
Q100 = 40 cfs DIRECTION AND QUANTITY OF FLOW
CHANNEL
1290 INDEX CONTOUR
INTERMEDIATE CONTOUR

VICINITY MAP



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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE
F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer — CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL — ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus
2255 N. 44th Street Suite 125
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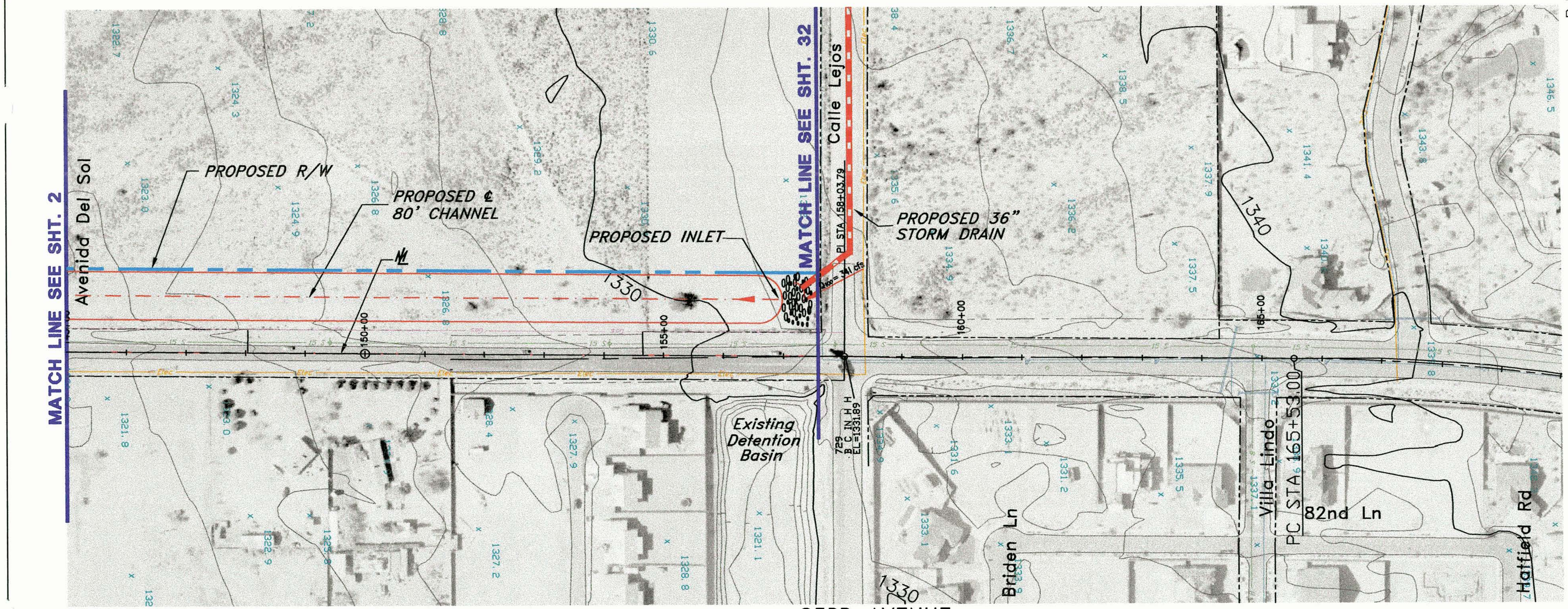
83RD AVENUE
STA. 120+00 TO 145+00

SHEET 2 OF 33



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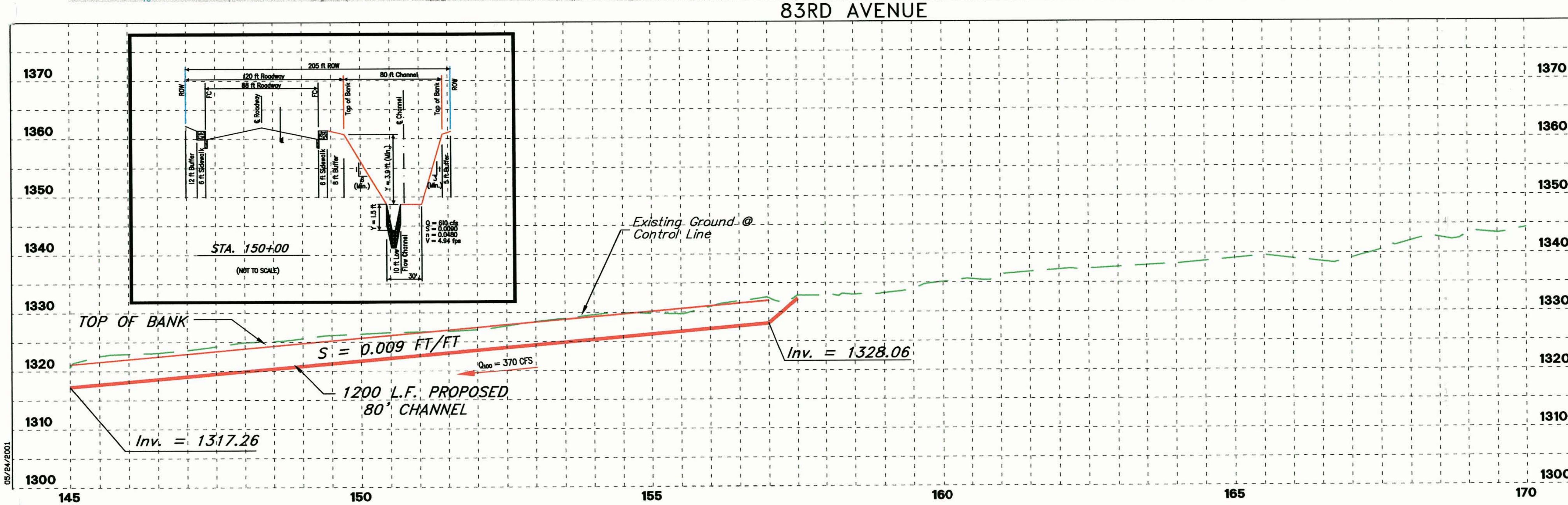

LEGEND

- EXISTING RIGHT–OF–WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
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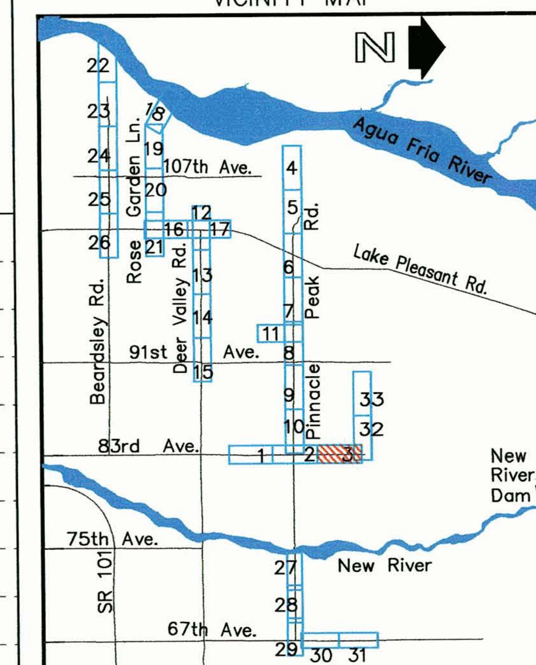
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT–OF–WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



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SCALE: 1"= 100'

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99–44

Registered Professional Engineer, Certificate No. 29737, HERNAN A. ARISTIZABAL, Arizona, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus — 2255 N. 44th Street Suite 125, Phoenix, AZ 85008.3279, Tel 602.244.2566, Fax 602.244.8947, E-mail www.entellus.com

83RD AVENUE STA. 145+00 TO 170+00 — SHEET 3 OF 33

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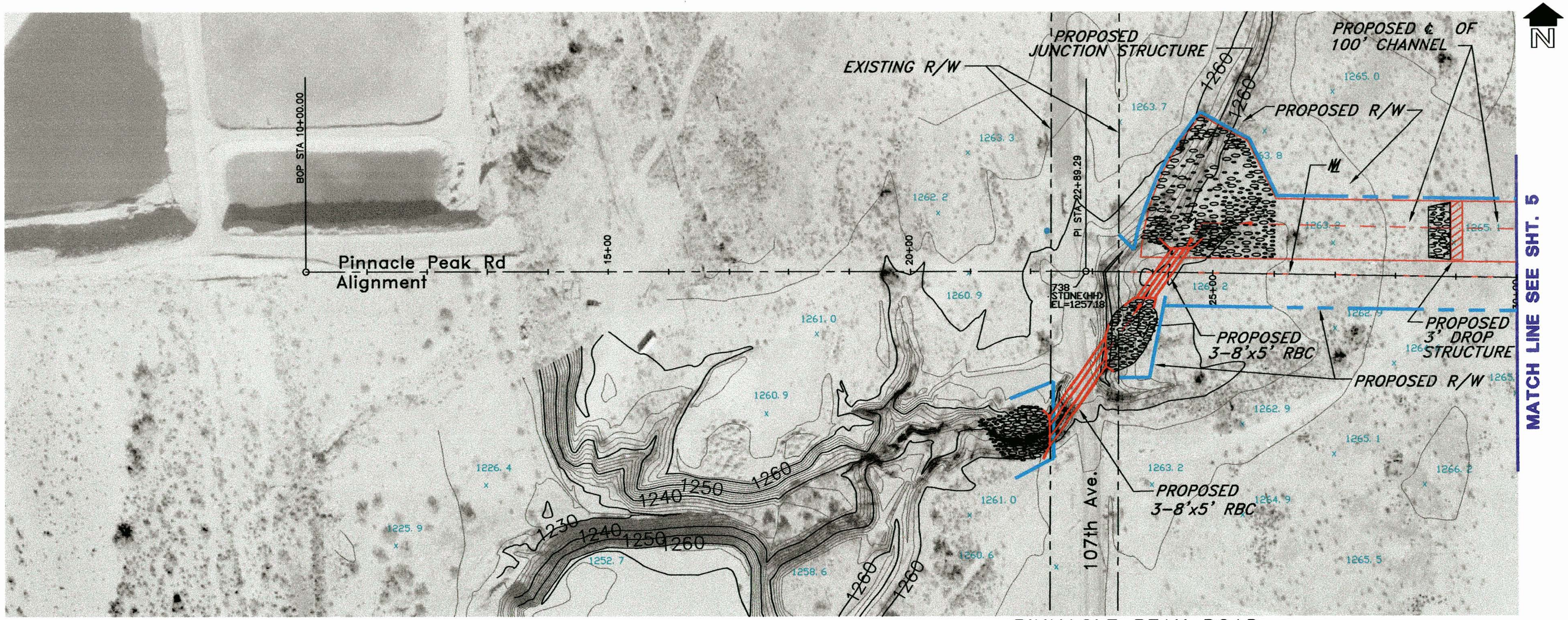
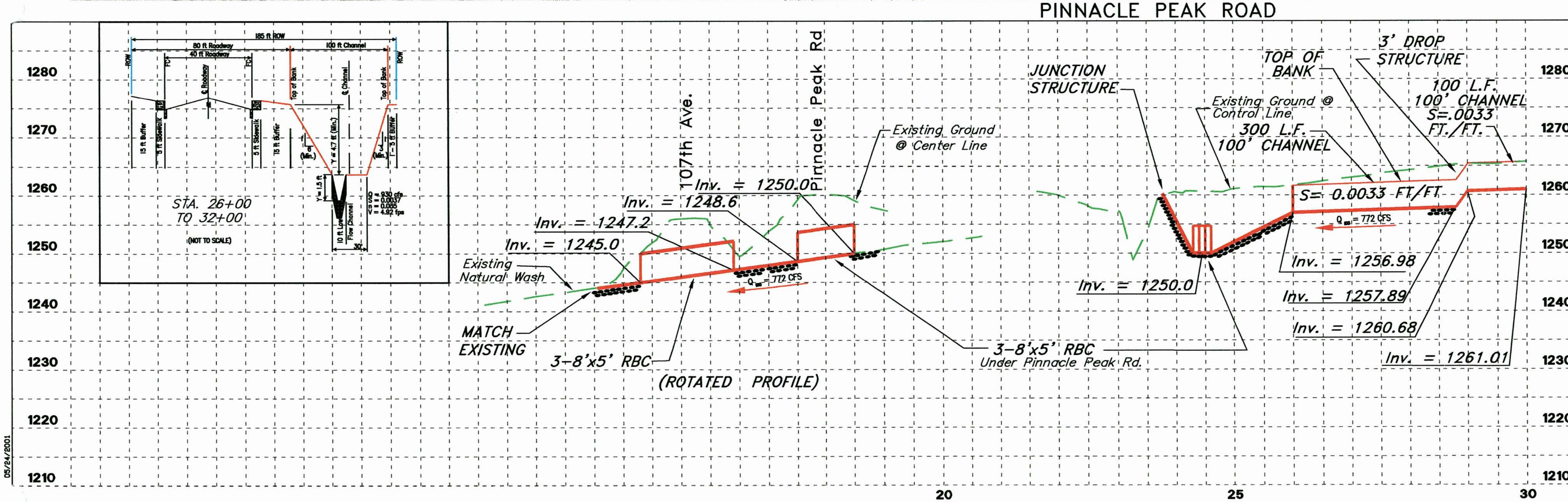


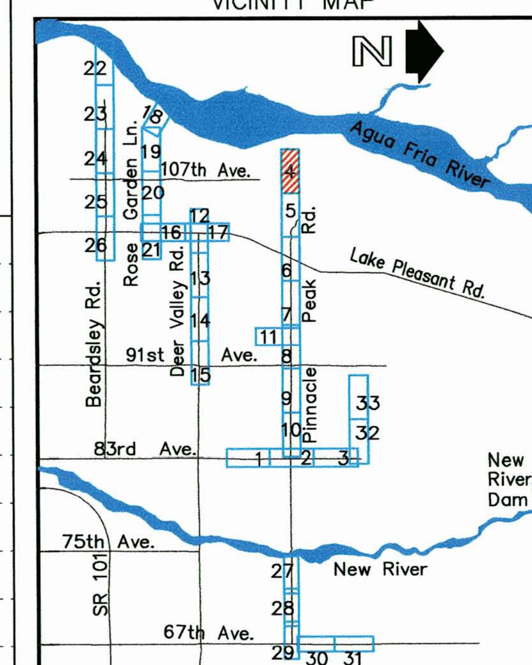
PINNACLE PEAK ROAD



LEGEND

	EXISTING RIGHT-OF-WAY
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



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SCALE: 1"= 100'

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus 2255 N. 44th Street Suite 125 Phoenix, AZ 85008.8279 Tel 602.244.2566 Fax 602.244.8947 E-mail www.entellus.com

PINNACLE PEAK ROAD
STA. 10+00 TO 30+00

SHEET 4 OF 33

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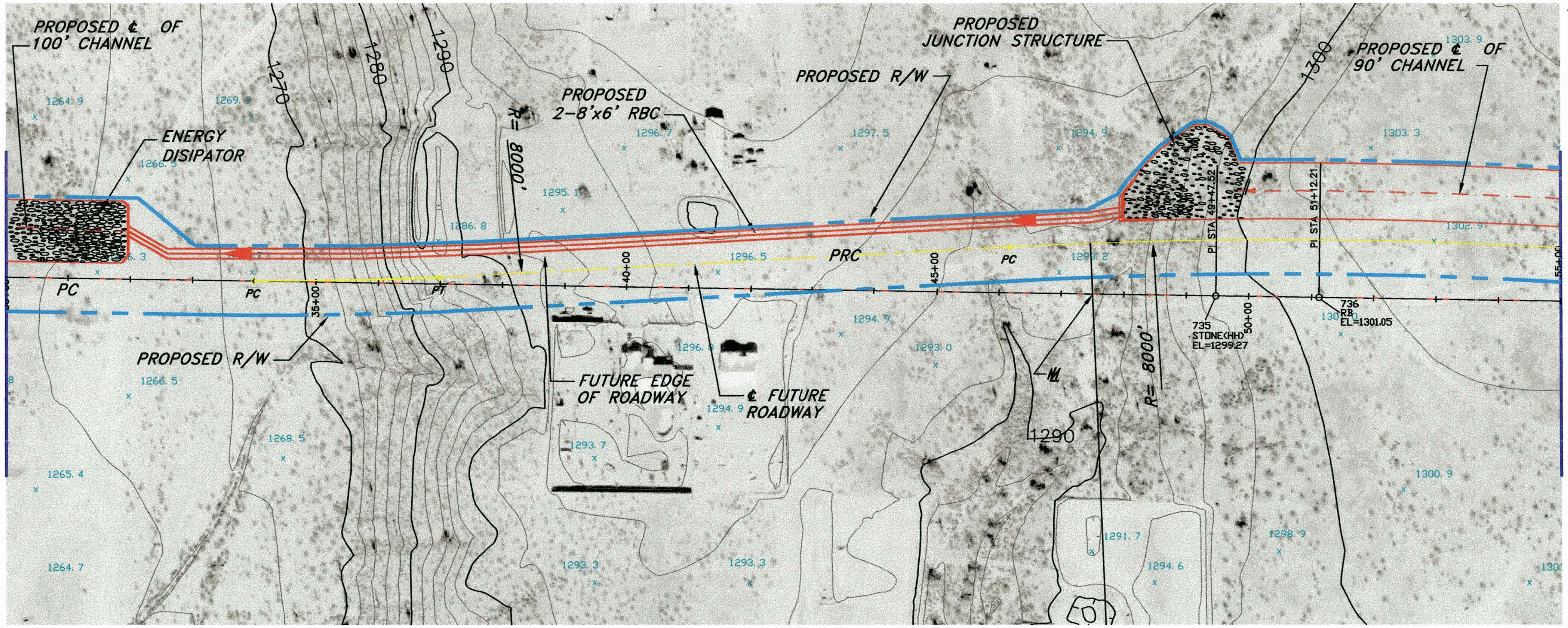

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GAS	EXISTING GAS LINE
W	EXISTING WATER LINE
Elec	EXISTING ELECTRIC LINE
CaTV	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100}= 40 cfs	DIRECTION AND QUANTITY OF FLOW
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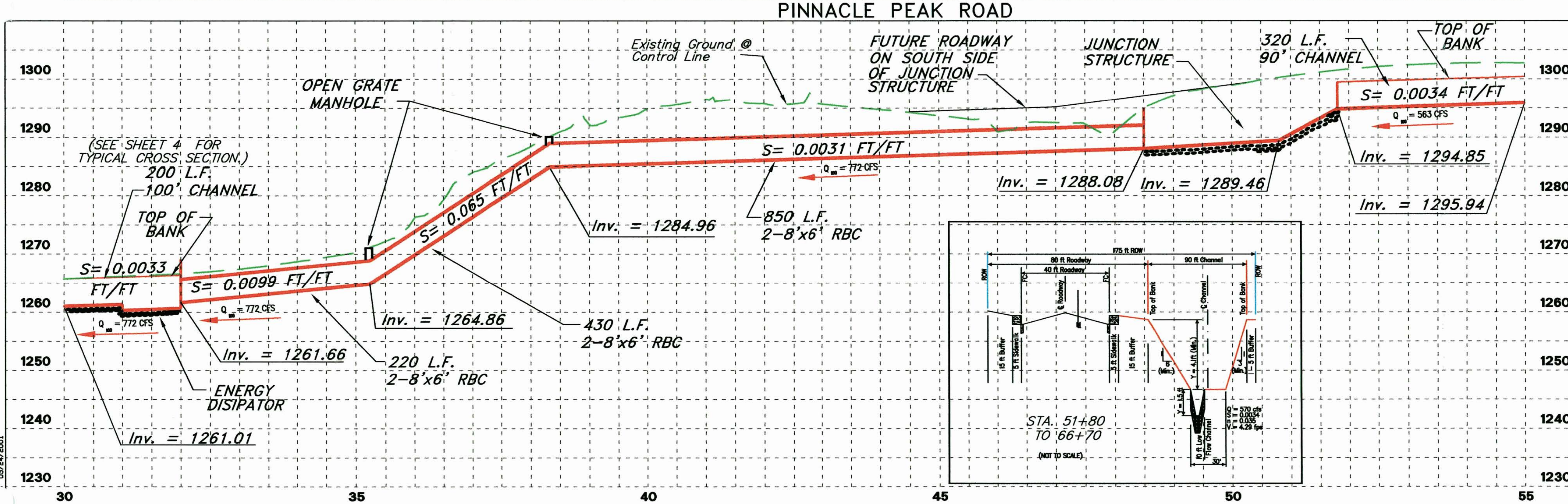
	INTERMEDIATE CONTOUR

PINNACLE PEAK ROAD



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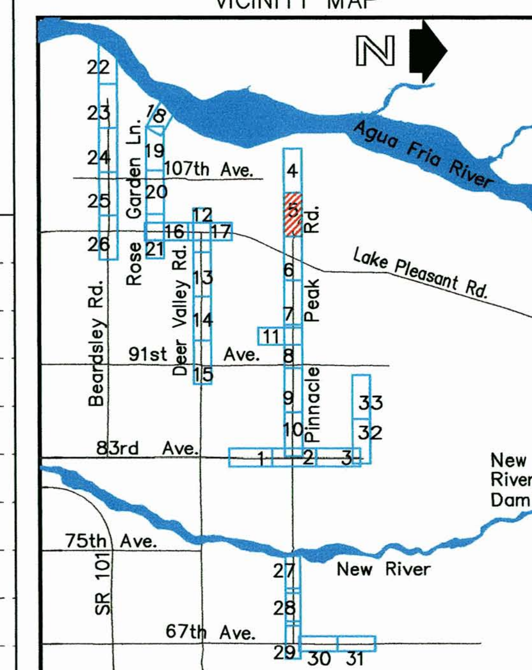

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99–44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus™
2255 N. 44th Street Suite 125
Phoenix. AZ 85008.3279
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Fax 602.244.8947
E-mail www.entellus.com

PINNACLE PEAK ROAD
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SHEET 5 OF 33

NOTE:
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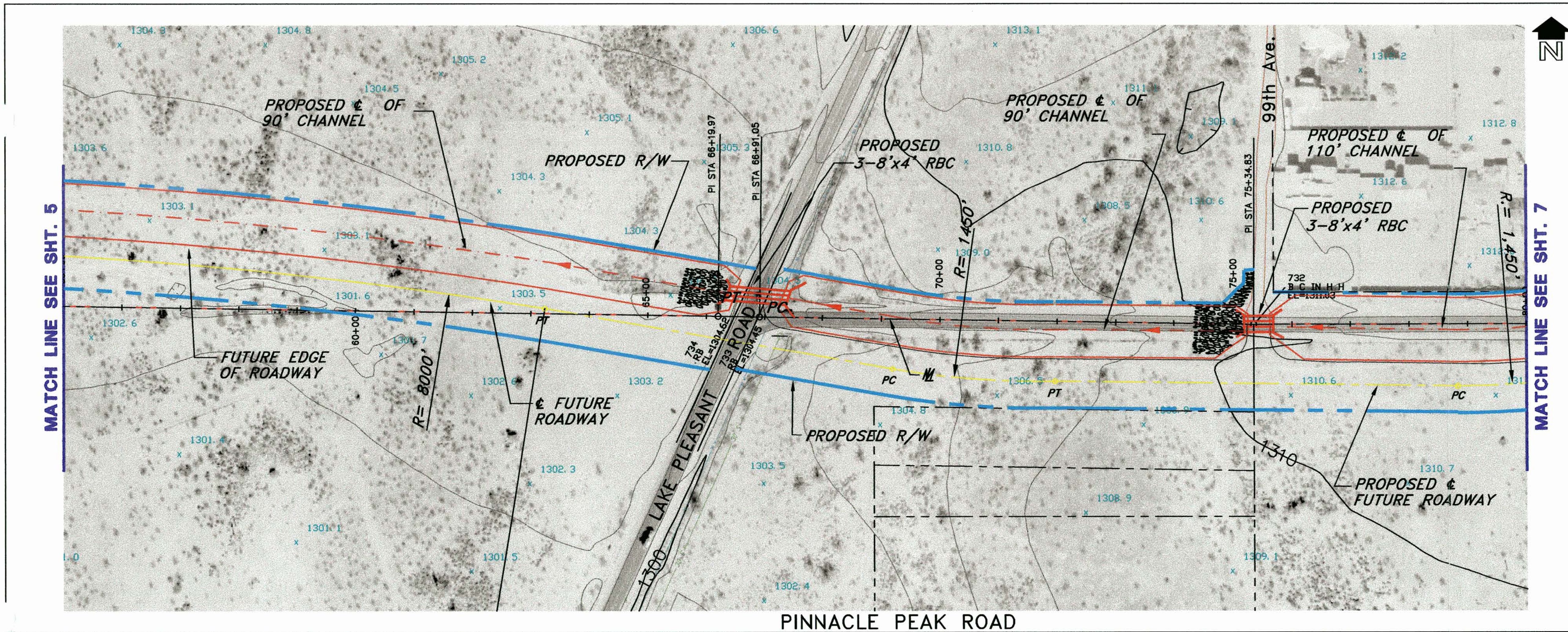

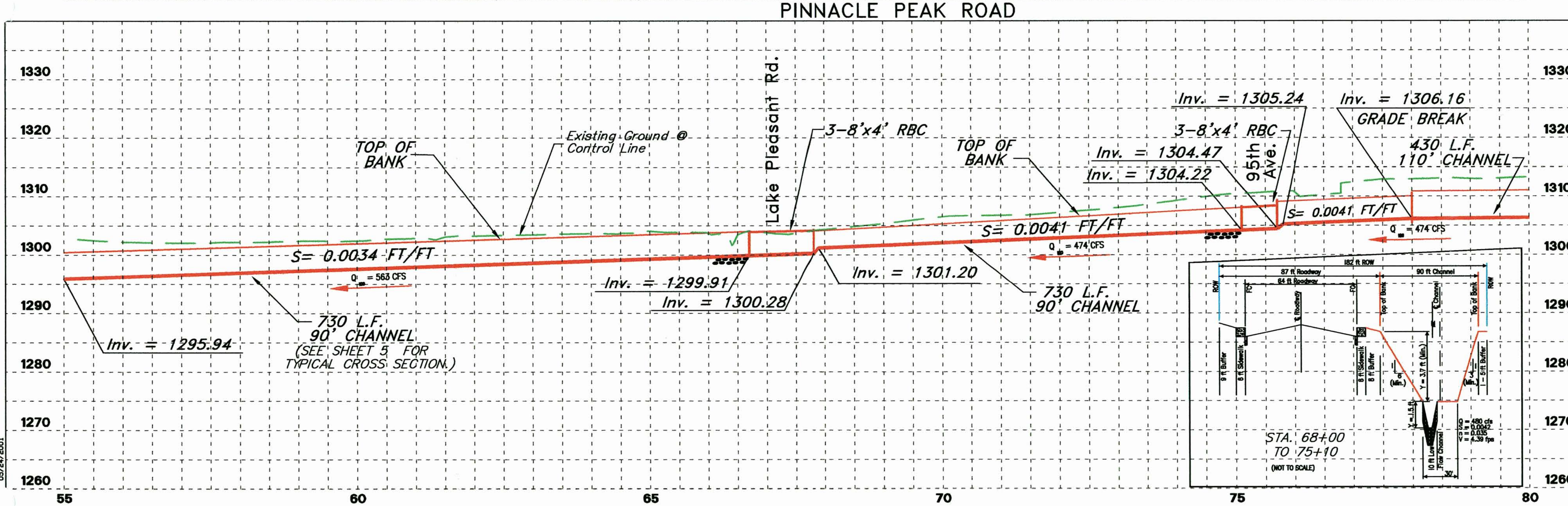

LEGEND

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- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
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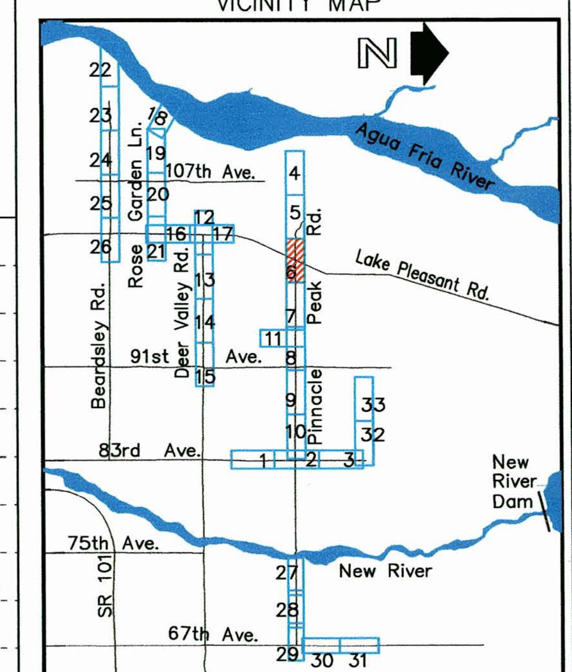
VICINITY MAP



100' 0' 100' 200'

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NO.	REVISION	BY	DATE
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Civil Engineer 29737 HERNAN A. ARISTIZABAL ARIZONA, U.S.A.

Entellus — 2255 N. 44th Street Suite 125, Phoenix, AZ 85008.3279, Tel 602.244.2566, Fax 602.244.8947, E-mail www.entellus.com

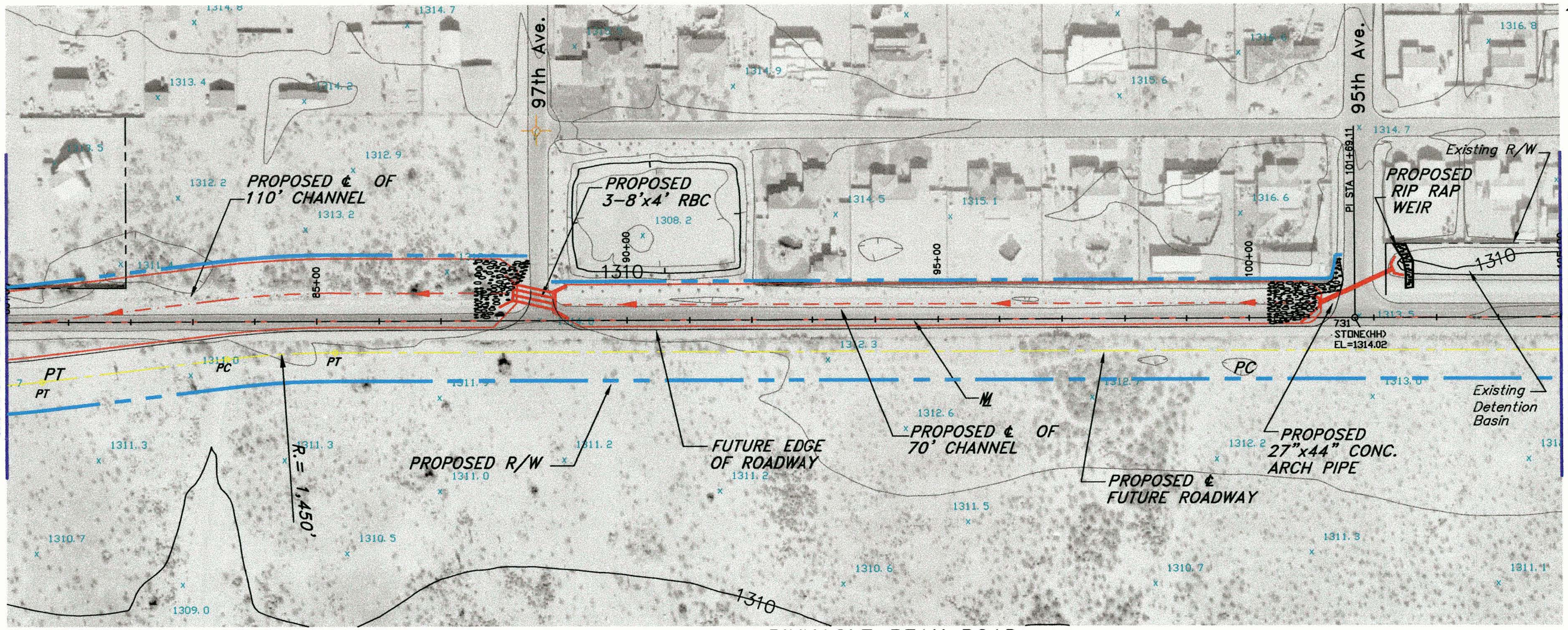
PINNACLE PEAK ROAD STA. 55+00 TO 80+00

SHEET 6 OF 33

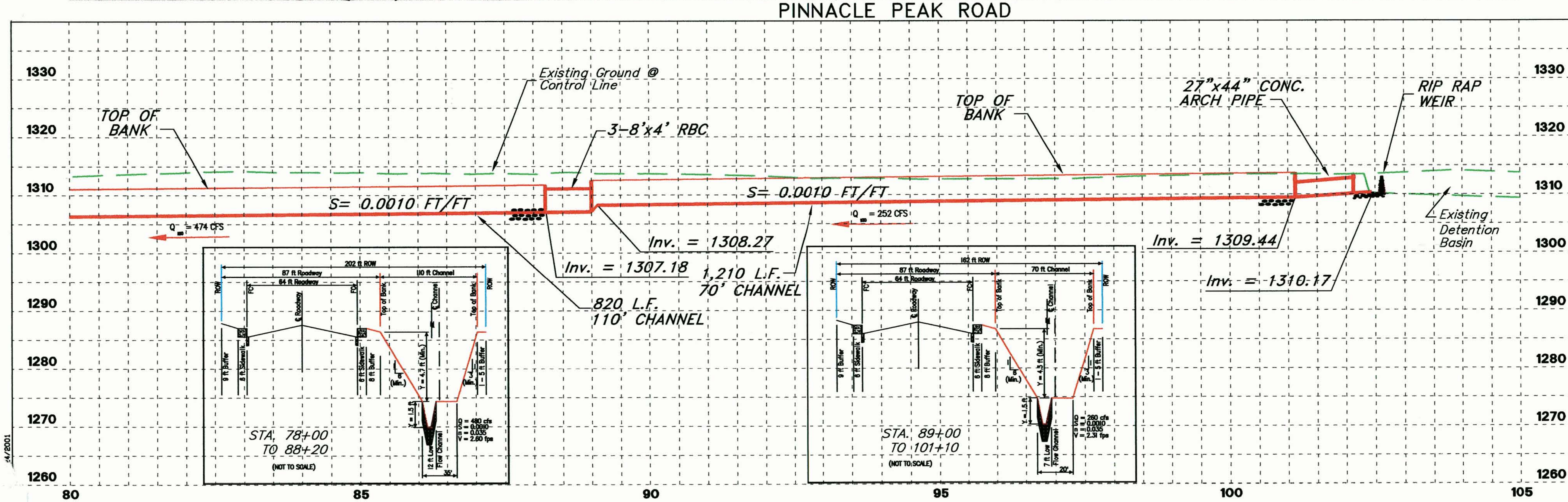
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

FILE: PPeak_Windows.dwg

05/24/2001



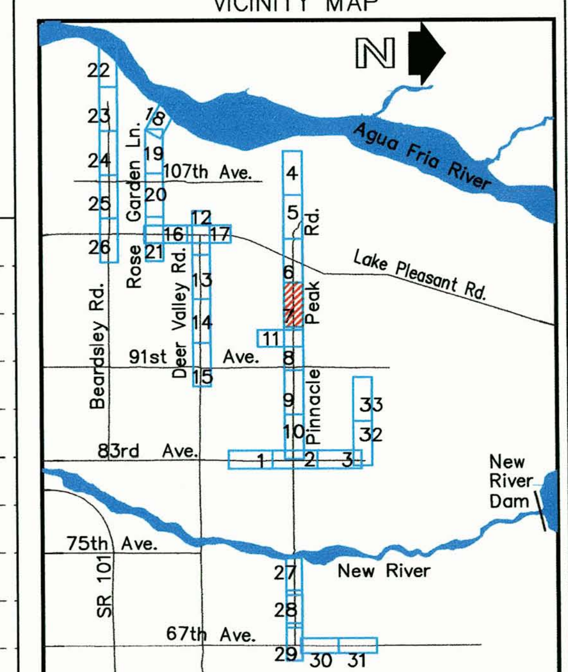
PINNACLE PEAK ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE
F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

29737 HERNAN A. ARISTIZABAL

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2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

PINNACLE PEAK ROAD
STA. 80+00 TO 105+00

SHEET 7 OF 33

NOTE:
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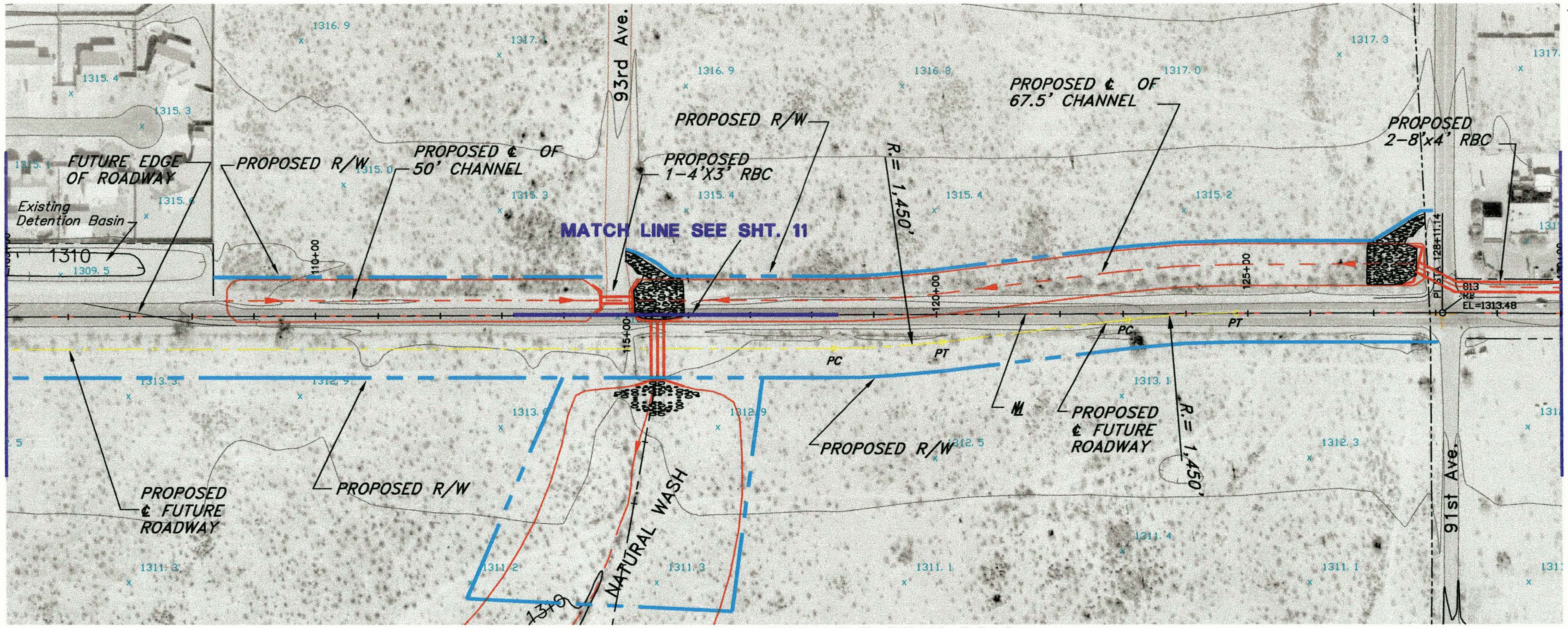
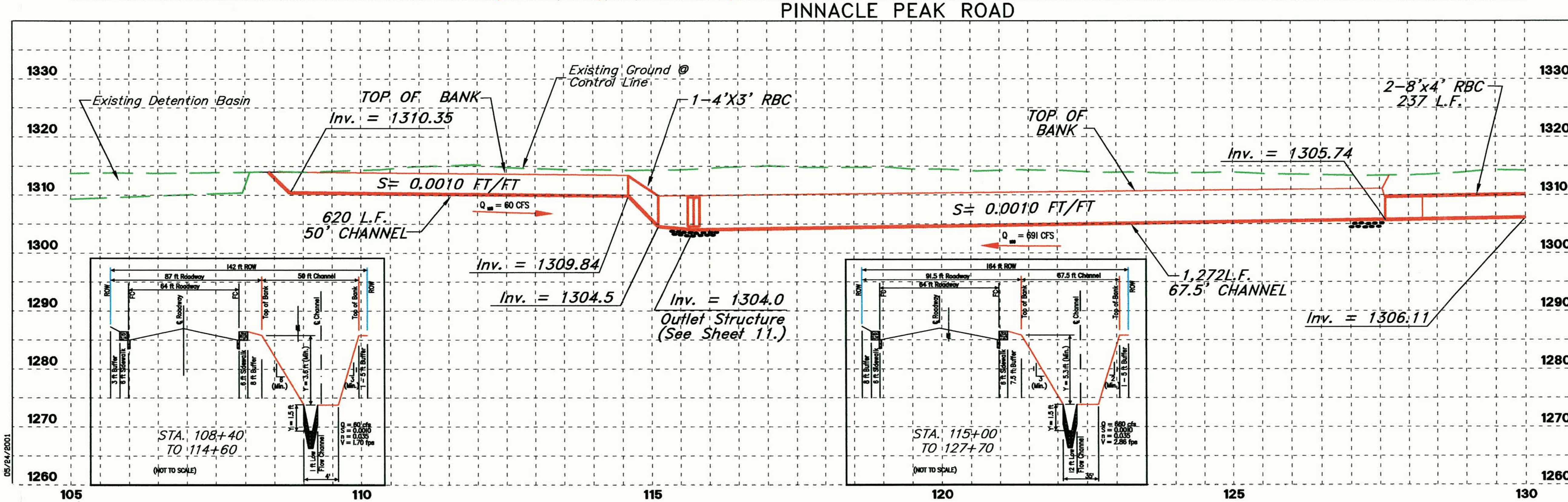
FILE: PPeak_Windows.dwg



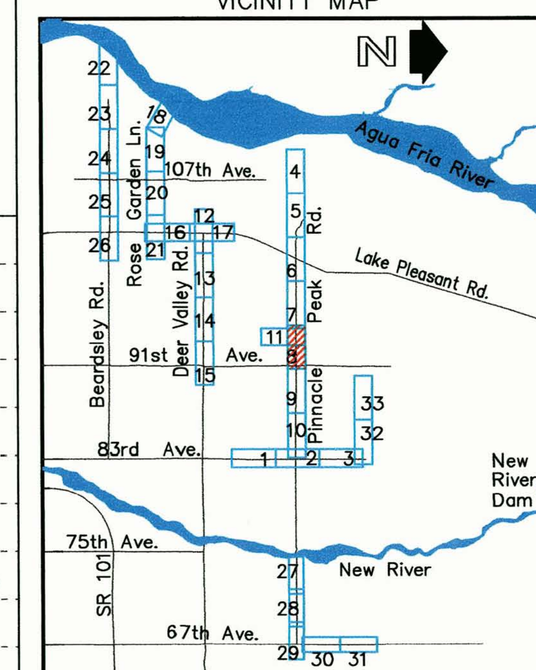
PINNACLE PEAK ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

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PINNACLE PEAK ROAD
STA. 105+00 TO 130+00

SHEET 8 OF 33

05/24/2001

FILE: PPeak_Windows.dwg

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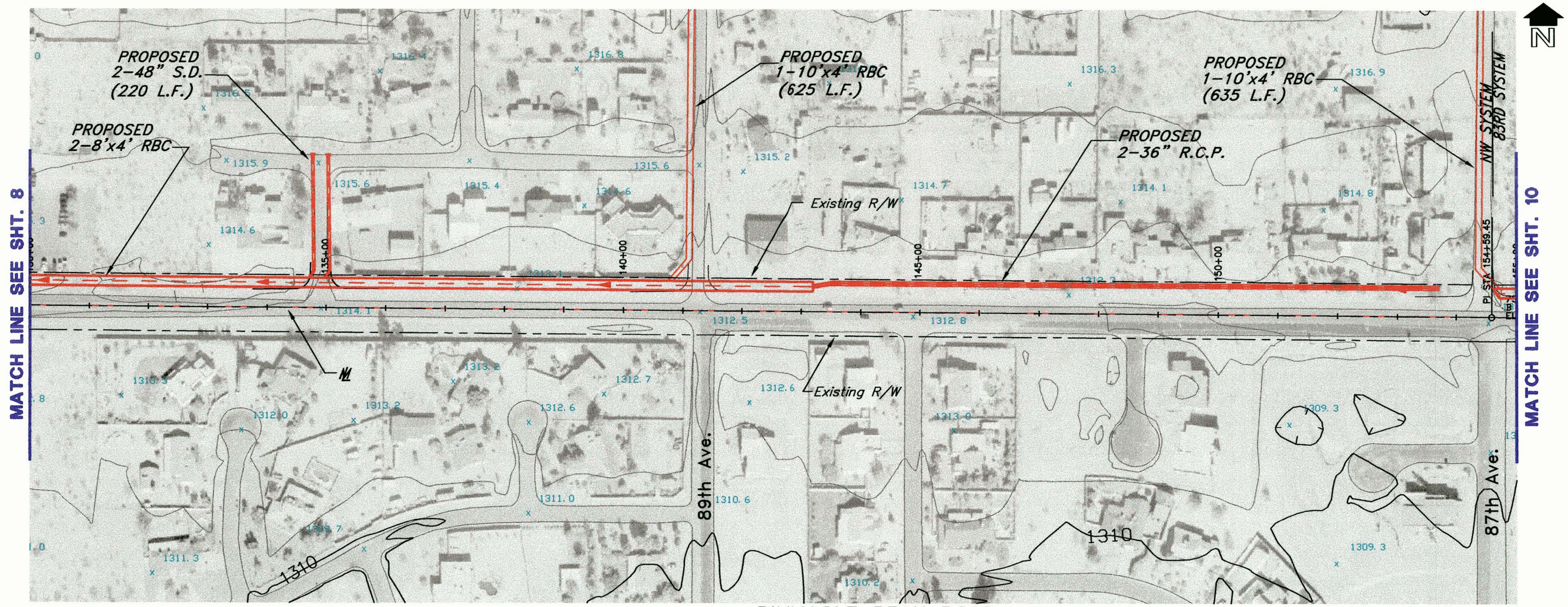
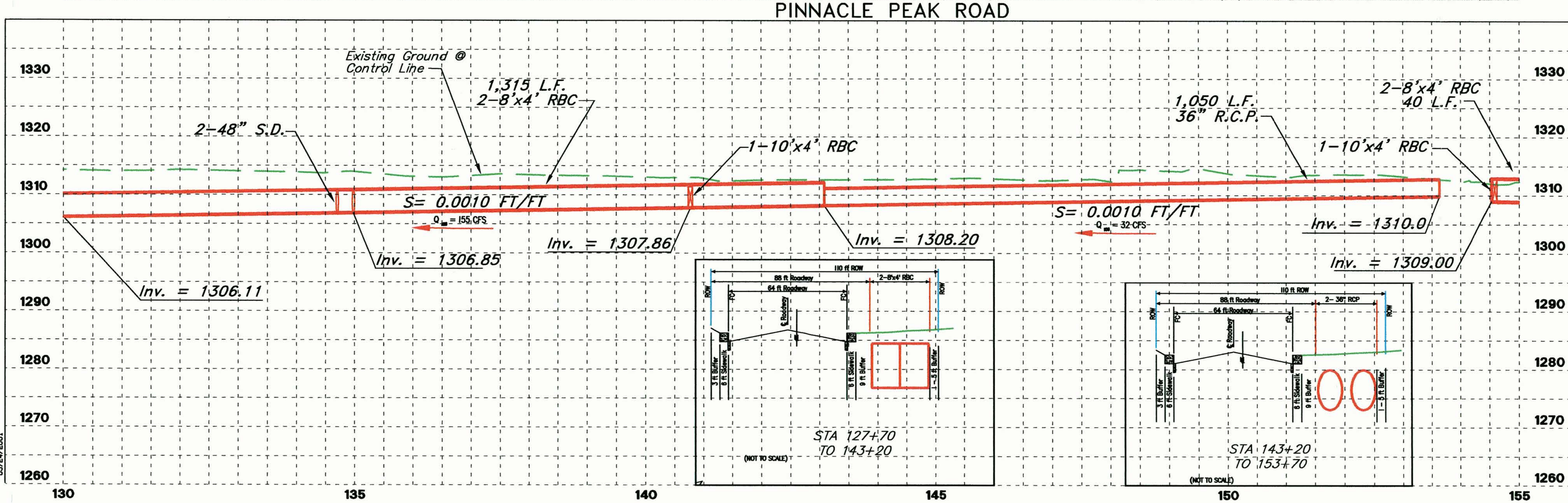


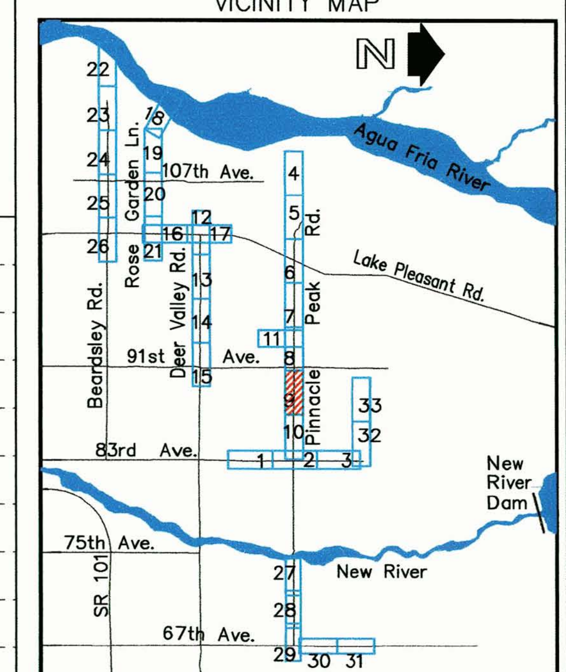
PINNACLE PEAK ROAD



LEGEND

EXISTING RIGHT-OF-WAY
EXISTING TELEPHONE LINE
EXISTING SEWER LINE
EXISTING GAS LINE
EXISTING WATER LINE
EXISTING ELECTRIC LINE
EXISTING CABLE TV LINE
PROPOSED RIGHT-OF-WAY
PROPOSED BASIN
ALTERNATE FACILITIES
PROPOSED STORM DRAIN
Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
CHANNEL
1290 INDEX CONTOUR
INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil)
CERTIFICATE NO. 29737
HERNAN A. ARISTIZABAL
Date Signed
ARIZONA, U.S.A.

	BY	DATE
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DRAWN	GLT/KAB	08/01
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PINNACLE PEAK ROAD
STA. 130+00 TO 155+00

SHEET 9 OF 33

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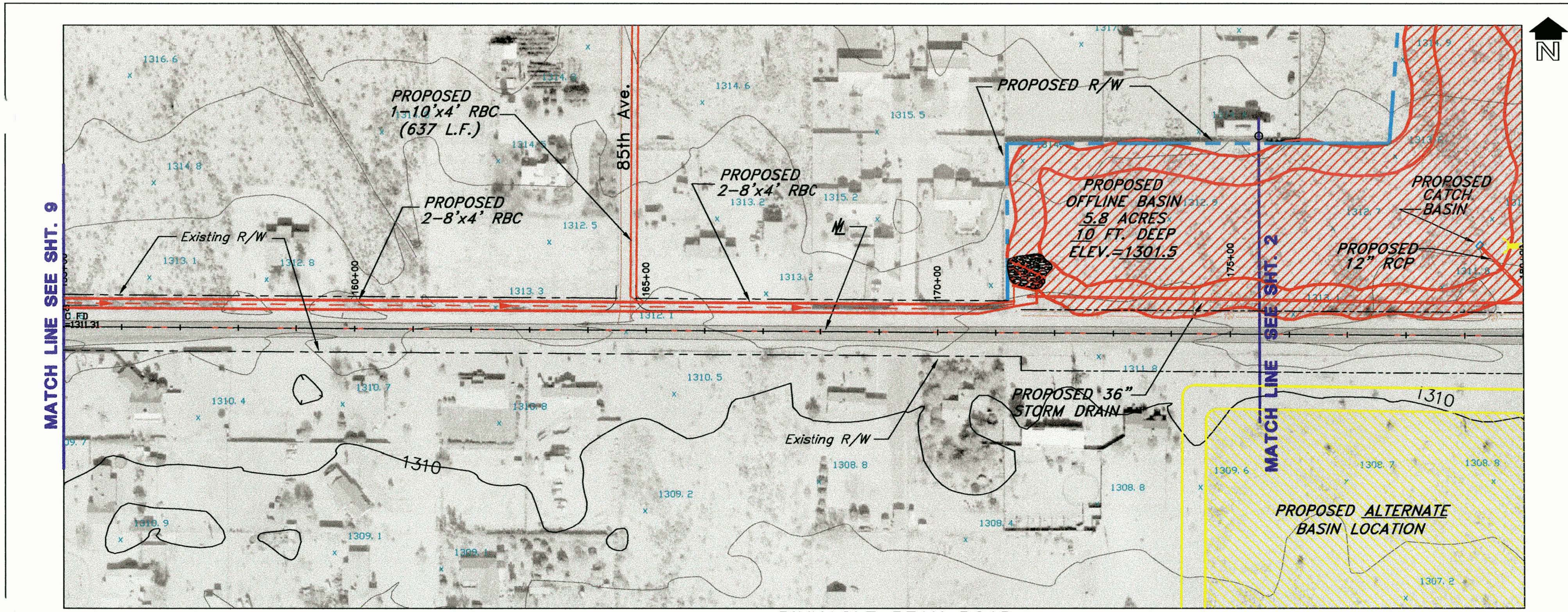
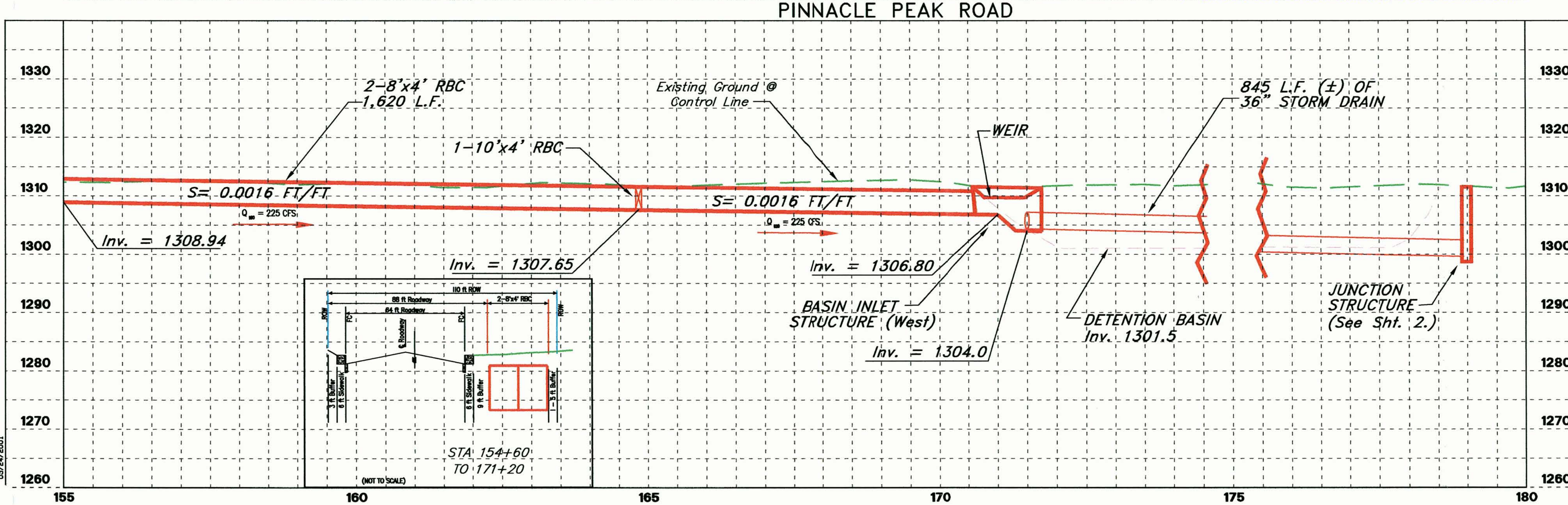
FILE: PPeak_Windows.dwg
05/24/2001



PINNACLE PEAK ROAD



05/24/2001

FILE: PPeak_Windows.dwg

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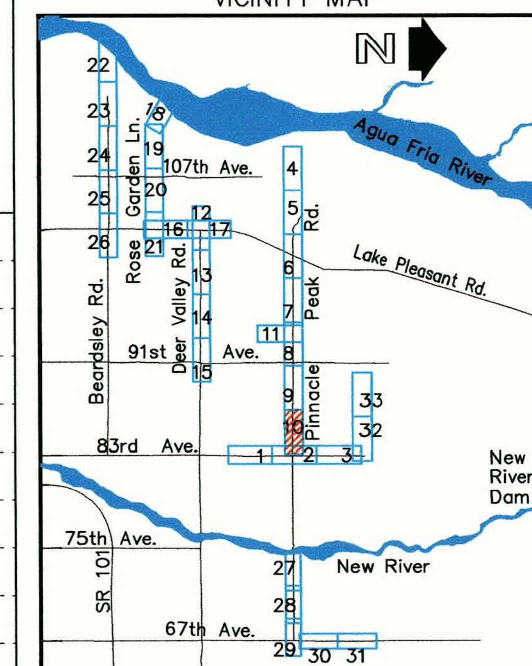
LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) Certificate No. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus
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Fax 602.244.8947
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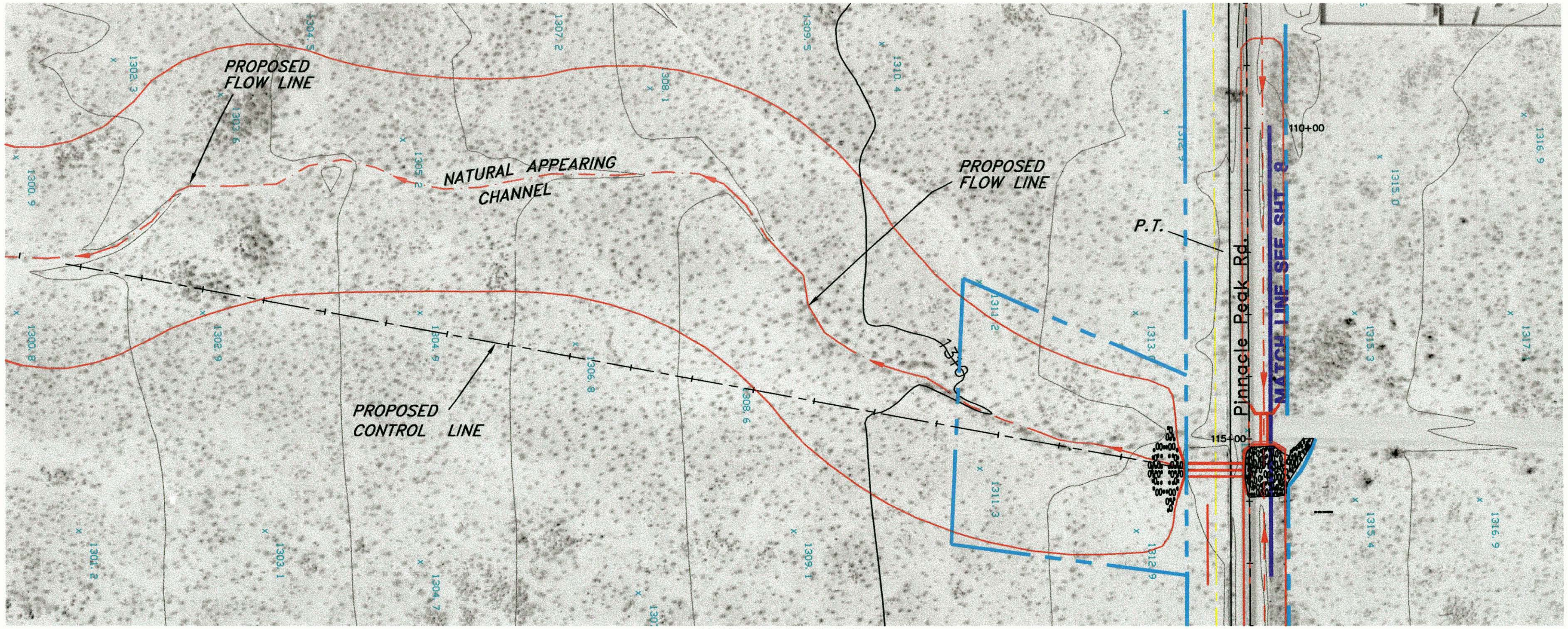
PINNACLE PEAK ROAD
STA. 155+00 TO 160+00

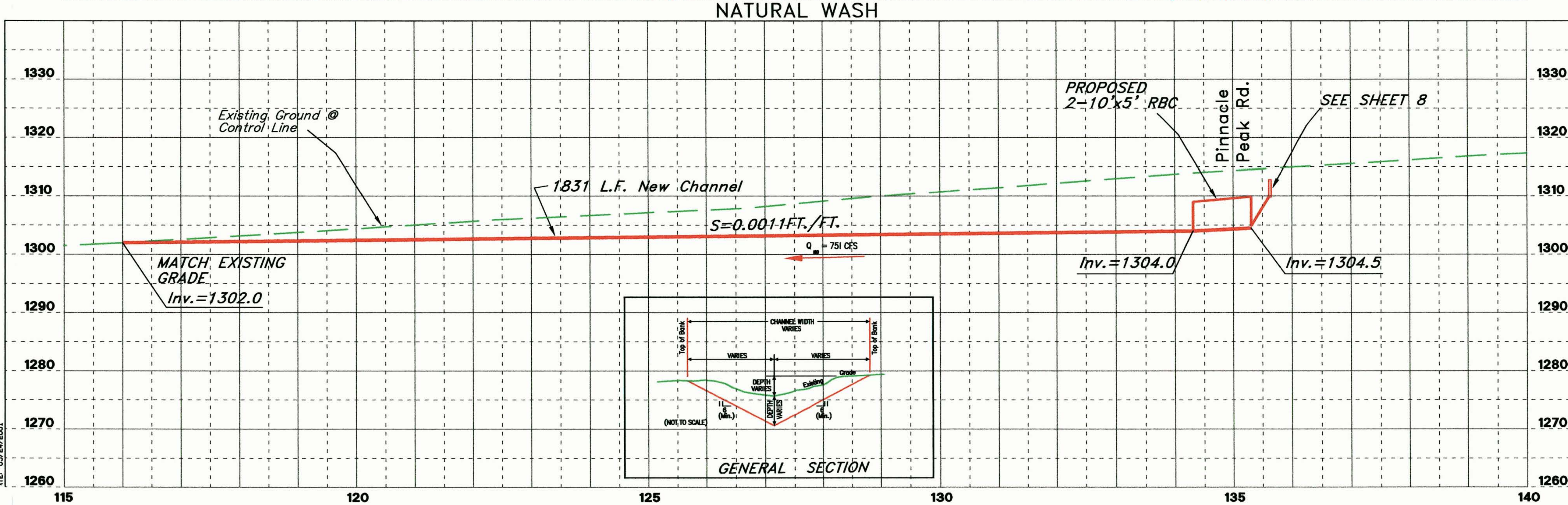
SHEET 10 OF 33



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

NATURAL WASH



VICINITY MAP

100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

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Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

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NATURAL WASH
STA. 115+00 TO 140+00

SHEET 11 OF 33

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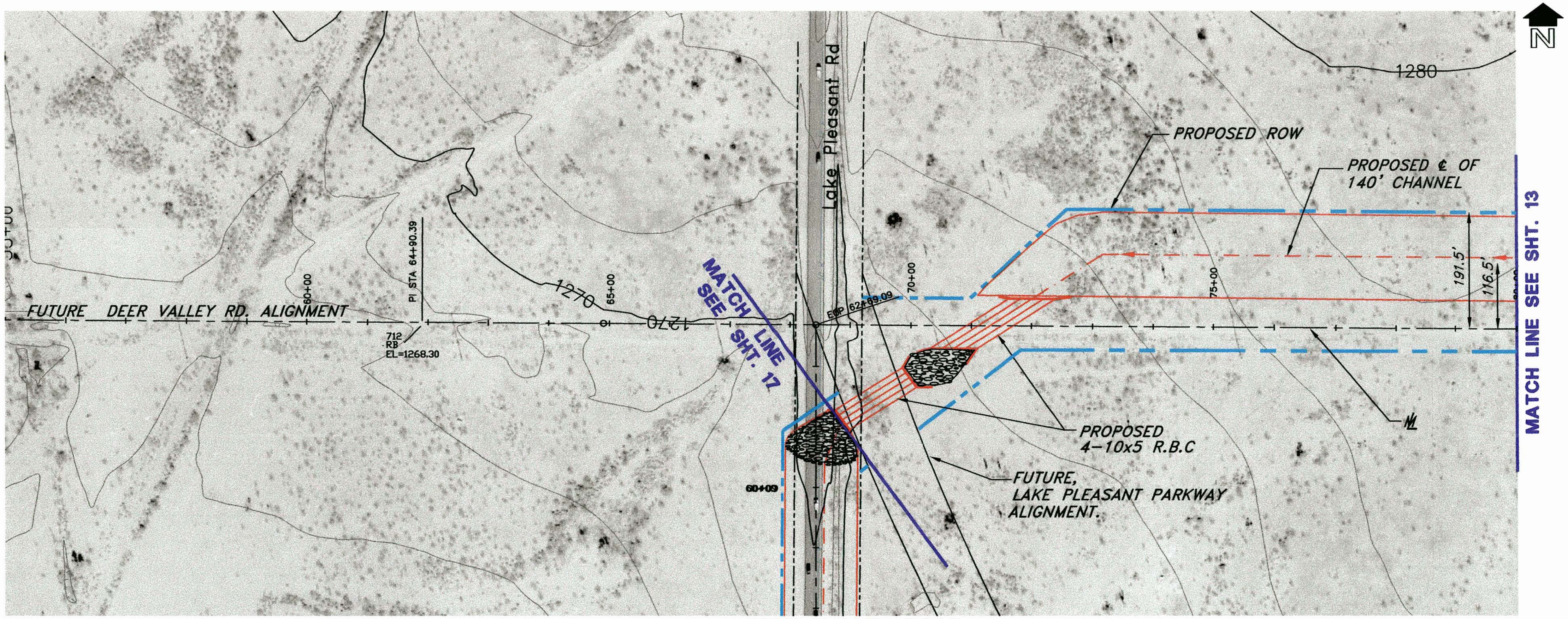
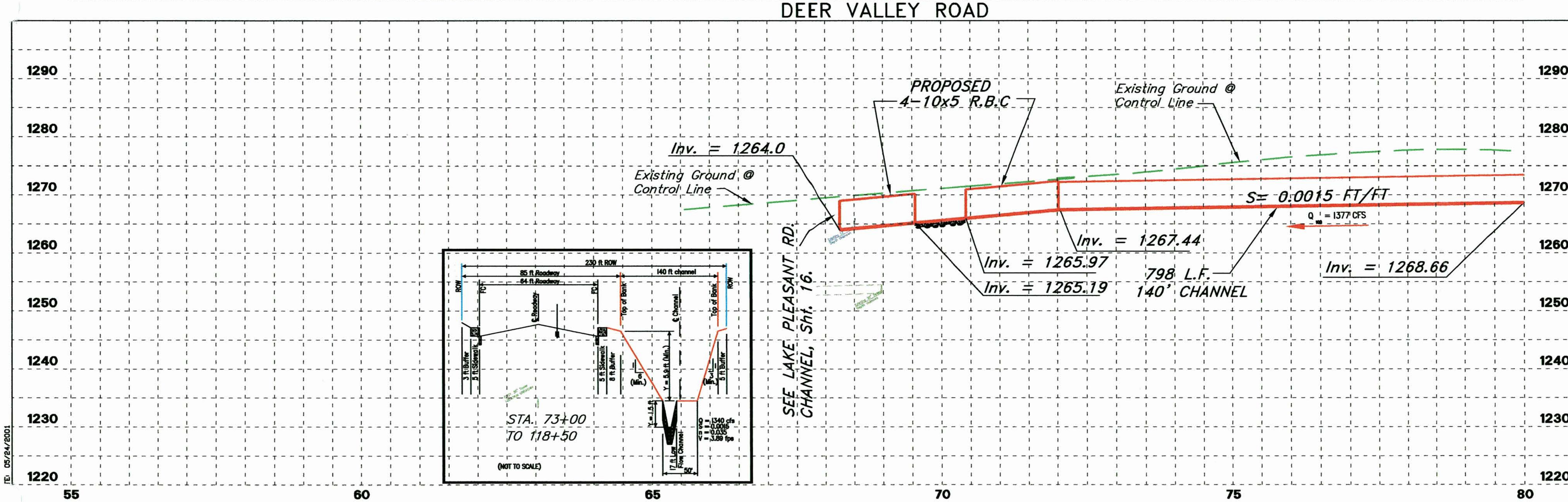
FILE: NAT-WASH_Windows. DATE: 05/24/2001



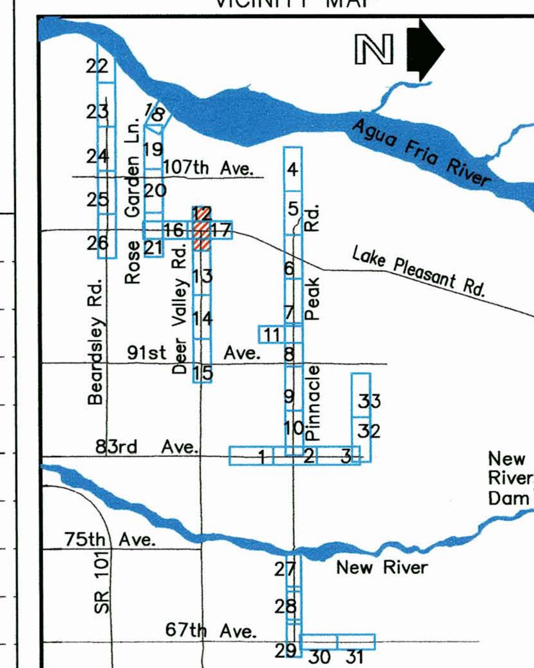
DEER VALLEY ROAD



LEGEND

	EXISTING RIGHT-OF-WAY
Tel	EXISTING TELEPHONE LINE
15 S	EXISTING SEWER LINE
GAS	EXISTING GAS LINE
W	EXISTING WATER LINE
Elec	EXISTING ELECTRIC LINE
CaTV	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer Certificate No. 29737 HERNAN A. ARISTIZABAL ARIZONA, U.S.A.

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Phoenix, AZ 85008.3279
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Fax 602.244.8947
E-mail www.entellus.com

DEER VALLEY ROAD
STA. 55+00 TO 80+00

SHEET 12 OF 33

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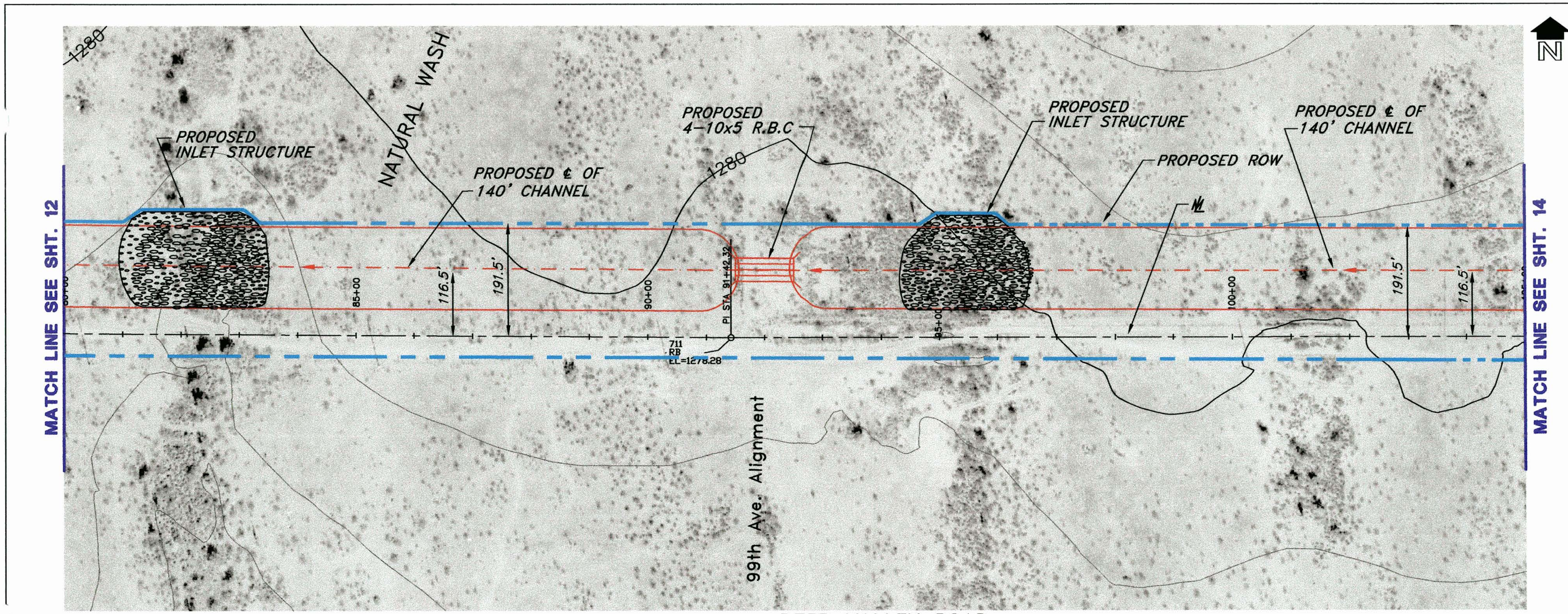
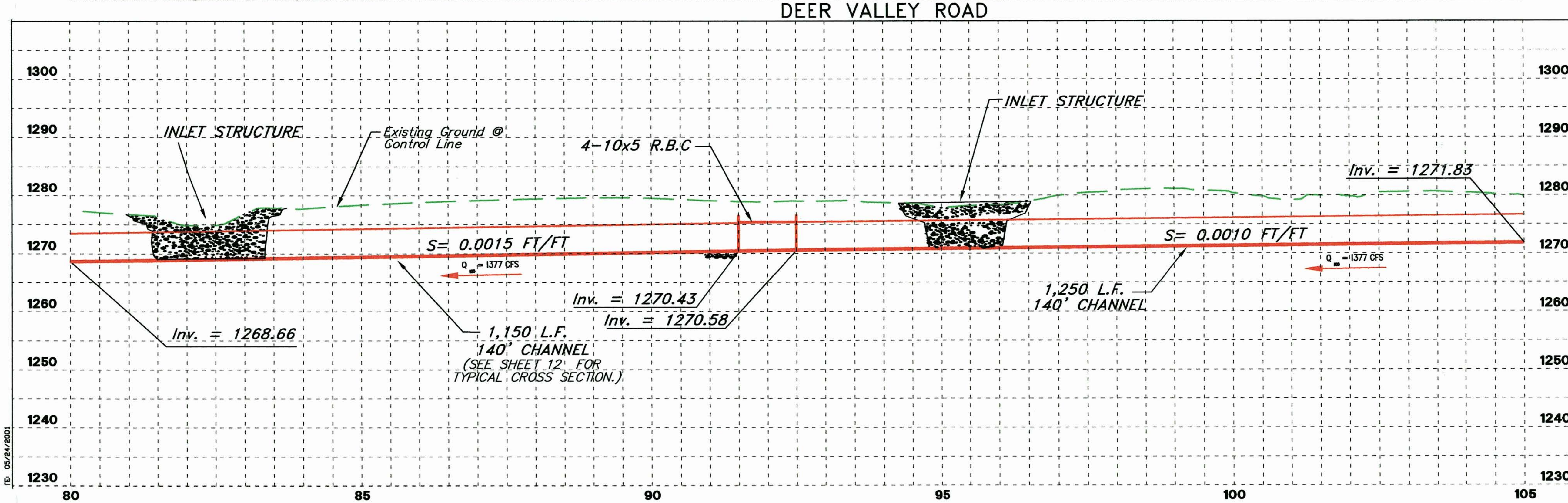
FILE: DValley_Windows ... ED 05/24/2001



DEER VALLEY ROAD



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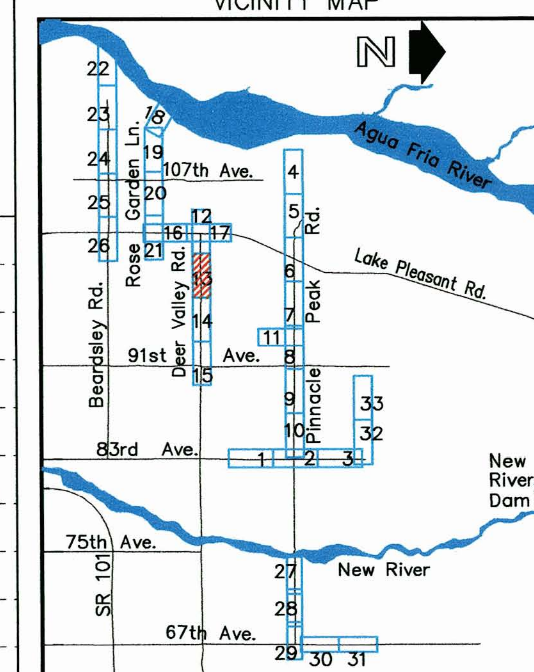
FILE: DValley_Vindows.dwg ED: 05/24/2001

LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer — Certificate No. 29737 — HERNAN A. ARISTIZABAL — ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008-3279
Tel 602.244.2566
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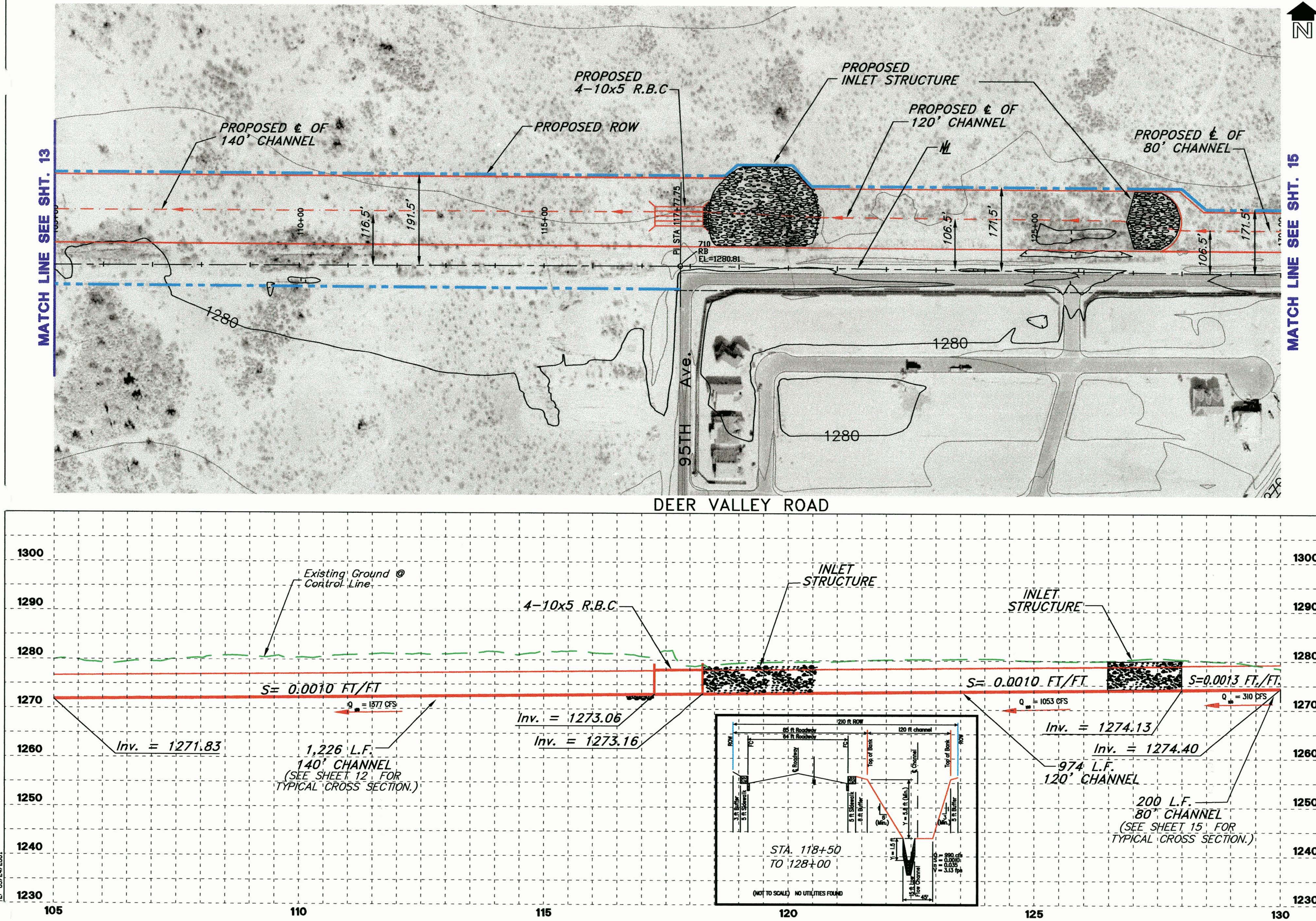
E-mail www.entellus.com

DEER VALLEY ROAD
STA. 80+00 TO 105+00

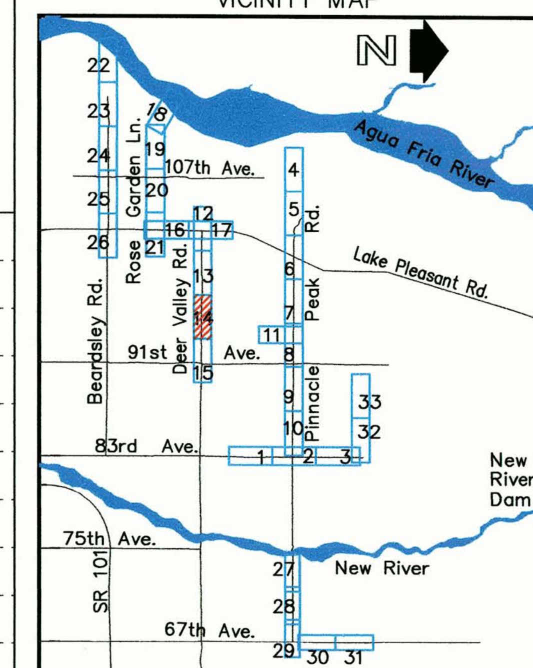
SHEET 13 OF 33



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) Certificate No. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
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DEER VALLEY ROAD
STA. 105+00 TO 130+00

SHEET 14 OF 33

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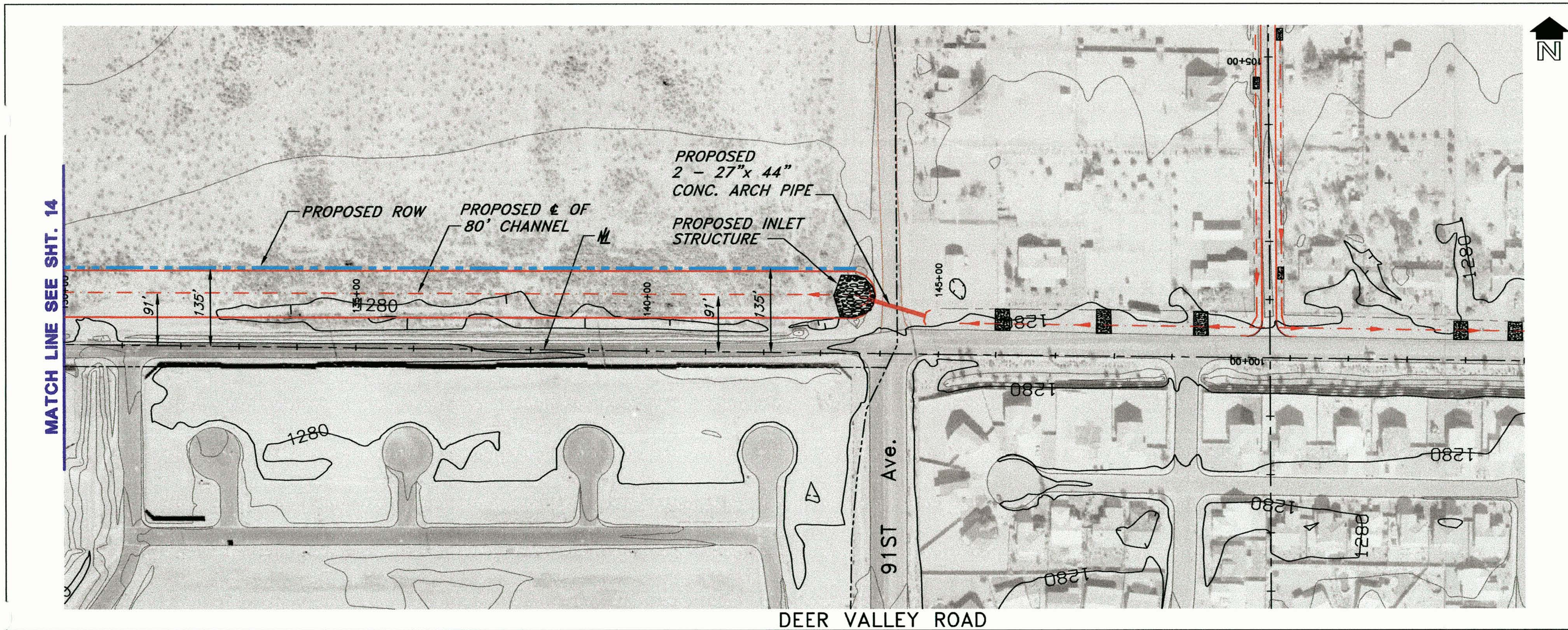
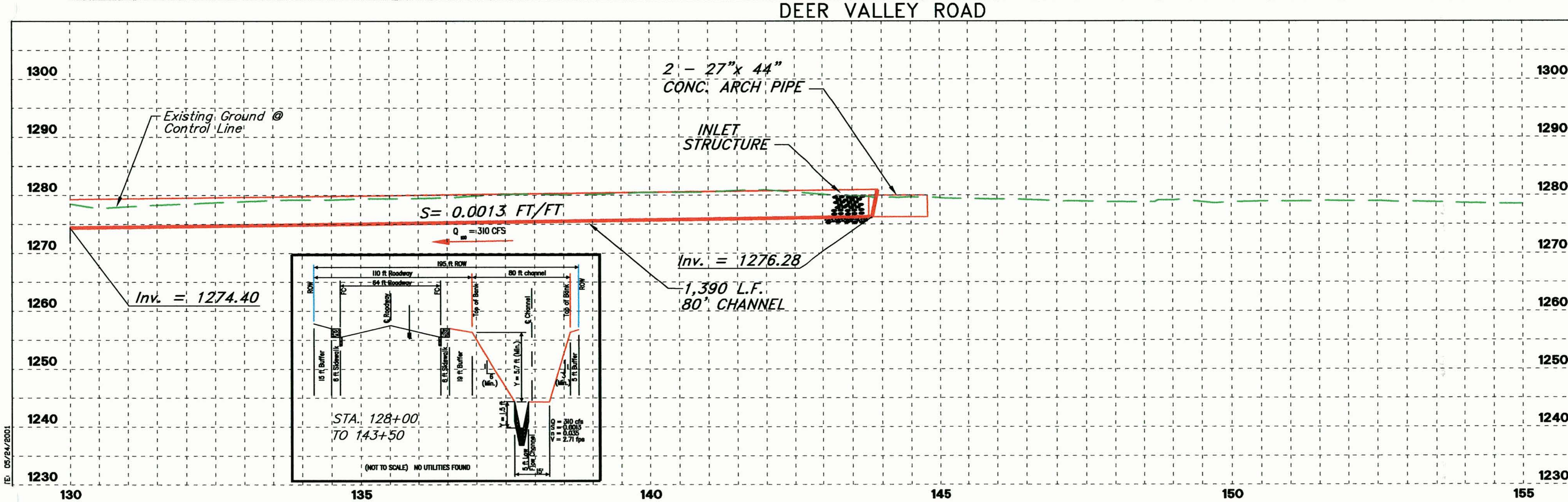
FILE: DValley_Windows.d[illegible] [illegible]ED: 05/24/2001

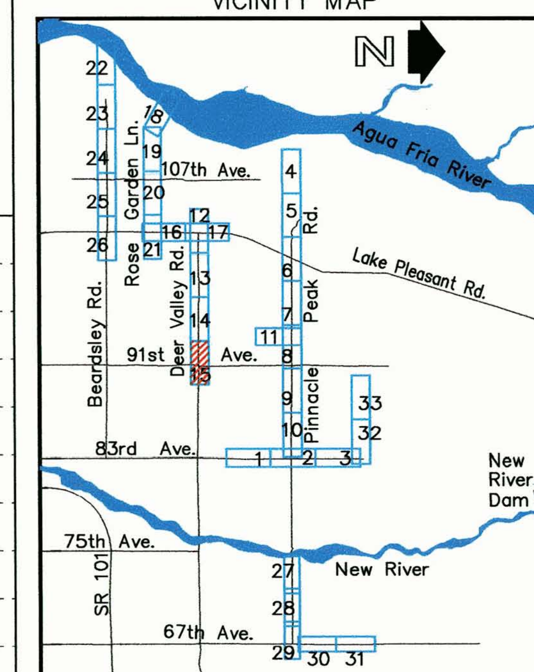




LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
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E-mail www.entellus.com

DEER VALLEY ROAD
STA. 130+00 TO 155+00

SHEET 15 OF 33

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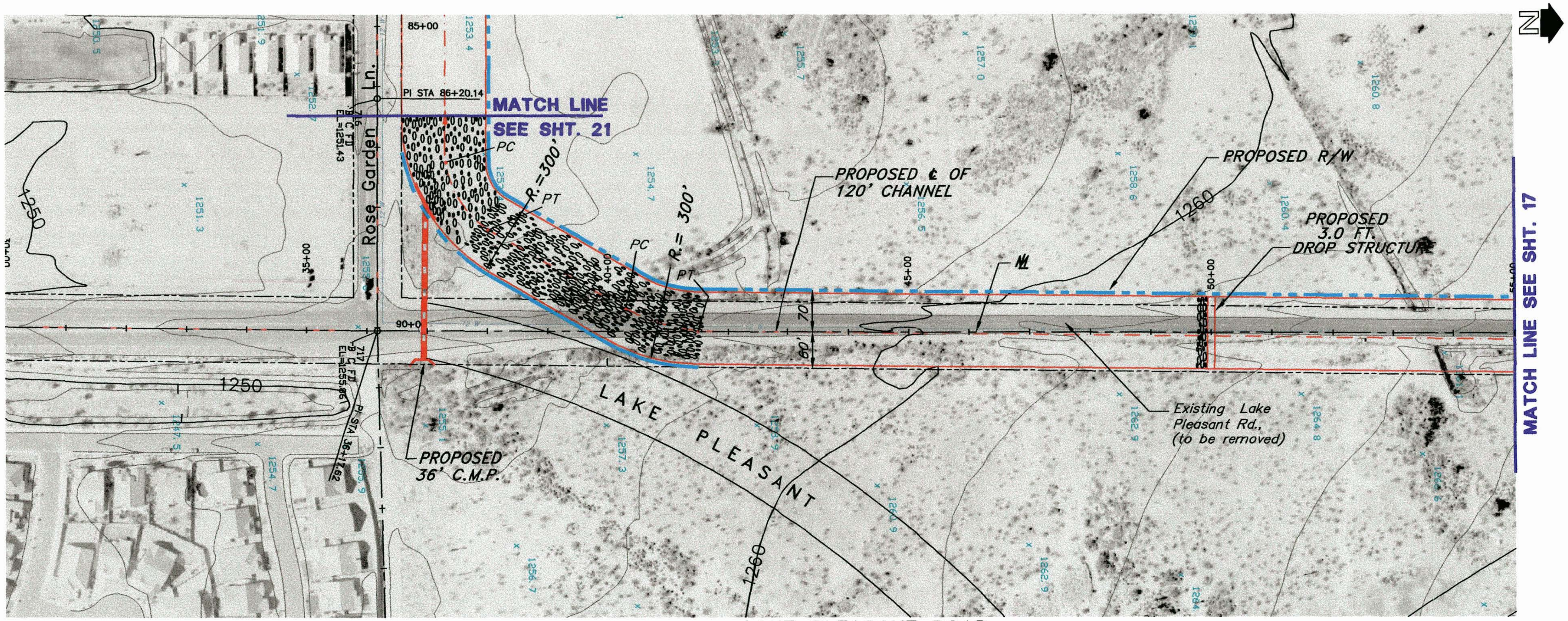
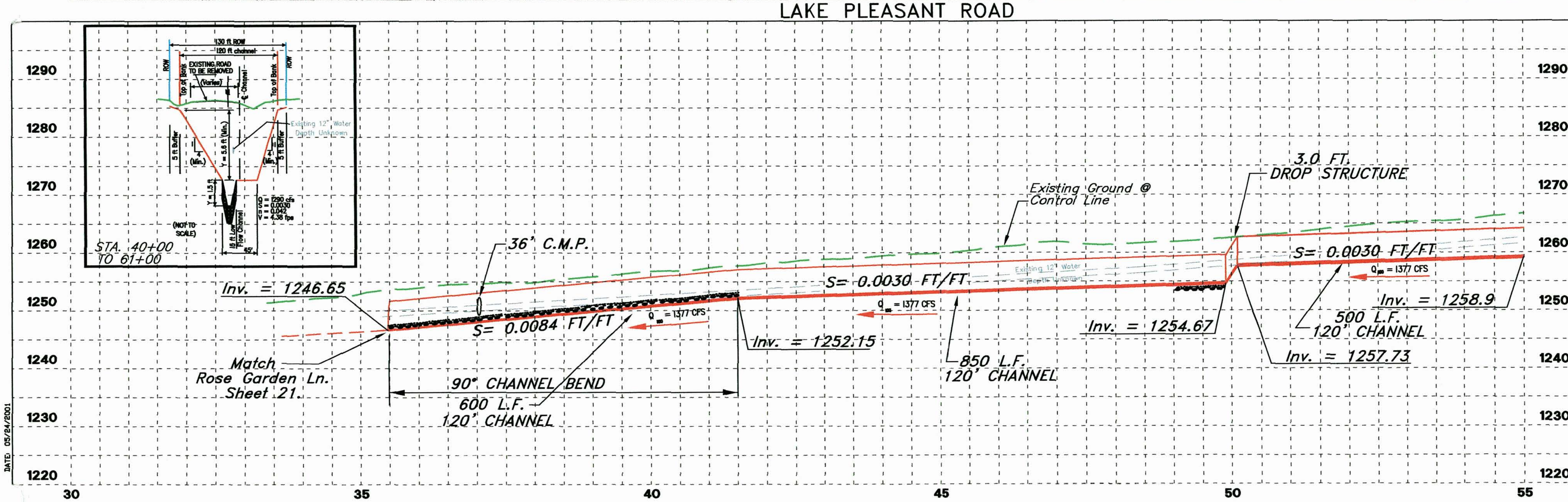
FILE: DValley_Windows.d
DATE: 05/24/2001

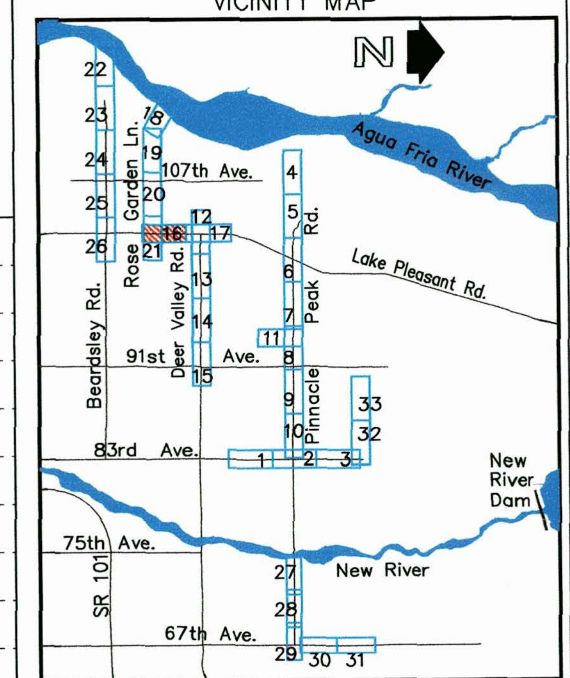




LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer, Certificate No. 29737, HERNAN A. ARISTIZABAL, ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

LAKE PLEASANT ROAD
STA. 30+00 TO 55+00

SHEET 16 OF 33

NOTE:
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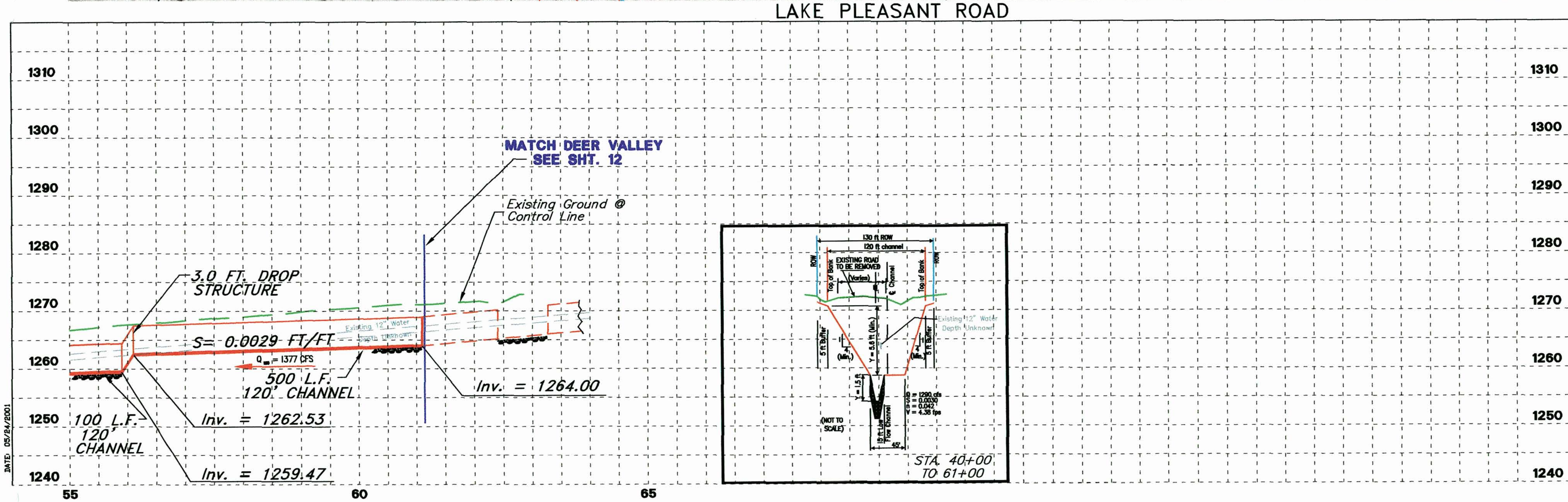
DATE: 05/24/2001
FILE: LakePleasant_Vina

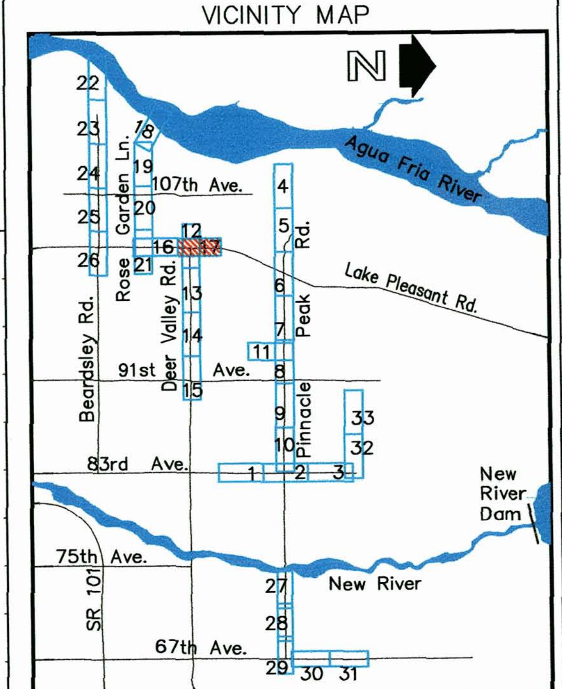
LAKE PLEASANT ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1" = 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE
F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer — Certificate No. 29737 — HERNAN A. ARISTIZABAL — ARIZONA, U.S.A.

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LAKE PLEASANT ROAD
STA. 55+00 TO 62+00

SHEET 17 OF 33

DATE 05/24/2001
FILE LakePleasant_V.Ind

NOTE:
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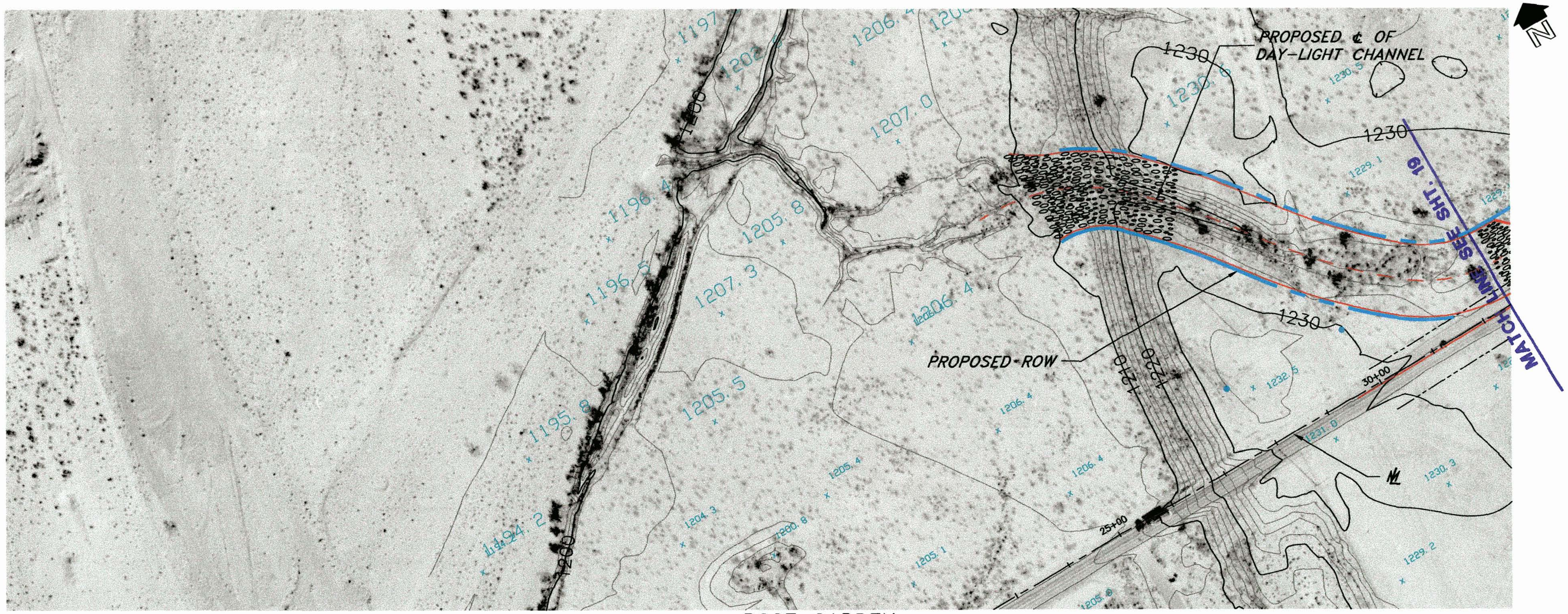
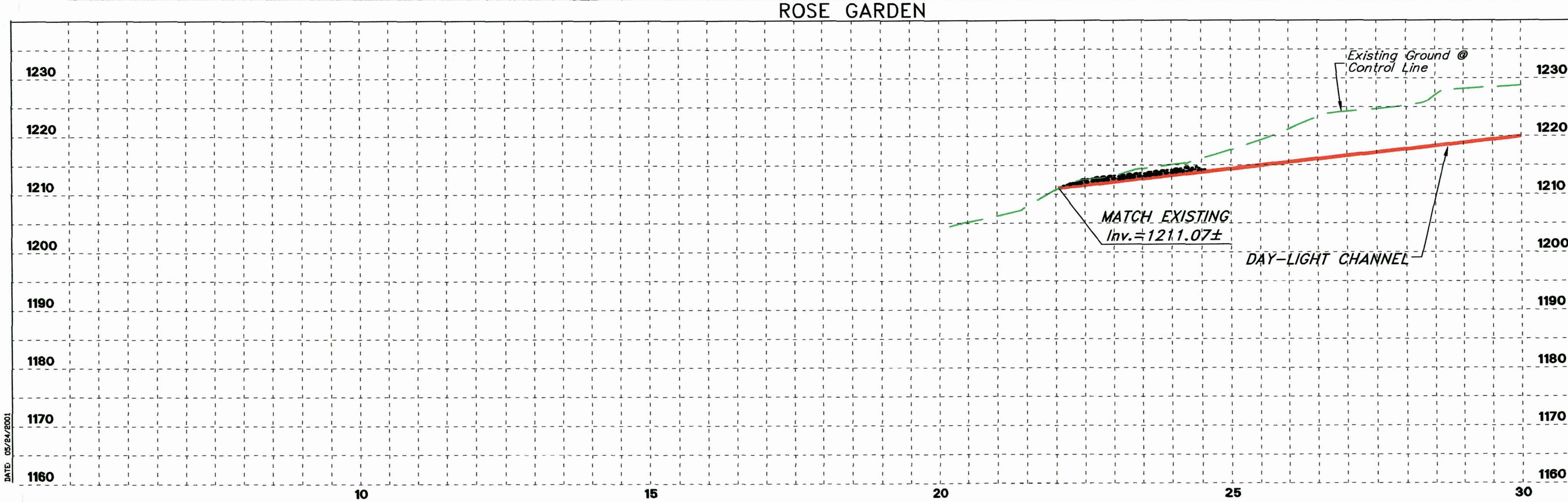


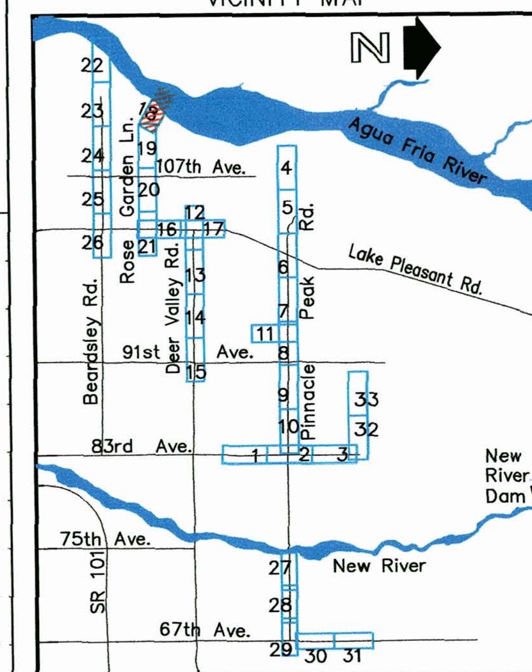
ROSE GARDEN



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100}= 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer
CERTIFICATE NO. 29737
HERNAN A. ARISTIZABAL
ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
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E-mail www.entellus.com

ROSE GARDEN
STA. 10+00 TO 30+00

SHEET 18 OF 33

NOTE:
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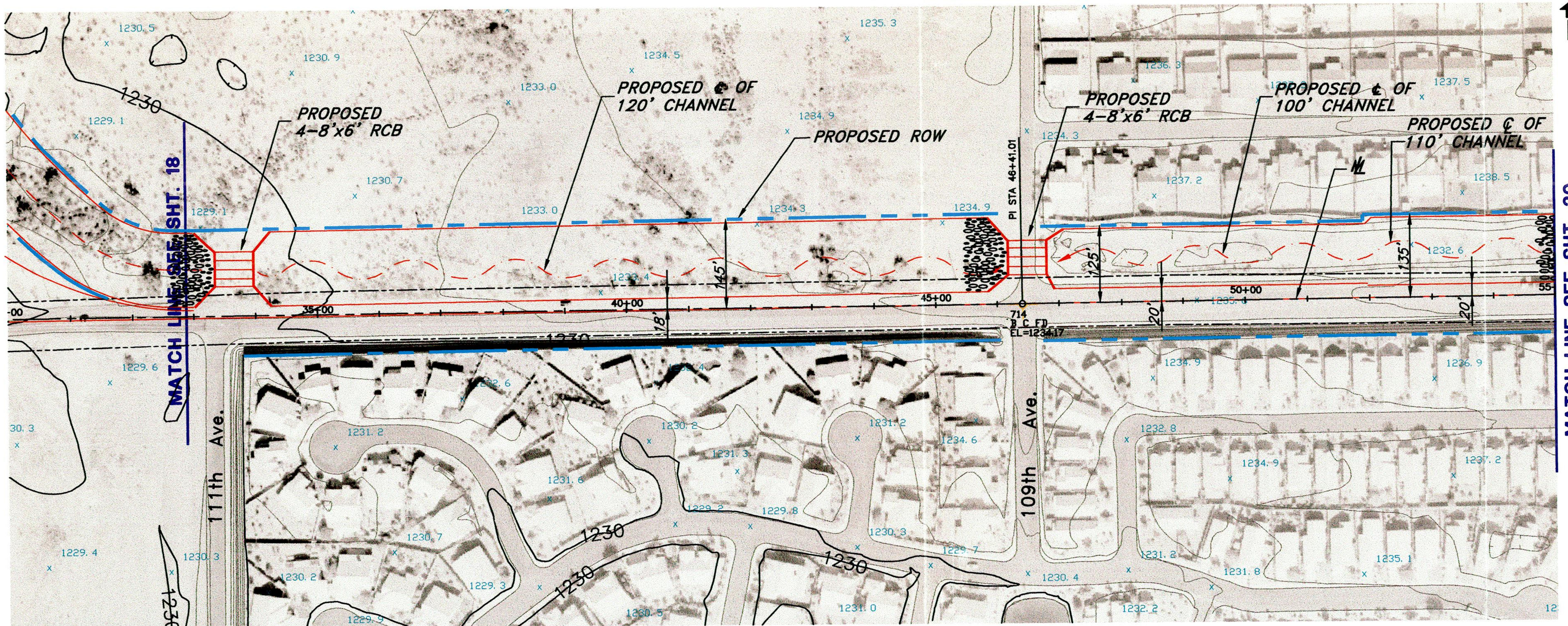
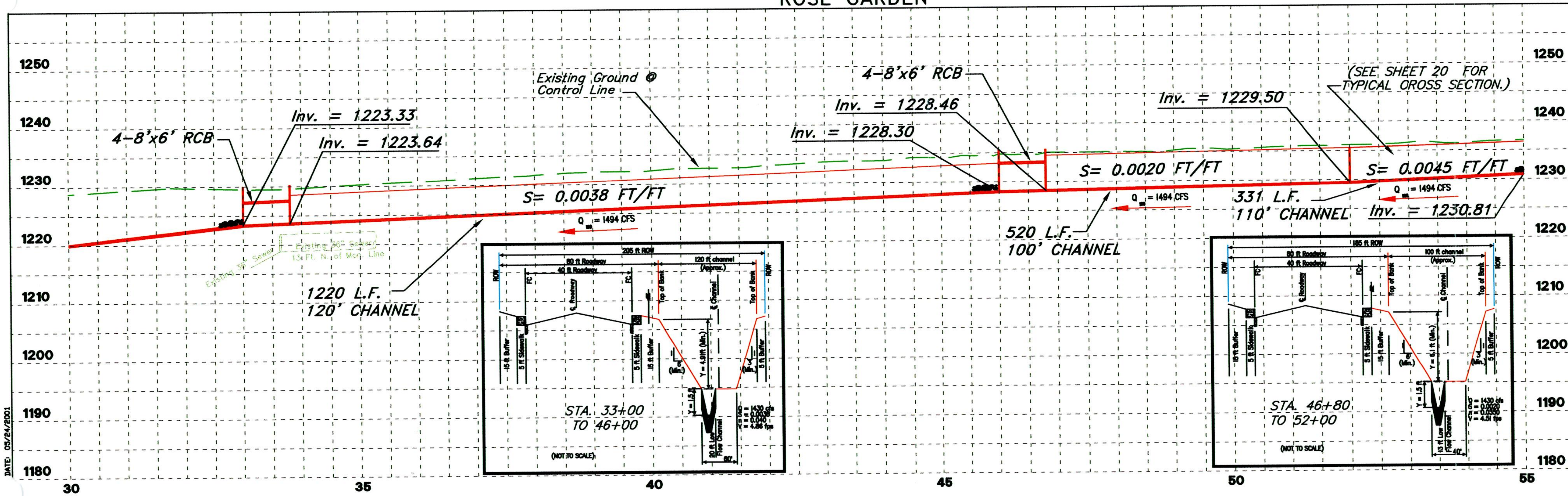
BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED
BY PENTACORE ARIZONA, INC.

FILE: RoseGarden_Window DATE: 05/24/2001



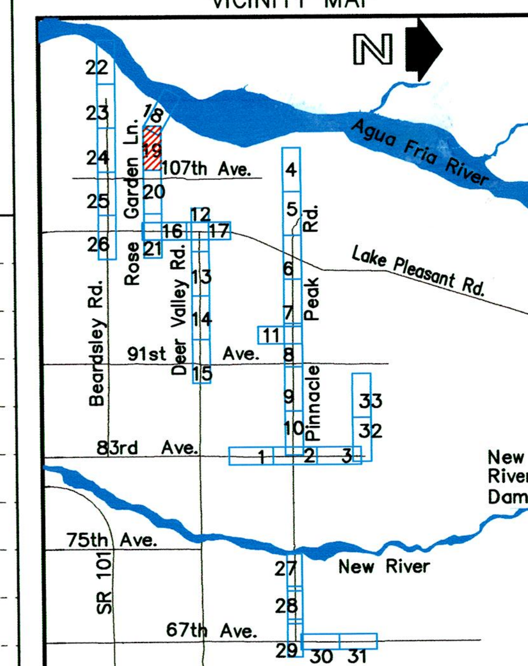
ROSE GARDEN



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer 29737 HERNAN A. ARISTIZABAL Date Signed 12/10/01 ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
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E-mail www.entellus.com

ROSE GARDEN
STA. 30+00 TO 55+00

SHEET 19 OF 33

NOTE:
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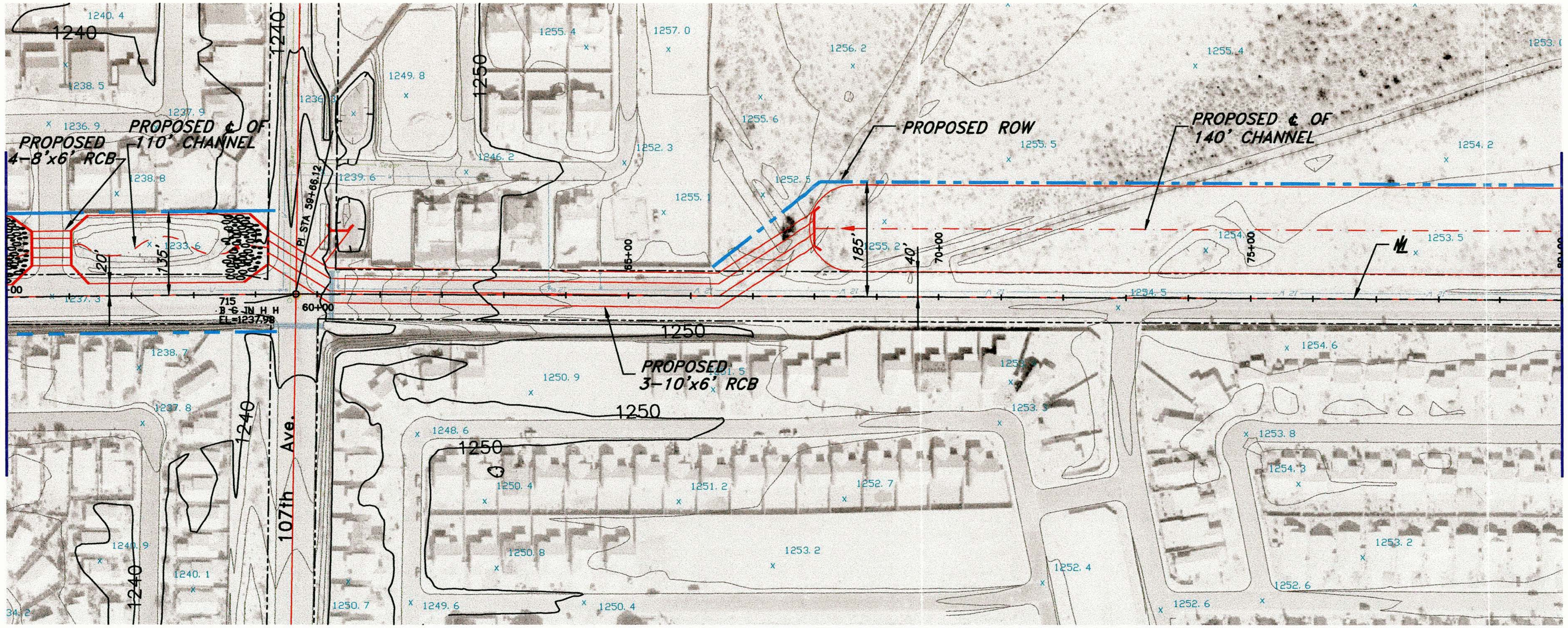
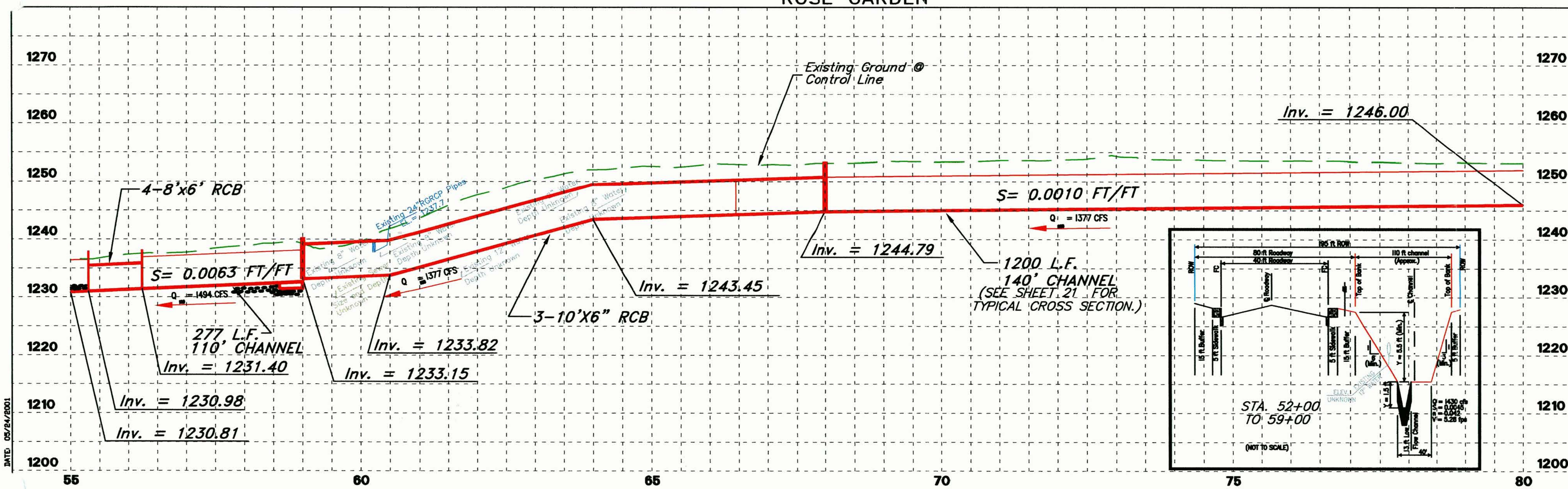
FILE: RoseGarden_Window DATE: 05/24/2001



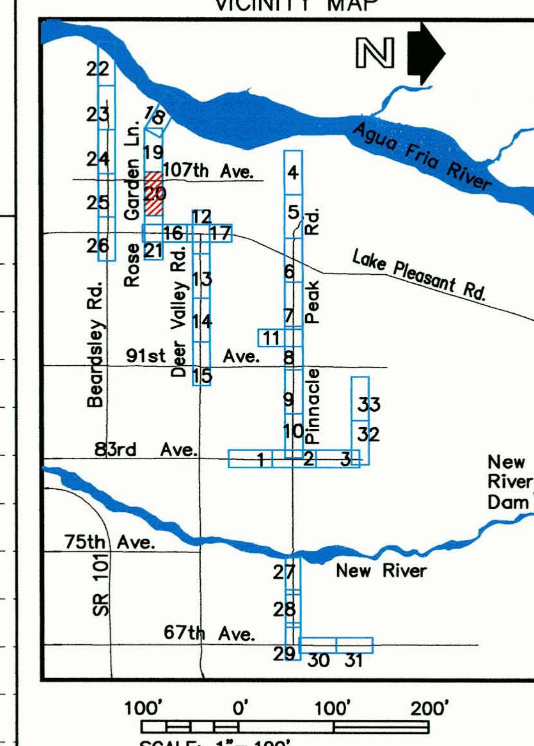
ROSE GARDEN



LEGEND

	EXISTING RIGHT-OF-WAY
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer 29737 HERNAN A. ARISTIZABAL ARIZONA, U.S.A.

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ROSE GARDEN
STA. 55+00 TO 80+00

SHEET 20 OF 33

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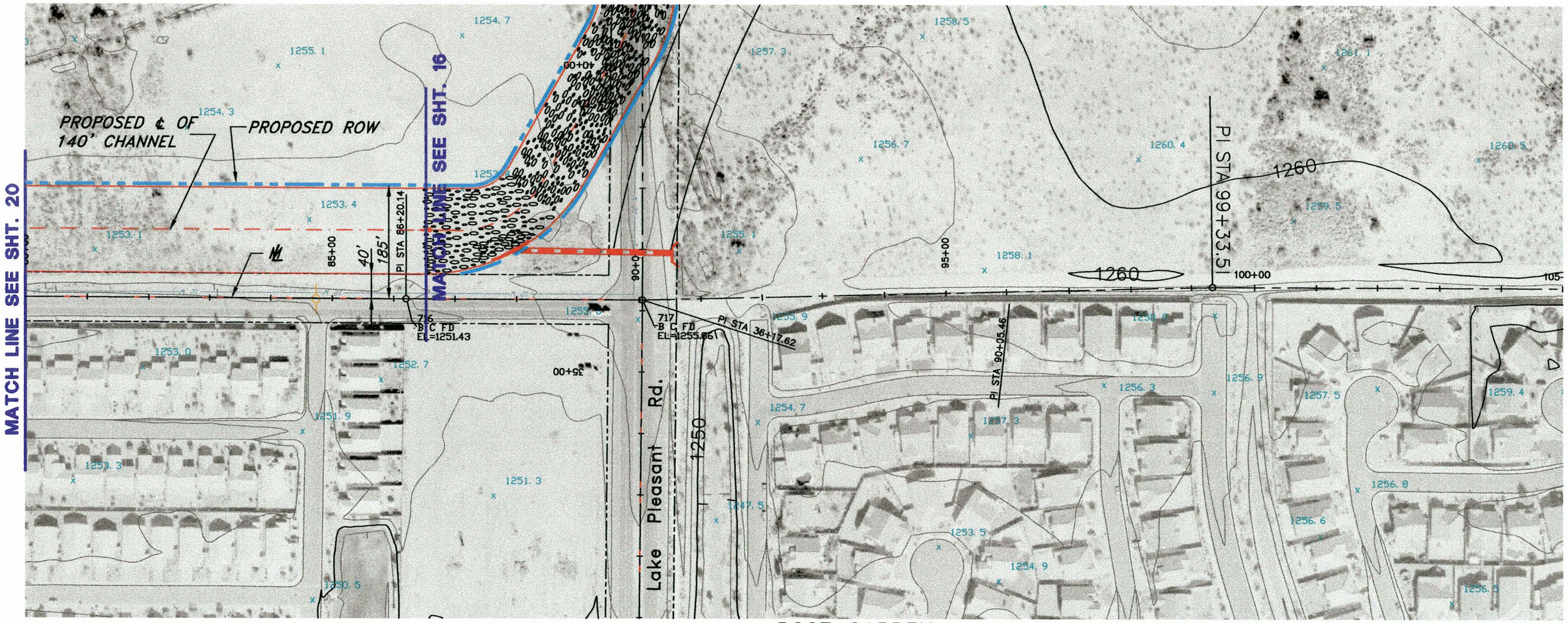
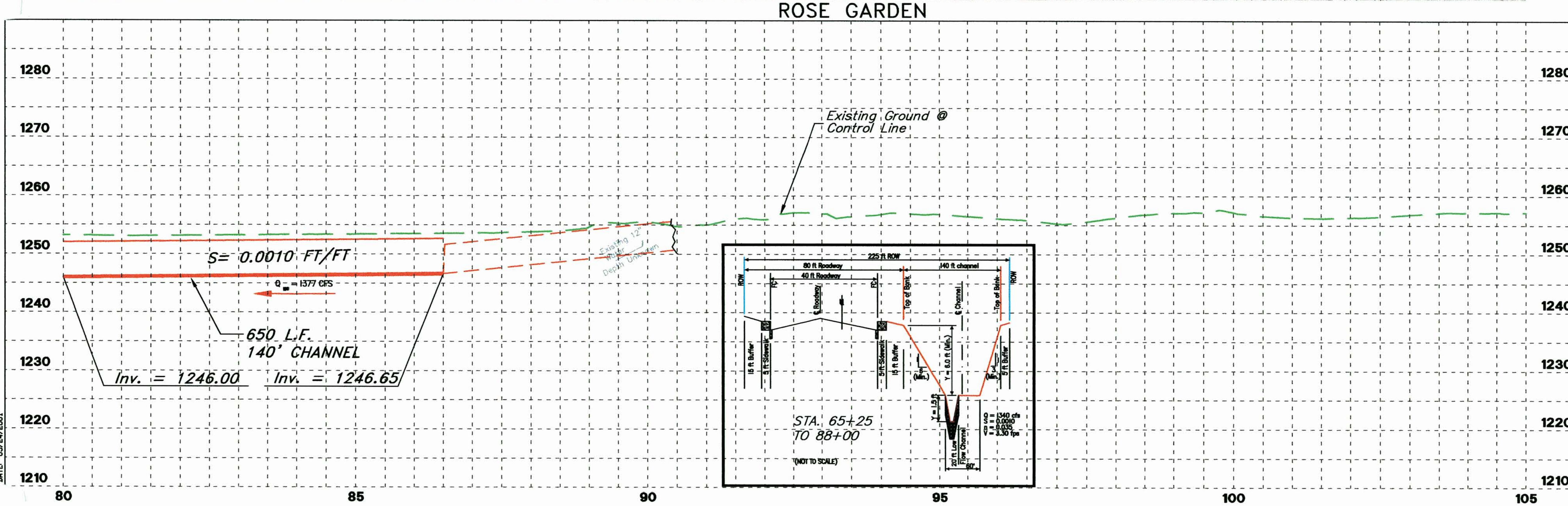
DATE: 05/24/2001
FILE: RoseGarden_Windo



ROSE GARDEN



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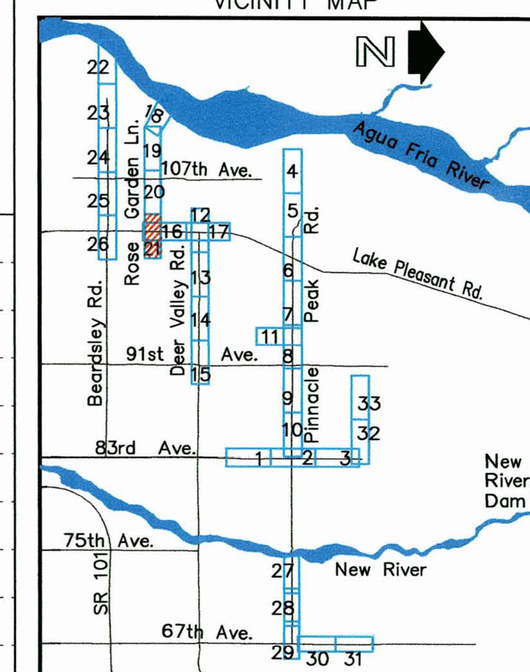
FILE: RoseGarden_Window

DATE: 05/24/2001

LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE
F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

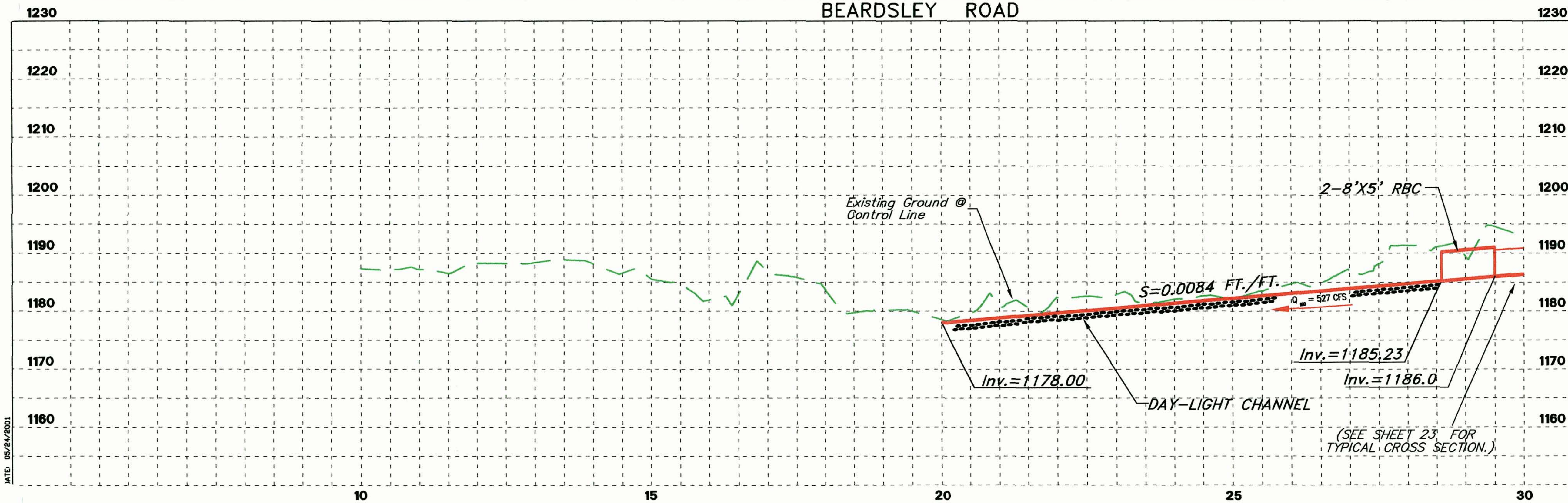
Registered Professional Engineer — Certificate No. 29737 — HERNAN A. ARISTIZABAL — ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

ROSE GARDEN
STA. 80+00 TO 105+00

SHEET 21 OF 33

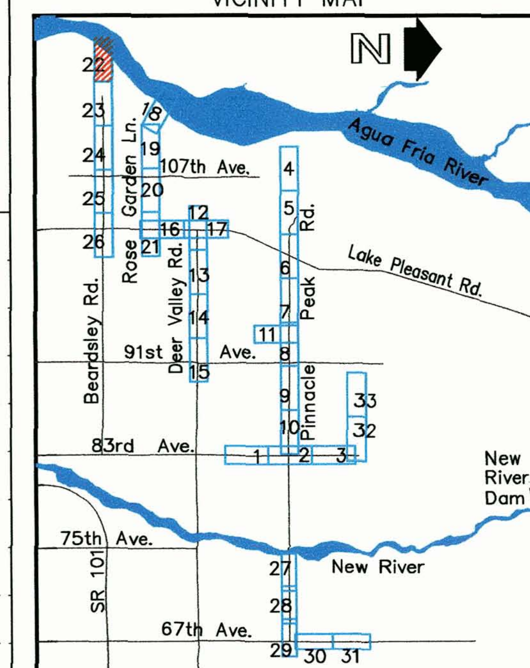
BEARDSLEY ROAD



LEGEND

EXISTING RIGHT-OF-WAY
EXISTING TELEPHONE LINE
EXISTING SEWER LINE
EXISTING GAS LINE
EXISTING WATER LINE
EXISTING ELECTRIC LINE
EXISTING CABLE TV LINE
PROPOSED RIGHT-OF-WAY
PROPOSED BASIN
ALTERNATE FACILITIES
PROPOSED STORM DRAIN
Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
CHANNEL
1290 INDEX CONTOUR
INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus™
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BEARDSLEY ROAD
STA. 10+00 TO 30+00

SHEET 22 OF 33

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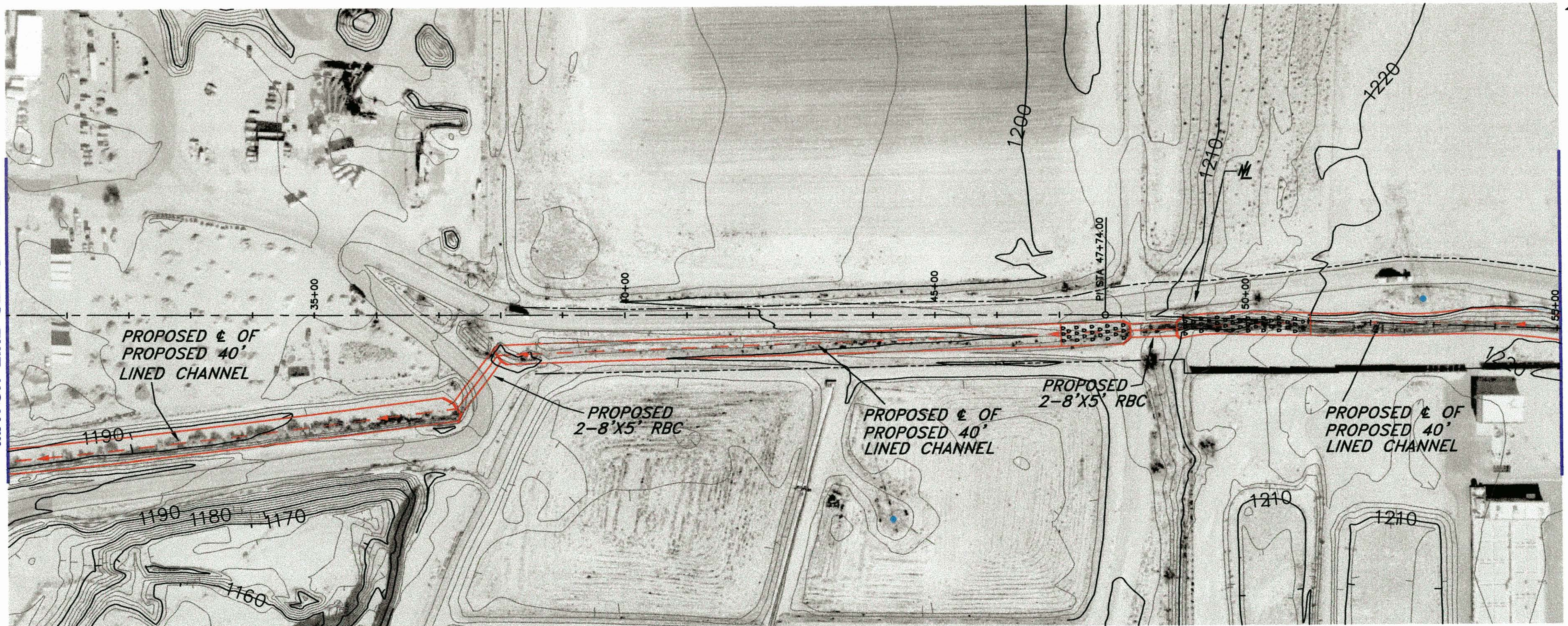
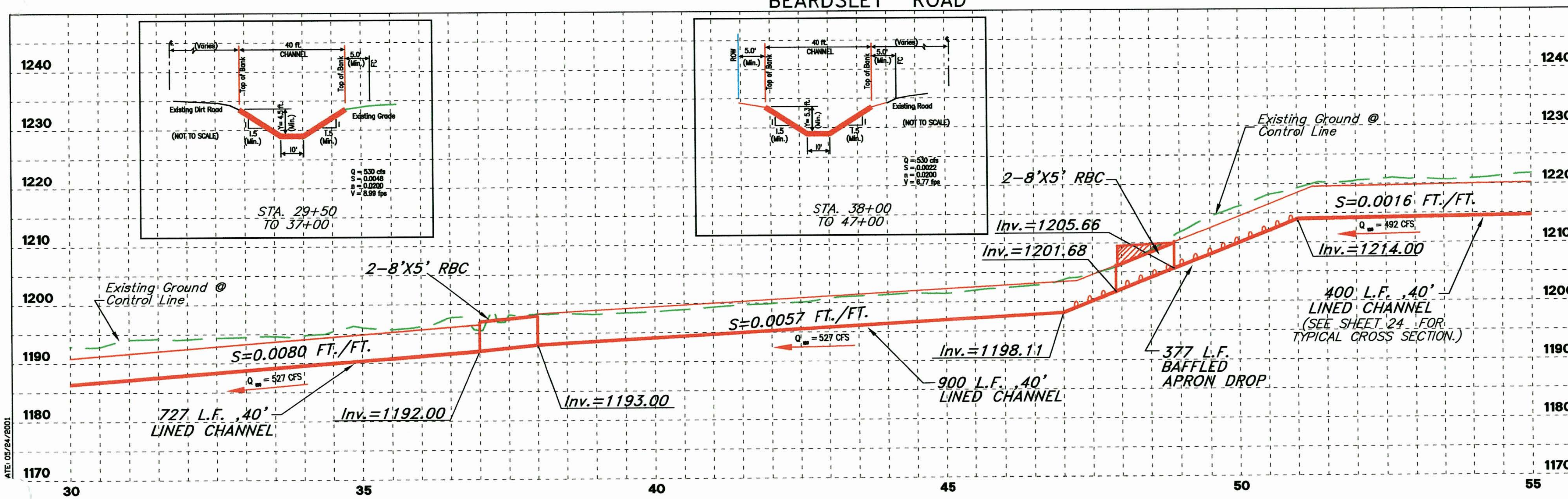
FILE: Beardsley_Windows
DATE: 05/24/2001



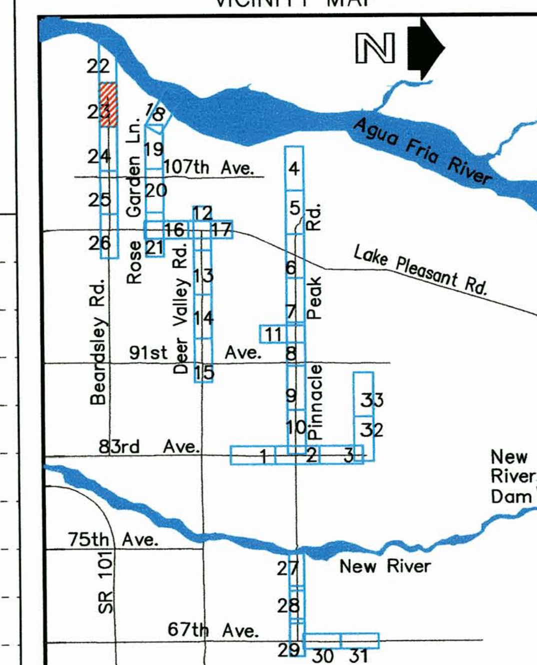
BEARDSLEY ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- DIRECTION AND QUANTITY OF FLOW (Q_{100} = 40 cfs)
- CHANNEL
- INDEX CONTOUR (1290)
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE
F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

29737 HERNAN A. ARISTIZABAL

Entellus
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Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
www.entellus.com

BEARDSLEY ROAD
STA. 30+00 TO 55+00

SHEET 23 OF 33

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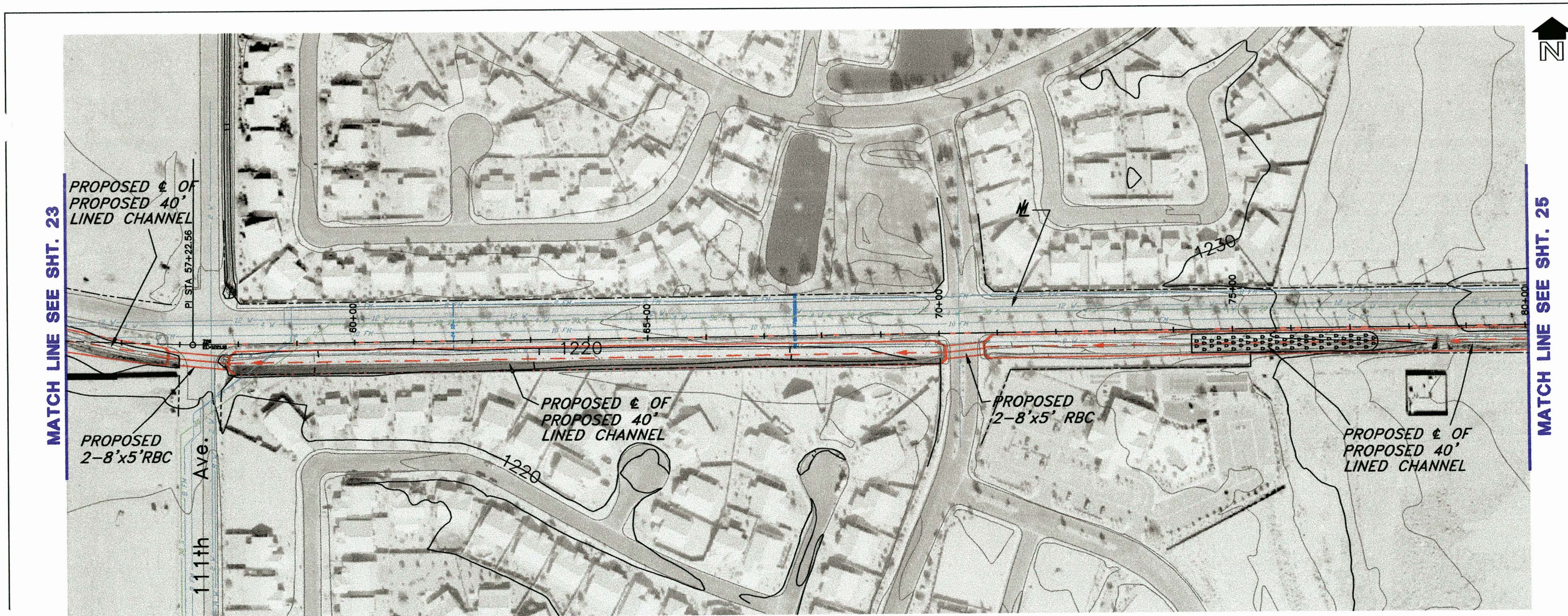
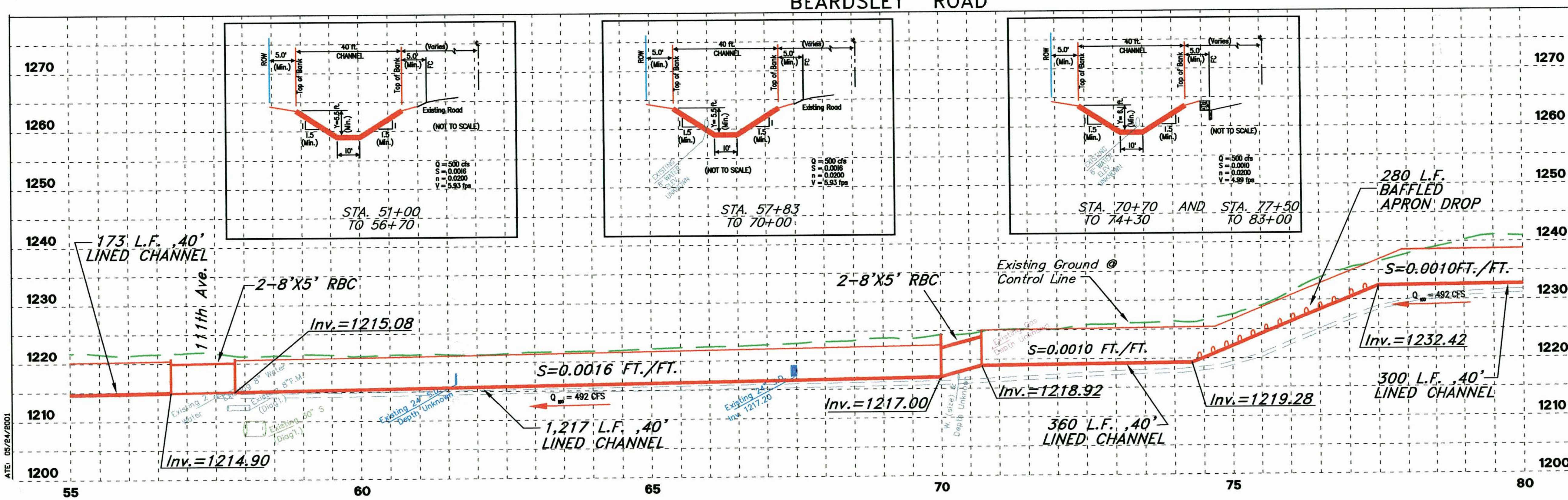
FILE: Beardsley_Windows DATE: 05/24/2001



BEARDSLEY ROAD



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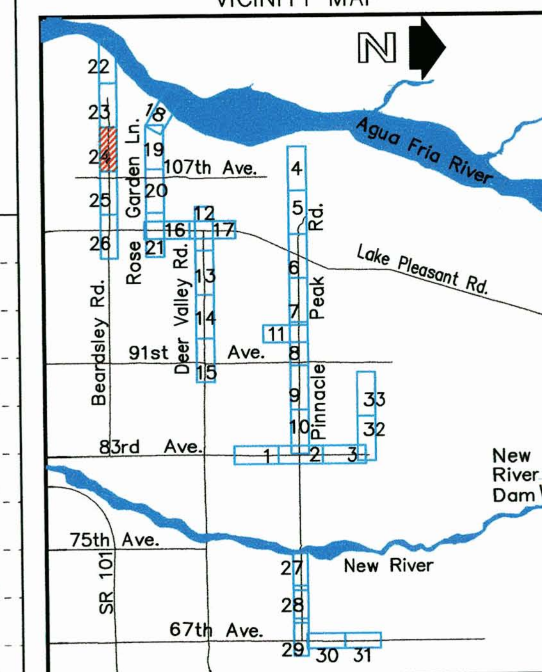
FILE: Beardsley_Windows.

DATE: 05/24/2001

LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

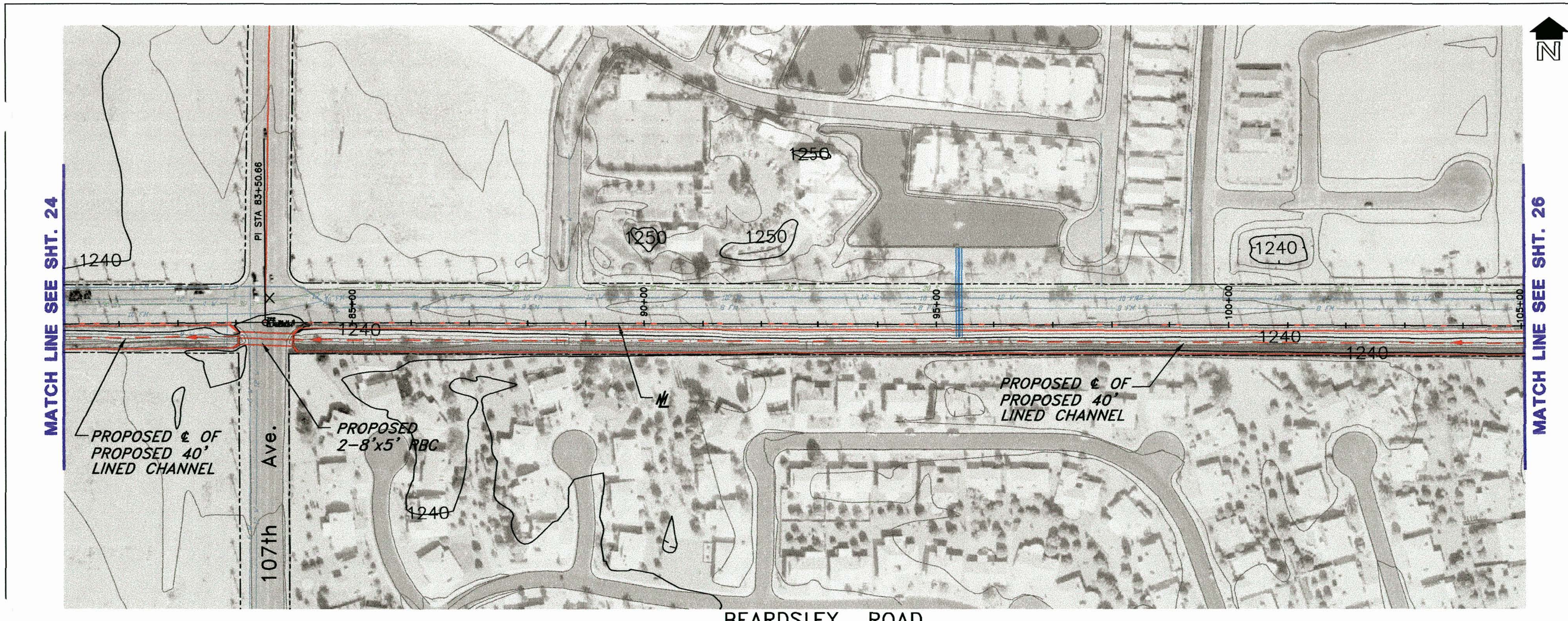
Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

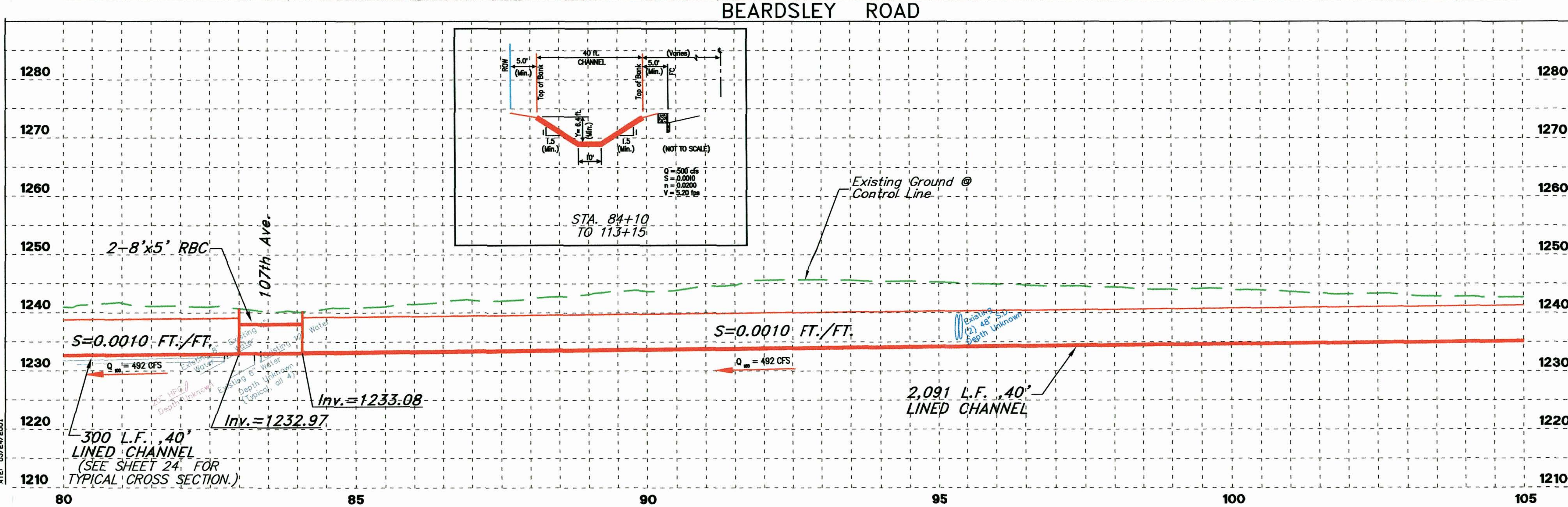
Entellus™ 2255 N. 44th Street Suite 125 Phoenix, AZ 85008.3279 Tel 602.244.2566 Fax 602.244.8947 E-mail www.entellus.com

BEARDSLEY ROAD
STA. 55+00 TO 80+00

SHEET 24 OF 33



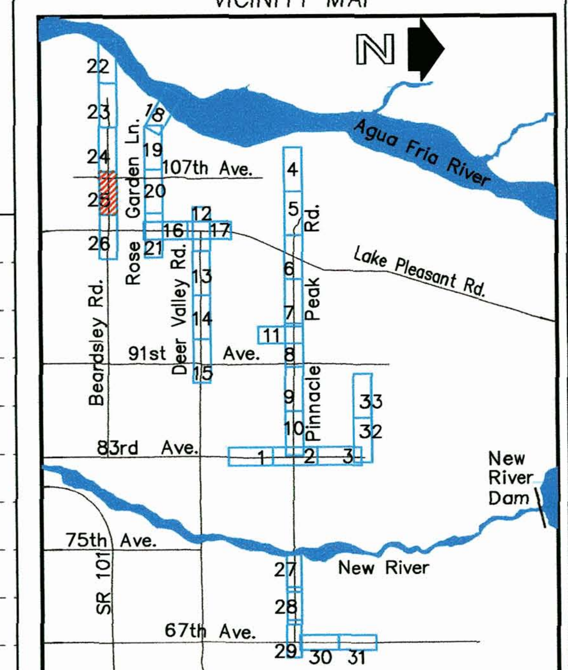
BEARDSLEY ROAD



LEGEND

	EXISTING RIGHT-OF-WAY
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer (Civil) Certificate No. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

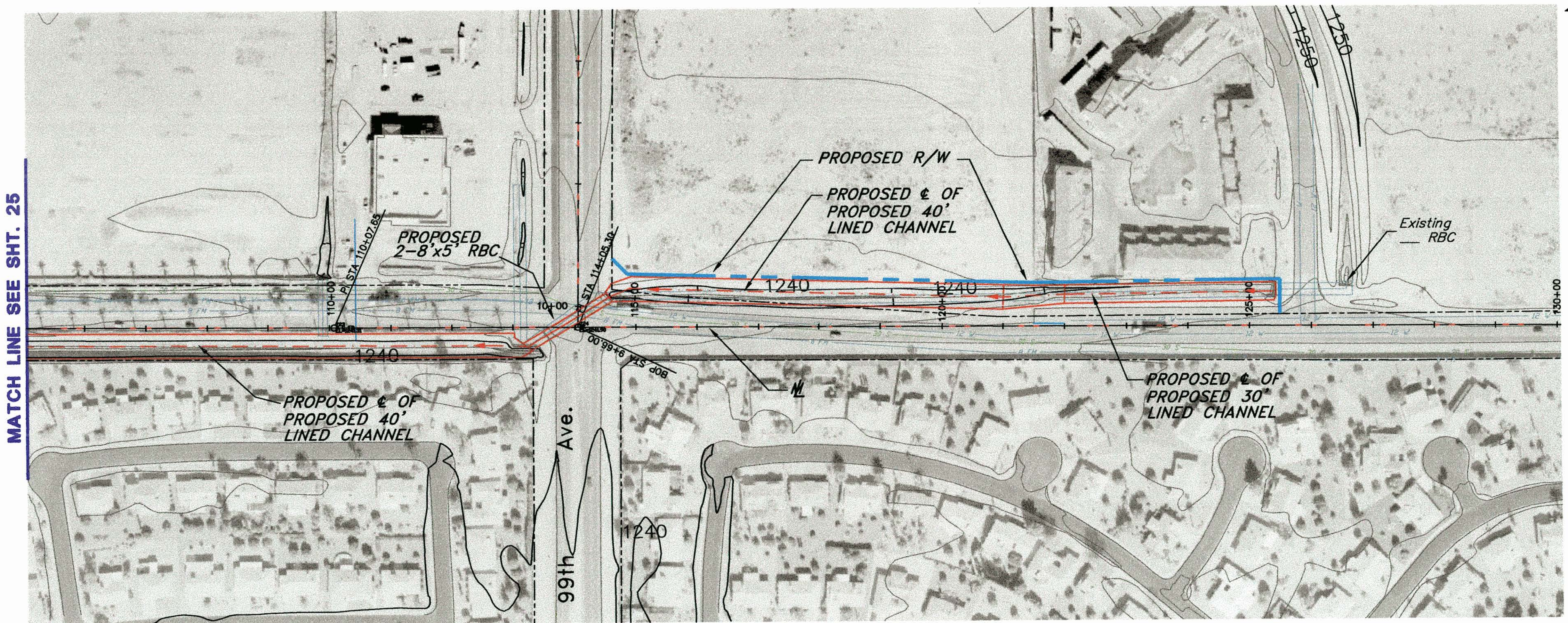
Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

BEARDSLEY ROAD
STA. 80+00 TO 105+00

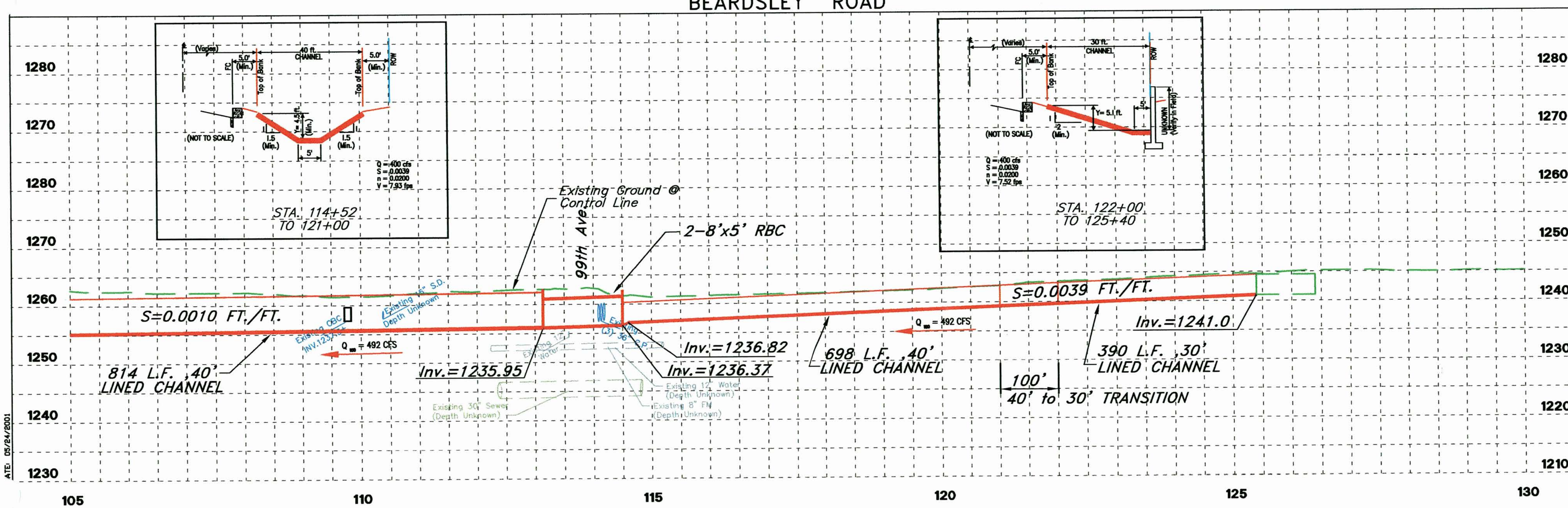
SHEET 25 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

FILE: Beardsley_Windows.



BEARDSLEY ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP

100' 0' 100' 200'

SCALE: 1" = 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) Certificate No. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

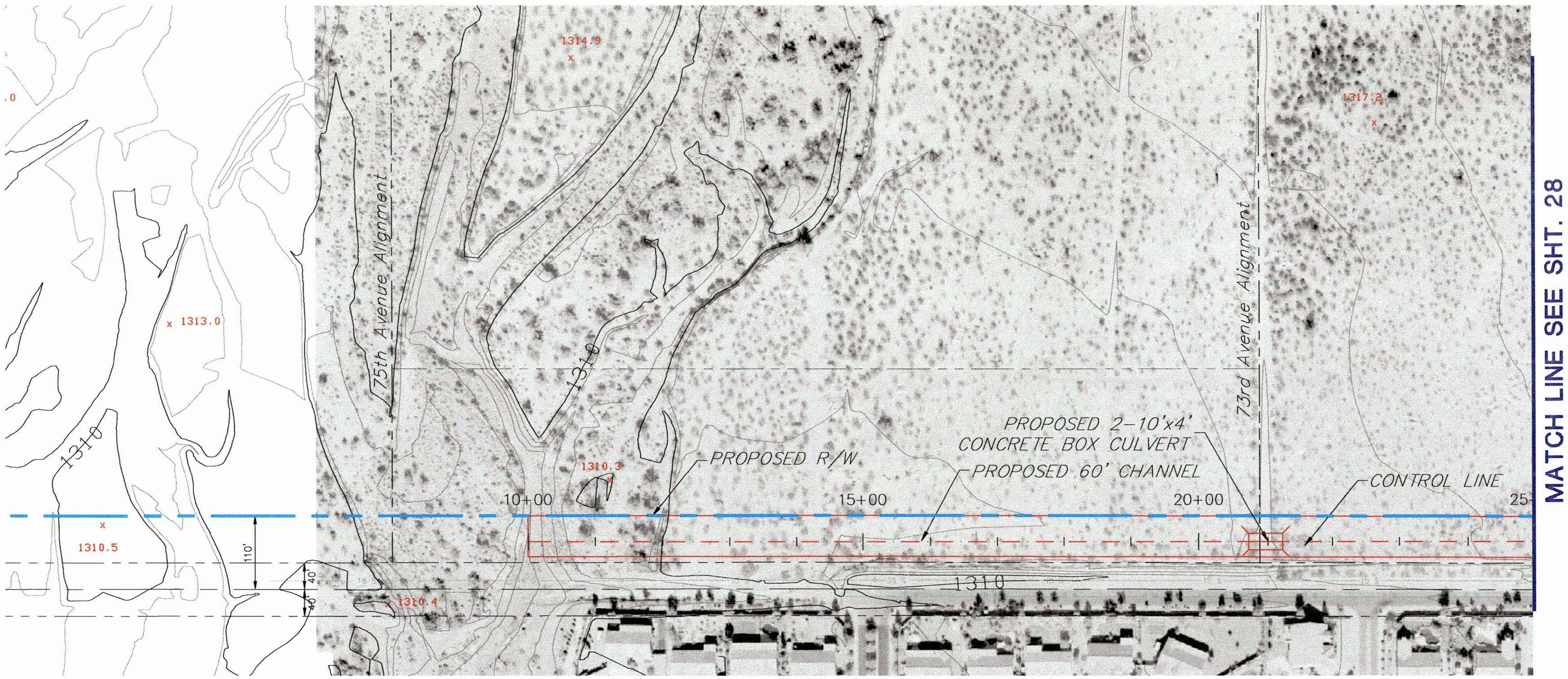
Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

BEARDSLEY ROAD
STA. 105+00 TO 130+00

SHEET 26 OF 33

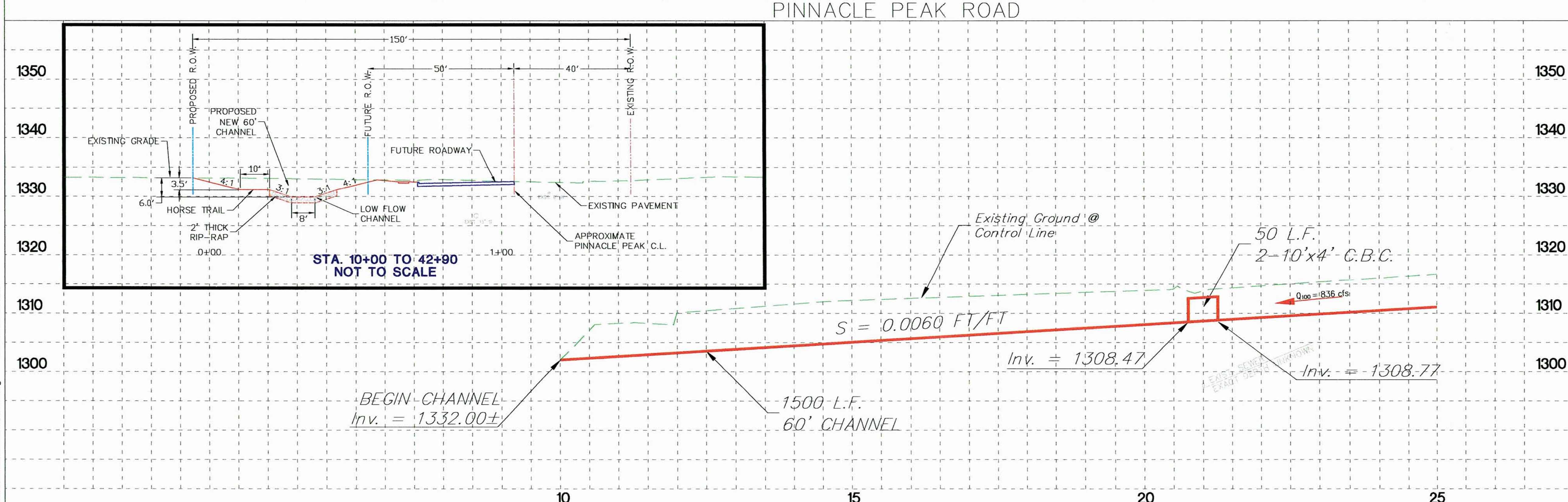
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

FILE: Beardsley_Windows. DATE: 05/24/2001

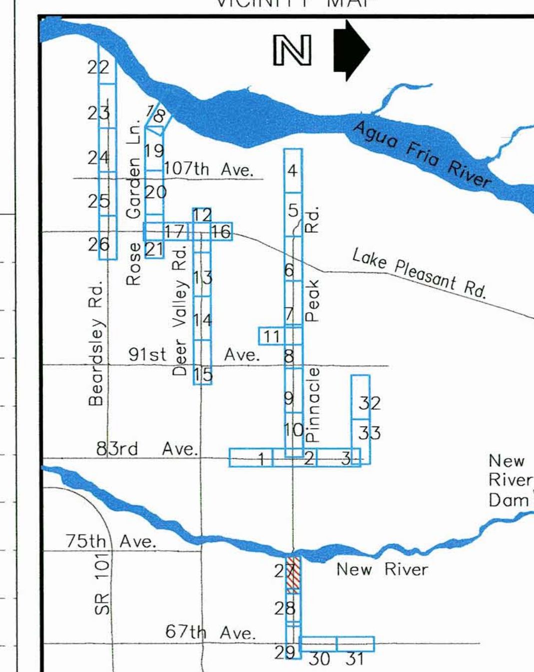


LEGEND

EXISTING RIGHT-OF-WAY
EXISTING TELEPHONE LINE
EXISTING SEWER LINE
EXISTING GAS LINE
EXISTING WATER LINE
EXISTING ELECTRIC LINE
EXISTING CABLE TV LINE
PROPOSED RIGHT-OF-WAY
PROPOSED BASIN
ALTERNATE FACILITIES
PROPOSED STORM DRAIN
Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
CHANNEL
1290 INDEX CONTOUR
INTERMEDIATE CONTOUR



VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER STUDY UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	KPK	08/01
DRAWN	DHN	02/02
CHECKED	VG	02/02

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

IN ASSOCIATION WITH:
PENTACORE ARIZONA
2255 No. 44th St., SUITE 255 Phoenix, AZ 85008
TELEPHONE (602) 681-9272 FAX (602) 681-9339

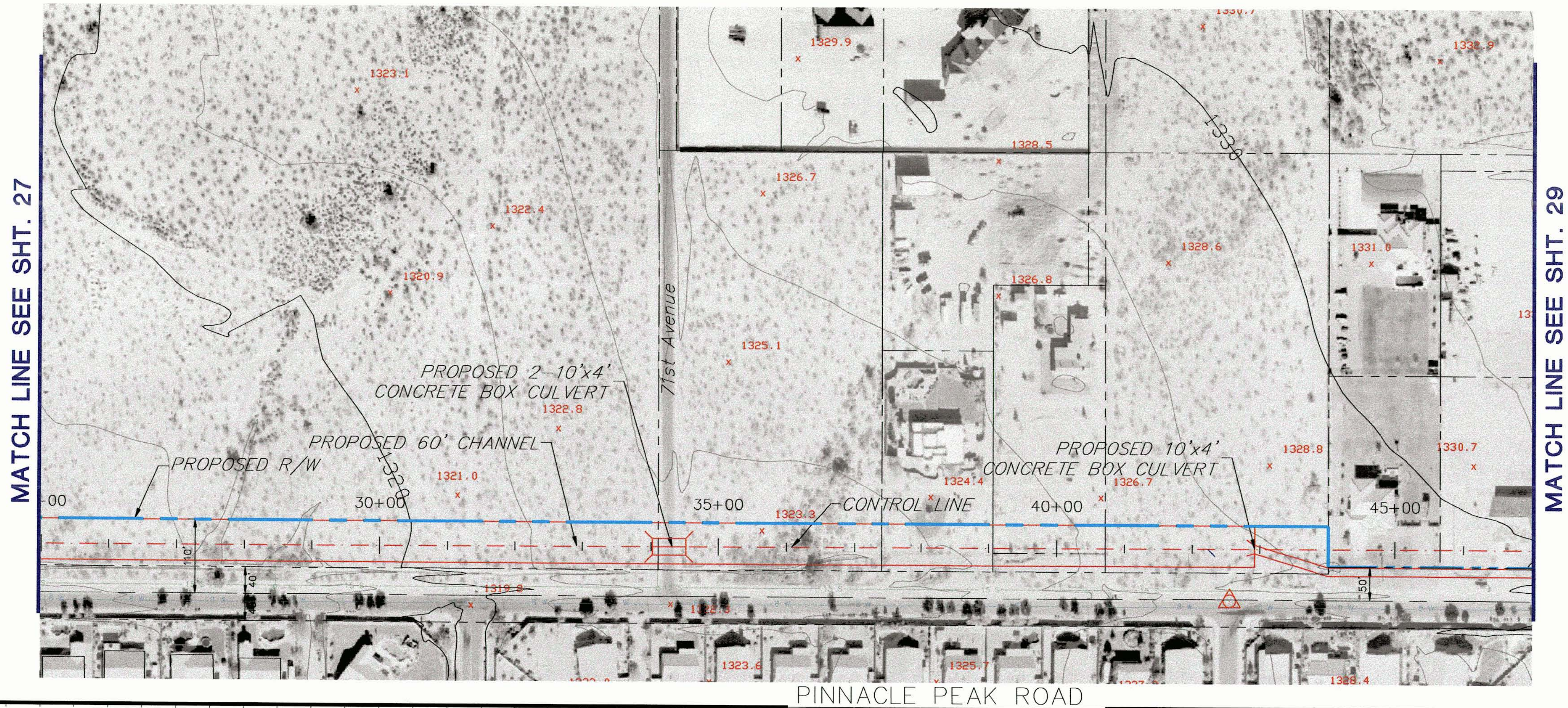
DRAWING NO.

PINNACLE PEAK ROAD
STA. 10+00 TO STA. 25+00

SHEET 27 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

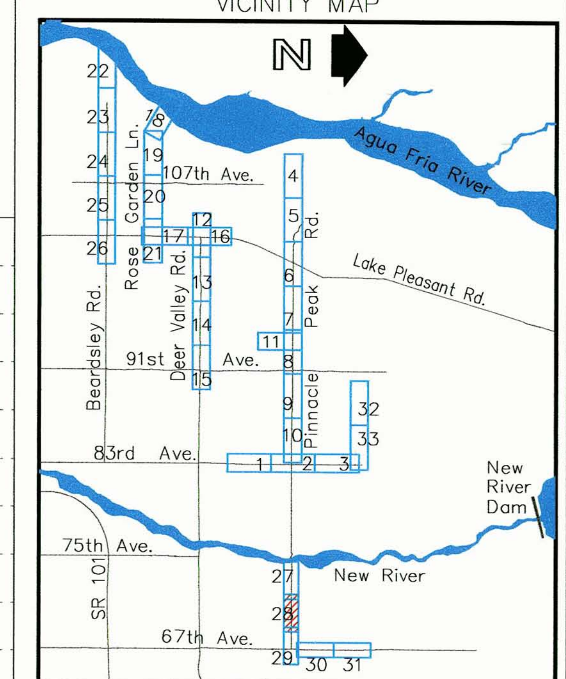
FILE: P:\50430001\Area9\cadd\ass...\sheets\sht...dwg DATED: 02/25/2002



LEGEND

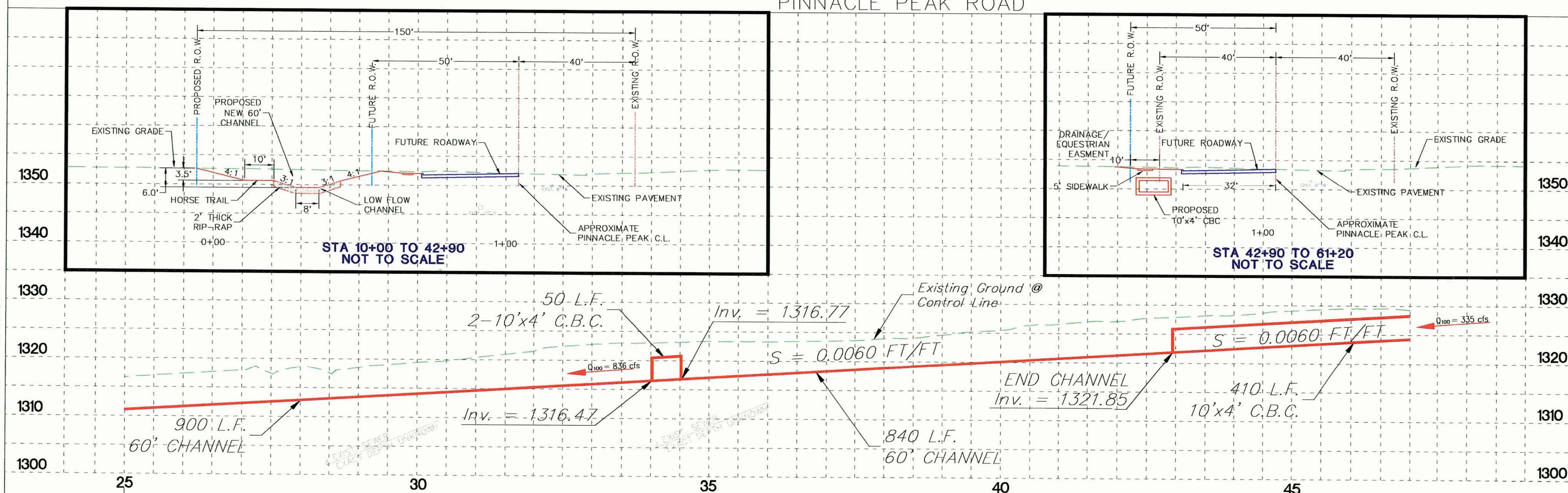
- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'



NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

FILE: P:\50430001\...\cadd\assmbled\sheets\sht2.dwg

DATED: 02/25/2002

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER STUDY UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	KPK	08/01
DRAWN	DHN	02/02
CHECKED	VG	02/02

20909 J. VINCE GIBBONS Date Signed 2/25/02 ARIZONA, U.S.A.

IN ASSOCIATION WITH:

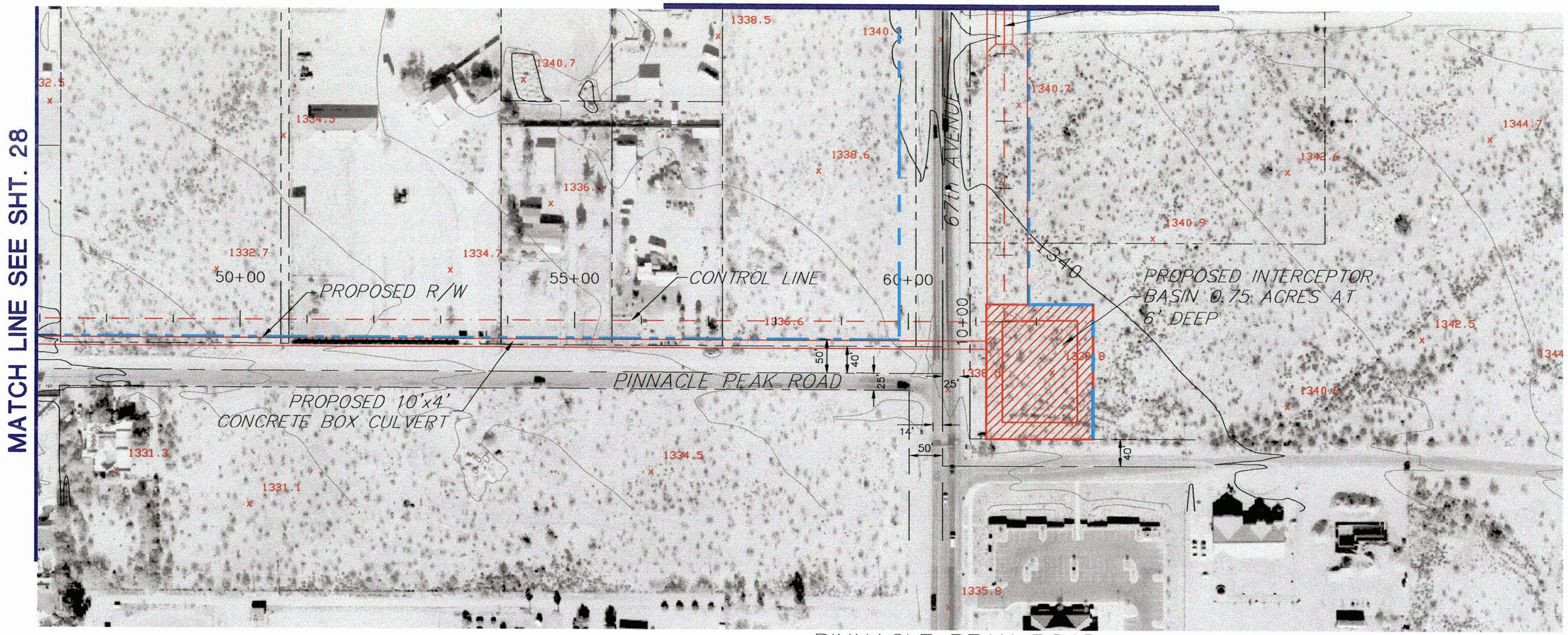
PENTACORE ARIZONA
Civil Engineering, Land Surveying, Construction Administration, Planning, ADA Consulting
2255 No. 44th St., SUITE 255 Phoenix, AZ 85008
TELEPHONE (602) 681-9272 FAX (602) 681-9339

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

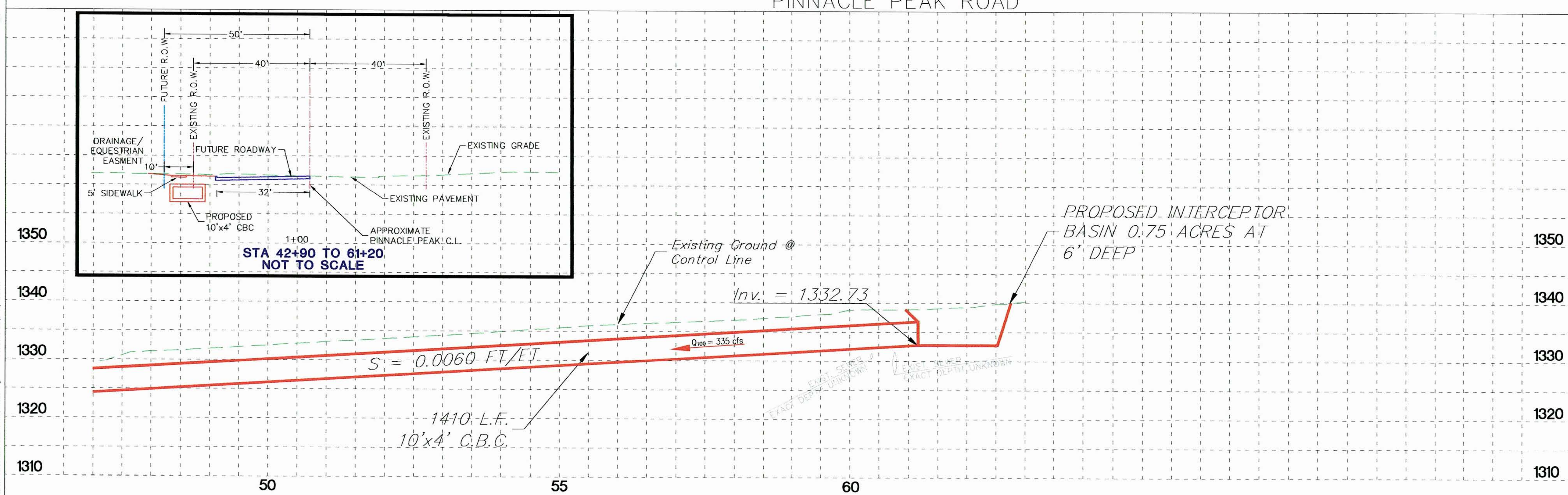
DRAWING NO.

PINNACLE PEAK ROAD
STA. 25+00 TO STA. 47+00

SHEET 28 OF 33



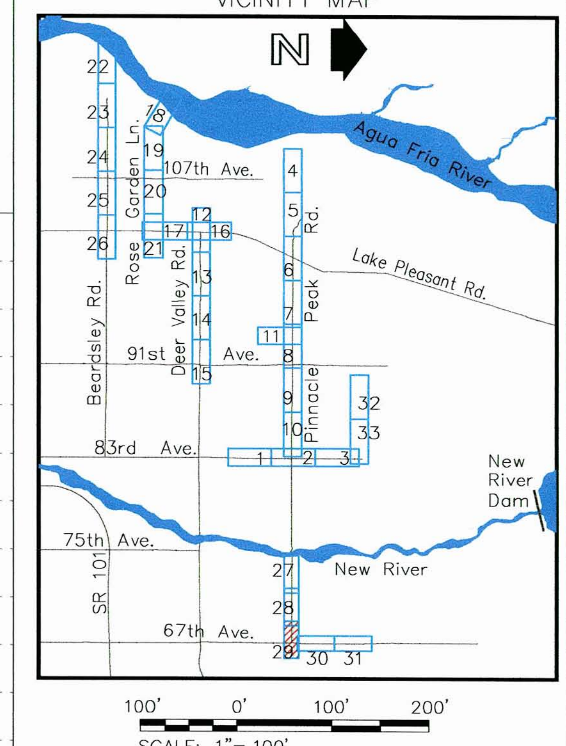
PINNACLE PEAK ROAD



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q100 = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER STUDY UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	KPK	08/01
DRAWN	DHN	02/02
CHECKED	KPK	02/02

Entellus — 2255 N. 44th Street Suite 125, Phoenix, AZ 85008.3279, Tel 602.244.2566, Fax 602.244.8947, E-mail www.entellus.com

IN ASSOCIATION WITH: PENTACORE ARIZONA — 2255 No. 44th St., SUITE 255 Phoenix, AZ 85008, TELEPHONE (602) 681-9272 FAX (602) 681-9339

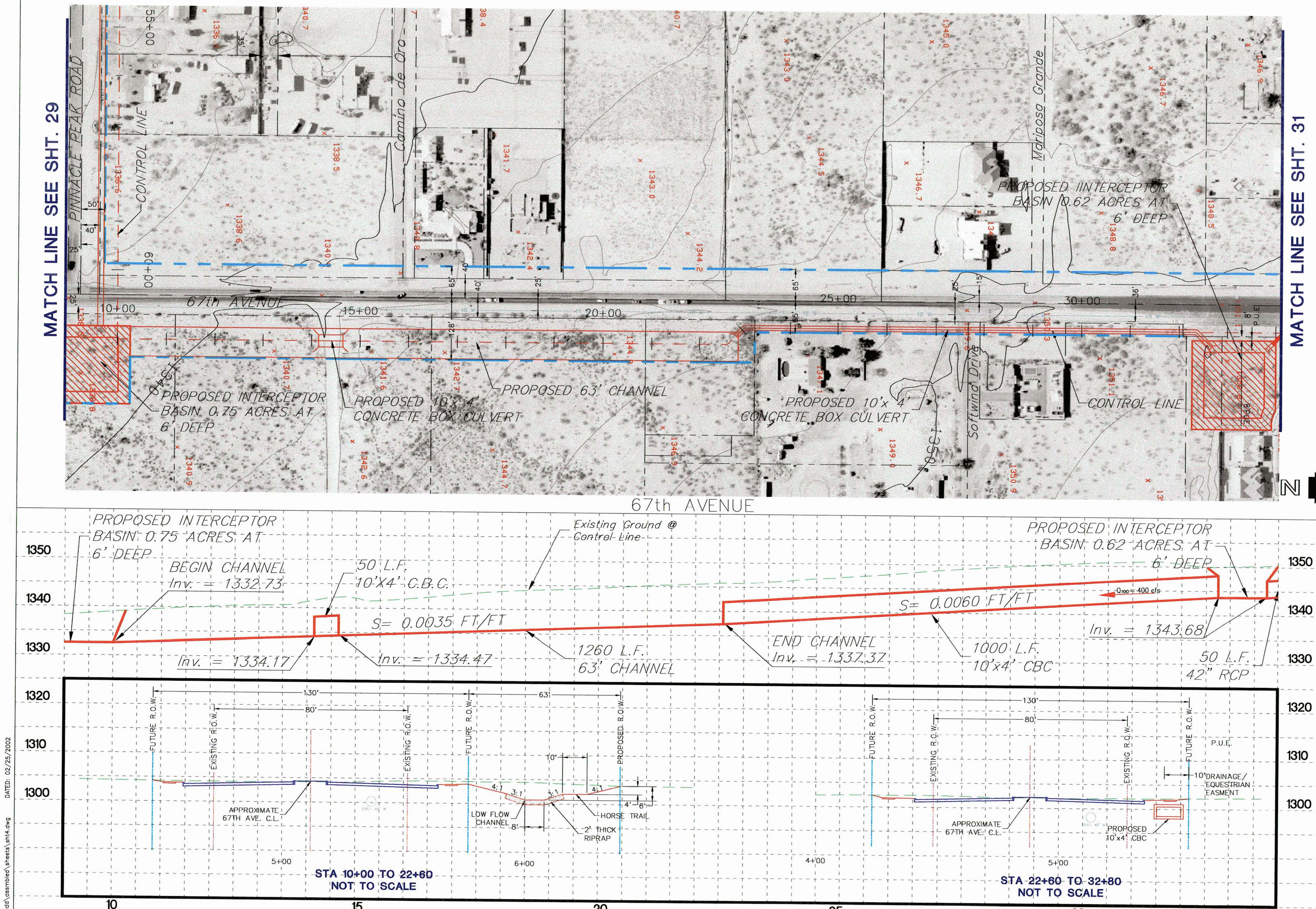
Registered Professional Engineer, 20909, J. VINCE GIBBONS, ARIZONA, U.S.A.

DRAWING NO. PINNACLE PEAK ROAD STA. 47+00 TO STA. 63+00

SHEET 29 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

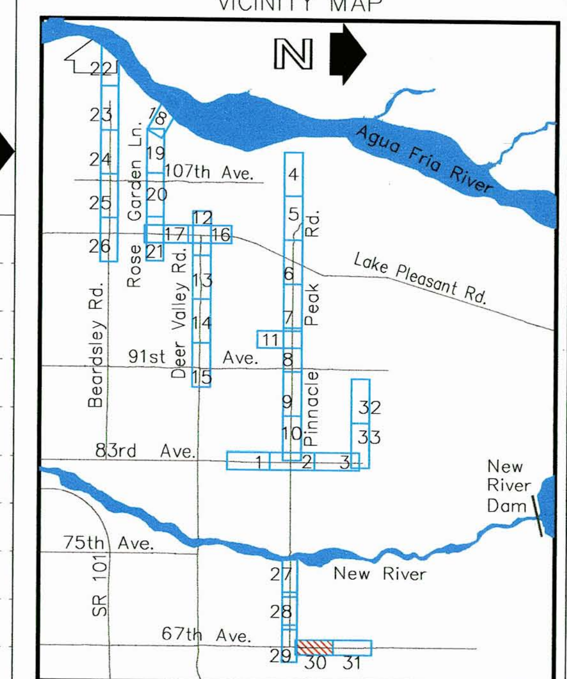
FILE: P:\5043000\...\cadd\assmbled\sheets\sht3.dwg DATED: 02/25/2002



LEGEND

- EXISTING RIGHT-OF-WAY
- EXISTING TELEPHONE LINE
- EXISTING SEWER LINE
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING ELECTRIC LINE
- EXISTING CABLE TV LINE
- PROPOSED RIGHT-OF-WAY
- PROPOSED BASIN
- ALTERNATE FACILITIES
- PROPOSED STORM DRAIN
- Q_{100} = 40 cfs — DIRECTION AND QUANTITY OF FLOW
- CHANNEL
- 1290 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER STUDY UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	KPK	08/01
DRAWN	DHN	02/02
CHECKED	VG	02/02

Entellus — 2255 N. 44th Street Suite 125, Phoenix, AZ 85008-3279, Tel 602.244.2566, Fax 602.244.8947, E-mail www.entellus.com

IN ASSOCIATION WITH: PENTACORE ARIZONA — 2255 No. 44th St., SUITE 255 Phoenix, AZ 85008, TELEPHONE (602) 681-9272 FAX (602) 681-9339

Registered Professional Engineer 20909 J. VINCE GIBBONS, ARIZONA, U.S.A.

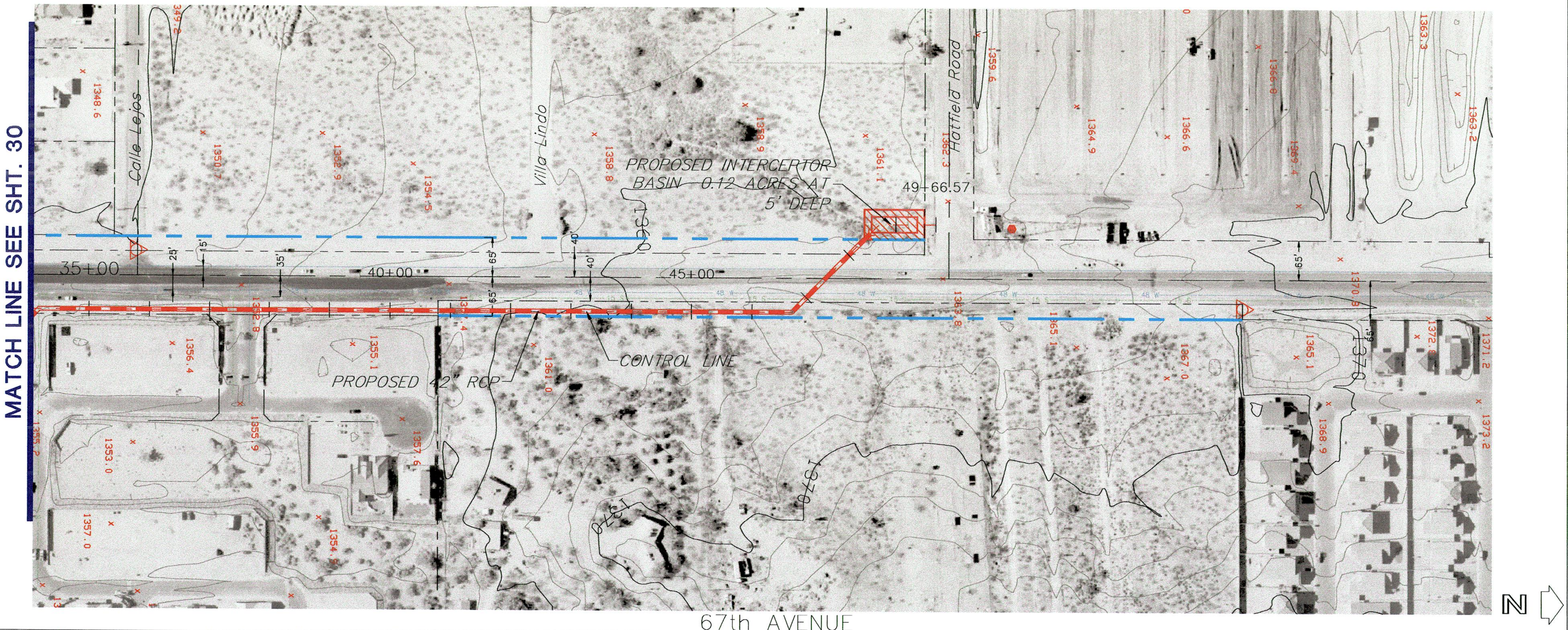
DRAWING NO.

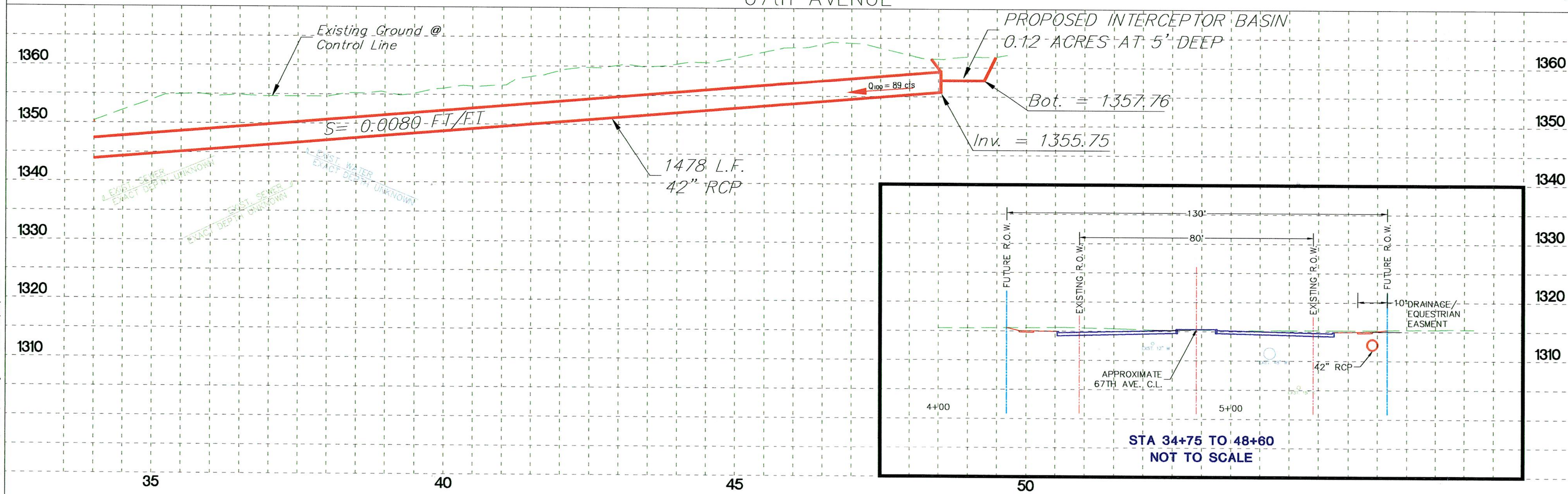
67th AVENUE STA. 10+00 TO STA. 33+00

SHEET 30 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

FILE: P:\5043000\...\cadd\assmbled\sheets\sht4.dwg DATED: 02/25/2002

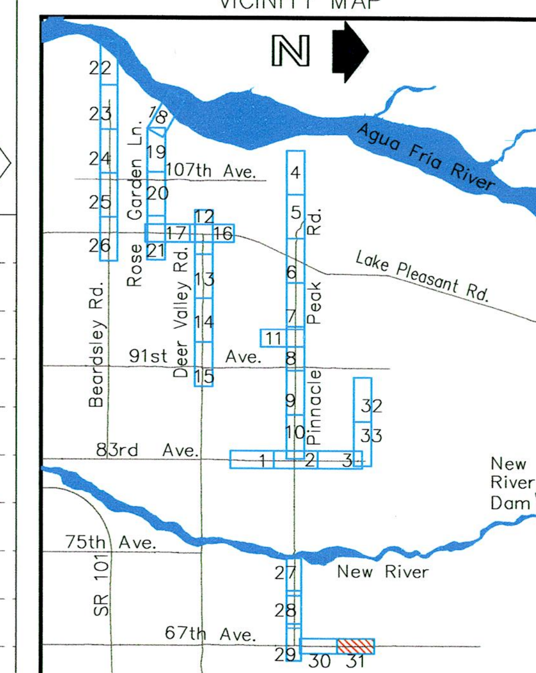




LEGEND

	EXISTING RIGHT-OF-WAY
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'
SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE
MASTER STUDY UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	KPK	08/01
DRAWN	DHN	02/02
CHECKED	VG	02/02

Entellus
2255 N. 44th Street Suite 125
Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

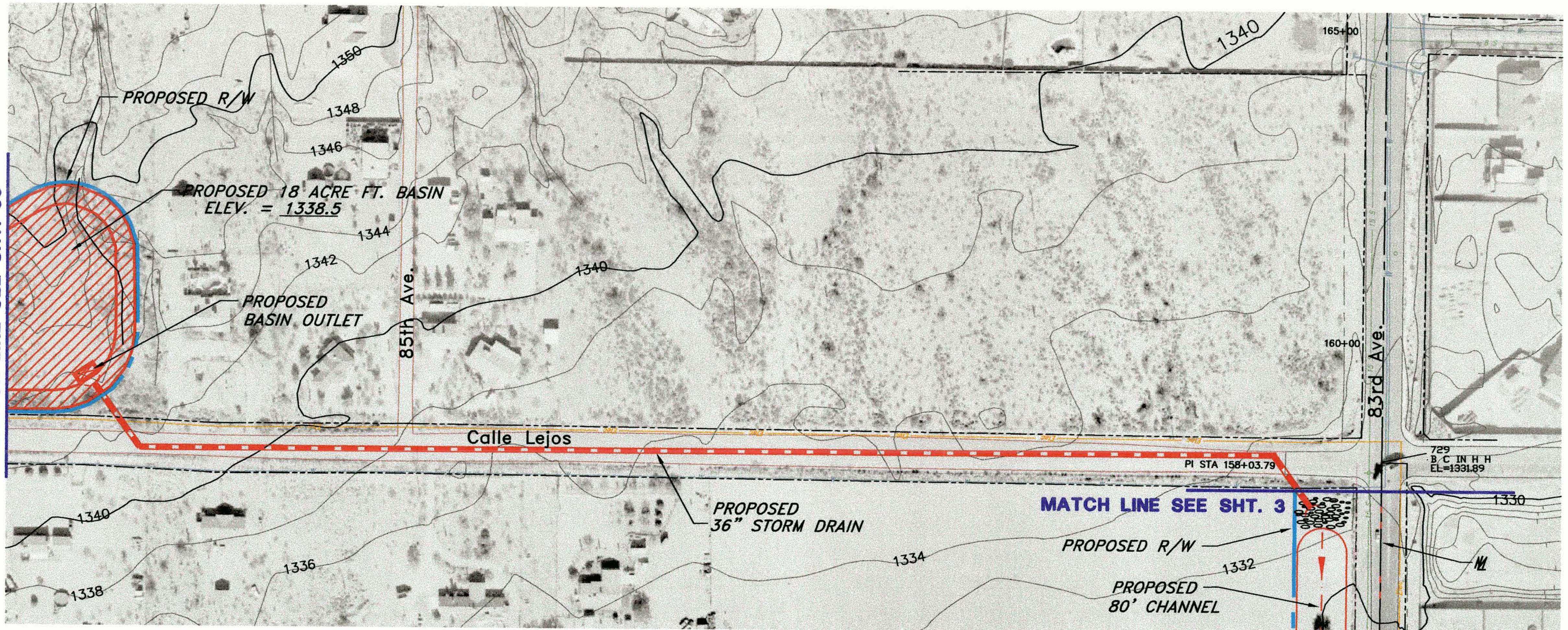
IN ASSOCIATION WITH:
PENTACORE ARIZONA
2255 No. 44th St., SUITE 255 Phoenix, AZ 85008
TELEPHONE (602) 681-9272 FAX (602) 681-9339

20909
J. VINCE GIBBONS
ARIZONA, U.S.A.

DRAWING NO.	67th AVENUE STA. 43+00 TO STA. 50+00	SHEET 31 OF 33

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PROVIDED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

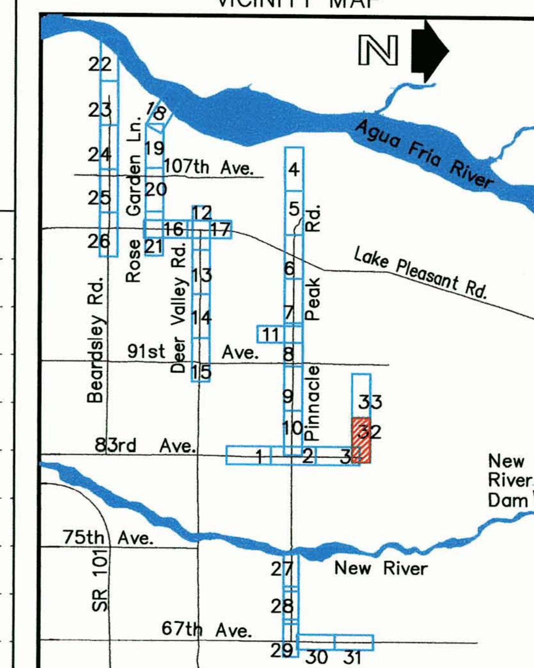
FILE: P:\50430001\Area9\cadd\assmbled\sheets\sht5.dwg DATED: 02/25/2002



LEGEND

	EXISTING RIGHT-OF-WAY
	EXISTING TELEPHONE LINE
	EXISTING SEWER LINE
	EXISTING GAS LINE
	EXISTING WATER LINE
	EXISTING ELECTRIC LINE
	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
$Q_{100} = 40$ cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Registered Professional Engineer Certificate No. 29737 HERNAN A. ARISTIZABAL ARIZONA, U.S.A.

Entellus
2255 N. 44th Street Suite 125 Phoenix, AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

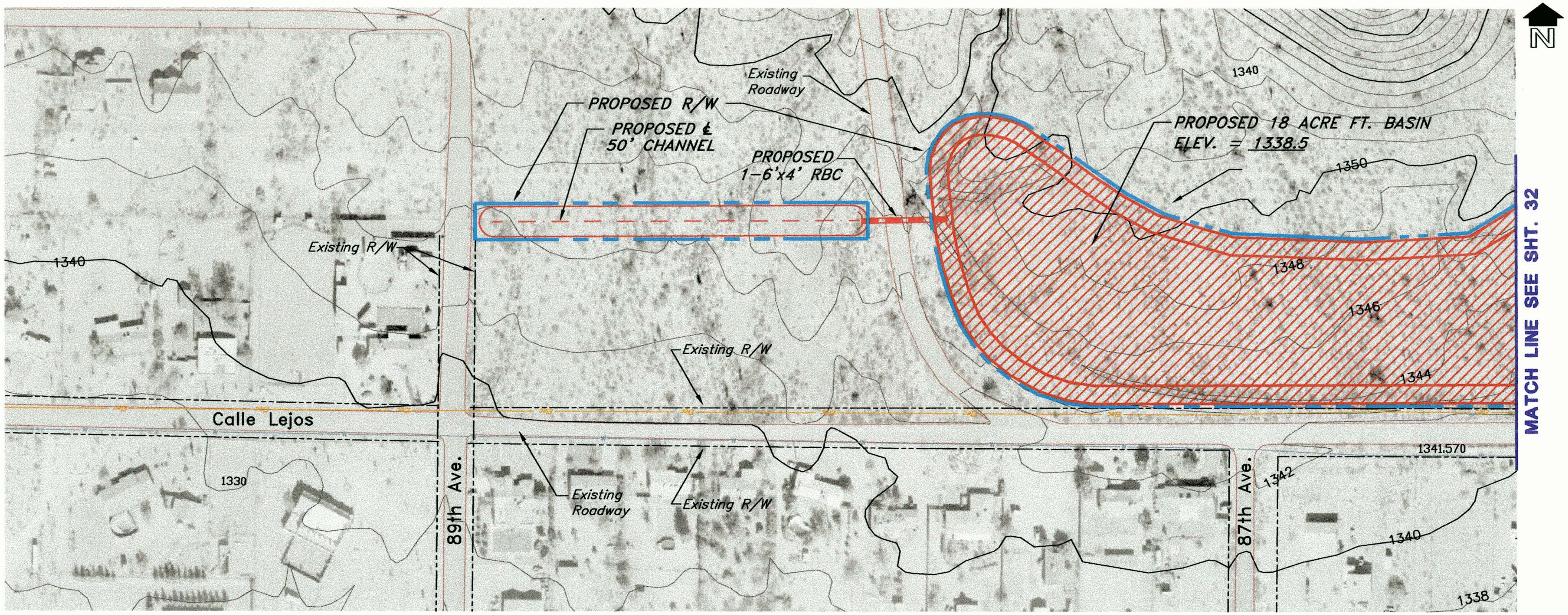
CALLE LEJOS
STA. 155+00 TO 180+00

SHEET 32 OF 33

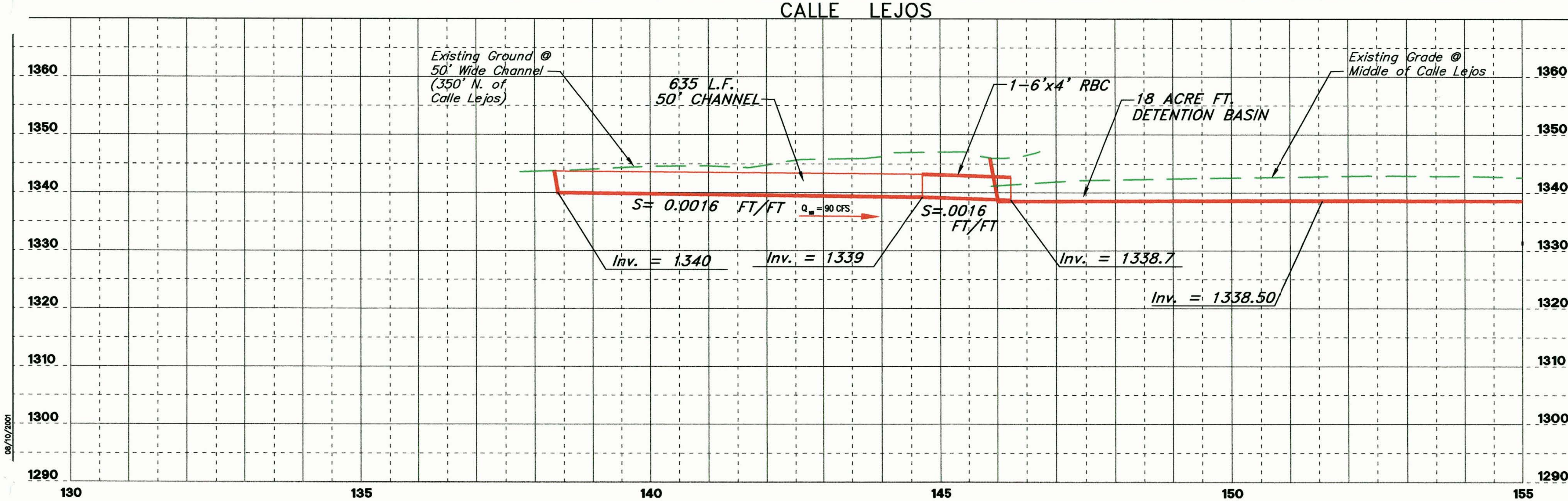
NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY. THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

DATE: 08/10/2001

FILE: alternate_four_Calle-le



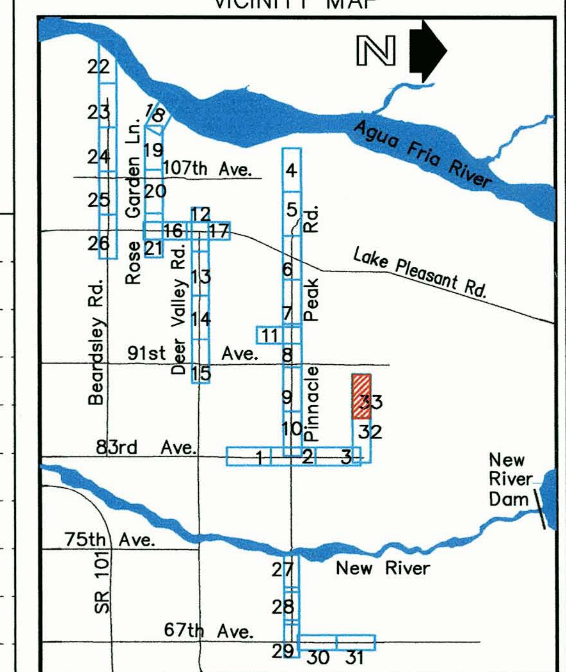
CALLE LEJOS



LEGEND

	EXISTING RIGHT-OF-WAY
Tel	EXISTING TELEPHONE LINE
15 S	EXISTING SEWER LINE
GAS	EXISTING GAS LINE
W	EXISTING WATER LINE
Elec	EXISTING ELECTRIC LINE
CaTV	EXISTING CABLE TV LINE
	PROPOSED RIGHT-OF-WAY
	PROPOSED BASIN
	ALTERNATE FACILITIES
	PROPOSED STORM DRAIN
Q_{100} = 40 cfs	DIRECTION AND QUANTITY OF FLOW
	CHANNEL
1290	INDEX CONTOUR
	INTERMEDIATE CONTOUR

VICINITY MAP



100' 0' 100' 200'

SCALE: 1"= 100'

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

GLENDALE / PEORIA
AREA DRAINAGE MASTER PLAN UPDATE

F.C.D. CONTRACT NO. 99-44

Registered Professional Engineer (Civil) CERTIFICATE NO. 29737 HERNAN A. ARISTIZABAL Date Signed ARIZONA, U.S.A.

	BY	DATE
DESIGNED	HAA	08/01
DRAWN	GLT/KAB	08/01
CHECKED	MJB	08/01

Entellus
2255 N. 44th Street Suite 125
Phoenix. AZ 85008.3279
Tel 602.244.2566
Fax 602.244.8947
E-mail www.entellus.com

CALLE LEJOS
STA. 130+00 TO 155+00

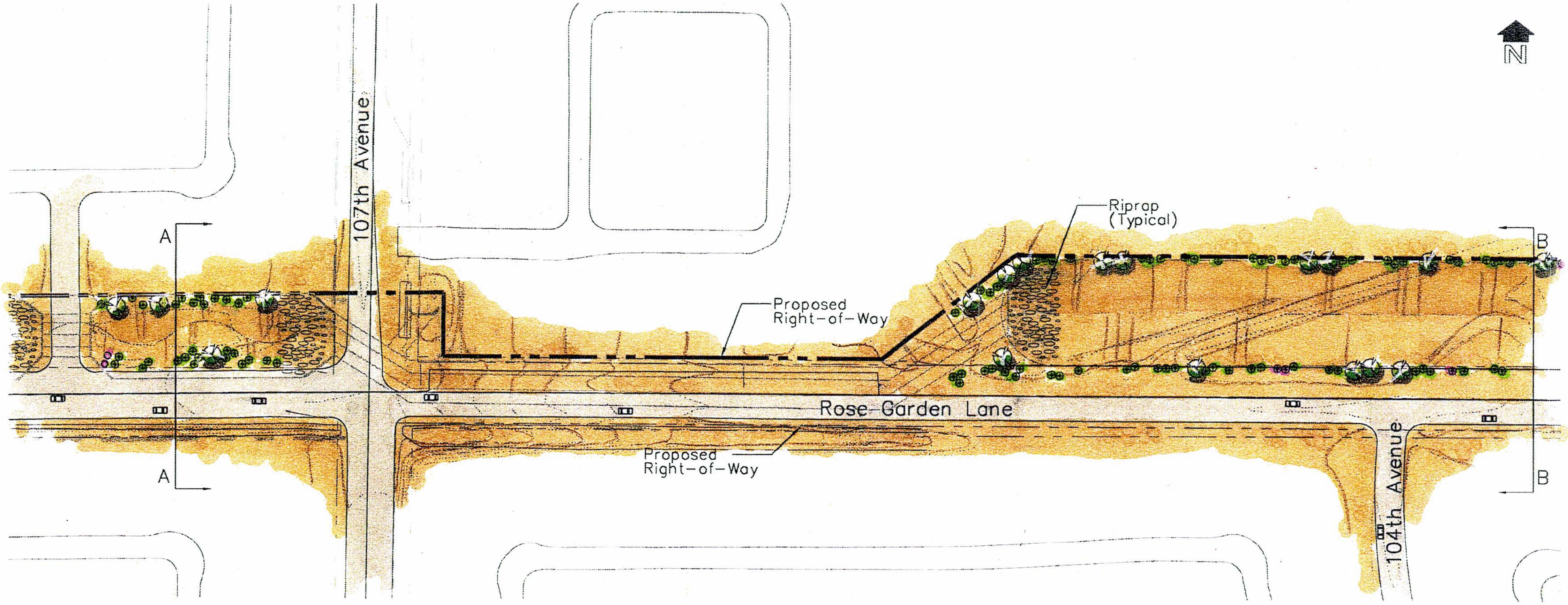
SHEET 33 OF 33

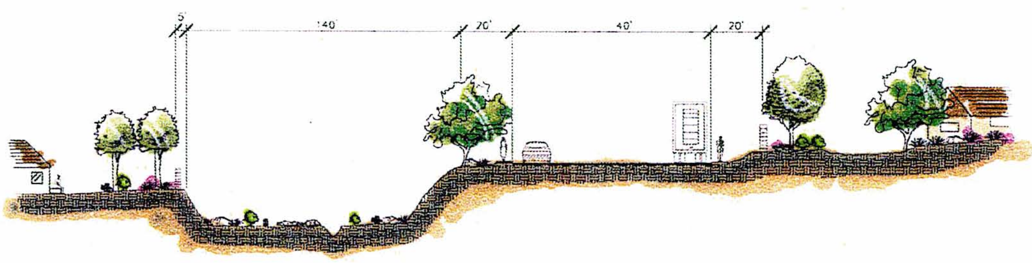
08/10/2001

FILE: alternate_four_Calle-

NOTE:
THESE PLANS ARE PRELIMINARY AND ARE PREPARED FOR PLANNING PURPOSES ONLY THE LOCATIONS OF ALL STRUCTURES, UTILITIES AND RIGHT-OF-WAY ARE APPROXIMATE AND ARE BASED UPON RECORD DOCUMENTS. AERIAL TOPOGRAPHY WAS PRODUCED AT A SCALE OF, ONE INCH = 200 FEET WITH 2 FOOT CONTOUR INTERVAL. MAPPING WAS PREPARED BY DATABASE TERRAIN MAPPING AND IS BASED ON GROUND CONTROL SURVEY DATA PROVIDED BY PENTACORE ARIZONA, INC.

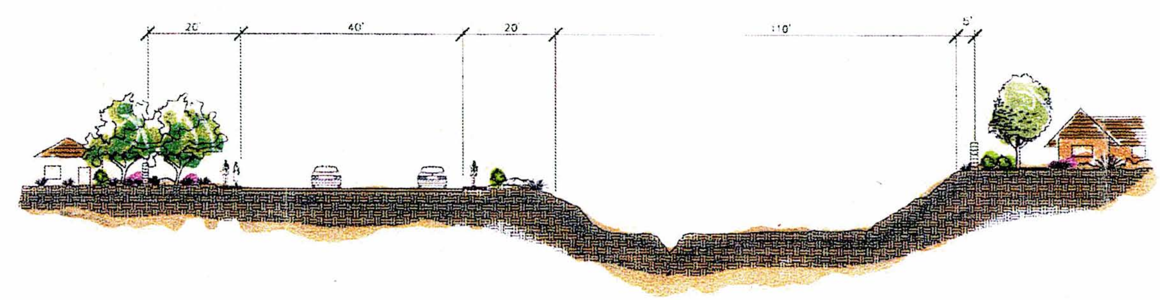
LANDSCAPING DESIGN CONCEPT PLANS





SECTION A-A

N.T.S.



SECTION B-B

N.T.S.

LEGEND

EXISTING RIGHT-OF-WAY

PROPOSED RIGHT-OF-WAY

PROPOSED CHANNEL

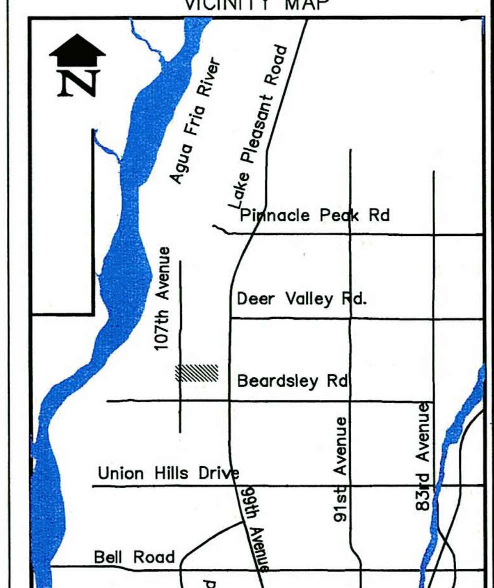
PROPOSED BASIN BOTTOM

TREE

SHRUB

ACCENT

VICINITY MAP



SCALE: N.T.S

ROSE GARDEN LANE AND 107TH AVENUE CHANNEL

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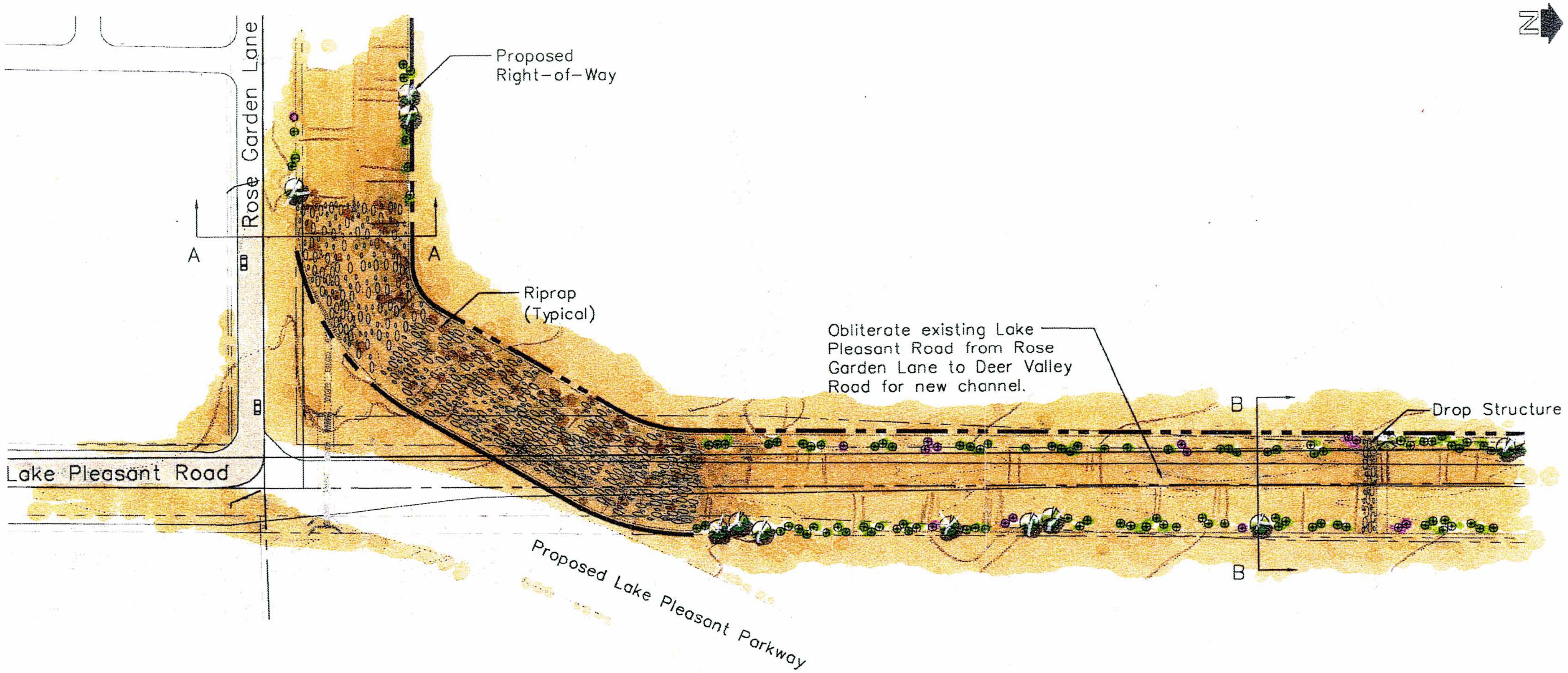
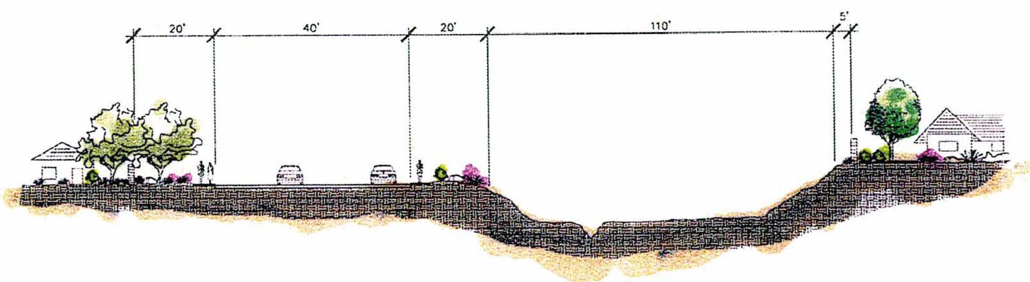


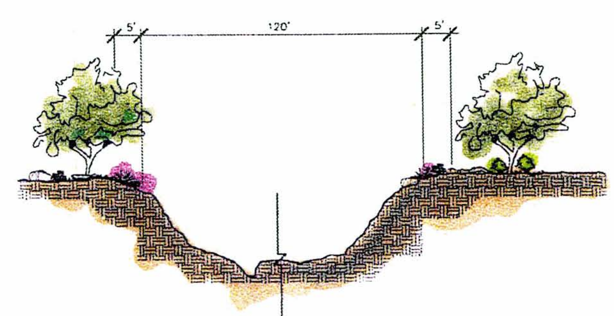
LEGEND

EXISTING RIGHT-OF-WAY
PROPOSED RIGHT-OF-WAY
PROPOSED CHANNEL
PROPOSED BASIN BOTTOM
TREE
SHRUB
ACCENT



SECTION A–A

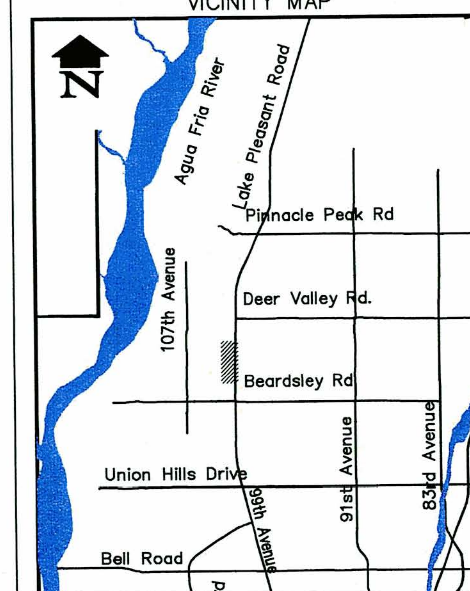
N.T.S.



SECTION B–B

N.T.S

VICINITY MAP



SCALE: N.T.S

LAKE PLEASANT ROAD & ROSE GARDEN LANE CHANNEL

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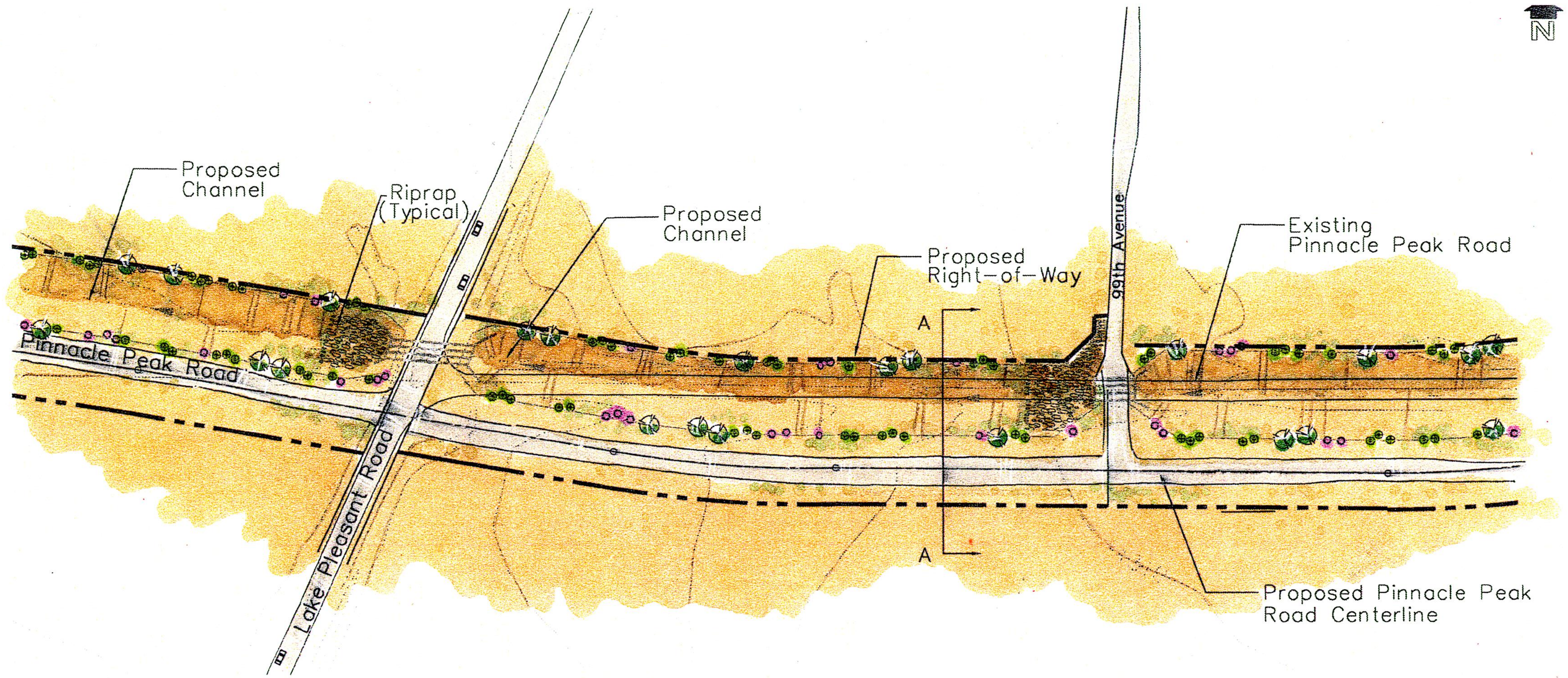
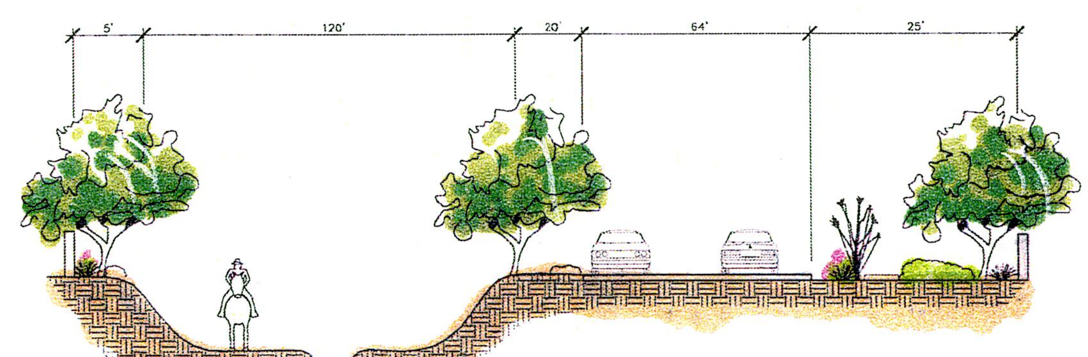




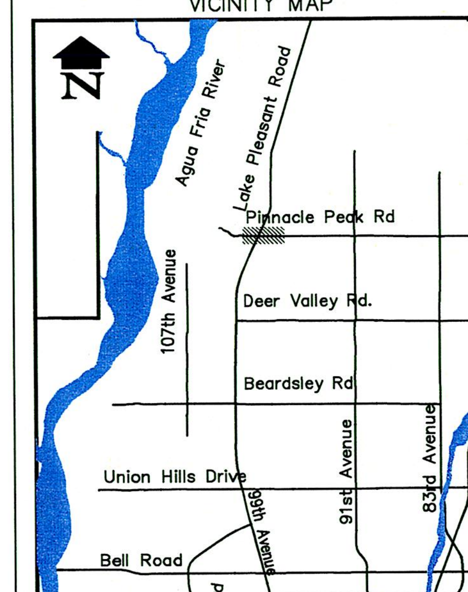
SECTION A–A

N.T.S.

LEGEND

- EXISTING RIGHT–OF–WAY
- PROPOSED RIGHT–OF–WAY
- PROPOSED CHANNEL
- PROPOSED BASIN BOTTOM
- TREE
- SHRUB
- ACCENT

VICINITY MAP



SCALE: N.T.S

PINNACLE PEAK ROAD & LAKE PLEASANT ROAD CHANNEL

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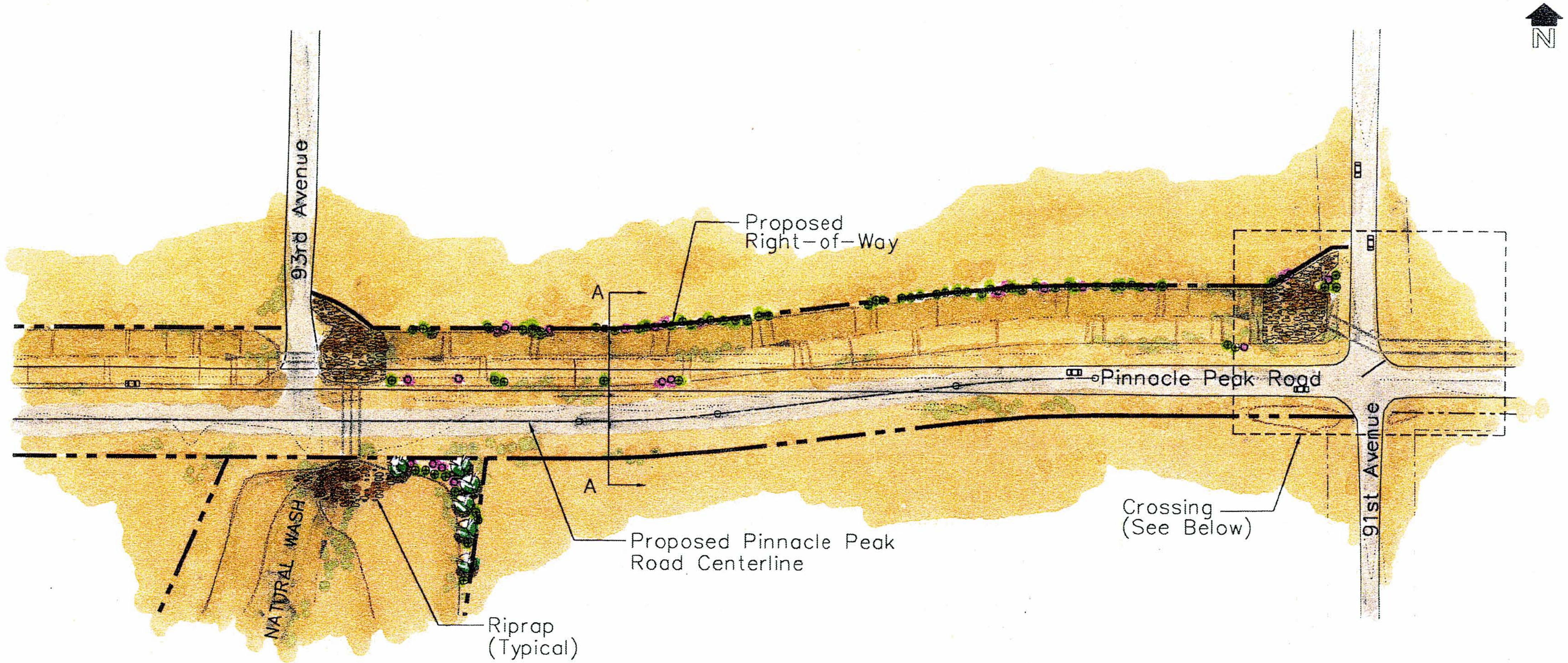
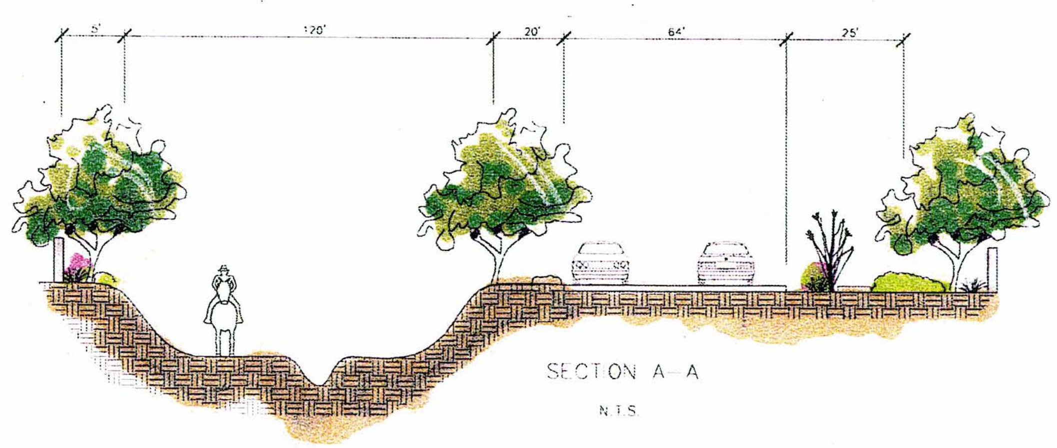


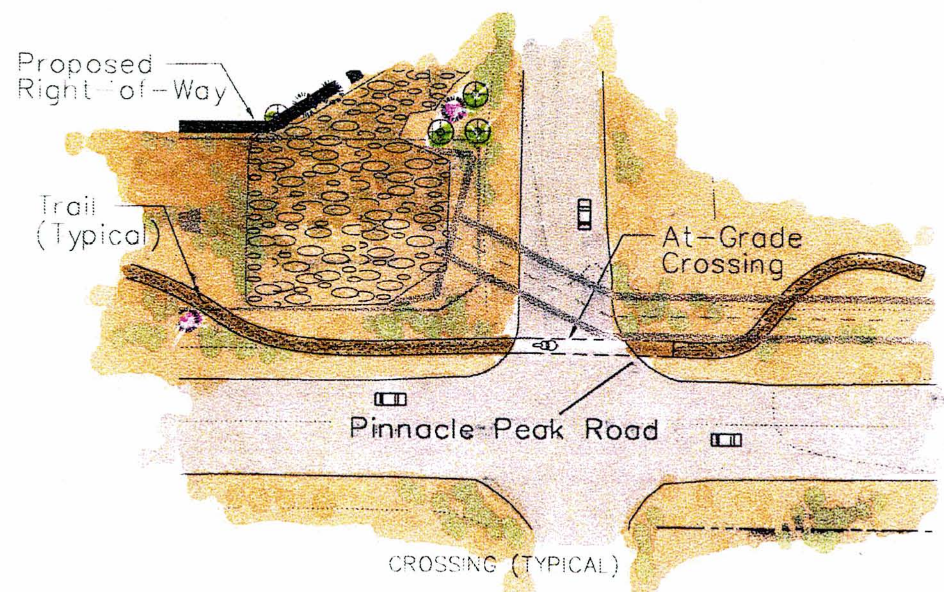
LEGEND

- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- PROPOSED CHANNEL
- PROPOSED BASIN BOTTOM
- TREE
- SHRUB
- ACCENT



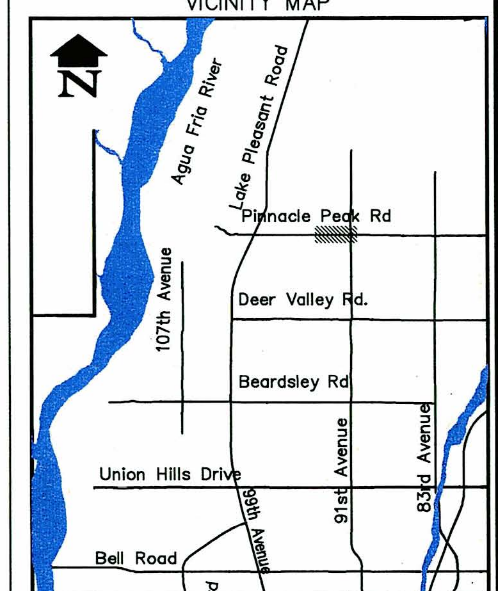
SECTION A–A

N.T.S.



CROSSING (TYPICAL)

VICINITY MAP



SCALE: N.T.S

PINNACLE PEAK ROAD & 91ST AVENUE CHANNEL

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LEGEND

PROPOSED STORM DRAIN

PROPOSED BOX CULVERT

EXISTING RIGHT-OF-WAY

PROPOSED RIGHT-OF-WAY

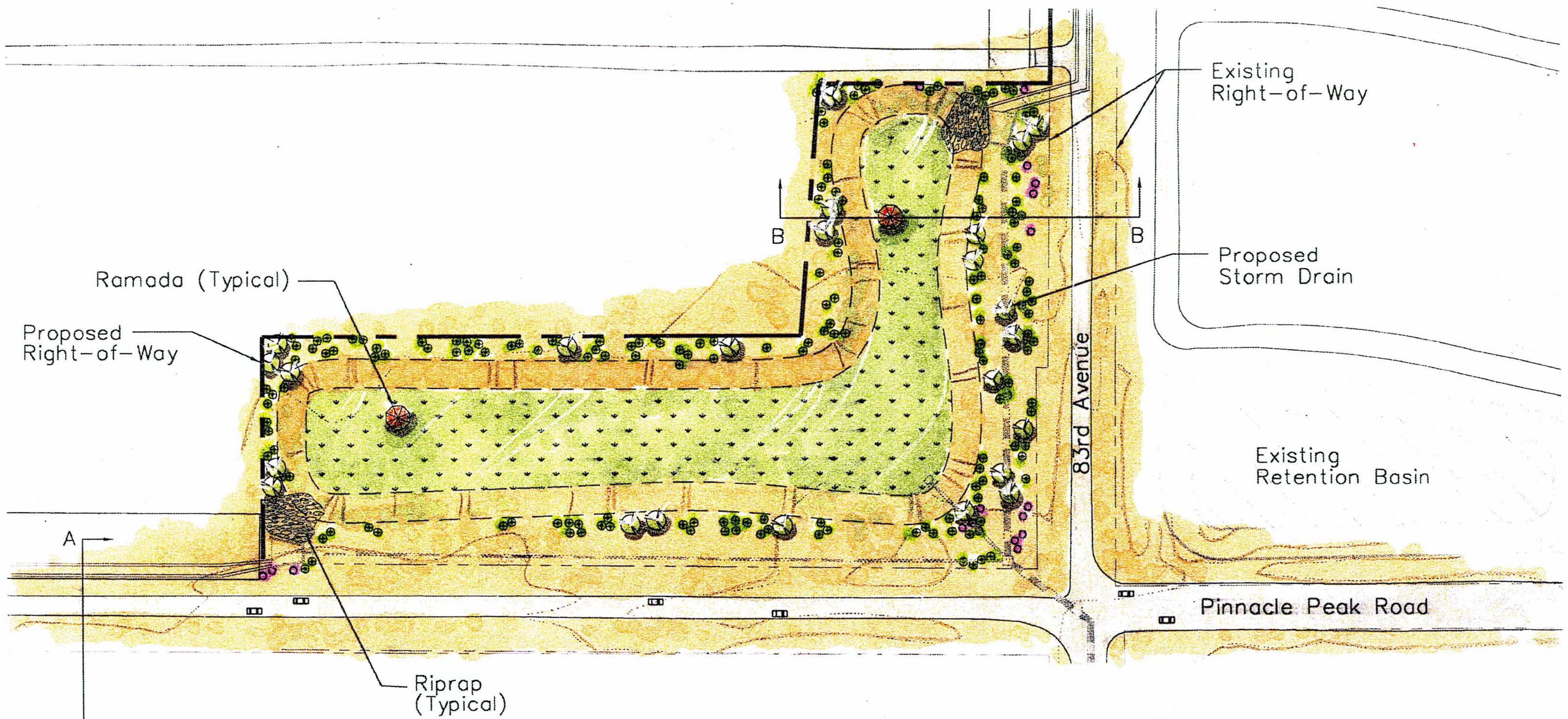
PROPOSED CHANNEL

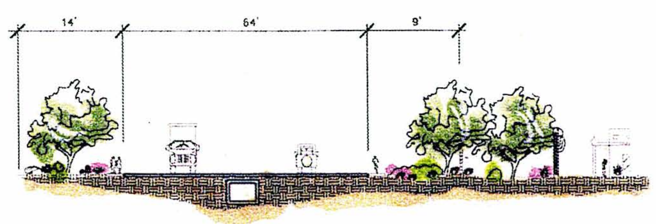
PROPOSED BASIN BOTTOM (Turf)

TREE

SHRUB

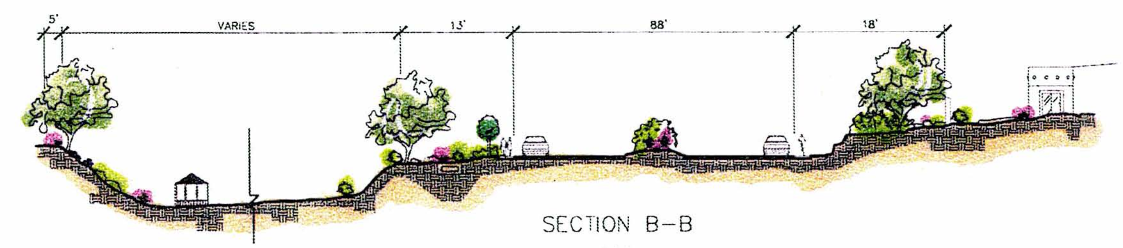
ACCENT





SECTION A-A

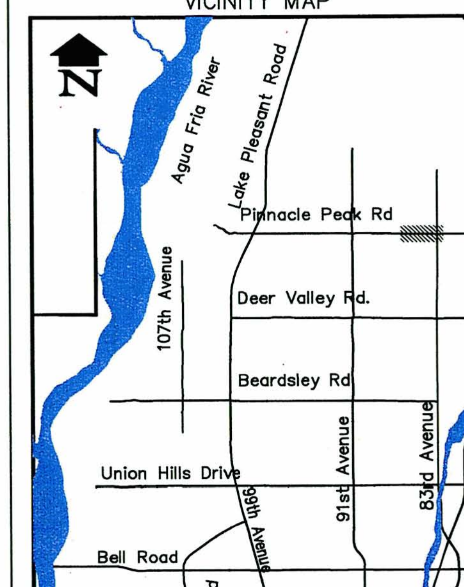
N.T.S



SECTION B-B

N.T.S

VICINITY MAP



SCALE: N.T.S

83RD AVENUE AND PINNACLE PEAK ROAD BASIN

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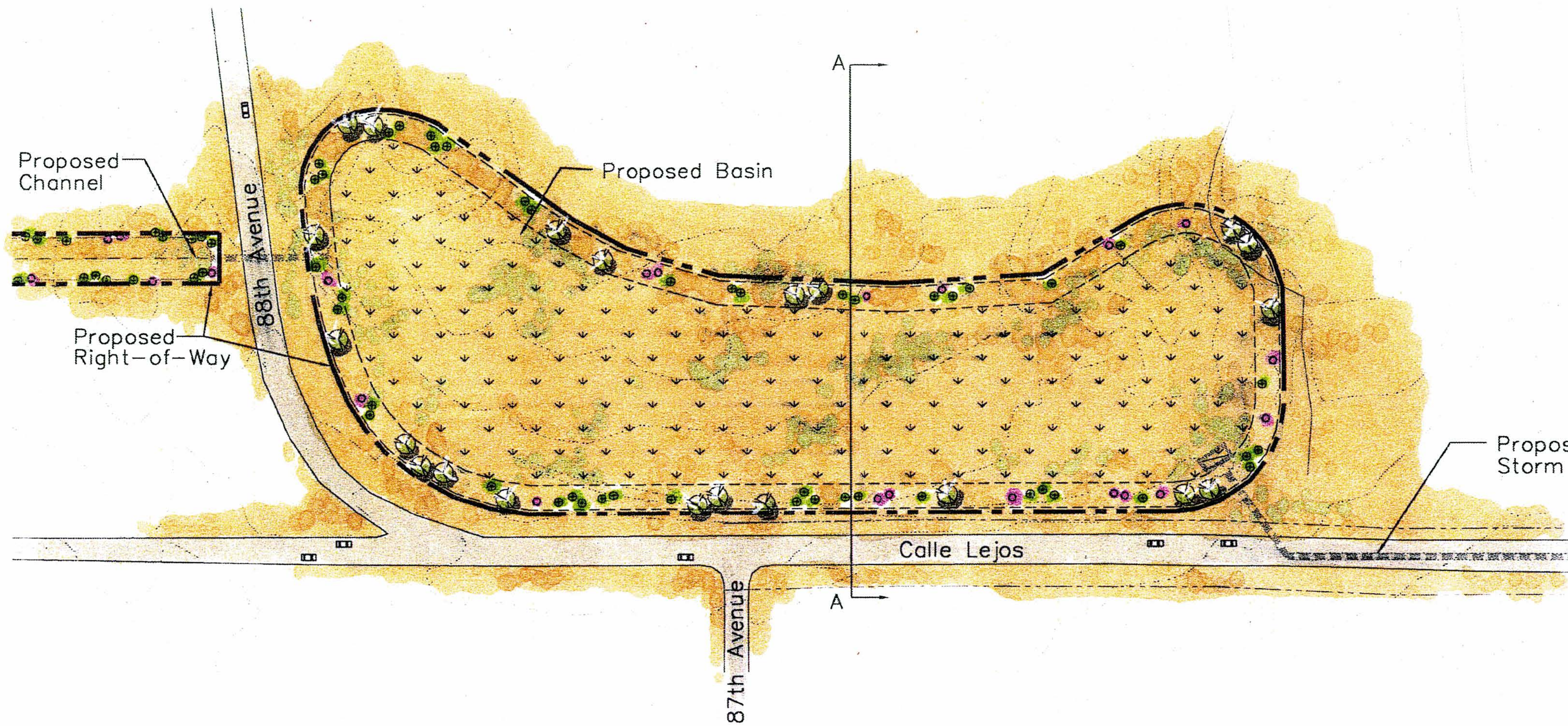
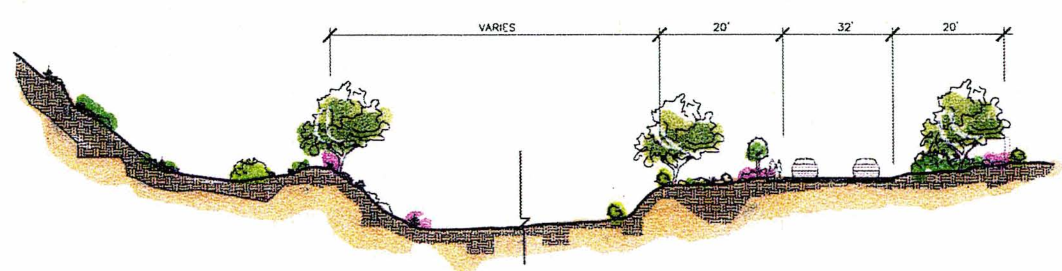




SECTION A-A

N.T.S

LEGEND

PROPOSED STORM DRAIN

EXISTING RIGHT-OF-WAY

PROPOSED RIGHT-OF-WAY

PROPOSED CHANNEL

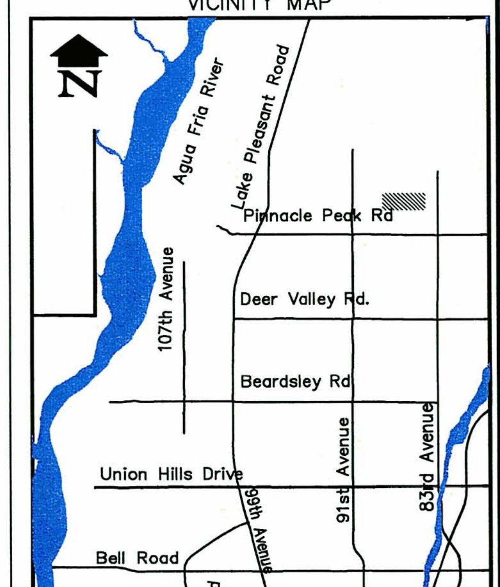
PROPOSED BASIN BOTTOM (Hydroseed)

TREE

SHRUB

ACCENT

VICINITY MAP



SCALE: N.T.S.

CALLE LEJOS BASIN

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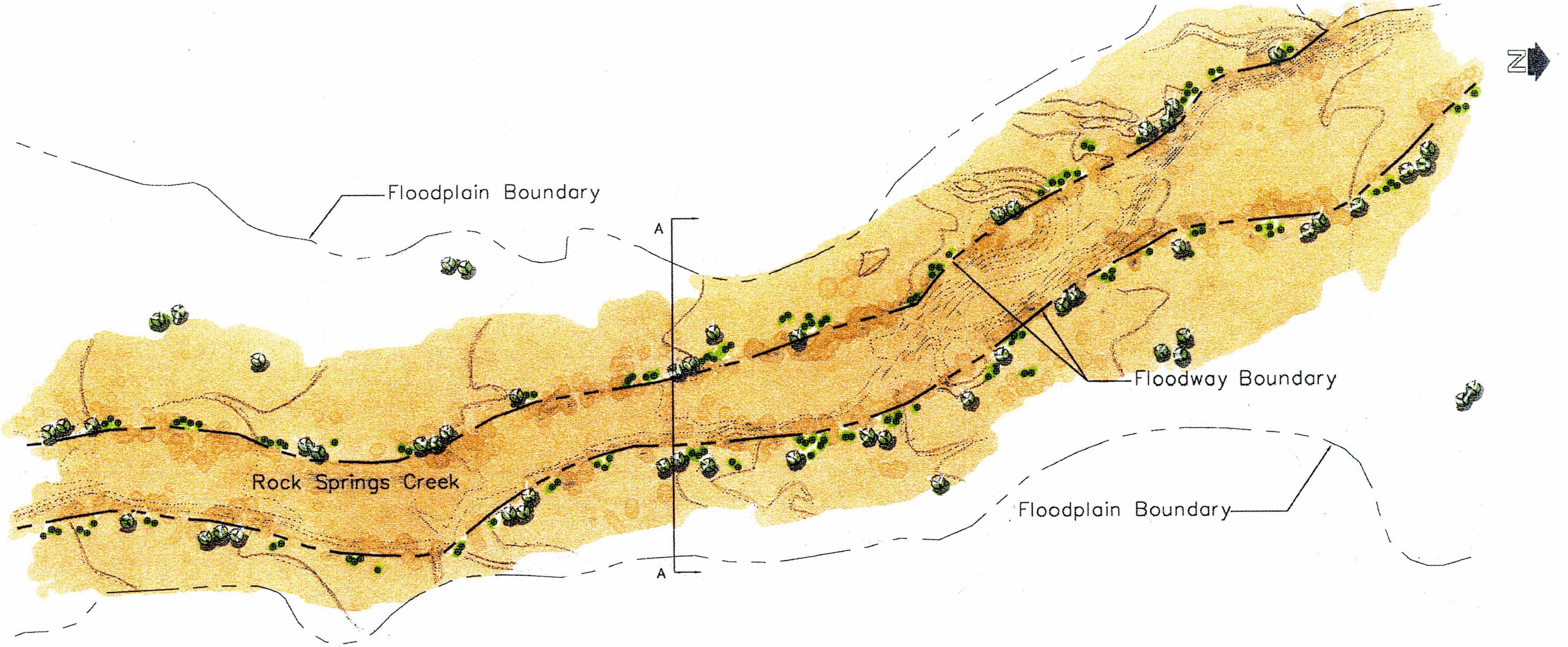


Preserve Existing Floodway

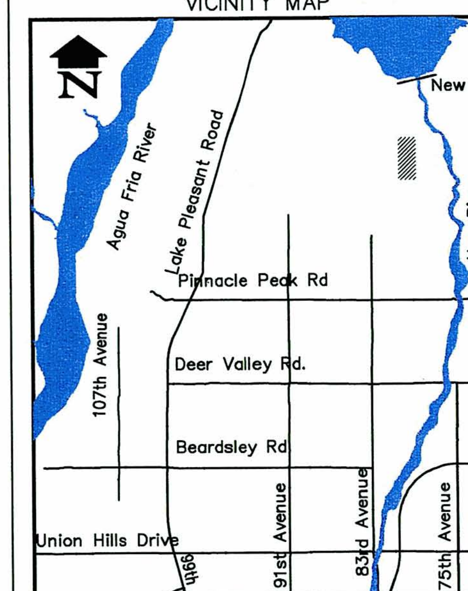
SECTION A-A
N.T.S

LEGEND

FLOODPLAIN
FLOODWAY

TREE
SHRUB
ACCENT

VICINITY MAP



SCALE: N.T.S

ROCK SPRINGS CREEK

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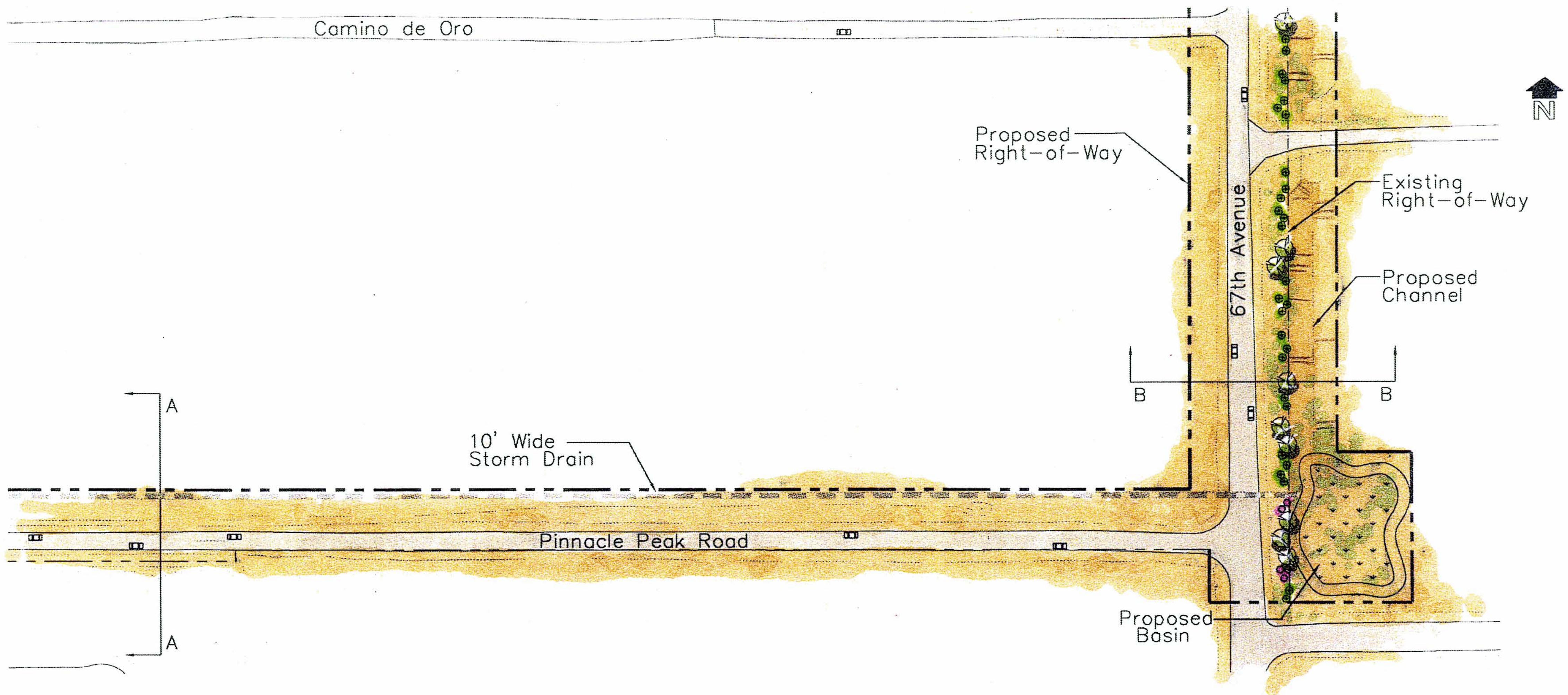
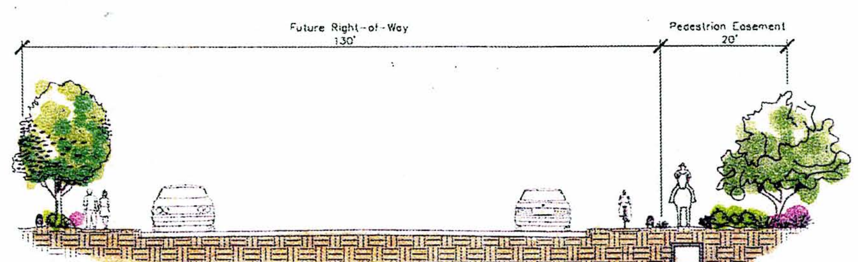
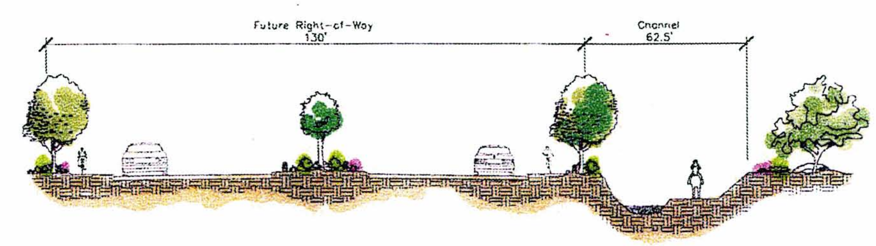




SECTION A-A

N.T.S.



SECTION B-B

N.T.S.

LEGEND

PROPOSED STORM DRAIN

EXISTING RIGHT-OF-WAY

PROPOSED RIGHT-OF-WAY

PROPOSED CHANNEL

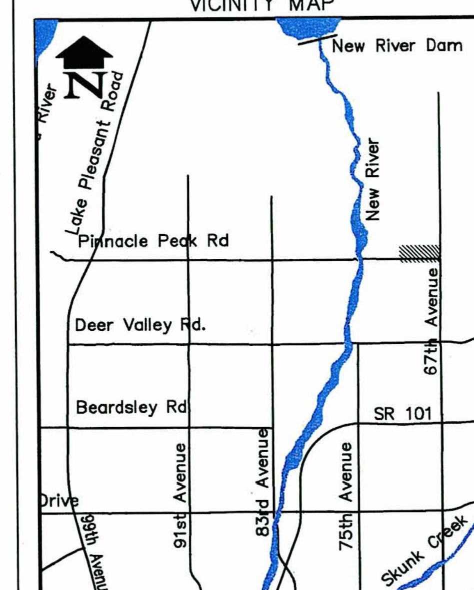
PROPOSED BASIN BOTTOM

TREE

SHRUB

ACCENT

VICINITY MAP



SCALE: N.T.S

PINNACLE PEAK ROAD & 67TH AVENUE BASIN

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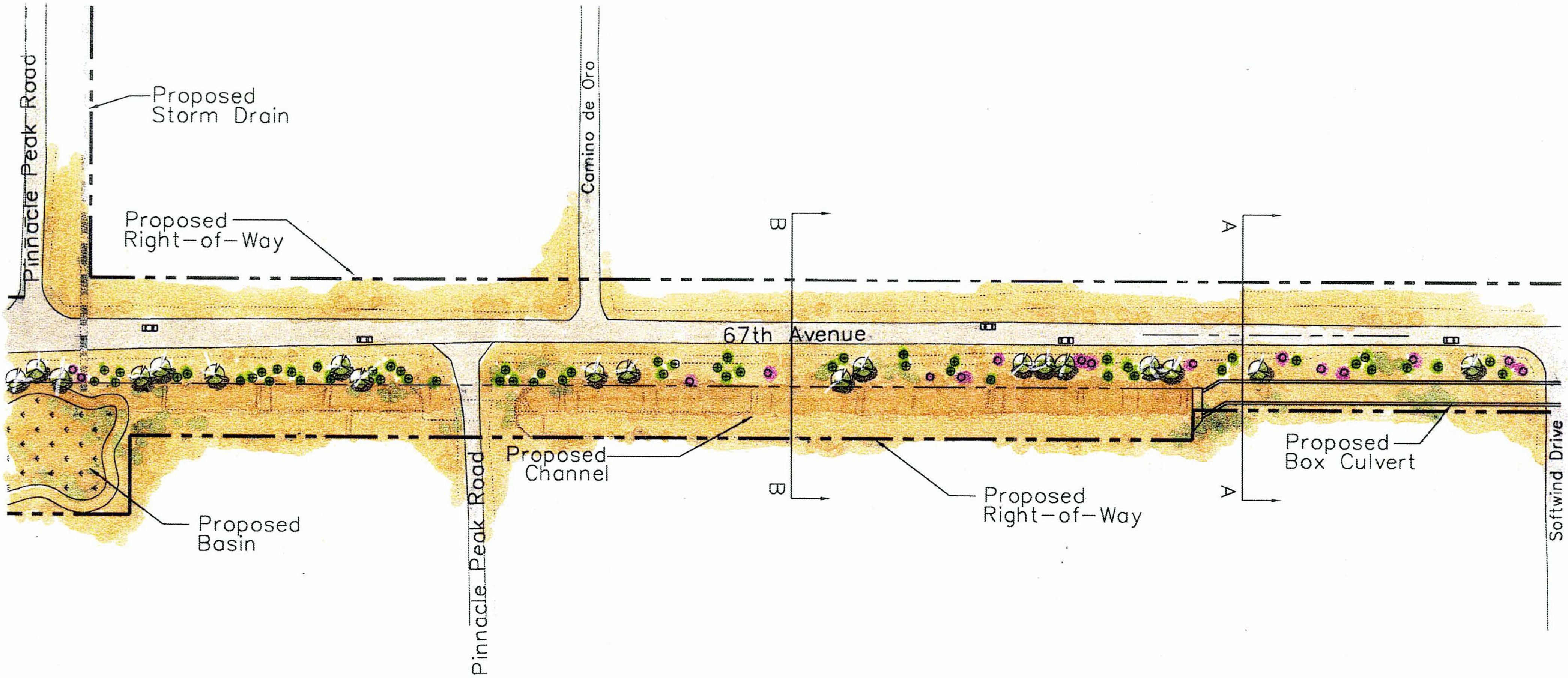
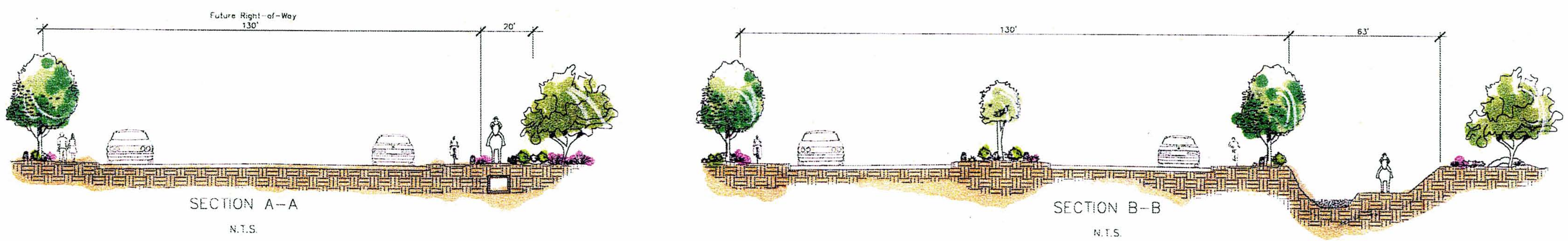
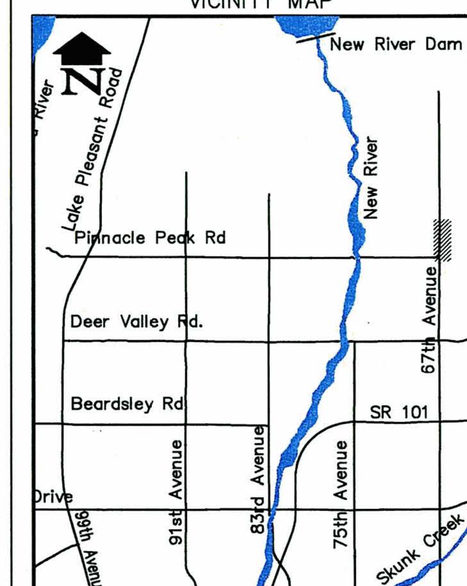


LEGEND

- PROPOSED BOX CULVERT
- PROPOSED STORM DRAIN
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- PROPOSED CHANNEL
- PROPOSED BASIN BOTTOM
- TREE
- SHRUB
- ACCENT



VICINITY MAP



SCALE: N.T.S

PINNACLE PEAK ROAD & 67TH AVENUE CHANNEL/ STORM DRAIN

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APPENDIX B. COST ESTIMATES (LEVEL II AND LEVEL III ANALYSIS)

LEVEL III COST ESTIMATES

Northwest Region Drainage Improvement Cost Analysis

Rose Garden Lane Channel		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	Riprap	$120,000
		4 - 6' x 8' (80 ft) RCB	$85,000
		4 - 6' x 8' (80 ft) RCB	$85,000
		4 - 6' x 8' (90 ft) RCB	$92,000
		3 - 6' x 10' (900 ft) RCB	$850,000
	Excavation (yd^3)	111,000 (yd^3)	$302,000
	Compaction (yd^3)	111,000 (yd^3)	$80,000
	Lanscaping Costs		$100,000
	Right-of-Way	12 Acres	$1,200,000
		Sub-Total Cost	$2,914,000
	Contingnency & Design Included	**Total Cost**	**$3,700,780**
Lake Pleasant Road		**Quantities**	**Costs**
Type	Open Channels		
	Structures	Riprap	$82,000
		2 Drop Structures	$775,000
	Excavation (yd^3)	43,750 (yd^3)	$131,250
	Compaction (yd^3)	43,750 (yd^3)	$43,750
	Lanscaping Costs		$200,000
	Right-of-Way	5 Acres	$500,000
		Sub-Total Cost	$1,732,000
	Contingnency & Design Included	**Total Cost**	**$2,199,640**
Deer Valley Road		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	4 - 5' x 10' (130 ft) RCB	$145,000
		4 - 5' x 10' (150 ft) RCB	$165,000
		4 - 5' x 10' (100 ft) RCB	$110,000
		4 - 5' x 10' (100 ft) RCB	$110,000
		inlet structure	$8,000
		Riprap	$338,000
	Excavation (yd^3)	158,000 (yd^3)	$474,000
	Compaction (yd^3)	158,000 (yd^3)	$158,000
	Lanscaping Costs		$380,000
	Right-of-Way	18	$1,800,000
		Sub-Total Cost	$3,543,000
	Contingnency & Design Included	**Total Cost**	**$4,499,610**

Pinnacle Peak Road Lake Pleasant Road to River		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	2 - 6' x 8' (1500 ft) RCB	$690,000
		3 - 5' x 8' (170 ft) RCB	$100,000
		3 - 5' x 8' (100 ft) RCB	$65,000
		junction structure	$40,000
		drop structure	$200,000
		Riprap	$135,000
		Roadway Relocation	$800,000
	Excavation (yd^3)	32,000 (yd^3)	$150,000
	Compaction (yd^3)	32,000 (yd^3)	$60,000
	Lanscaping Costs		$380,000
	Right-of-Way	8	$800,000
		Sub-Total Cost	$2,630,000
	Contingnency & Design Included	**Total Cost**	**$3,340,100**
Pinnacle Peak Road 95th Avenue to Lake Pleasant Road		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	2 - 4' x 8' (80) RCB	$47,000
		3 - 5' x 8' (130 ft) RCB	$105,000
		3 - 4' x 8' (40 ft) RCB	$28,000
		Riprap	$400,000
		Roadway Relocation	$500,000
	Excavation (yd^3)	43,000 (yd^3)	$175,000
	Compaction (yd^3)	43,000 (yd^3)	$65,000
	Lanscaping Costs		$400,000
	Right-of-Way	8	$800,000
		Sub-Total Cost	$2,520,000
	Contingnency & Design Included	**Total Cost**	**$3,200,400**
Pinnacle Peak Road 95th Avenue to 87th Avenue		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	2 - 4' x 8' (80) RCB	$50,000
		3 - 5' x 8' (130 ft) RCB	$110,000
		3 - 4' x 8' (40 ft) RCB	$30,000
		Riprap	$415,000
		Roadway Relocation	$600,000
	Excavation (yd^3)	43,000 (yd^3)	$160,000
	Compaction (yd^3)	43,000 (yd^3)	$65,000
	Lanscaping Costs		$447,000
	Right-of-Way	8	$800,000
		Sub-Total Cost	$2,677,000
	Contingnency & Design Included	**Total Cost**	**$3,399,790**

Beardsley Road Northwest Region		**Quantities**	**Costs**
Type	Open Channels with culverts		
	Structures	2 - 5' x 8' (90 ft) RCB	$40,000
		2 - 5' x 8' (100 ft) RCB	$44,000
		2 - 5' x 8' (100 ft) RCB	$44,000
		2 - 5' x 8' (110 ft) RCB	$44,000
		2 - 5' x 8' (70 ft) RCB	$31,000
		2 - 5' x 8' (110 ft) RCB	$44,000
		2 - 5' x 8' (136 ft) RCB	$60,000
		2 - drop structures	$150,000
		Riprap	$60,000
	Excavation (yd^3)	97,000 (yd^3)	$291,000
	Compaction (yd^3)	5,000 (yd^3)	$15,000
	Lanscaping Costs		$0
	Right-of-Way	0	$0
		Sub-Total Cost	$783,000
	Contingnency & Design Included	**Total Cost**	**$994,410**

UNIT COST ESTIMATE

	Item	Unit	Unit Cost
0	Blank	N/A	$0.00
1	Excavation	C.Y.	$3.00
2	Pavement Replacement	S.Y.	$50.00
3	Stuctures (3-10x6 RBC)	EA.	$166,000.00
4	Channel Lining	S.F.	$5.00
5	Repair Channel Lining	L.F.	$10.00
6	36" RCP Installed	L.F.	$130.00
7	Transition Structures (Channel)	EA	$12,000.00
8	Transition Structures (36" RCP)	EA	$1,200.00
9	Juntion Structure (3-36,1-24)	EA.	$5,000.00
10	Outlet Structures	EA.	$900.00
11	Side inlet	EA.	$5,000.00
12	Grouted Riprap	C.Y.	$100.00
13	Structural Concrete	C.Y.	$300.00
14	3-foot Drop Structure - Concrete	EA.	$250.00
15	3-foot Drop Structure - Grouted Riprap	EA.	$350.00
16	3-foot Drop Structure - Earthen	EA.	$280.00
17	5-foot Drop Structure	EA.	$280.00
18	Culvert w/ Energy Dissapator 70' channel	E.A.	$200,000.00
19	Culvert w/ Energy Dissapator 40' channel	E.A.	$120,000.00
	ROW Aquisition		0
20	Undeveloped Residential	Acre	$100,000.00
21	Developed Residential	Acre	$180,000.00
22	Undeveloped Commercial	Acre	$300,000.00
	Landscape/Environmental		0
23	Desert Landscaping	S.F	$1.20
24	Lush Desert Landscaping	S.F.	$1.30
25	Drip Irrigation System	L.F.	$0.00
26	Park & Playground Equipment	EA.	$10,000.00
27	Conc. S/W & D/W	S.F.	$5.00
	Miscellaneous		0
28	Fence	LF	$10.00
29	Bridge crossing -	EA.	$2,700.00
30	Box Culvert Crossing	EA.	$2,500.00
31	Maintenance of Earthen Channel (30 years)	LF	$100.00
32	Maintenance of Riprap Channel (30 years)	LF	$50.00
33	Maintenance of Concrete Channel (30 years)	LF	$6.00
34	20-foot Drop Structure	EA.	$45,000.00
35	10x4 Box Culvert	EA.	$56,000.00
36	2-8x5 Structure	EA.	$88,000.00
37	Diversion Structure	EA.	$12,000.00
38	3-10x6 Storm Drain	L.F.	$1,200.00
39	Structural Backfill	C.Y.	$40.00
40	Residential Desert Landscaping	S.F	$1.40
41	Residental Basin Landscaping	S.F. + $50K	$1.40
42	Equestrial Trail	L.F.	$3.50
43	Natural Wash Landscaping	S.F.	$1.40
44	Natural Wash Seeding	S.F.	$1.10
45	24" Drain Pipe Installed	L.F.	$100.00
46	Basin Construction	C.Y.	$4.50
47	36" RCP Excavation	C.Y.	$3.00
48	24" Pipe Excavation	C.Y	$3.00
49	Inlet Structure Excavation	C.Y.	$3.00
50	Catch Basin per M.A.G. Std. Det. 534-1	EA.	$3.00
51	Conc. By-Pass Structure	C.Y.	$3.00
52	Conc. Weir Structure	C.Y.	$3.00
53	Channel Construction	C.Y.	$3.00

67th Avenue and Pinnacle Peak Region Drainage Improvement Cost Analysis

	Quantities & Costs	Unit	Unit Cost	Peoria Quant.	Peoria Cost	Phoenix Quant.	Phoenix Cost	Project Cost
0	**Drainage Improvements**	**N/A**						
1	Excavation	C Y	$3 00	45166	$135.498 00	20830	$62.490 00	
2	Pavement Replacement	S Y	$50 00	426	$21,300 00	426	$21,300 00	
3	Stuctures (3-10x6 RBC)	EA	$166,000 00	0	$0 00	0	$0 00	
4	Channel Lining	S F	$5 00	0	$0 00	0	$0 00	
5	Repair Channel Lining	L F	$0 00	0	$0.00	0	$0 00	
6	Dry Well	EA	$5,000 00	0	$0 00	1	$5,000 00	
7	42" RCP	L F	$110 00	107	$11,770 00	1426	$156,860 00	
8	10' x 4' Concrete Box Culvert	L F	$360 00	1850	$666,000 00	936	$336,960 00	
9	Inlet Structures	EA	$600 00	0	$0 00	0	$0.00	
10	Outlet Structures	EA	$900 00	0	$0 00	1	$900 00	
11	Side inlet	EA	$0 00	0	$0 00	0	$0 00	
12	Grouted Riprap	C Y	$65 00	6090	$395,850 00	2360	$153,400 00	
13	Structural Concrete	C Y	$300 00	20	$6,000 00	32	$9,600 00	
14	3-foot Drop Structure - Concrete	EA	$250 00	0	$0 00	0	$0 00	
15	3-foot Drop Structure - Grouted Riprap	EA	$350 00	0	$0 00	0	$0 00	
16	3-foot Drop Structure - Earthen	EA	$280 00	0	$0 00	0	$0 00	
17	5-foot Drop Structure	EA	$280 00	0	$0 00	0	$0 00	
18	Culvert w/ Energy Dissapator	E A	$0 00	0	$0 00	0	$0 00	
19	Basin Landscaping	L S	$50,000.00	0	$0 00	0	$0 00	
	Subtotal				$1,236,418 00		$746,510 00	
	Contigency (25%)				$309,104 50		$186,627 50	
	Total Cost				$1,545,522 50		$933,137 50	**$2,478,660.00**
0	**ROW Aquisition**	**N/A**						
20	Undeveloped Residential	Acre	$100,000 00	2 4	$240,000 00	1 9	$190,000 00	
21	Developed Residential	Acre	$180,000 00	2 3	$414,000 00	0	$0 00	
22	Undeveloped Commercial	Acre	$300,000 00	0 1	$30,000 00	0 8	$240,000 00	
	Subtotal				$684,000 00		$430,000 00	
	Contigency (25%)				$171,000 00		$107,500 00	
	Total Cost				$855,000 00		$537,500 00	**$1,392,500.00**
0	**Landsape/Environmental**	**N/A**						
23	Basin Landscaping	S F	$1 40	5000	$7,000 00	32000	$44,800 00	
24	Channel Landscaping	S F.	$1 40	207000	$289,800 00	80640	$112,896 00	
25	Drip Irrigation System	L F	$0 00	0	$0 00	0	$0 00	
					$296,800 00		$157,696 00	**$454,496.00**

83rd Avenue Region Drainage Improvement Cost Analysis

	Quantities	Costs
PP 87th to Basin 83rd Avenue Region	**Quantities**	**Costs**
Station 155+00 to 171+30		
Type Storm Drain		
Size	2-4' x 8' - (1630 ft) RBC	$678,000
Structures	18 inlets 8 la	$603,400
	10 inlets	$50,000
	8 large grates	$160,000
Excavation (yd^3)	6100 (yd^3)	$18,200
Compaction (yd^3)	2500 (yd^3)	$2,500
Lanscaping Costs		$0
Right-of-Way	0 Acres	$0
	Sub-Total Cost	$1,512,100
Contingnency & Design Included	**Total Cost**	**$1,920,367**
83rd Ave. Basin [illegible]	**Quantities**	**Costs**
Type Open Detention		
Size		
Structures	2 offline inlets	$80,000
	1 outlet structure	$10,000
	1 junction structure	$10,000
Excavation (yd^3)	96800 (yd^3)	$290,400
Compaction (yd^3)	96800 (yd^3)	$96,800
Lanscaping Costs		$642,000
Right-of-Way	6 Acres	$650,000
	Sub-Total Cost	$1,779,200
Contingnency & Design Included	**Total Cost**	**$2,259,584**
83rd Calle lejos to Avenida del Sol [illegible]	**Quantities**	**Costs**
Station 157+00 to 145+00		
Type Open Channel		
80 ft Top Width		
Structures	1 riprap inlet	$37,100
Excavation (yd^3)	15950 (yd^3)	$47,900
Compaction (yd^3)	12820 (yd^3)	$12,820
Lanscaping Costs		$192,000
Right-of-Way	2 Acres	$200,000
	Sub-Total Cost	$489,820
Contingnency & Design Included	**Total Cost**	**$622,071**
83rd Avenida del Sol to Basin [illegible]	**Quantities**	**Costs**
Station 145+00 to 137+70		
Type Storm Drain		
Size	2-4' x 10' - (730 ft) RBC	$403,000
Structures	8 inlets	$40,000
	1 Head Wall Inlet	$5,000
	Rip-Rap	$21,000
Excavation (yd^3)	9100 (yd^3)	$27,100
Compaction (yd^3)	7300 (yd^3)	$7,300
Lanscaping Costs		$116,800
Right-of-Way	3 Acres	$300,000
	Sub-Total Cost	$920,200
Contingnency & Design Included	**Total Cost**	**$1,168,654**

83rd Basin to Williams Road		Quantities	Costs
Type	Storm Drain		
	Size	48" (3035 ft) RCP	$735,000
	Structures	1 inlet structure	$10,000
		Rip-Rap	$20,000
		Headwalls	$15,000
		5 inlets	$50,000
		1 waterline relocation	$20,000
	Lanscaping Costs		$0
	Right-of-Way	0 Acres	$0
		Sub-Total Cost	$850,000
	Contingency & Design Included	**Total Cost**	**$1,079,500**
Calle Lejos Channel to Basin		**Quantities**	**Costs**
Type	Open Channel	Open Channel	
	50 ft Top Width	50ft	
	Structures	1- 4' x 6' (75') RCB	$19,000
		2 Headwalls	$10,000
	Excavation (yd^3)	4200 (yd^3)	$12,400
	Compaction (yd^3)	4200 (yd^3)	$4,200
	Lanscaping Costs		$107,000
	Right-of-Way	0 Acres	$100,000
		Sub-Total Cost	$252,600
	Contingency & Design Included	**Total Cost**	**$320,802**
Calle Lejos Basin		**Quantities**	**Costs**
Type	Open Detention		
	Structures	1 online inlets	$40,000
		1 outlet structure	$10,000
		Rip-Rap	$20,000
	Excavation (yd^3)	29040 (yd^3)	$116,160
	Compaction (yd^3)	29040 (yd^3)	$29,040
	Lanscaping Costs		$523,000
	Right-of-Way	6 Acres	$600,000
		Sub-Total Cost	$1,338,200
	Contingency & Design Included	**Total Cost**	**$1,699,514**
Calle Lejos Basin to 83rd Ave		**Quantities**	**Costs**
Type	Storm Drain		
	Size	36" (2420 ft) RCP	$602,300
	Structures	1 outlet structure	$10,000
		8 inlets	$40,000
	Lanscaping Costs		$0
	Right-of-Way	0 Acres	$0
		Sub-Total Cost	$652,300
	Contingency & Design Included	**Total Cost**	**$828,421**

LEVEL II COST ESTIMATES

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Northwest Region Alternative 1**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	383114	$1 149 342 00
2	Pavement Replacement	$50 00	S Y	15500	$775,000 00
3	Stuctures (3-10x6 RBC)	$166,000 00	EA	12	$1 992,000 00
4	Channel Lining	$5 00	S F	337600	$1 688,000 00
5	Repair Channel Lining	$10 00	L F	4030	$40,300 00
6	36" RCP	$110 00	L F	2650	$291 500 00
7	Transition Structures (Channel)	$12,000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1 200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900 00	EA	0	$0 00
11	Side inlet	$5,000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y	0	$0 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	1	$250 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	1	$280 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000 00	E A	3	$600,000 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000 00	E A	0	$0 00
20	ROW Aquisition				
20	Undeveloped Residential	$100,000 00	Acre	95 5	$9,550,000 00
21	Developed Residential	$180,000 00	Acre	7 2	$1,301 647 81
22	Undeveloped Commercial	$300,000 00	Acre	0 0	$0 00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F	0	$0 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	S F	1813150	$2 538 410 00
41	Residental Basin Landscaping	$1 40	F + $50	50000	$70,000 00
42	Equestrial Trail	$3 50	L F	0	$0 00
43	Natural Wash Landscaping	$1 40	S F	0	$0 00
44	Natural Wash Seeding	$1 10	S F	2625000	$2,887,500 00
0	Miscellaneous				$0.00
28	Fence	$10 00	LF	0	$0 00
29	Bridge crossing -	$2 700 00	EA	0	$0 00
30	Box Culvert Crossing	$2 500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	35935	$3 593 500 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	8250	$49 500 00
34	20-foot Drop Structure	$45,000 00	EA	3	$135,000 00
35	10x4 Box Culvert	$56,000 00	EA	3	$168,000 00
36	2-8x5 Structure	$88,000 00	EA	2	$176,000 00
37	Diversion Structure	$12,000 00	EA	2	$24,000 00
38	3-10x6 Storm Drain	$1,200 00	L F	800	$960,000 00
39	Structural Backfill	$40 00	C Y	1955 6	$78 222 22

BASE ALTERNATIVE SUBTOTAL **$28,068,452.03**

Construction Contingencies	27%	$7 578 482 05
Engineering	7%	$1 964 791 64
Construction Administration	6%	$1 684 107 12

BASE ALTERNATIVE TOTAL **$39,295,832.85**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Northwest Region Alternative 2 (with Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C.Y.	383114	$1,149,341.45
2	Pavement Replacement	$50.00	S.Y.	15500	$775,000.00
3	Stuctures (3-10x6 RBC)	$166,000.00	EA	12	$1,992,000.00
4	Channel Lining	$5.00	S.F.	337600	$1,688,000.00
5	Repair Channel Lining	$10.00	L.F.	4030	$40,300.00
6	36" RCP	$110.00	L.F.	2650	$291,500.00
7	Transition Structures (Channel)	$12,000.00	EA	0	$0.00
8	Transition Structures (36" RCP)	$1,200.00	EA	0	$0.00
9	Inlet Structures	$600.00	EA	0	$0.00
10	Outlet Structures	$900.00	EA	0	$0.00
11	Side inlet	$5,000.00	EA	0	$0.00
12	Grouted Riprap	$65.00	C.Y.	0	$0.00
13	Structural Concrete	$300.00	C.Y.	0	$0.00
14	3-foot Drop Structure - Concrete	$250.00	EA	1	$250.00
15	3-foot Drop Structure - Grouted Riprap	$350.00	EA	0	$0.00
16	3-foot Drop Structure - Earthen	$280.00	EA	0	$0.00
17	5-foot Drop Structure	$280.00	EA.	1	$280.00
18	Culvert w/ Energy Dissapator 70' channel	$200,000.00	E.A.	3	$600,000.00
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E.A.	0	$0.00
0	ROW Acquisition				
20	Undeveloped Residential	$100,000.00	Acre	114.7	$11,472,277.93
21	Developed Residential	$180,000.00	Acre	7.2	$1,301,647.81
22	Undeveloped Commercial	$300,000.00	Acre	0.0	$0.00
0	Landsape/Environmental				
23	Desert Landscaping	$1.20	S.F.	0	$0.00
24	Lush Desert Landscaping	$1.30	S.F.	0	$0.00
25	Drip Irrigation System	$0.00	L.F.	0	$0.00
26	Park & Playground Equipment	$10,000.00	EA	0	$0.00
27	Conc. S/W & D/W	$5.00	S.F.	0	$0.00
40	Residential Desert Landscaping	$1.40	S.F.	1707470	$2,390,458.00
41	Residental Basin Landscaping	$1.40	S.F. + $50K	1177115	$1,697,961.00
42	Equestrial Trail	$3.50	L.F.	0	$0.00
43	Natural Wash Landscaping	$1.40	S.F.	0	$0.00
44	Natural Wash Seeding	$1.10	S.F.	2625000	$2,887,500.00
0	Miscellaneous				$0.00
28	Fence	$10.00	LF	0	$0.00
29	Bridge crossing -	$2,700.00	EA.	0	$0.00
30	Box Culvert Crossing	$2,500.00	EA	0	$0.00
31	Maintenance of Earthen Channel (30 years)	$100.00	LF	35935	$3,593,500.00
32	Maintenance of Riprap Channel (30 years)	$50.00	LF	0	$0.00
33	Maintenance of Concrete Channel (30 years)	$6.00	LF	8250	$49,500.00
34	20-foot Drop Structure	$45,000.00	EA	3	$135,000.00
35	10x4 Box Culvert	$56,000.00	EA	3	$168,000.00
36	2-8x5 Structure	$88,000.00	EA	2	$176,000.00
37	Diversion Structure	$12,000.00	EA.	2	$24,000.00
38	3-10x6 Storm Drain	$1,200.00	L.F.	800	$960,000.00
39	Structural Backfill	$40.00	C.Y.	1955.6	$78,222.22

BASE ALTERNATIVE SUBTOTA **$31,470,738.42**

Construction Contingencies	27%	$8,497,099.37
Engineering	7%	$2,202,951.69
Construction Administration	6%	$1,888,244.31

BASE ALTERNATIVE TOTAL **$44,059,033.79**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Northwest Region Alternative 3**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C.Y.	388051	$1,164,153.00
2	Pavement Replacement	$50.00	S.Y.	11944	$597,200.00
3	Stuctures (3-10x6 RBC)	$166,000.00	EA	14	$2,324,000.00
4	Channel Lining	$5.00	S.F.	337600	$1,688,000.00
5	Repair Channel Lining	$10.00	L.F.	4030	$40,300.00
6	36" RCP	$110.00	L.F.	2650	$291,500.00
7	Transition Structures (Channel)	$12,000.00	EA	0	$0.00
8	Transition Structures (36" RCP)	$1,200.00	EA	0	$0.00
9	Inlet Structures	$600.00	EA	0	$0.00
10	Outlet Structures	$900.00	EA	0	$0.00
11	Side inlet	$5,000.00	EA	0	$0.00
12	Grouted Riprap	$65.00	C.Y.	0	$0.00
13	Structural Concrete	$300.00	C.Y.	0	$0.00
14	3-foot Drop Structure - Concrete	$250.00	EA	1	$250.00
15	3-foot Drop Structure - Grouted Riprap	$350.00	EA	0	$0.00
16	3-foot Drop Structure - Earthen	$280.00	EA	0	$0.00
17	5-foot Drop Structure	$280.00	EA	1	$280.00
18	Culvert w/ Energy Dissapator 70' channel	$200,000.00	E.A.	3	$600,000.00
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E.A.	0	$0.00
0	ROW Aquisition				
20	Undeveloped Residential	$100,000.00	Acre	98.4	$9,840,000.00
21	Developed Residential	$180,000.00	Acre	7.2	$1,301,647.81
22	Undeveloped Commercial	$300,000.00	Acre	0.0	$0.00
0	Landsape/Environmental				
23	Desert Landscaping	$1.20	S.F.	0	$0.00
24	Lush Desert Landscaping	$1.30	S.F.	0	$0.00
25	Drip Irrigation System	$0.00	L.F.	0	$0.00
26	Park & Playground Equipment	$10,000.00	EA	0	$0.00
27	Conc. S/W & D/W	$5.00	S.F.	0	$0.00
40	Residential Desert Landscaping	$1.40	S.F.	1937550	$2,712,570.00
41	Residental Basin Landscaping	$1.40	F + $50	0	$0.00
42	Equestrial Trail	$3.50	L.F.	0	$0.00
43	Natural Wash Landscaping	$1.40	S.F.	0	$0.00
44	Natural Wash Seeding	$1.10	S.F.	1890000	$2,079,000.00
0	Miscellaneous				$0.00
28	Fence	$10.00	LF	0	$0.00
29	Bridge crossing -	$2,700.00	EA	0	$0.00
30	Box Culvert Crossing	$2,500.00	EA	0	$0.00
31	Maintenance of Earthen Channel (30 years)	$100.00	LF	33115	$3,311,500.00
32	Maintenance of Riprap Channel (30 years)	$50.00	LF	0	$0.00
33	Maintenance of Concrete Channel (30 years)	$6.00	LF	8250	$49,500.00
34	20-foot Drop Structure	$45,000.00	EA	3	$135,000.00
35	10x4 Box Culvert	$56,000.00	EA	3	$168,000.00
36	2-8x5 Structure	$88,000.00	EA	0	$0.00
37	Diversion Structure	$12,000.00	EA	4	$48,000.00
38	3-10x6 Storm Drain	$1,200.00	L.F.	0	$0.00
39	Structural Backfill	$40.00	C.Y.	0.0	$0.00

BASE ALTERNATIVE SUBTOTAL **$26,350,900.81**

Construction Contingencies	27%	$7,114,743.22
Engineering	7%	$1,844,563.06
Construction Administration	6%	$1,581,054.05

BASE ALTERNATIVE TOTAL $36,891,261.14

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Northwest Region Alternative 4 (with Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C Y.	490051	$1,470,153.00
2	Pavement Replacement	$50 00	S Y	11944	$597,200.00
3	Stuctures (3-10x6 RBC)	$166,000 00	EA	14	$2,324,000 00
4	Channel Lining	$5.00	S F	337600	$1,688,000 00
5	Repair Channel Lining	$10 00	L F	4030	$40,300 00
6	36" RCP	$110 00	L F	2650	$291,500 00
7	Transition Structures (Channel)	$12,000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1,200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900.00	EA	0	$0.00
11	Side inlet	$5,000 00	EA	0	$0.00
12	Grouted Riprap	$65 00	C Y	0	$0 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	1	$250 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280.00	EA	0	$0.00
17	5-foot Drop Structure	$280 00	EA	1	$280 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000 00	E A	3	$600,000 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E A	0	$0.00
0	ROW Aquisiton				
20	Undeveloped Residential	$100,000 00	Acre	117 3	$11,730,000.00
21	Developed Residential	$180,000.00	Acre	7 2	$1,301,647.81
22	Undeveloped Commercial	$300,000 00	Acre	0 0	$0.00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F	0	$0 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	S F	2996545	$4,195,163 00
41	Residental Basin Lancscaping	$1 40	F. + $50	1177115	$1,697,961.00
42	Equestrial Trail	$3 50	L F	0	$0 00
43	Natural Wash Landscaping	$1 40	S F	0	$0 00
44	Natural Wash Seeding	$1 10	S F	1890000	$2,079,000 00
0	Miscellaneous				$0.00
28	Fence	$10 00	LF	0	$0.00
29	Bridge crossing -	$2,700 00	EA	0	$0.00
30	Box Culvert Crossing	$2,500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	33115	$3,311,500.00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	8250	$49 500 00
34	20-foot Drop Structure	$45,000 00	EA	3	$135,000 00
35	10x4 Box Culvert	$56,000 00	EA	3	$168,000 00
36	2-8x5 Structure	$88,000 00	EA	0	$0 00
37	Diversion Structure	$12,000 00	EA	4	$48,000.00
38	3-10x6 Storm Drain	$1,200.00	L.F.	0	$0 00
39	Structural Backfill	$40 00	C Y	0 0	$0 00

BASE ALTERNATIVE SUBTOTAL **$31,727,454.81**

Construction Contingencies	27%	$8,566,412 80
Engineering	7%	$2,220,921 84
Construction Administration	6%	$1,903,647 29

BASE ALTERNATIVE TOTAL $44,418,436.74

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE — **Contract FCD 99-44**

Flood Control District of Maricopa County — **Entellus No. 310.017**

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **83rd Ave. Alternative I (Channel along 83rd Avenue)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C.Y.	172.920	$518 760 00
2	Pavement Replacement	$50 00	S.Y.	2.667	$133 350 00
38	3-10x6 Storm Drain	$1.200 00	L.F.	150	$180 000 00
5	Repair Channel Lining	$10.00	L.F.	0	$0 00
6	36" RCP	$110 00	L.F.	3.100	$341 000 00
7	Transition Structures (Channel)	$12.000.00	EA	1	$12 000 00
8	Transition Structures (36" RCP)	$1.200.00	EA	2	$2 400 00
39	Structural Backfill	$40.00	C.Y.	367	$14.680 00
	ROW Aquisition				
20	Undeveloped Residential	$100.000 00	Acre	1.6	$162 610 32
21	Developed Residential	$180.000 00	Acre	4 2	$756 000 00
22	Undeveloped Commercial	$300.000 00	Acre	9 0	$2 700 000 00
	Landsape/Environmental				
19	Culvert w/ Energy Dissapator 40' channel	$120.000 00	E.A.	0	$0 00
23	Desert Landscaping	$1 20	S.F.	0	$0 00
24	Lush Desert Landscaping	$1 30	S.F.	0	$0 00
40	Residential Desert Landscaping	$1 40	S.F.	245.500	$343 700 00
41	Residental Basin Landscaping	$1 40	S.F. + $50K	398.370	$607 718 00
26	Park & Playground Equipment	$10.000.00	EA.	1	$10 000 00

	SUBTOTAL	**$5.782.218.32**
Construction Contingencies	27%	$1 561 198 95
Engineering	7%	$404 755 28
Construction Administration	6%	$346 933 10
	TOTAL CONSTRUCTION	**$8.095.105.65**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **83rd Ave. Alternative 2 (Combination channel/storm drain along 83rd Ave.)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C.Y	169,238	$507,714.00
2	Pavement Replacement	$50.00	S.Y	3,333	$166,650.00
38	3-10x6 Storm Drain	$1,200.00	L.F	1,000	$1,200,000.00
4	Channel Lining	$5.00	S.F	0	$0.00
6	36" RCP	$110.00	L.F	3,100	$341,000.00
7	Transition Structures (Channel)	$12,000.00	EA	3	$36,000.00
8	Transition Structures (36" RCP)	$1,200.00	EA	2	$2,400.00
39	Structural Backfill	$40.00	C.Y	2,444	$97,760.00
	ROW Aquisition				
20	Undeveloped Residential	$100,000.00	Acre	1.6	$160,000.00
21	Developed Residential	$180,000.00	Acre	3.2	$576,000.00
22	Undeveloped Commercial	$300,000.00	Acre	9.0	$2,700,000.00
	Landsape/Environmental				
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E.A	0	$0.00
23	Desert Landscaping	$1.20	S.F	0	$0.00
24	Lush Desert Landscaping	$1.30	S.F	0	$0.00
40	Residential Desert Landscaping	$1.40	S.F.	210,500	$294,700.00
41	Residential Basin Landscaping	$1.40	S.F. + $50K	398,370	$557,718.00
26	Park & Playground Equipment	$10,000.00	EA	1	$10,000.00
				SUBTOTAL	**$6,649,942.00**

Construction Contingencies	27%	$1,795,484.34
Engineering	7%	$465,495.94
Construction Administration	6%	$398,996.52
TOTAL CONSTRUCTION		**$9,309,918.80**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **67th Ave and Pinnacle Peak Rd Region Alternative 1**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C Y	54900	$164,700.00
2	Pavement Replacement	$50.00	S Y	0	$0.00
3	Stuctures (3-10x6 RBC)	$166,000.00	EA	0	$0.00
4	Channel Lining	$5.00	S F	0	$0.00
5	Repair Channel Lining	$10.00	L F	0	$0.00
6	36" RCP	$110.00	L F	850	$93,500.00
7	42" RCP	$110.00	EA	1920	$211,200.00
8	10' x 4' Concrete Box	$360.00	EA	2000	$720,000.00
9	Inlet Structures	$600.00	EA	3	$1,800.00
10	Outlet Structures	$900.00	EA	3	$2,700.00
11	Side inlet	$5,000.00	EA	0	$0.00
12	Grouted Riprap	$65.00	C Y	8600	$559,000.00
13	Structural Concrete	$300.00	C Y	2233	$669,900.00
14	3-foot Drop Structure - Concrete	$250.00	EA	0	$0.00
15	3-foot Drop Structure - Grouted Riprap	$350.00	EA	0	$0.00
16	3-foot Drop Structure - Earthen	$280.00	EA	0	$0.00
17	5-foot Drop Structure	$280.00	EA	0	$0.00
18	Culvert w/ Energy Dissapator 70' channel	$200,000.00	E A	0	$0.00
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E A	0	$0.00
0	RCW Aquisition				
20	Undeveloped Residential	$100,000.00	Acre	0.0	$0.00
21	Developed Residential	$180,000.00	Acre	8.0	$1,440,000.00
22	Undeveloped Commercial	$300,000.00	Acre	1.0	$300,000.00
0	Landsape/Environmental				
23	Desert Landscaping	$1.20	S F	0	$0.00
24	Lush Desert Landscaping	$1.30	S F	0	$0.00
25	Drip Irrigation System	$0.00	L F	0	$0.00
26	Park & Playground Equipment	$10,000.00	EA	0	$0.00
27	Conc. S/W & D/W	$5.00	S F	0	$0.00
40	Channel Landscaping	$1.40	S F	205000	$287,000.00
41	Basin Landscaping	$1.40	F + $50	33900	$97,460.00
42	Equestrial Trail	$3.50	L F	0	$0.00
43	Natural Wash Landscaping	$1.40	S F	0	$0.00
44	Natural Wash Seeding	$1.10	S F	0	$0.00
0	Miscellaneous				$0.00
28	Fence	$10.00	LF	0	$0.00
29	Bridge crossing -	$2,700.00	EA	0	$0.00
30	Box Culvert Crossing	$2,500.00	EA	0	$0.00
31	Maintenance of Earthen Channel (30 years)	$100.00	LF	0	$0.00
32	Maintenance of Riprap Channel (30 years)	$50.00	LF	0	$0.00
33	Maintenance of Concrete Channel (30 years)	$6.00	LF	0	$0.00
34	20-foot Drop Structure	$45,000.00	EA	0	$0.00
35	10x4 Box Culvert	$56,000.00	EA	0	$0.00
36	2-8x5 Structure	$88,000.00	EA	0	$0.00
37	Diversion Structure	$12,000.00	EA	0	$0.00
38	3-10x6 Storm Drain	$1,200.00	L F	0	$0.00
39	Structural Backfill	$40.00	C Y	0.0	$0.00

BASE ALTERNATIVE SUBTOTAL **$4,547,260.00**

Construction Contingencies	27%	$1,227,760.20
Engineering	7%	$318,308.20
Construction Administration	6%	$272,835.60

BASE ALTERNATIVE TOTAL $6,366,164.00

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **67th Ave and Pinnacle Peak Rd Region Alternative 2 (w/ Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3.00	C Y	500000	$1,500,000.00
2	Pavement Replacement	$50.00	S Y	0	$0.00
3	Stuctures (3-10x6 RBC)	$166,000.00	EA	0	$0.00
4	Channel Lining	$5.00	S F	0	$0.00
5	Repair Channel Lining	$10.00	L F	0	$0.00
6	36" RCP	$110.00	L F	850	$93,500.00
7	42" RCP	$110.00	EA	3920	$431,200.00
8	10' x 4' Concrete Box	$360.00	EA	0	$0.00
9	Inlet Structures	$600.00	EA	3	$1,800.00
10	Outlet Structures	$900.00	EA	3	$2,700.00
11	Side inlet	$5,000.00	EA	0	$0.00
12	Grouted Riprap	$65.00	C Y	7700	$500,500.00
13	Structural Concrete	$300.00	C Y	0	$0.00
14	3-foot Drop Structure - Concrete	$250.00	EA	0	$0.00
15	3-foot Drop Structure - Grouted Riprap	$350.00	EA	0	$0.00
16	3-foot Drop Structure - Earthen	$280.00	EA	0	$0.00
17	5-foot Drop Structure	$280.00	EA	0	$0.00
18	Culvert w/ Energy Dissapator 70' channel	$200,000.00	E A	0	$0.00
19	Culvert w/ Energy Dissapator 40' channel	$120,000.00	E A	0	$0.00
0	ROW Aquisition				
20	Undeveloped Residential	$100,000.00	Acre	0.0	$0.00
21	Developed Residential	$180,000.00	Acre	8.0	$1,440,000.00
22	Undeveloped Commercial	$300,000.00	Acre	10.0	$3,000,000.00
0	Landsape/Environmental				
23	Desert Landscaping	$1.20	S F	0	$0.00
24	Lush Desert Landscaping	$1.30	S F	0	$0.00
25	Drip Irrigation System	$0.00	L F	0	$0.00
26	Park & Playground Equipment	$10,000.00	EA	0	$0.00
27	Conc S/W & D/W	$5.00	S F	0	$0.00
40	Channel Landscaping	$1.40	S F	181000	$253,400.00
41	Basin Landscaping	$1.40	F. + $50	424900	$694,860.00
42	Equestrial Trail	$3.50	L F	0	$0.00
43	Natural Wash Landscaping	$1.40	S F	0	$0.00
44	Natural Wash Seeding	$1.10	S F	0	$0.00
0	Miscellaneous				$0.00
28	Fence	$10.00	LF	0	$0.00
29	Bridge crossing -	$2,700.00	EA	0	$0.00
30	Box Culvert Crossing	$2,500.00	EA	0	$0.00
31	Maintenance of Earthen Channel (30 years)	$100.00	LF	0	$0.00
32	Maintenance of Riprap Channel (30 years)	$50.00	LF	0	$0.00
33	Maintenance of Concrete Channel (30 years)	$6.00	LF	0	$0.00
34	20-foot Drop Structure	$45,000.00	EA	0	$0.00
35	10x4 Box Culvert	$56,000.00	EA	0	$0.00
36	2-8x5 Structure	$88,000.00	EA	0	$0.00
37	Diversion Structure	$12,000.00	EA	0	$0.00
38	3-10x6 Storm Drain	$1,200.00	L F	0	$0.00
39	Structural Backfill	$40.00	C Y	0.0	$0.00

BASE ALTERNATIVE SUBTOTAL $7,917,960.00

Construction Contingencies	27%	$2,137,849.20
Engineering	7%	$554,257.20
Construction Administration	6%	$475,077.60

BASE ALTERNATIVE TOTAL $11,085,144.00

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **67th Ave and Pinnacle Peak Rd Region Alternative 3**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	69600	$208,800 00
2	Pavement Replacement	$50 00	S Y	0	$0 00
3	Stuctures (3-10x6 RBC)	$166,000 00	EA	0	$0 00
4	Channel Lining	$5 00	S F	0	$0 00
5	Repair Channel Lining	$10 00	L F	0	$0 00
6	36" RCP	$110 00	L F	850	$93,500.00
7	42" RCP	$110 00	EA	0	$0.00
8	10' x 4' Concrete Box	$360 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	1	$600 00
10	Outlet Structures	$900 00	EA	1	$900 00
11	Side inlet	$5,000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y	12000	$780,000 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	0	$0 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0.00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	0	$0 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000 00	E A	0	$0 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000 00	E A	0	$0 00
0	ROW Aquisition				
20	Undeveloped Residential	$100,000 00	Acre	0 0	$0 00
21	Developed Residential	$180,000 00	Acre	10 0	$1,800,000 00
22	Undeveloped Commercial	$300,000 00	Acre	1 0	$300,000 00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F	0	$0 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Channel Landscaping	$1 40	S F	285000	$399,000 00
41	Basin Landscaping	$1 40	F + $50	33900	$97,460 00
42	Equestrial Trai	$3 50	L F	0	$0 00
43	Natural Wash Landscaping	$1 40	S F	0	$0 00
44	Natural Wash Seeding	$1.10	S F	0	$0 00
0	Miscellaneous				$0.00
28	Fence	$10.00	LF	0	$0 00
29	Bridge crossing -	$2,700.00	EA	0	$0 00
30	Box Culvert Crossing	$2,500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	0	$0 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	0	$0 00
34	20-foot Drop Structure	$45,000 00	EA	0	$0 00
35	10x4 Box Culvert	$56,000 00	EA	0	$0 00
36	2-8x5 Structure	$88,000 00	EA	0	$0 00
37	Diversion Structure	$12,000 00	EA	0	$0 00
38	3-10x6 Storm Drain	$1,200 00	L F	0	$0 00
39	Structural Backfill	$40 00	C Y	0 0	$0 00

BASE ALTERNATIVE SUBTOTAL **$3,680,260.00**

Construction Contingencies	27%	$993,670 20
Engineering	7%	$257,618 20
Construction Administration	6%	$220,815 60

BASE ALTERNATIVE TOTAL **$5,152,364.00**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Rock Springs Alternative 1 (Channel along Patrick Lane)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	29720	$89,160 75
2	Pavement Replacement	$50 00	S Y	0	$0 00
3	Stuctures (3-10x6 RBC)	$166 000 00	EA	0	$0 00
4	Channel Lining	$5 00	S F	0	$0.00
5	Repair Channel Lining	$10 00	L F.	0	$0.00
6	36" RCP	$110 00	L F	0	$0 00
7	Transition Structures (Channel)	$12,000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1,200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900 00	EA	0	$0 00
11	Side inlet	$5,000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y.	0	$0 00
13	Structural Concrete	$300 00	C Y.	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	0	$0 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	0	$0 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000.00	E A	0	$0 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000 00	E A	0	$0 00
0	ROW Aquisition				
20	Undeveloped Residential	$100,000 00	Acre	5	$500,000 00
21	Developed Residential	$180,000 00	Acre	0	$0 00
22	Undeveloped Commercial	$300,000.00	Acre	0	$0 00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F.	450000	$540,000 00
24	Lush Desert Landscaping	$1 30	S F.	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA.	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	LF	0	$0 00
41	Residental Basin Landscaping	$1 40	LF	0	$0 00
42	Equestrial Trail	$3 50	LF	11000	$38,500 00
43	Natural Wash Landscaping	$1.40	LF	0	$0 00
0	Miscellaneous				
28	Fence	$10.00	LF	0	$0 00
29	Bridge crossing -	$2,700 00	EA	0	$0 00
30	Box Culvert Crossing	$2,500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	1890	$189,000 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	0	$0 00
34	20-foot Drop Structure	$45,000 00	LF	0	$0 00
35	10x4 Box Culvert	$56,000 00	LF	0	$0 00
36	2-8x5 Structure	$88,000 00	LF	0	$0 00
37	Diversion Structure	$12,000 00	LF	0	$0 00
39	Structural Backfill	$40 00	LF	0	$0 00

BASE ALTERNATIVE SUBTOTAL **$1,356,660.75**

Construction Contingencies	27%	$366,298 40
Engineering	7%	$94,966 25
Construction Administration	6%	$81,399 65

BASE ALTERNATIVE TOTAL **$1,899,325.05**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Rock Springs Alternative 2 (Channel along Patrick Lane w/ Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	131943	$395,829 00
2	Pavement Replacement	$50 00	S Y	0	$0 00
3	Stuctures (3-10x6 RBC)	$166,000 00	EA	0	$0 00
4	Channel Lining	$5 00	S F	0	$0 00
5	Repair Channel Lining	$10 00	L F	0	$0 00
6	36" RCP	$110 00	L F	0	$0 00
7	Transition Structures (Channel)	$12,000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1,200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900 00	EA	0	$0 00
11	Side inlet	$5,000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y	0	$0 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	0	$0 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	0	$0 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000 00	E A	0	$0 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000 00	E A	0	$0 00
5.0	**ROW Aquisition**				
20	Undeveloped Residential	$100,000 00	Acre	21	$2,100,000 00
21	Developed Residential	$180,000 00	Acre	0	$0 00
22	Undeveloped Commercial	$300,000 00	Acre	0	$0 00
[illegible]0	**Landsape/Environmental**				
23	Desert Landscaping	$1 20	S F	450000	$540,000 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	LF	0	$0 00
41	Residental Basin Landscaping	$1 40	LF	690072	$966,100 80
42	Equestrial Trail	$3 50	LF	11000	$38,500 00
43	Natural Wash Landscaping	$1 40	LF	0	$0 00
[illegible]0	**Miscellaneous**				
28	Fence	$10 00	LF	0	$0 00
29	Bridge crossing -	$2,700 00	EA	0	$0 00
30	Box Culvert Crossing	$2,500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	1890	$189,000 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	0	$0 00
34	20-foot Drop Structure	$45,000 00	LF	0	$0 00
35	10x4 Box Culvert	$56,000 00	LF	0	$0 00
36	2-8x5 Structure	$88,000 00	LF	0	$0 00
37	Diversion Structure	$12,000 00	LF	0	$0 00
39	Structural Backfill	$40 00	LF	0	$0 00

BASE ALTERNATIVE SUBTOTAL **$4,229,429.80**

Construction Contingencies	27%	$1,141,946 05
Engineering	7%	$296,060 09
Construction Administration	6%	$253,765 79

BASE ALTERNATIVE TOTAL $5,921,201.72

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Rock Springs Alternative 3 (Channel along Patrick Lane w/o Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	32000	$96 000 00
2	Pavement Replacement	$50 00	S Y	0	$0 00
3	Stuctures (3-10x6 RBC)	$166 000 00	EA	0	$0 00
4	Channel Lining	$5 00	S F	0	$0 00
5	Repair Channel Lining	$10 00	L F	0	$0 00
6	36" RCP	$110 00	L F	0	$0 00
7	Transition Structures (Channel)	$12 000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1 200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900 00	EA	0	$0 00
11	Side inlet	$5 000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y	0	$0 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	0	$0 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	0	$0 00
18	Culvert w/ Energy Dissapator 70' channel	$200 000 00	E A	0	$0 00
19	Culvert w/ Energy Dissapator 40' channel	$120 000 00	E A	0	$0 00
0	ROW Aquisition				
20	Undeveloped Residential	$100 000 00	Acre	6	$600 000 00
21	Developed Residential	$180 000 00	Acre	0	$0 00
22	Undeveloped Commercial	$300 000 00	Acre	0	$0 00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F	47000	$56 400 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10 000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	LF	0	$0 00
41	Residental Basin Landscaping	$1 40	LF	0	$0 00
42	Equestrial Trail	$3 50	LF	11000	$38 500 00
43	Natural Wash Landscaping	$1 40	LF	0	$0 00
0	Miscellaneous				
28	Fence	$10 00	LF	0	$0 00
29	Bridge crossing -	$2 700 00	EA	0	$0 00
30	Box Culvert Crossing	$2 500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	1890	$189 000 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	0	$0 00
34	20-foot Drop Structure	$45 000 00	LF	0	$0 00
35	10x4 Box Culvert	$56 000 00	LF	0	$0 00
36	2-8x5 Structure	$88 000 00	LF	0	$0 00
37	Diversion Structure	$12 000 00	LF	0	$0 00
39	Structural Backfill	$40 00	LF	0	$0 00

BASE ALTERNATIVE SUBTOTAL **$979,900.00**

Construction Contingencies	27%	$264 573 00
Engineering	7%	$68 593 00
Construction Administration	6%	$58 794 00

BASE ALTERNATIVE TOTAL **$1,371,860.00**

Appendix D
LEVEL II COST ANALYSIS

GLENDALE/PEORIA AREA DRAINAGE MASTER PLAN UPDATE
Flood Control District of Maricopa County

Contract FCD 99-44
Entellus No. 310.017

FLOOD MITIGATION OPTIONS

STUDY AREA LOCATION: **Rock Springs Alternative 4 (Channel along Patrick Lane w/ Basin)**

DRAINAGE IMPROVEMENT ELEMENTS:

ITEM	DESCRIPTION	UNIT PRICE	UNIT	QUANTITY	AMOUNT
1	Excavation	$3 00	C Y	133000	$399,000 00
2	Pavement Replacement	$50 00	S Y	0	$0 00
3	Stuctures (3-10x6 RBC)	$166,000 00	EA	0	$0 00
4	Channel Lining	$5 00	S F	0	$0 00
5	Repair Channel Lining	$10 00	L F	0	$0 00
6	36" RCP	$110 00	L F	0	$0 00
7	Transition Structures (Channel)	$12,000 00	EA	0	$0 00
8	Transition Structures (36" RCP)	$1,200 00	EA	0	$0 00
9	Inlet Structures	$600 00	EA	0	$0 00
10	Outlet Structures	$900 00	EA	0	$0 00
11	Side inlet	$5,000 00	EA	0	$0 00
12	Grouted Riprap	$65 00	C Y	0	$0 00
13	Structural Concrete	$300 00	C Y	0	$0 00
14	3-foot Drop Structure - Concrete	$250 00	EA	0	$0 00
15	3-foot Drop Structure - Grouted Riprap	$350 00	EA	0	$0 00
16	3-foot Drop Structure - Earthen	$280 00	EA	0	$0 00
17	5-foot Drop Structure	$280 00	EA	0	$0 00
18	Culvert w/ Energy Dissapator 70' channel	$200,000 00	E A	0	$0 00
19	Culvert w/ Energy Dissapator 40' channel	$120,000 00	E A	0	$0 00
0	ROW Aquisition				
20	Undeveloped Residential	$100,000 00	Acre	22	$2,200,000 00
21	Developed Residential	$180,000 00	Acre	0	$0 00
22	Undeveloped Commercial	$300,000 00	Acre	0	$0 00
0	Landsape/Environmental				
23	Desert Landscaping	$1 20	S F	45400	$54,480 00
24	Lush Desert Landscaping	$1 30	S F	0	$0 00
25	Drip Irrigation System	$0 00	L F	0	$0 00
26	Park & Playground Equipment	$10,000 00	EA	0	$0 00
27	Conc S/W & D/W	$5 00	S F	0	$0 00
40	Residential Desert Landscaping	$1 40	LF	0	$0 00
41	Residental Basin Landscaping	$1 40	LF	690072	$966,100 80
42	Equestrial Trail	$3 50	LF	11000	$38,500 00
43	Natural Wash Landscaping	$1 40	LF	0	$0 00
0	Miscellaneous				
28	Fence	$10 00	LF	0	$0 00
29	Bridge crossing -	$2,700 00	EA	0	$0 00
30	Box Culvert Crossing	$2,500 00	EA	0	$0 00
31	Maintenance of Earthen Channel (30 years)	$100 00	LF	2000	$200,000 00
32	Maintenance of Riprap Channel (30 years)	$50 00	LF	0	$0 00
33	Maintenance of Concrete Channel (30 years)	$6 00	LF	0	$0 00
34	20-foot Drop Structure	$45,000 00	LF	0	$0 00
35	10x4 Box Culvert	$56,000 00	LF	0	$0 00
36	2-8x5 Structure	$88,000 00	LF	0	$0 00
37	Diversion Structure	$12,000 00	LF	0	$0 00
39	Structural Backfill	$40 00	LF	0	$0 00

BASE ALTERNATIVE SUBTOTAL **$3,858,080.80**

Construction Contingencies	27%	$1,041,681 82
Engineering	7%	$270,065 66
Construction Administration	6%	$231,484 85

BASE ALTERNATIVE TOTAL **$5,401,313.12**

APPENDIX C. HYDRAULIC CALCULATIONS

LEVEL III CHANNEL CALCULATIONS

Begining Station	Ending Station	Length (ft)	Location	Normal Flow Depth y (ft)	Freeboard	Top Width (Flow + FB)	Bottom Width B (ft)	Right Slope Zr (Zr:1)	Left Slope Zl (Zl:1)	Manning's Roughness Coefficient n	Area A (sft)	Wetted Perimeter P (ft)	Hydraulic Radius R	Bottom Slope S (ft/ft)	Velocity V (fps)	Normal Flow Q2 (cfs)	Total Depth	Add'l Average Cut (ft)	Max Cut	Total Top Width (ft)	Total R/W Width (ft)	Low Flow Channel Width (1/3B) (ft)	Low Flow Channel Depth (ft)	Side Slopes (Z:1)	Low Flow Channel Top Width (ft)	Low Flow Channel Area (ft)	Low Flow Channel Perimeter (ft)	Compaction Section (ft)	Excavation Section (sft)
			Lake Pleasant																										
35+50	41+50	600	90° bend													1290													
41+50	49+90	840	Channel	4.57	1.00	89.54	45.00	4.00	4.00	0.0420	288.99	82.67	3.50	0.0030	4.46	1290	5.6	1.5	2.2	102	110	15	1.5	2	21	27.00	21.71	103.99	596.84
49+90	50+10	20	**Drop Structure**													1290													
50+10	55+90	580	Channel	4.51	1.00	94.60	45.00	6.00	3.00	0.0420	294.56	86.70	3.40	0.0030	4.38	1290	5.6	1.5	3.3	108	120	15	1.5	2	21	27.00	21.71	131.00	629.18
55+90	56+10	20	**Drop Structure**													1290													
56+10	61+10	500	Channel	4.51	1.00	94.60	45.00	6.00	3.00	0.0420	294.56	86.70	3.40	0.0030	4.38	1290	5.6	1.5	3.2	108	120	15	1.5	2	21	27.00	21.71	131.00	629.18
			Deer Valley Road to Lake Pleasent																										
68+70	70+00	130	**Culvert under Lake Pleasant Parkway**	**4-10'X5' RBC**												1340					140								705.11
70+00	70+50	50	Deer Valley between culverts													1340					140								705.11
70+50	72+00	150	**Culvert under Deer Valley Road**	**4-10'X5' RBC**												1340					140								705.11
72+00	91+50	1950	Channel	4.80	1.00	102.24	50.00	6.00	3.00	0.0350	344.10	94.42	3.64	0.0015	3.89	1340	5.9	1.5	4.3	116	140	17	1.5	2	23	30.00	23.71	139.57	705.11
91+50	92+50	100	**Culvert under 99th Ave**	**4-10'X5' RBC**												1340					140								705.11
92+50	117+25	2475	Channel	5.59	1.00	104.33	45.00	6.00	3.00	0.0350	392.33	96.70	4.06	0.0010	3.42	1340	6.6	1.5	4	118	140	15	1.5	2	21	27.00	21.71	144.15	757.85
117+25	118+25	100	**Culvert under 95th Ave**	**4-10'X5' RBC**												1340					140								757.85
118+25	120+60	235	**Inlet Structure**	5.59	1.00	104.33	45.00	6.00	3.00	0.0350	392.33	96.70	4.06	0.0010	3.42	1340	6.6	1.5	1	118	120	15	1.5	2	21	27.00	21.71	144.15	757.85
120+60	128+00	740	Channel	4.76	1.00	96.88	45.00	6.00	3.00	0.0350	316.56	89.05	3.55	0.0010	3.13	990	5.8	1.5	1.5	110	120	15	1.5	2	21	27.00	21.71	134.09	658.44
128+00	143+90	1590	Channel	3.65	1.00	56.82	15.00	6.00	3.00	0.0350	114.53	48.71	2.35	0.0013	2.71	310	4.7	1.5	1.5	70	80	5	1.5	2	11	12.00	11.71	90.48	319.44
			91st Ave.																										
			Pinnacle Peak to Aqua Fria River																										
20+30	20+80	50	**Daylight to natural wash**																										
20+80	22+50	170	**Culvet 107th Ave**	**170 LF 3-8'X5' RBC**												780													
22+50	23+60	110	Pinnacle Peak between culverts													780													
23+60	24+60	100	**Culvert Pinnacle Peak**	**100 LF 3-8'X5' RBC**												780													
24+60	28+90	430	Pinnacle Peak	3.62	1.00	71.56	30.00	6.00	3.00	0.0350	167.46	63.45	2.64	0.0033	4.66	780	4.7	1.5	2.8	85	100	10	1.5	2	16	19.50	16.71	105.14	424.06
28+90	29+10	20	**Drop Structure**	2.4 drop												780													
29+10	32+00	290	Pinnacle Peak	3.62	1.00	71.56	30.00	6.00	3.00	0.0350	167.46	63.45	2.64	0.0033	4.66	780	4.7	1.5	2.8	85	100	10	1.5	2	16	19.50	16.71	105.14	424.06
32+00	48+50	1650	**Tunnel**	**1500 LF 2-8'X6' RBC**												780													
48+50	51+75	325	**Junction Structure**													780													
51+75	66+70	1495	Pinnacle Peak	3.04	1.00	66.35	30.00	6.00	3.00	0.0350	132.73	58.10	2.28	0.0034	4.29	570	4.1	1.5	2.1	80	90	10	1.5	2	16	19.50	16.71	98.09	372.78
66+70	67+80	110	**Culvert Lake Pleasant Road**	**130 LF 3-8'X5' RBC**												480													
67+80	75+10	730	Pinnacle Peak	2.62	1.00	62.55	30.00	6.00	3.00	0.0350	109.28	54.19	2.02	0.0042	4.39	480	3.7	1.5	3.8	76	90	10	1.5	2	16	19.50	16.71	92.95	337.25
75+10	75+70	60	**Culvert 95th Ave**	**40 LF 3-8'X4' RBC**												480													
75+70	80+00	430	Pinnacle Peak	2.62	1.00	62.55	30.00	6.00	3.00	0.0350	109.28	54.19	2.02	0.0042	4.39	480	3.7	1.5	3.8	76	90	10	1.5	2	16	19.50	16.71	92.95	337.25
80+00	88+20	820	Pinnacle Peak	3.60	1.00	76.41	35.00	6.00	3.00	0.0350	184.38	68.29	2.70	0.0010	2.60	480	4.7	1.5	3.3	90	110	12	1.5	2	18	22.50	18.71	109.93	458.49
88+20	89+00	80	**Culvert 94th Ave**	**80 LF 2-8'X4' RBC**												260													
89+00	101+10	1210	Pinnacle Peak	3.25	1.00	58.29	20.00	6.00	3.00	0.0350	112.75	50.09	2.25	0.0010	2.31	260	4.3	1.5	1.2	72	70	7	1.5	2	13	15.00	13.71	90.71	324.45
			Pinnacle Peak to state land																										
108+40	114+60	620	Pinnacle Peak 108+00 to 115+00	2.52	1.00	32.13	4.00	6.00	2.00	0.0350	35.38	24.93	1.42	0.0010	1.70	60	3.6	1.5	1.5	44	50	1	1.5	2	7	6.00	7.71	65.73	159.57
114+60	115+10	50	**Culvert 92nd Ave**	**50 LF 1-4' x 3' RBC**												60													
115+10	115+70	60	**Junction Structure**	**130 LF 3-8'X5' RBC**												660													
115+70	127+60	1190	Pinnacle Peak 115+00 to 128+00	4.28	1.00	67.52	20.00	6.00	3.00	0.0350	168.03	59.57	2.82	0.0010	2.68	450	5.3	1.5	5	81	110	7	1.5	2	13	15.00	13.71	103.19	409.05
127+60	134+60	700	**Pinnacle Peak Storm Drain**	**700 LF 2-8' x 4' RBC**												150													
1+00	3+20	220	**Culverts from 90th Ave.**	**220 LF 2-48" RCP**												150													
134+60	141+00	640	**Pinnacle Peak Storm Drain**	**640 LF 2-8' x 4' RBC**												150													
1+00	7+25	625	**Culvert from 89th Ave.**	**625 LF 1-10' x 4' RBC**												150													
141+00	143+20	220	**Pinnacle Peak Storm Drain**	**220 LF 2-8' x 4' RBC**												150													
143+20	154+10	1090	**Pinnacle Peak Storm Drain**	**1090 LF 2-36" RCP**												30													
128+11	154+00	2589	**4-12' X 4' RBC Alternate structure**	4.01	1.00	48.00	48.00			0.0180	192.62	128.10	1.50	0.0010	3.43	660	5.1	1.5	5	48	50	16	1.5	2	22	28.50	22.71	61.73	371.99
			Calle Lejos to 83rd Basin																										
138+33	144+68	635	Calle Lejos Channel into Basin	2.52	1.00	32.13	4.00	6.00	2.00	0.0350	35.38	24.93	1.42	0.0010	1.70	60	3.6	1.5	1.5	44	50	1	1.5	2	7	6.00	7.71	65.73	159.57
144+68	146+23	155	**Culvert into Calle Lejos Basin**	**155 LF 1-6' x 4' RBC**												60													
146+23	156+37	1014	**Calle Lejos Basin**	**155 LF 1-6' x 4' RBC**												60													
156+37	176+00	1963	**Calle Lejos Basin Storm Drain Outlet**	**1963 LF 1-36" RCP**												60													
			Pinnacle Peak to 83rd Avenue																										
154+60	171+31	1671.00	Pinnacle Peak Storm Drain	**2-8'X4' RBC**												290													
1+00	7+37	637.00	**Culvert from 85th Ave.**	**1-8'X4' RBC**												290													
			Rose Garden Lane																										
22+05	33+00	1095.00	Daylight to natural wash													1430													
33+00	33+80	80.00	**4-8'X6' RBC**													1430													
33+80	46+00	1220.00	Rose Garden 33+00 to 46+00	3.81	1.00	103.33	60.00	6.00	3.00	0.0400	294.35	95.27	3.09	0.0038	4.86	1430	4.9	1.5	1.2	117	120	20	1.5	2	26	34.50	26.71	137.53	661.57
46+00	46+80	80.00	**4-8'X6' RBC**													1430													
46+80	52+00	520.00	Rose Garden 47+00 to 52+00	5.06	1.00	94.50	40.00	6.00	3.00	0.0350	317.26	86.74	3.66	0.0020	4.51	1430	6.1	1.5	0	108	100	13	1.5	2	19	24.00	19.71	132.63	649.45
52+00	55+30	330.00	Rose Garden 52+00 to 55+30	4.50	1.00	89.46	40.00	6.00	3.00	0.0420	270.75	81.56	3.32	0.0045	5.28	1430	5.5	1.5	1.2	103	110	13	1.5	2	19	24.00	19.71	125.81	586.92
55+30	56+20	90.00	**4-8'x6' RBC**													1340													
56+20	59+00	280.00	Rose Garden 56+20 to 59+00	4.50	1.00	89.46	40.00	6.00	3.00	0.0420	270.75	81.56	3.32	0.0045	5.28	1430	5.5	1.5	1.2	103	110	13	1.5	2	19	24.00	19.71	125.81	586.92
59+00	68+00	900.00	Tunnel, 3-10'x6'													1340													
68+00	86+50	1850.00	Rose Garden 68+00 to 86+50	4.94	1.00	113.49	60.00	6.00	3.00	0.0350	406.56	105.70	3.85	0.0010	3.30	1340	6	1.5	3.2	127	140	20	1.5	2	26	34.50	26.71	151.26	806.04
			83rd Avenue																										
101+75	132+10	3035	**48" Storm drain**													90													
132+10	132+20	10	**Junction Structure**																										
132+20	137+70	550	**Detention basin**																										
137+70	157+00	1930	80' Channel (Top Width)	4.50	1.00	79.50	30.00	6.00	3.00	0.0480	226.13	71.60	3.16	0.0090	6.32	1430	5.6	1.5	1.2	93	100	10	1.5	2	16	19.50	16.71	115.87	507.93

Begining Station	Ending Station	Length (ft)	Location	Normal Flow Depth y (ft)	Freeboard	Top Width (Flow + FB)	Bottom Width B (ft)	Right Slope Zr (Zr:1)	Left Slope Zl (Zl:1)	Manning's Roughness Coefficient n	Area A (sft)	Wetted Perimeter P (ft)	Hydraulic Radius R	Bottom Slope S (ft/ft)	Velocity V (fps)	Normal Flow Q2 (cfs)	Total Depth	Add'l Average Cut (ft)	Max Cut	Total Top Width (ft)	Total R/W Width (ft)	Low Flow Channel Width (1/3B) (ft)	Low Flow Channel Depth (ft)	Side Slopes (Z:1)	Low Flow Channel Top Width (ft)	Low Flow Channel Area (ft)	Low Flow Channel Perimeter (ft)	Compaction Section (ft)	Excavation Section (sft)
			Beardsley Rd																										
20+00	28+60	860	**Daylight to natural wash**																										
28+60	29+50	90	**Culvert Coyote lakes fence**	**2-8'X5' RBC**																									
29+50	37+00	750	Channel	3.48	1.00	27.91	10.00	2.00	2.00	0.0200	58.96	25.55	2.31	0.0048	8.99	530	4.5	1.5	1.5	34	40	3	1.5	2	9	9.00	9.71	37.44	158.96
37+00	38+00	100	**Culvert**	**2-8'X5' RBC**																									
38+00	47+00	900	Channel	4.24	1.00	30.96	10.00	2.00	2.00	0.0200	78.34	28.96	2.71	0.0022	6.77	530	5.3	1.5	1.5	37	40	3	1.5	2	9	9.00	9.71	40.85	187.65
47+00	51+00	400	**Baffeled Drop Structure**																										
51+00	56+73	573	Channel	4.46	1.00	31.83	10.00	2.00	2.00	0.0200	84.34	29.94	2.82	0.0016	5.93	500	5.5	1.5	1.2	38	40	3	1.5	2	9	9.00	9.71	41.83	196.34
56+73	57+83	110	**Culvert**																										
57+83	70+00	1217	Channel	4.46	1.00	31.83	10.00	2.00	2.00	0.0200	84.34	29.94	2.82	0.0016	5.93	500	5.5	1.5	1.2	38	40	3	1.5	2	9	9.00	9.71	41.83	196.34
70+00	70+70	70	**Culvert**																										
70+70	74+30	360	Channel	5.01	1.00	34.03	10.00	2.00	2.00	0.0200	100.22	32.39	3.09	0.0010	4.99	500	6.1	1.5	1.2	40	40	3	1.5	2	9	9.00	9.71	44.28	218.94
74+30	77+50	320	**Baffeled Drop Structure**																										
77+50	83+00	550	Channel	5.01	1.00	34.03	10.00	2.00	2.00	0.0200	100.22	32.39	3.09	0.0010	4.99	500	6.1	1.5	1.4	40	40	3	1.5	2	9	9.00	9.71	44.28	218.94
83+00	84+10	110	**Culvert**																										
84+10	113+15	2905	Channel	5.34	1.00	29.03	10.00	1.50	1.50	0.0200	96.23	29.26	3.29	0.0010	5.20	500	6.4	1.5	4	34	40	3	1.5	2	9	9.00	9.71	38.98	199.16
113+15	114+52	137	**Culvert**																										
114+52	121+00	648	Channel	3.92	1.00	24.70	5.00	2.00	2.00	0.0200	50.42	22.55	2.24	0.0039	7.93	400	5	1.5	1.5	31	40	2	1.5	2	8	7.50	8.71	34.44	139.38
121+00	125+40	440	Channel	4.06	1.00	25.23	5.00	4.00		0.0200	53.19	25.78	2.06	0.0039	7.52	400	5.1	1.5	1	31	30	2	1.5	2	8	7.50	8.71	59.77	156.14

LEVEL III CULVERT AND STORM DRAIN CALCULATIONS

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME Normal Depth Q for Box Culverts

JOB NO. 310.017

$\boxed{4' \times 6' \text{ RCB}}$

$n = 0.018$ $\quad$ Area $= 24\,ft^2$

$S_1 = 0.001$ $\quad$ $W_p = 20\,ft$

$S_2 = 0.0016$

$$Q_1 = \left(\frac{1.49}{0.018}\right)(.001)^{1/2}(24)\left(\frac{24}{20}\right)^{2/3} = 71\,cfs$$

$$Q_2 = \left(\frac{1.49}{0.018}\right)(.0016)^{1/2}(24)\left(24/20\right)^{2/3} = 90\,cfs$$

$\boxed{4' \times 8' \text{ RCB}}$

$n = 0.018$ $\quad$ Area $= 32\,ft^2$

$S_1 = 0.001$ $\quad$ $W_p = 24\,ft$

$S_2 = 0.0016$

$$Q_1 = \left(\frac{1.49}{0.018}\right)(.001)^{1/2}(32)\left(\frac{32}{24}\right)^{2/3} = 101\,cfs$$

$$Q_2 = \left(\frac{1.49}{0.018}\right)(.0016)^{1/2}(32)\left(32/24\right)^{2/3} = 128\,cfs$$

$\boxed{4' \times 10' \text{ RCB}}$

$n = 0.018$ $\quad$ Area $= 40\,ft^2$

$S_1 = 0.001$ $\quad$ $W_p = 28\,ft$

$S_2 = 0.0016$

$$Q_1 = \left(\frac{1.49}{0.018}\right)(.001)^{1/2}(40)\left(40/28\right)^{2/3} = 133\,cfs$$

$$Q_2 = \left(\frac{1.49}{0.018}\right)(.0016)^{1/2}(40)\left(40/28\right)^{2/3} = 168\,cfs$$

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME Storm Drain Calculations

JOB NO. 310.017

Route R11L3E

Q= 230cfs

S= 0.0016

2 cell 4'x8'= 2x Q_2 (previous page)

2x 128cfs= 256cfs

R11L3E is 2-4'x8' RCB

∴ R11L4E, RN21I1, & RN21I2 are the same size because flow and slope is the same.

Route RN11L5

Q= 150cfs

S= 0.001

2cell 4'x8' = 2xQ_1 (previas page)

2x 101cfs= 202cfs

RN11L5 is 2-4'x8' RCB

∴ RN11L1 is the same size because flow and slope are the same.

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME Normal Depth Calculations for Storm Drains JOB NO. ______

R11L3W

D=3'

Q= 25cfs

S= 0.001

n= 0.015

$A = \pi r^2 = \pi (1.5)^2 = 7.07 \text{ ft}^2$

$W_p = 2\pi r = 9.42 \text{ ft}$

$Q = \frac{1.49}{0.015} (.001)^{1/2} (7.07) \left(\frac{7.07}{9.42}\right)^{2/3} = 19 \text{ cfs}$

19cfs x2 = 38cfs

2-36" RCP's

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/14/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

Beardsley channel @ Coyote Lakes wall

CHART 8

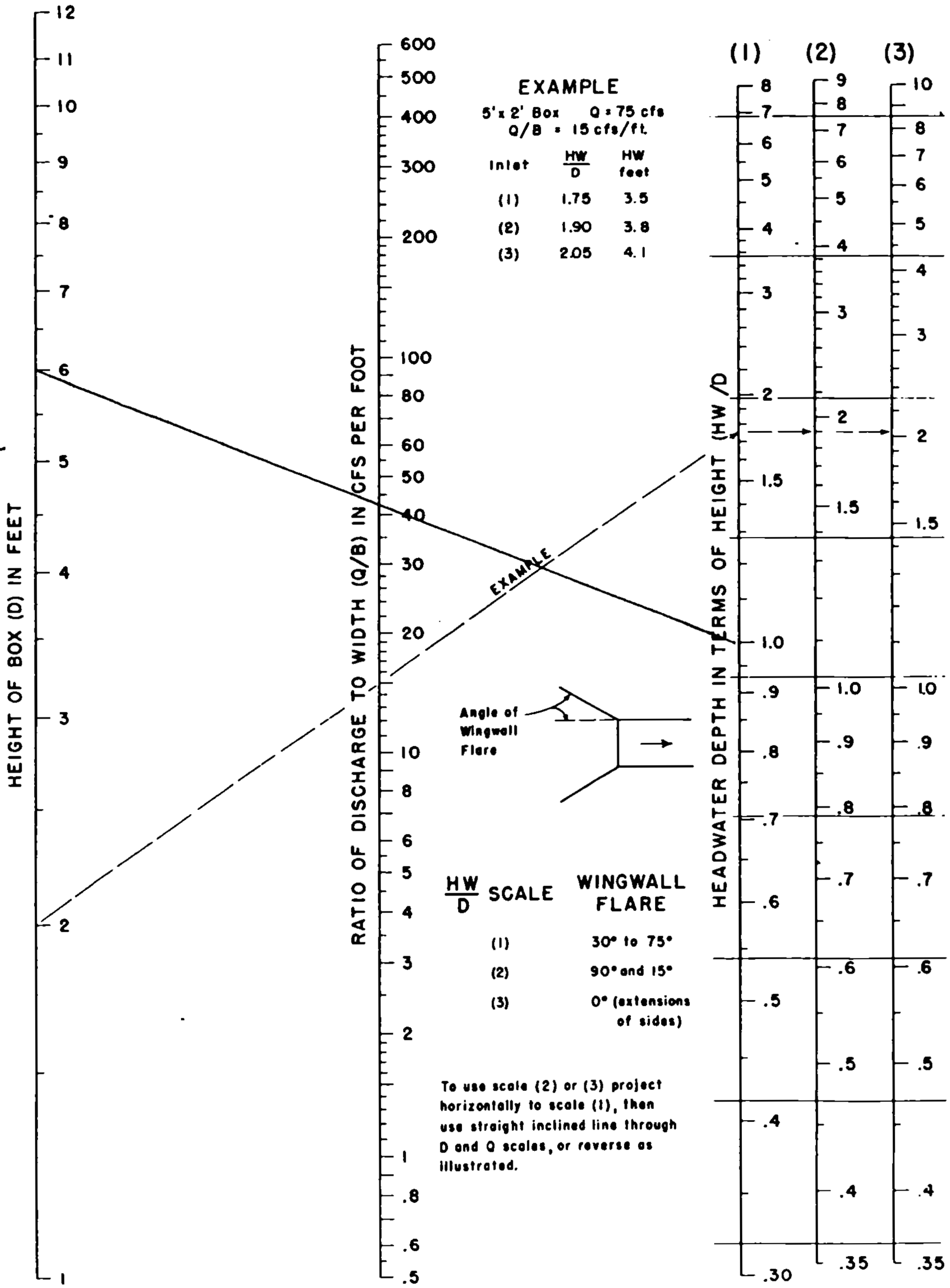
Q=530

Q/B=42

B=530/42

B≈13

2-8'x6'



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/14/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

Beardsley Rd @ Coyote lakes fence

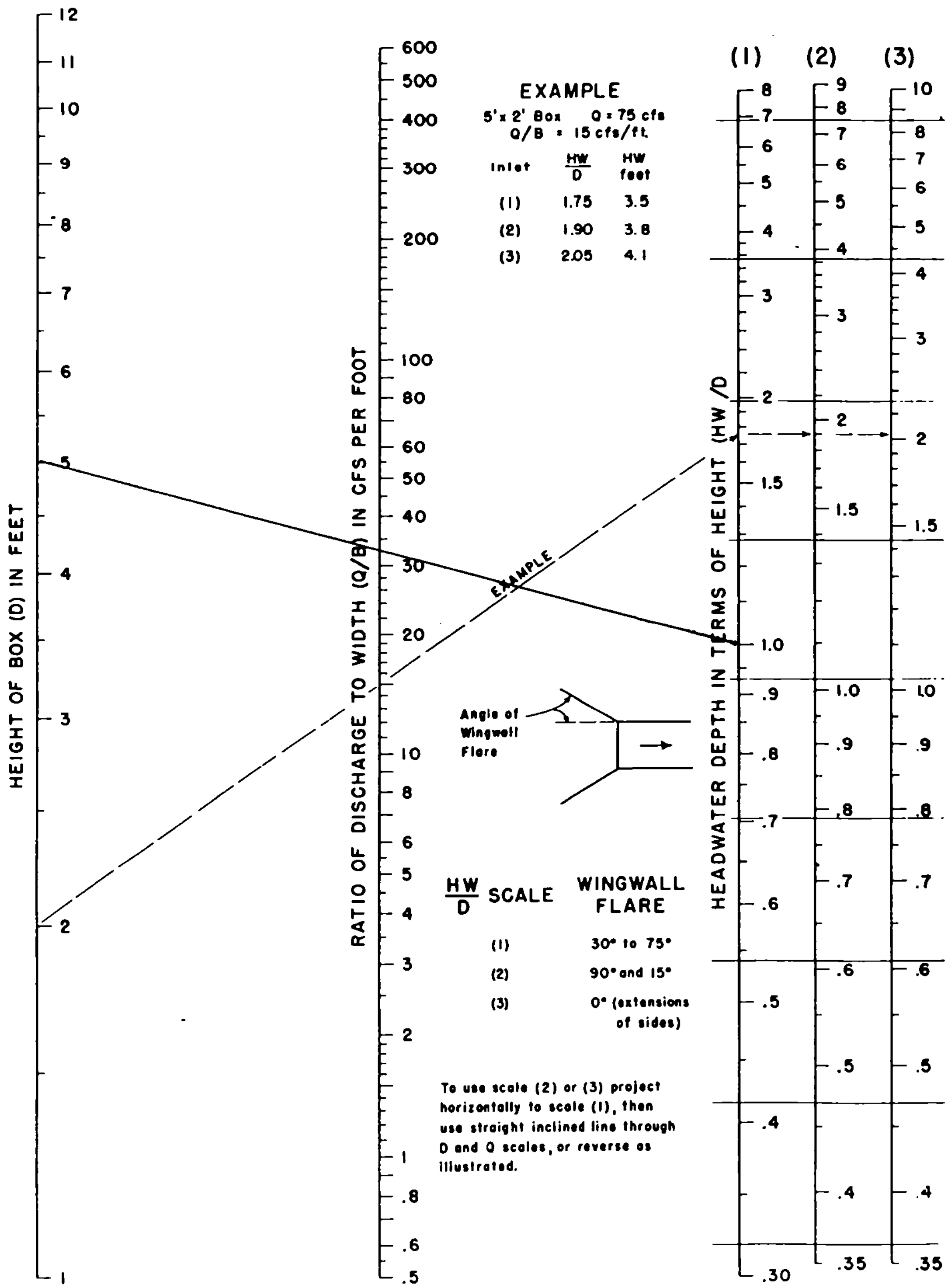
CHART 8

Q=530

Q/B=33

B≈16

2-8'x5'



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAM DATE 5/14/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME 6/P ADMP Update JOB NO. 310.017

Pinnacle Peak @ 91st Ave.

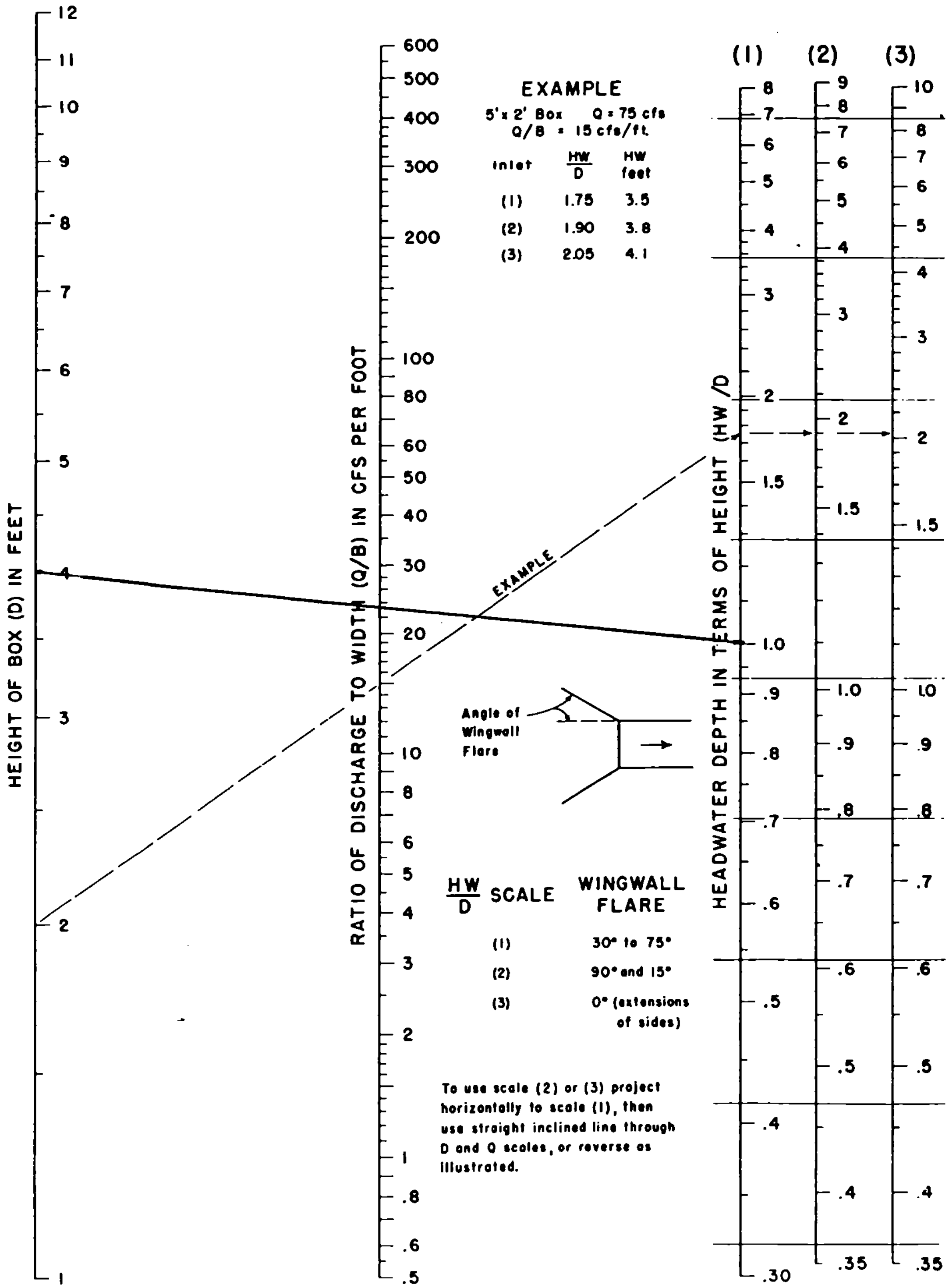
Q=660

Q/B = 23

B≈29
use 30

3-10'x4'

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ________ OF ________

BY ________ DATE ________

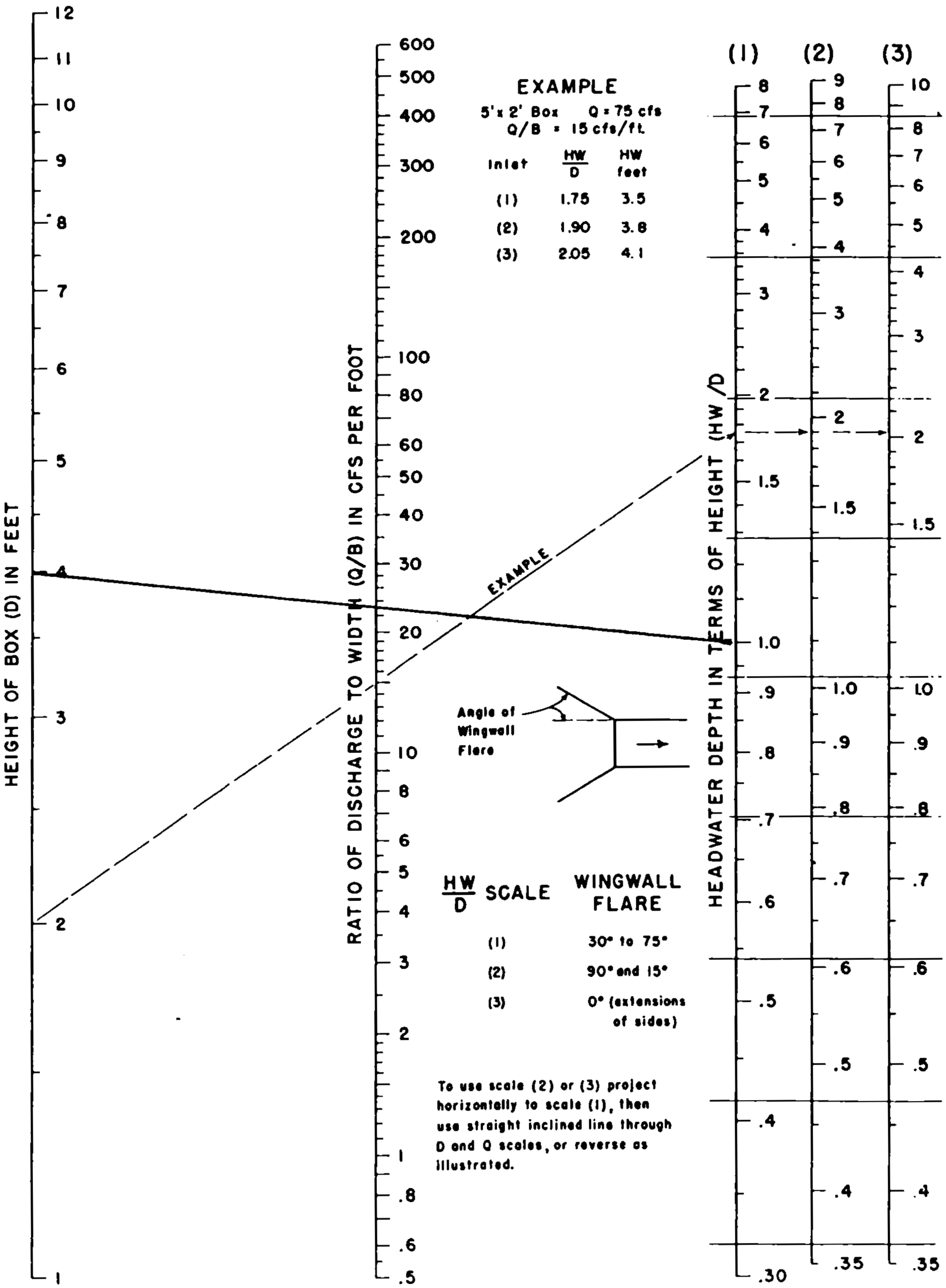
CHECK ________ DATE ________

CLIENT ________________________

JOB NAME ________________________ JOB NO. ________

CHART 8

H= 4
Q=500
Q/B = 23
B = 22'
3-8'x4'



HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

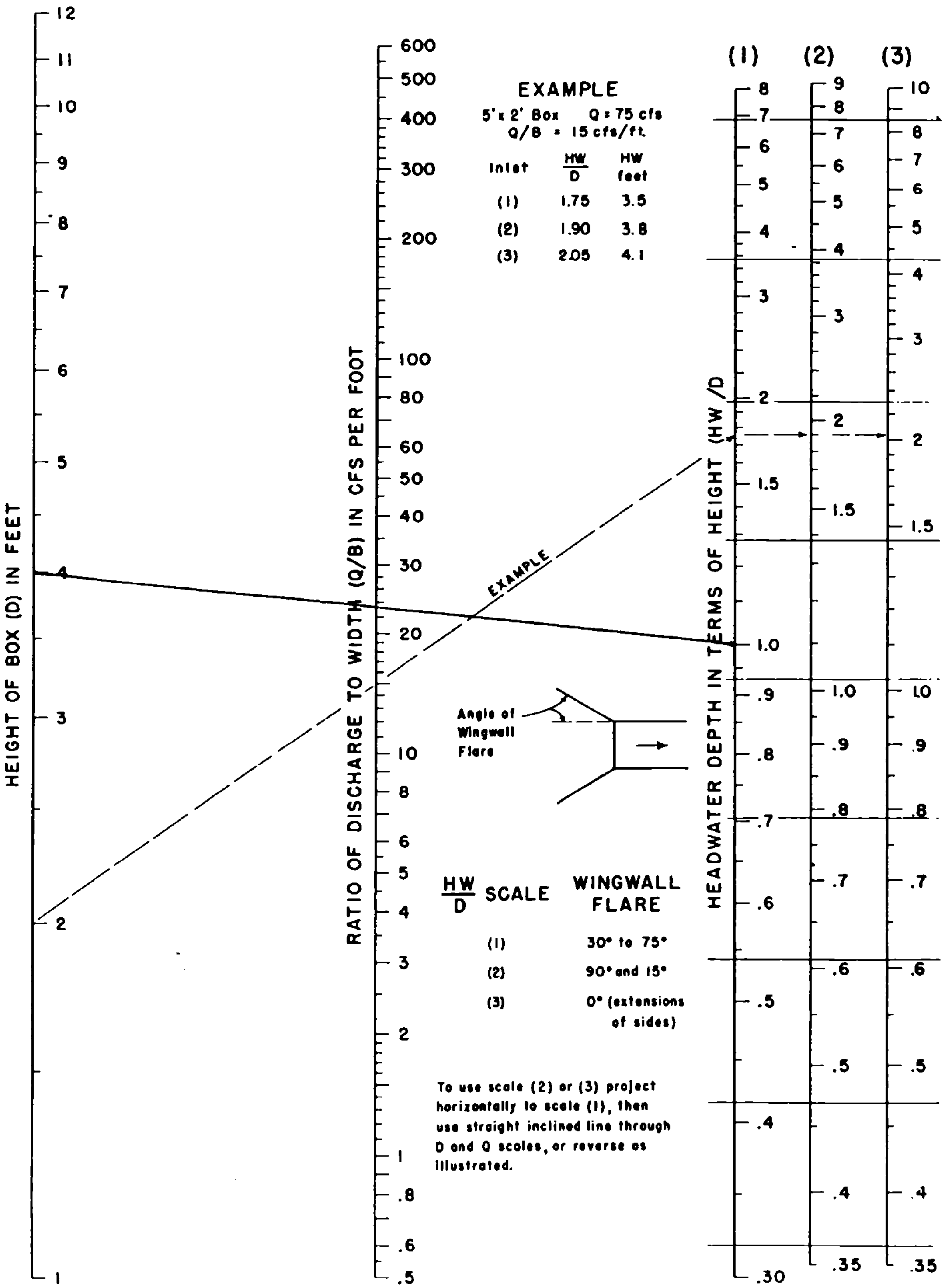
SHEET ______ OF ______
BY HAA DATE 5/1/01
CHECK ______ DATE ______

CLIENT FCDMC
JOB NAME G/P ADMP Update
JOB NO. 310.017

Lake Pleasant Rd @ Pinnacle Peak

CHART 8

Q/B = 23
Q = 480
B = 480 / 23
= 21
3-8'x4



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/7/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP UPDAte JOB NO. 310.017

Deer Valley Rd @ Lake Pleasant

under Deer Valley and Lake Pleasant Parkway

$Q = 1340$

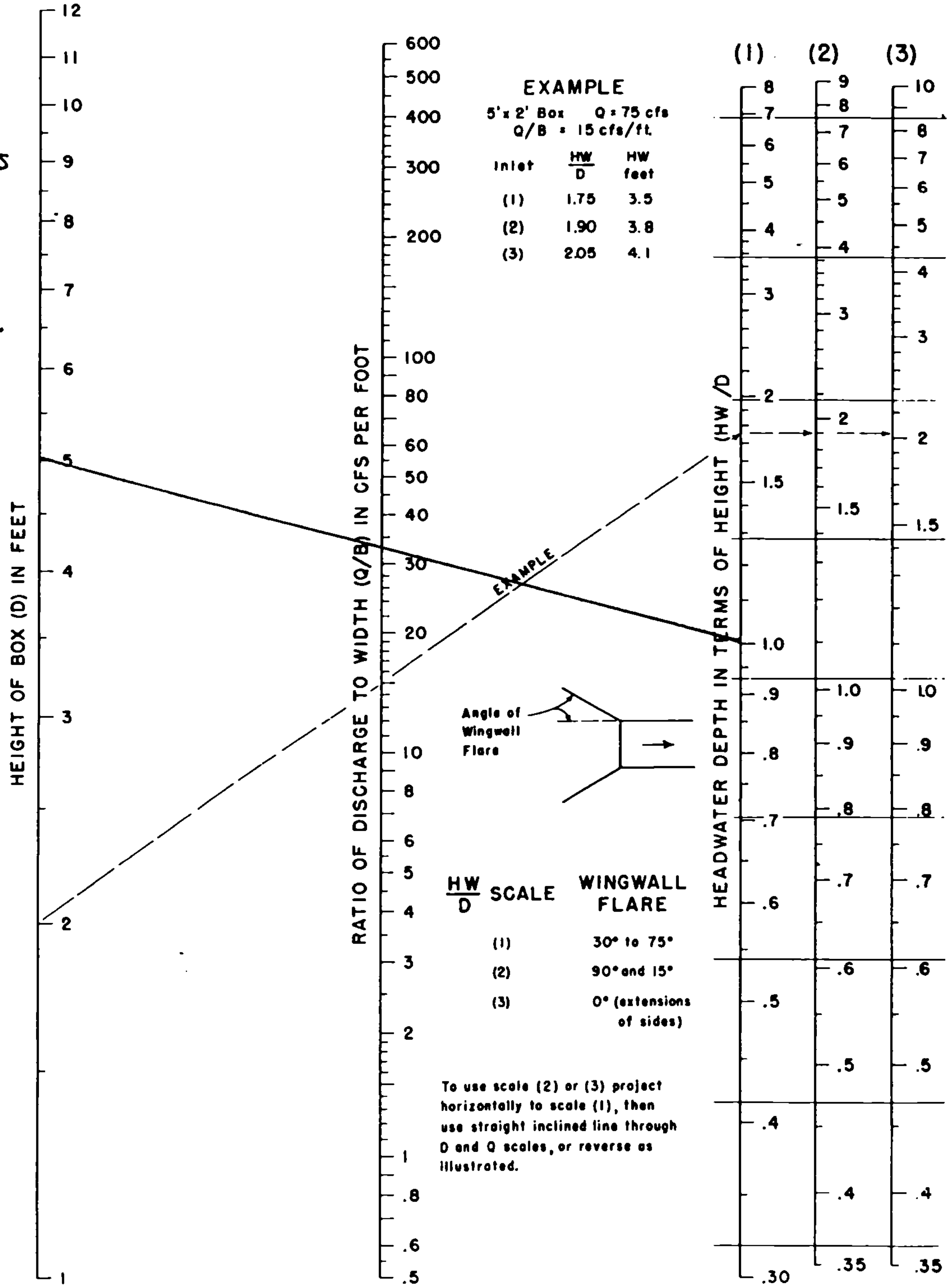
$Q/B = 33$ cfs

$B = \frac{1340}{33}$

≈ 40 ft

4-10' x 5'

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/1/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update

JOB NO. 310.017

Pinnacle Peak Rd Tunnel

CHART 8

1.2 HW/D

Q/B = 53 cfs

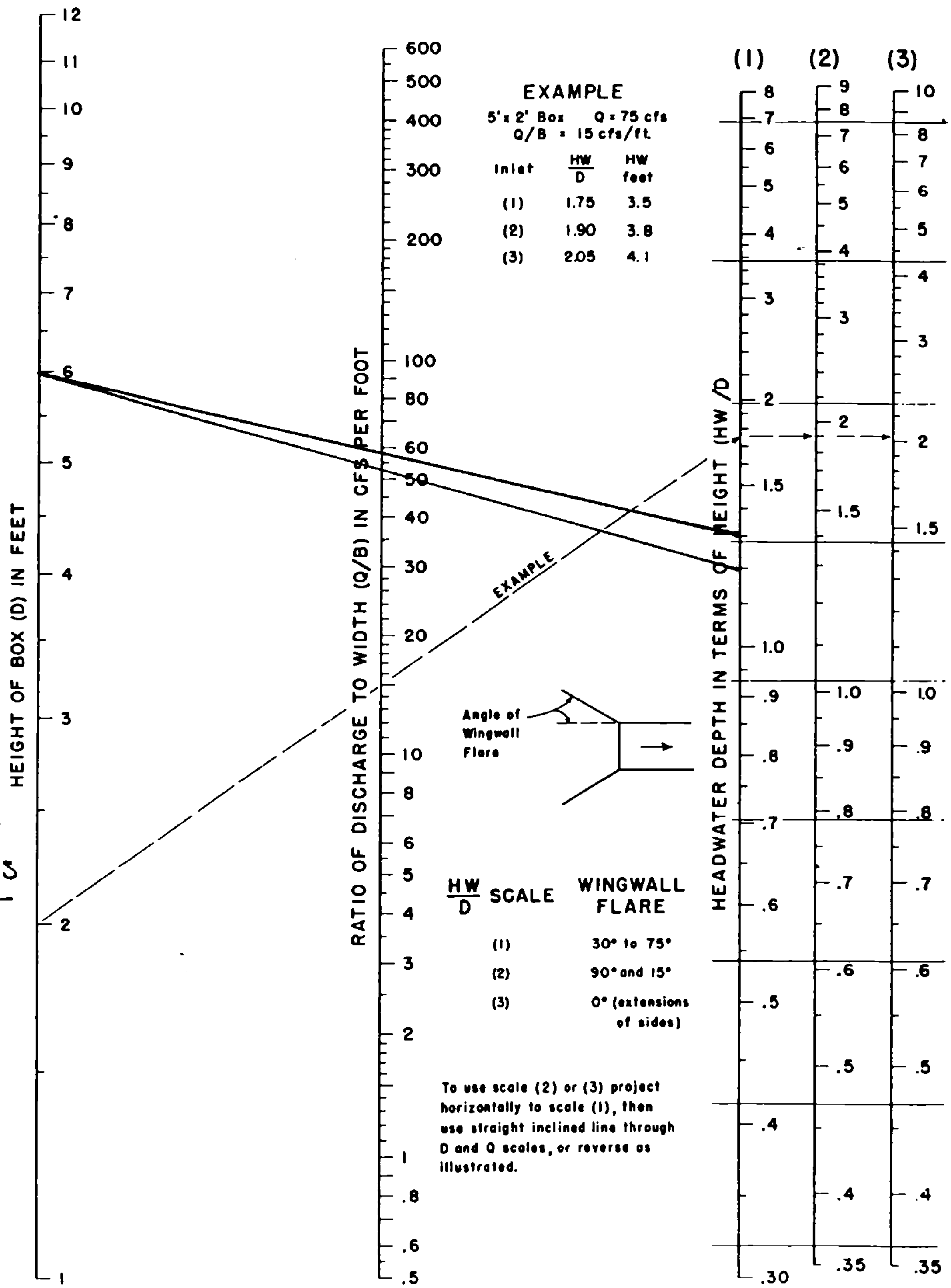
B = 760/53

B = 15

$\boxed{2\text{-}8' \times 6'}$

V = 760 / (2x8x6)

≈ 8 fps



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

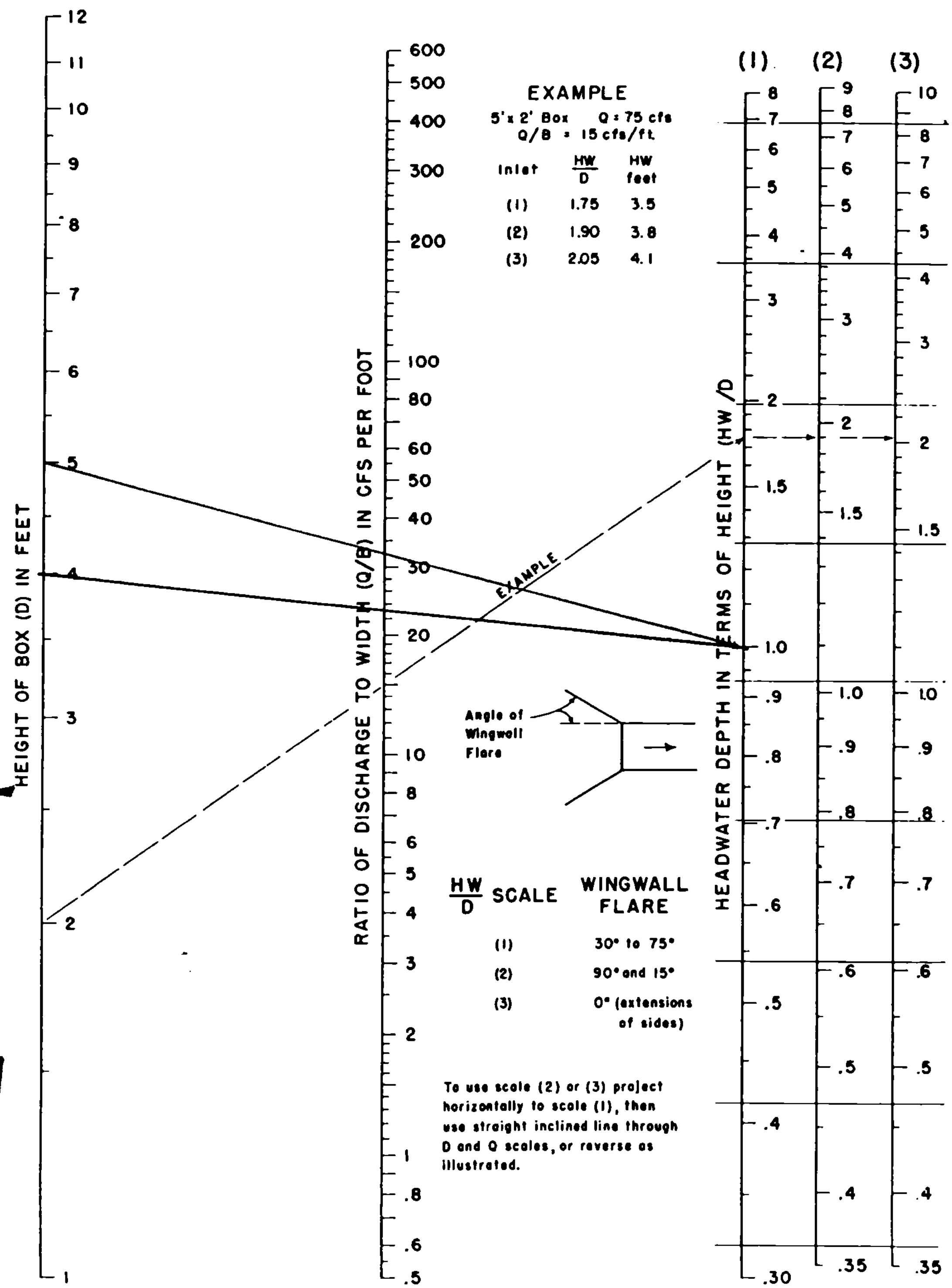
Entellus™

SHEET ______ OF ______
BY HAA DATE 5/1/01
CHECK ______ DATE ______

CLIENT FCDMC
JOB NAME G/P ADMP update
JOB NO. 310.017

107 Ave. South of Pinnacle Peak Rd

CHART 8



4 foot High'
Q/B = 23 qs
B = 780 / 23
= 34'
4 - 10 x 4

5' height
Q/B = 33
B = 780 / 33
= 24
$\boxed{3 - 8 \times 5}$

V =

HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______
BY HAA DATE 5/1/01
CHECK ______ DATE ______

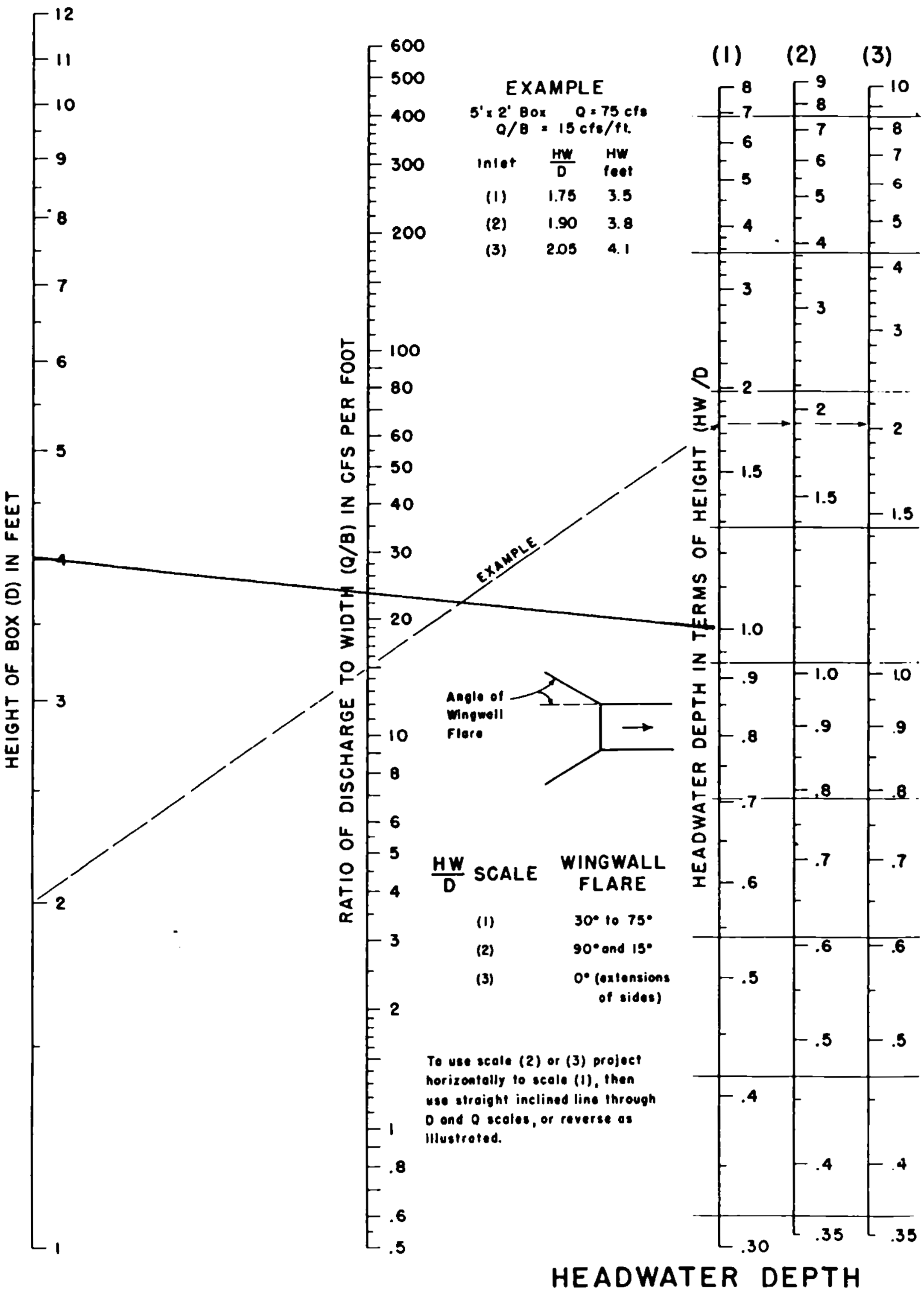
CLIENT FCDMC
JOB NAME 6/P ADMP Update
JOB NO. 310.017

95th Ave @ Pinnacle Peak

$Q/B = 23$
$Q = 480$
$B = \frac{480}{23}$
≈ 21

3-8'x4'

CHART 8



HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAP DATE 5/9/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update

JOB NO. 310.017

H = 6

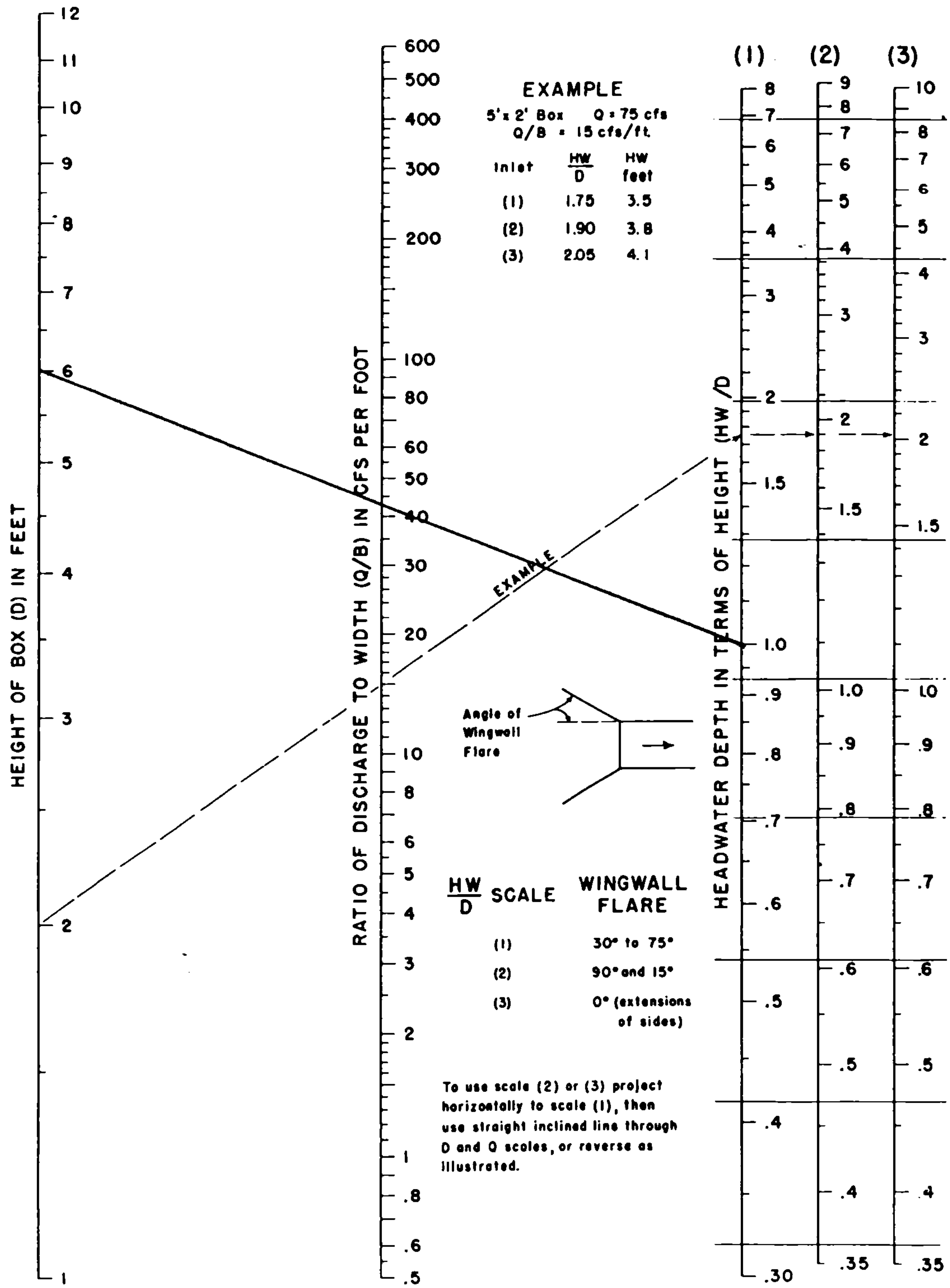
Q/B = 43

$B = \frac{1340}{43}$

≈ 30'

3-10 x 6

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 8/2/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

Pinnacle Peak Rd @ 92nd Ave

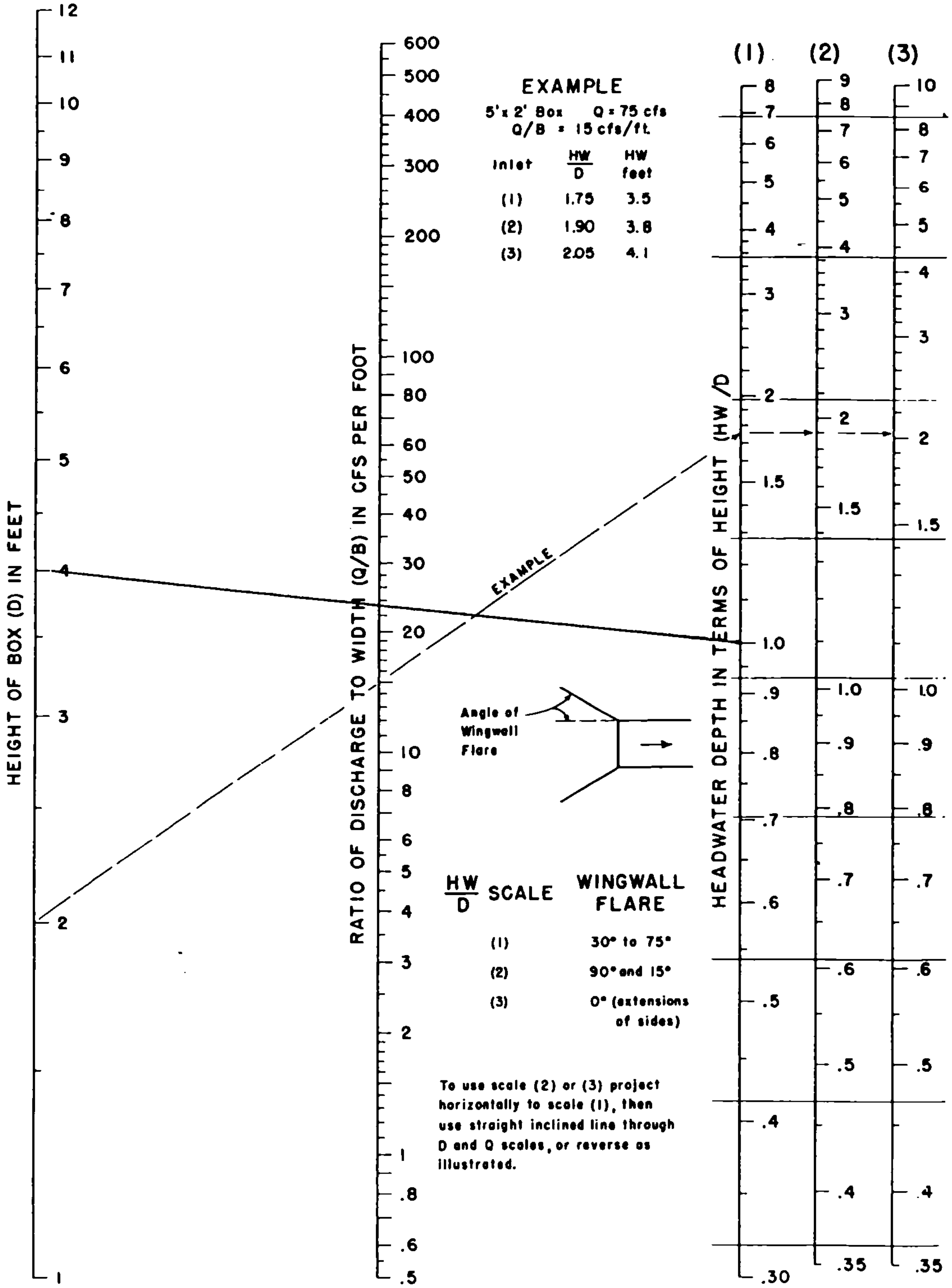
CHART 8

B = 23

B = 60/23

= 3

1-4x4



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

CHECK ______ DATE ______

CLIENT ______

JOB NAME ______ JOB NO. ______

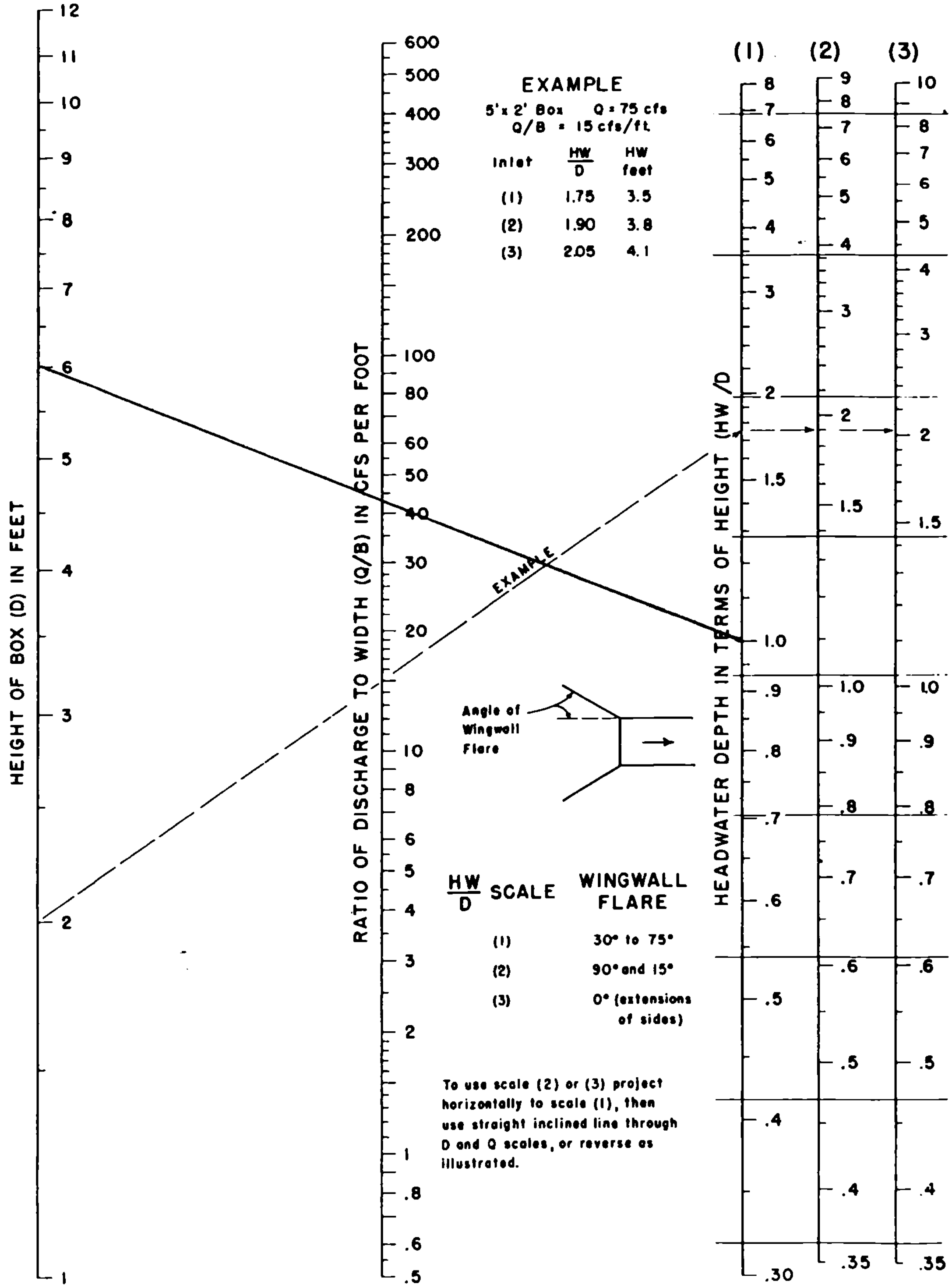
CHART 8

Q = 1430

Q/B = 44

B ≈ 33

1 - 8'x6'



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

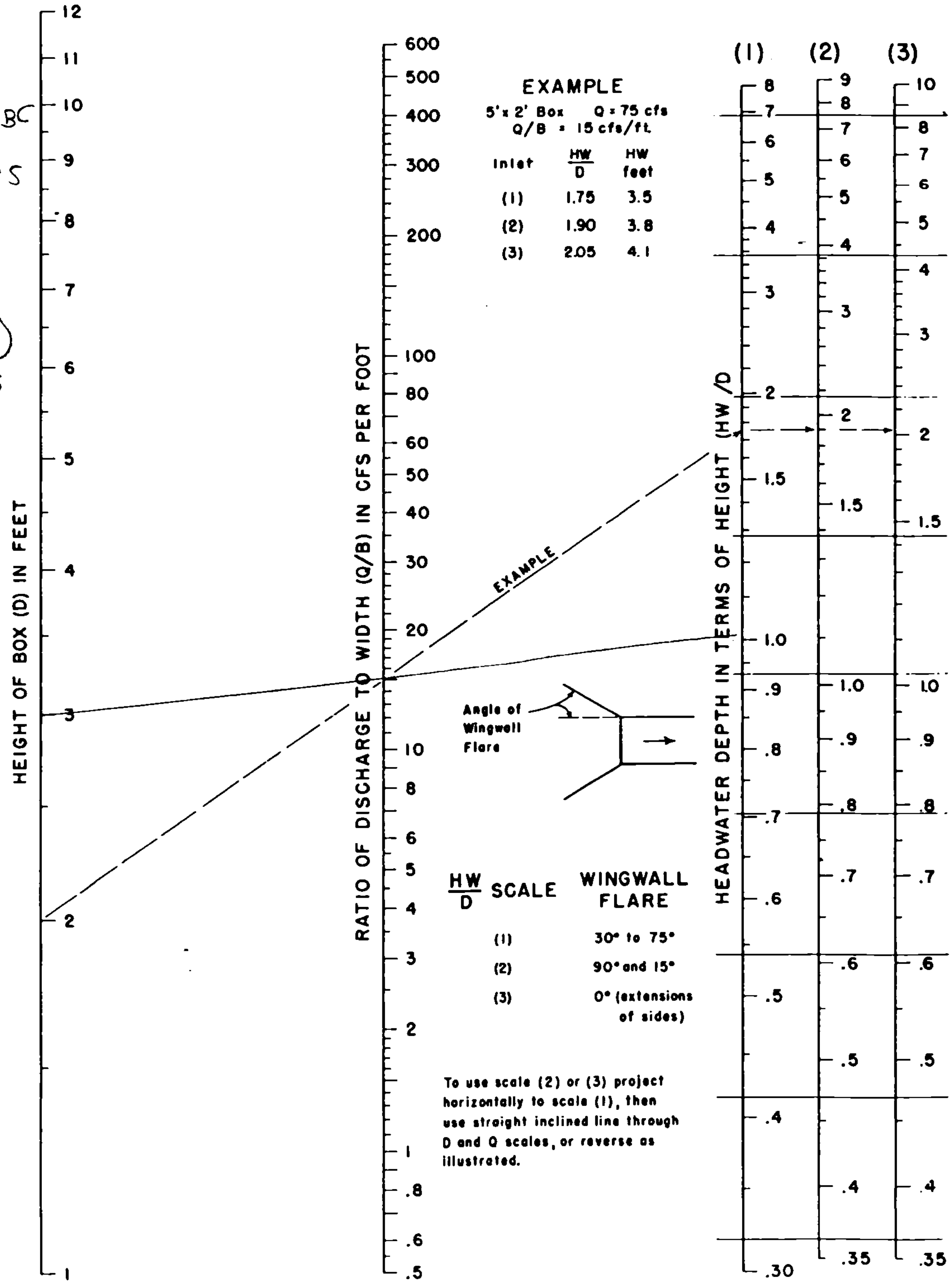
SHEET ______ OF ______
BY HAP DATE ______
CHECK ______ DATE ______

CLIENT FCDMC
JOB NAME G/P ADMP Update
JOB NO. 310.017

Existing culver capacity East of Lake Pleasant Rd

3-8×3 RBC
Q/B = 15 cfs
B = 3×8
= 24'
Q = (24)(15)
= 360 cfs

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/14/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

Pinnacle Peak @ 85th Avenue

CHART 8

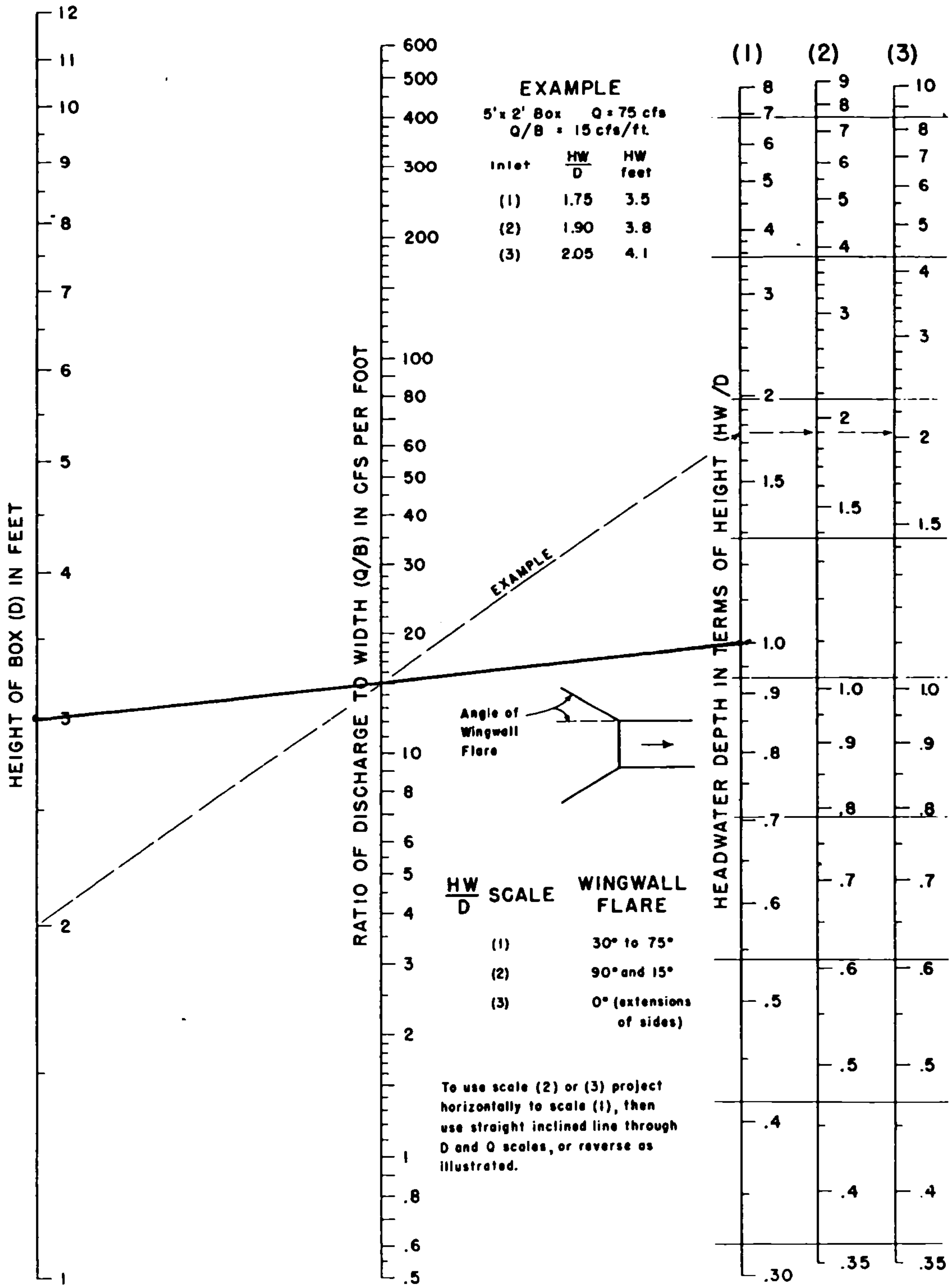
Q=290

Q/B ≈ 15

B ≈ 19

use 20

2-10 x 3



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ____ OF ____

BY HAA DATE 5/14/01

CHECK ____ DATE ____

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

Pinnacle Peak Rd and 92nd Ave.

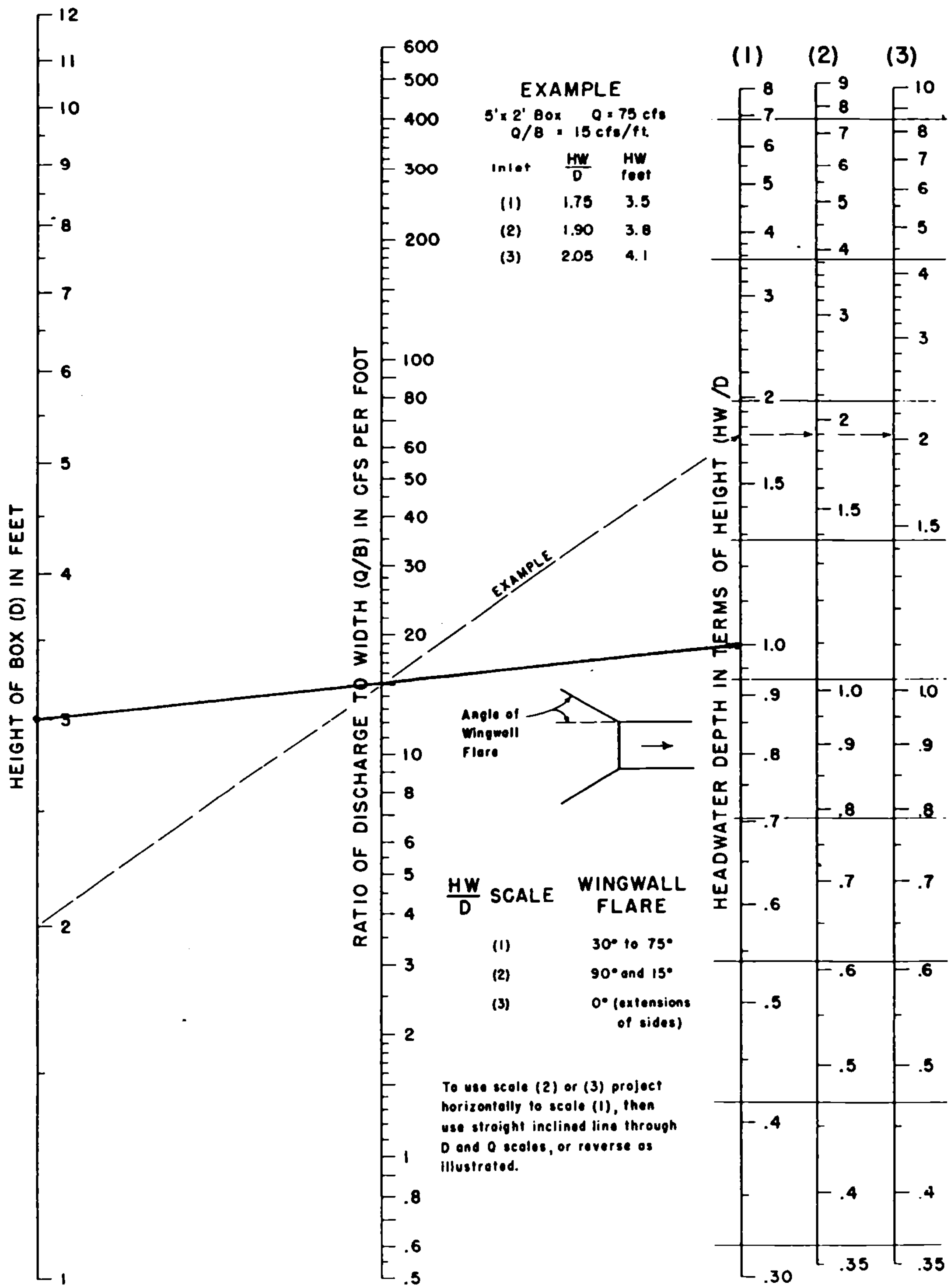
CHART 8

$Q/B = 15$

$B = 60/15$

$B = 4$

1- 4'x3'



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

Entellus™

SHEET ________ OF ________

BY HAA DATE 5/1/01

CHECK ________ DATE ________

CLIENT FCDMC

JOB NAME 6/P ADMP Update JOB NO. 310.017

Pinnacle Peak Rd to state land

CHART 8

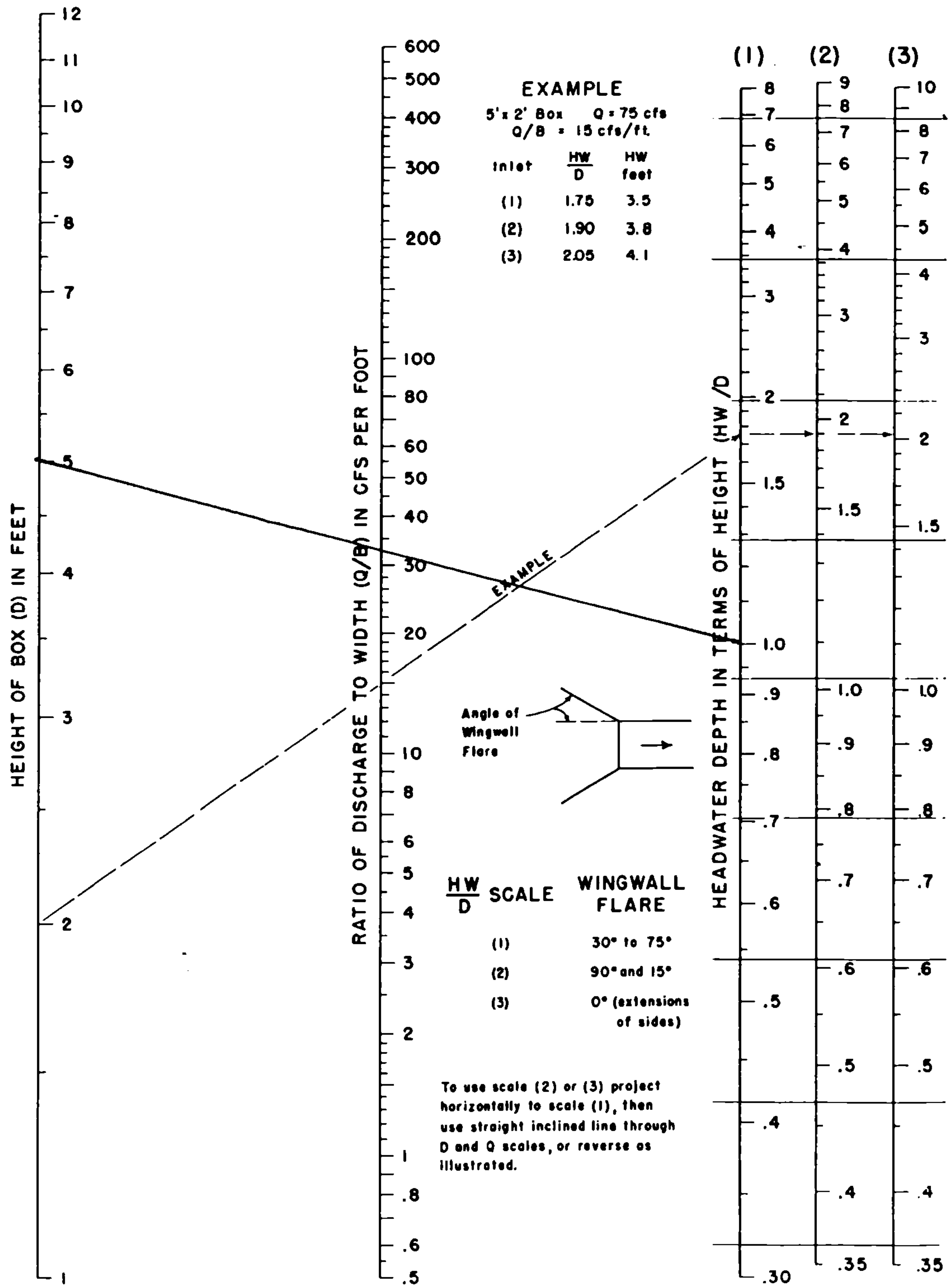
$Q/B = 33$

$Q = 660$

$B = \frac{660}{33}$

$= 20$

$\boxed{2\text{-}10' \times 5'}$



HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Entellus™

SHEET ______ OF ______

BY HAA DATE 5/2/01

CHECK ______ DATE ______

CLIENT FCDMC

JOB NAME G/P ADMP Update JOB NO. 310.017

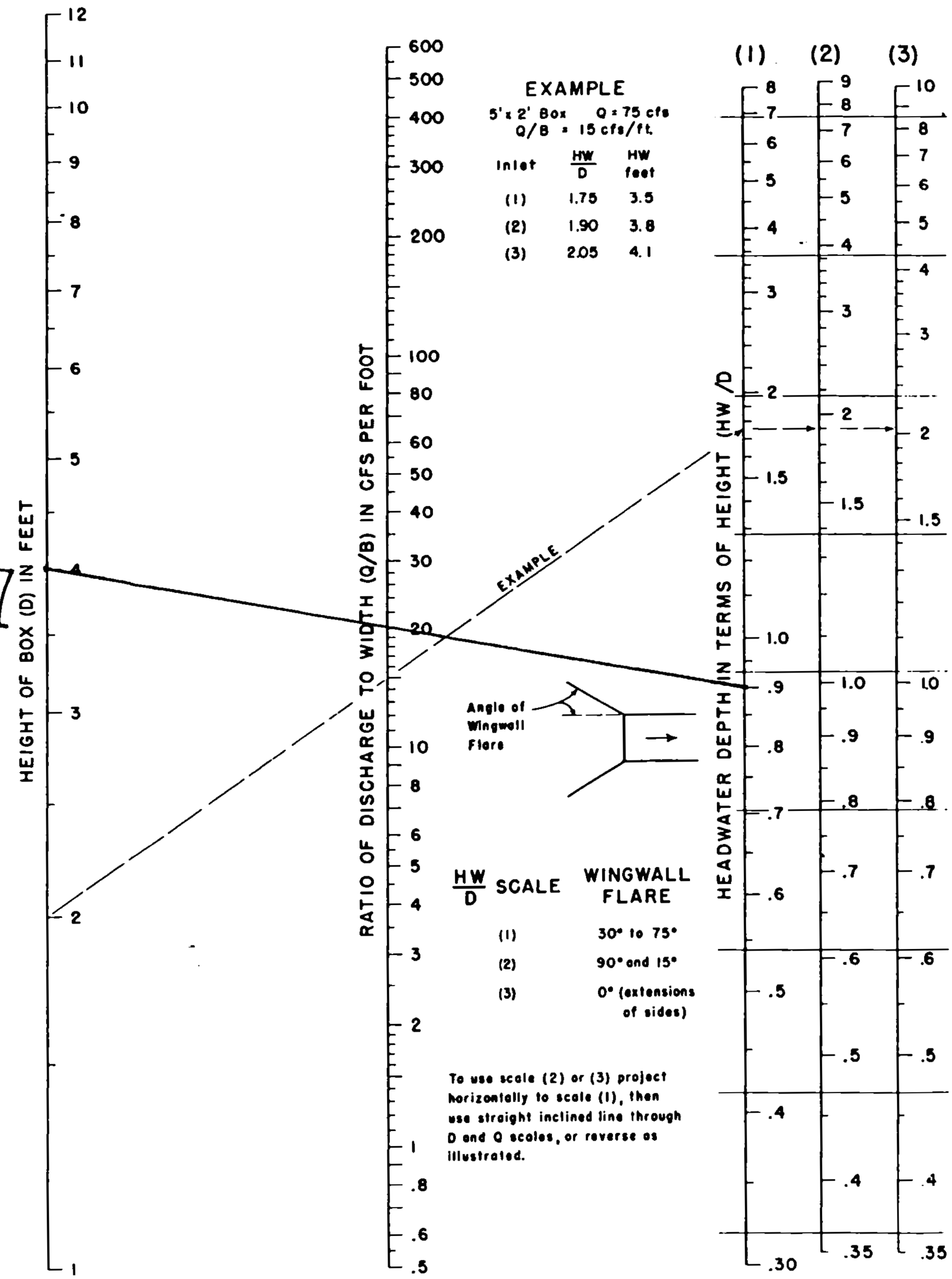
94th Ave. @ Pinnacle Peak

Q/B = 20

B = 260/20

2-8'x4'

CHART 8



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

PINNACLE PEAK ROAD
Station 43+00
1 Barrel - 10'x4' Concrete Box Culvert


```
CURRENT DATE: 05-29-2001                                 FILE DATE: 05-29-2001
CURRENT TIME: 10:17:25                                   FILE NAME: PP4300

********************************************************************************
**************************    FHWA CULVERT ANALYSIS     **************************
**************************     HY-8, VERSION 6.0        **************************
********************************************************************************
| C |       SITE DATA            |    CULVERT SHAPE, MATERIAL, INLET             |
| U |----------------------------|-----------------------------------------------|
| L |  INLET   OUTLET  CULVERT   | BARRELS                                       |
| V |  ELEV.   ELEV.   LENGTH    | SHAPE        SPAN   RISE  MANNING   INLET     |
|NO.|  (ft)    (ft)    (ft)      | MATERIAL     (ft)   (ft)    n       TYPE      |
| 1 |1332.50  1321.50  1820.03   | 1 RCB        10.00  4.00   .018   CONVENTIONAL|
| 2 |                            |                                               |
| 3 |                            |                                               |
| 4 |                            |                                               |
| 5 |                            |                                               |
| 6 |                            |                                               |
********************************************************************************

********************************************************************************
SUMMARY OF CULVERT FLOWS (cfs)          FILE: PP4300             DATE: 05-29-2001

 ELEV (ft)   TOTAL      1       2       3       4       5       6   ROADWAY ITR
     0.00      0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1333.87     50.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1334.68    100.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1335.41    150.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1336.08    200.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1336.74    250.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1337.42    300.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1337.92    335.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1338.93    400.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1348.75    450.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
  1354.20    500.0     0.0     0.0     0.0     0.0     0.0     0.0     0.00  0
     0.00      0.0     0.0     0.0     0.0     0.0     0.0     0.0 OVERTOPPING
********************************************************************************

********************************************************************************
  SUMMARY OF ITERATIVE SOLUTION ERRORS   FILE: PP4300            DATE: 05-29-2001

       HEAD            HEAD            TOTAL          FLOW           % FLOW
     ELEV (ft)      ERROR (ft)      FLOW (cfs)     ERROR (cfs)       ERROR
       0.00           0.000            0.00           0.00            0.00
    1333.87           0.000           50.00           0.00            0.00
    1334.68           0.000          100.00           0.00            0.00
    1335.41           0.000          150.00           0.00            0.00
    1336.08           0.000          200.00           0.00            0.00
    1336.74           0.000          250.00           0.00            0.00
    1337.42           0.000          300.00           0.00            0.00
    1337.92           0.000          335.00           0.00            0.00
    1338.93           0.000          400.00           0.00            0.00
    1348.75           0.000          450.00           0.00            0.00
    1354.20           0.000          500.00           0.00            0.00
********************************************************************************
  <1> TOLERANCE (ft) = 0.010                        <2> TOLERANCE (%) = 1.000
********************************************************************************
```

Culvert Rating Curve
Pinnacle Peak - Station 43+00

Discharge	0	36	89	157	181	306	372	403
Elevation	1332.5	1333.5	1334.5	1335.5	1336.5	1337.5	1338.5	1339.5

PINNACLE PEAK ROAD
Station 43+00
1 Barrel - 10'x4' Concrete Box Culvert


```
CURRENT DATE: 05-29-2001                                FILE DATE: 05-29-2001
CURRENT TIME: 10:17:25                                  FILE NAME: PP4300
**********************************************************************************
     PERFORMANCE CURVE FOR CULVERT 1 - 1( 10.00 (ft) BY   4.00 (ft)) RCB
**********************************************************************************
  DIS-     HEAD-  INLET  OUTLET
 CHARGE    WATER CONTROL CONTROL FLOW NORMAL  CRIT. OUTLET   TW    OUTLET    TW
  FLOW     ELEV.  DEPTH   DEPTH  TYPE  DEPTH  DEPTH  DEPTH  DEPTH   VEL.    VEL.
 (cfs)     (ft)   (ft)    (ft)   <F4>   (ft)   (ft)   (ft)   (ft)  (fps)   (fps)
**********************************************************************************
   0.00  1332.50   0.00 -11.00 0-NF    0.00   0.00   0.00 %-1321.50   0.00   0.00
  50.00  1333.87   1.37  -8.25 1-S2n   0.91   0.92   0.82 %-1317.98   6.09   4.17
 100.00  1334.68   2.18  -7.12 1-S2n   1.44   1.46   1.36 %-1317.51   7.34   5.20
 150.00  1335.41   2.91  -5.46 1-S2n   1.89   1.92   1.82 %-1317.13   8.26   5.89
 200.00  1336.08   3.58  -3.25 1-S2n   2.30   2.32   2.22 %-1316.81   9.01   6.43
 250.00  1336.74   4.24  -0.48 1-S2n   2.69   2.69   2.59 %-1316.55   9.64   6.86
 300.00  1337.42   4.92   4.85 2-M2c   3.05   3.04   3.04 %-1316.30   9.86   7.23
 335.00  1337.92   5.42   5.22 2-M2c   3.30   3.27   3.27 %-1316.14  10.23   7.47
 400.00  1338.93   6.43   5.87 2-M2c   4.00   3.68   3.68 %-1315.86  10.86   7.86
 450.00  1348.75   7.29  16.25 2-M2c   4.00   3.99   3.99 %-1315.66  11.29   8.12
 500.00  1354.20   8.24  21.70 6-FFc   4.00   4.00   4.00 %-1315.50  12.50   8.33
**********************************************************************************
       El. inlet face invert    1332.50 ft   El. outlet invert  1321.50 ft
       El. inlet throat invert     0.00 ft   El. inlet crest       0.00 ft
**********************************************************************************

***** SITE DATA ***** CULVERT INVERT **************
      INLET STATION                         6120.00 ft
      INLET ELEVATION                       1332.50 ft
      OUTLET STATION                        4300.00 ft
      OUTLET ELEVATION                      1321.50 ft
      NUMBER OF BARRELS                        1
      SLOPE (V/H)                              0.0060
      CULVERT LENGTH ALONG SLOPE            1820.03 ft

***** CULVERT DATA SUMMARY ************************
      BARREL SHAPE         BOX
      BARREL SPAN           10.00 ft
      BARREL RISE            4.00 ft
      BARREL MATERIAL      CONCRETE
      BARREL MANNING'S n   0.018
      INLET TYPE           CONVENTIONAL
      INLET EDGE AND WALL  BEVELED EDGE (1.5:1)
      INLET DEPRESSION     NONE

**********************************************************************************
```

PINNACLE PEAK ROAD
Station 43+00
1 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001
CURRENT TIME: 10:17:25

FILE DATE: 05-29-2001
FILE NAME: PP4300

****
************************* TAILWATER *************************
****

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: PP4300
FILE DATE: 5/29/01

MAIN CHANNEL	
LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.025
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0060 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	6.00
2	14.00	2.50
3	24.00	2.50
4	31.50	0.00
5	39.50	0.00
6	47.00	2.50
7	61.00	6.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	0.00	0.000	%-1321.50	0.00	0.00
50.00	3.52	0.000	%-1317.98	4.17	0.32
100.00	3.99	0.000	%-1317.51	5.20	0.45
150.00	4.37	0.000	%-1317.13	5.89	0.54
200.00	4.68	0.000	%-1316.81	6.43	0.62
250.00	4.95	0.000	%-1316.55	6.86	0.68
300.00	5.20	0.000	%-1316.30	7.23	0.74
335.00	5.36	0.000	%-1316.14	7.47	0.77
400.00	5.64	0.000	%-1315.86	7.86	0.83
450.00	5.84	0.000	%-1315.66	8.12	0.88
500.00	6.00	0.000	%-1315.50	8.33	0.91

Note: Shear stress was calculated using R.

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	70.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	1341.00 ft

****

PINNACLE PEAK ROAD
Station 34+00
2 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001
CURRENT TIME: 10:49:58

FILE DATE: 05-29-2001
FILE NAME: PP3400

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

C U L V NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1316.50	1316.20	50.00	2 RCB	10.00	4.00	.018	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: PP3400 DATE: 05-29-2001

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1318.70	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1319.08	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1319.48	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1320.08	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1320.74	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1321.42	600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1322.14	700.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1322.93	800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1323.23	836.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1324.74	1000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: PP3400 DATE: 05-29-2001

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
0.00	0.000	0.00	0.00	0.00
1318.70	0.000	100.00	0.00	0.00
1319.08	0.000	200.00	0.00	0.00
1319.48	0.000	300.00	0.00	0.00
1320.08	0.000	400.00	0.00	0.00
1320.74	0.000	500.00	0.00	0.00
1321.42	0.000	600.00	0.00	0.00
1322.14	0.000	700.00	0.00	0.00
1322.93	0.000	800.00	0.00	0.00
1323.23	0.000	836.00	0.00	0.00
1324.74	0.000	1000.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

PINNACLE PEAK ROAD
Station 34+00
2 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001 FILE DATE: 05-29-2001
CURRENT TIME: 10:49:58 FILE NAME: PP3400

PERFORMANCE CURVE FOR CULVERT 1 - 2(10.00 (ft) BY 4.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1316.50	0.00	-0.30	0-NF	0.00	0.00	0.00	%-1316.20	0.00	0.00
100.00	1318.70	1.37	2.20	1-S2n	0.91	0.92	0.91	%-1312.21	5.47	5.20
200.00	1319.08	2.18	2.58	1-S2n	1.44	1.46	1.44	%-1311.52	6.95	6.42
300.00	1319.48	2.91	2.98	1-S2n	1.89	1.92	1.89	%-1311.00	7.93	7.23
400.00	1320.08	3.58	3.44	1-S2n	2.30	2.32	2.22	%-1310.56	9.01	7.85
500.00	1320.74	4.24	3.95	1-S2n	2.69	2.69	2.59	%-1310.20	9.64	8.33
600.00	1321.42	4.92	4.85	2-M2c	3.05	3.04	3.04	%-1310.20	9.86	8.33
700.00	1322.14	5.64	5.38	2-M2c	3.41	3.37	3.37	%-1310.20	10.38	8.33
800.00	1322.93	6.43	5.87	2-M2c	4.00	3.68	3.68	%-1310.20	10.86	8.33
836.00	1323.23	6.73	6.04	2-M2c	4.00	3.79	3.79	%-1310.20	11.02	8.33
1000.00	1324.74	8.24	7.32	6-FFc	4.00	4.00	3.79	%-1310.20	13.18	8.33

El. inlet face invert 1316.50 ft El. outlet invert 1316.20 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT *************

INLET STATION	3450.00 ft
INLET ELEVATION	1316.50 ft
OUTLET STATION	3400.00 ft
OUTLET ELEVATION	1316.20 ft
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0060
CULVERT LENGTH ALONG SLOPE	50.00 ft

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.018
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	BEVELED EDGE (1.5:1)
INLET DEPRESSION	NONE

PINNACLE PEAK ROAD
Station 34+00
2 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001 FILE DATE: 05-29-2001
CURRENT TIME: 10:49:58 FILE NAME: PP3400

****
************************* TAILWATER *************************
****

***** USER DEFINED CHANNEL CROSS-SECTION FILE NAME: PP4300
MAIN CHANNEL FILE DATE: 5/29/01

LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.025
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0060 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	0.00	6.00
2	14.00	2.50
3	24.00	2.50
4	31.50	0.00
5	39.50	0.00
6	47.00	2.50
7	61.00	6.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	0.00	0.000	%-1316.20	0.00	0.00
100.00	3.99	0.000	%-1312.21	5.20	0.45
200.00	4.68	0.000	%-1311.52	6.42	0.62
300.00	5.20	0.000	%-1311.00	7.23	0.74
400.00	5.64	0.000	%-1310.56	7.85	0.83
500.00	6.00	0.000	%-1310.20	8.33	0.91
600.00	6.00	0.000	%-1310.20	8.33	0.91
700.00	6.00	0.000	%-1310.20	8.33	0.91
800.00	6.00	0.000	%-1310.20	8.33	0.91
836.00	6.00	0.000	%-1310.20	8.33	0.91
1000.00	6.00	0.000	%-1310.20	8.33	0.91

Note: Shear stress was calculated using R.

****
************************* ROADWAY OVERTOPPING DATA *************************
****

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	70.00 ft
CREST LENGTH	60.00 ft
OVERTOPPING CREST ELEVATION	1323.00 ft

****

Pinnacle Peak Road - 60' Wide Channel - 335 cfs
Worksheet for Irregular Channel

Project Description	
Worksheet	Alternative 1 - Pinnacle Peak Rd. Section 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.006000	ft/ft
Discharge	335.00	cfs

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Method	mproved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.029	
Water Surface Elevation	3.17	ft
Elevation Range	0.00 to 6.00	
Flow Area	62.6	ft²
Wetted Perimeter	39.16	ft
Top Width	38.18	ft
Actual Depth	3.17	ft
Critical Elevation	2.82	ft
Critical Slope	0.011658	ft/ft
Velocity	5.35	ft/s
Velocity Head	0.44	ft
Specific Energy	3.62	ft
Froude Number	0.74	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.0	0+24.0	0.025
0+24.0	0+47.0	0.035
0+47.0	0+60.0	0.025

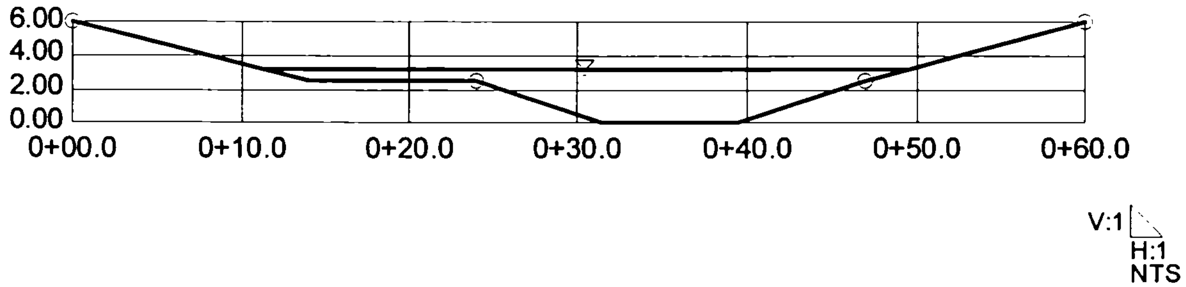
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.0	6.00
0+14.0	2.50
0+24.0	2.50
0+31.5	0.00
0+39.5	0.00
0+47.0	2.50
0+60.0	6.00

Pinnacle Peak Road - 60' Wide Channel - 335 cfs
Cross Section for Irregular Channel

Project Description	
Worksheet	Alternative 1 - Pinnacle Peak Rd. Section 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.029	
Slope	0.006000	ft/ft
Water Surface Elevation	3.17	ft
Elevation Range	0.00 to 6.00	
Discharge	335.00	cfs



Project Engineer: W. Scott Ogden
p:\50430001\area9\engr\fmw\options.fm2 Pentacore Engineering Inc FlowMaster v6.0 [614b]
05/29/01 11:45:51 AM 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Pinnacle Peak Road - 60' Wide Channel - 836 cfs
Worksheet for Irregular Channel

Project Description	
Worksheet	Alternative 1 - Pinnacle Peak Rd. Section 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	0.006000	ft/ft
Discharge	836.00	cfs

Options	
Current Roughness Method	mproved Lotter's Method
Open Channel Weighting Method	mproved Lotter's Method
Closed Channel Weighting Metho	Horton's Method

Results		
Mannings Coefficient	0.029	
Water Surface Elevation	4.46	ft
Elevation Range	0.00 to 6.00	
Flow Area	118.4	ft²
Wetted Perimeter	49.45	ft
Top Width	48.14	ft
Actual Depth	4.46	ft
Critical Elevation	4.05	ft
Critical Slope	0.009857	ft/ft
Velocity	7.06	ft/s
Velocity Head	0.78	ft
Specific Energy	5.24	ft
Froude Number	0.79	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.0	0+24.0	0.025
0+24.0	0+47.0	0.035
0+47.0	0+60.0	0.025

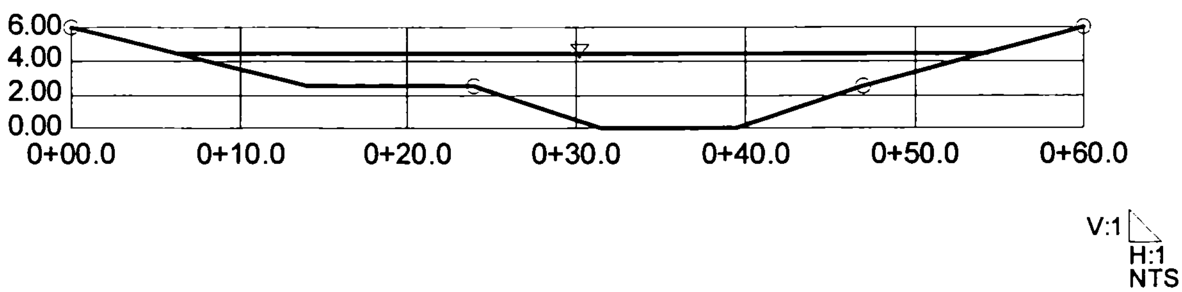
Natural Channel Points

Station (ft)	Elevation (ft)
0+00.0	6.00
0+14.0	2.50
0+24.0	2.50
0+31.5	0.00
0+39.5	0.00
0+47.0	2.50
0+60.0	6.00

Pinnacle Peak Road - 60' Wide Channel - 836 cfs
Cross Section for Irregular Channel

Project Description	
Worksheet	Alternative 1 - Pinnacle Peak Rd. Section 3
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.029	
Slope	0.006000	ft/ft
Water Surface Elevation	4.46	ft
Elevation Range	0.00 to 6.00	
Discharge	836.00	cfs



P n Identification: **Basin 1**

Bottom Area =	17,024.00 Ft²		0.39 Ac
Top Area =	32,000.00 Ft²		0.73 Ac
Bottom Elevation =	1,332.50 Ft		
Top Elevation =	1,338.50 Ft		
Incremental Calculation Depth =	0.50 Ft.	*Note: A minimum of 0.1 foot is the smallest incremental value that can be used.*	
Calculated Total Depth =	**6.00 Ft**		
Calculated Average Volume =	**144728.53 Ft³**		**3.32 Ac-Ft**

Depth D (Ft)	Surface Water Elevation WSEL (Ft)	Incremental Surface Area ΔA (Ft²)	Volume V (Ft³)	Volume V (Ac-Ft)	Percent Total Volume (%)	Incr. Diff. Volume (%)
0.0	1332.5	17024.0	0.0	0.000	0.00	n/a
0.5	1333.0	18272.0	8822.2	0.203	6.10	6.10
1.0	1333.5	19520.0	18268.4	0.419	12.62	6.53
1.5	1334.0	20768.0	28338.8	0.651	19.58	6.96
2.0	1334.5	22016.0	39033.3	0.896	26.97	7.39
2.5	1335.0	23264.0	50351.9	1.156	34.79	7.82
3.0	1335.5	24512.0	62294.5	1.430	43.04	8.25
3.5	1336.0	25760.0	74861.2	1.719	51.73	8.68
4.0	1336.5	27008.0	88052.0	2.021	60.84	9.11
4.5	1337.0	28256.0	101866.8	2.339	70.38	9.55
5.0	1337.5	29504.0	116305.7	2.670	80.36	9.98
5.5	1338.0	30752.0	131368.6	3.016	90.77	10.41
6.0	1338.5	32000.0	147055.6	3.376	101.61	10.84
6.5	1339.0	33248.0	163366.6	3.750	112.88	11.27
7.0	1339.5	34496.0	180301.6	4.139	124.58	11.70
7.5	1340.0	35744.0	197860.7	4.542	136.71	12.13

67^{TH} AVENUE
Station 22+52
1 Barrel - 10'x4' Concrete Box Culvert

1

CURRENT DATE: 06-01-2001   FILE DATE: 06-01-2001
CURRENT TIME: 14:46:06   FILE NAME: 67TH2252

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

C U L V NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1344.00	1338.00	1000.02	1 RCB	10.00	4.00	.018	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs)   FILE: 67TH2252   DATE: 06-01-2001

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1345.37	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1346.18	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1346.91	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1347.58	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1348.24	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1348.92	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1349.64	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1350.43	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1355.83	450.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1359.08	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS   FILE: 67TH2252   DATE: 06-01-2001

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
0.00	0.000	0.00	0.00	0.00
1345.37	0.000	50.00	0.00	0.00
1346.18	0.000	100.00	0.00	0.00
1346.91	0.000	150.00	0.00	0.00
1347.58	0.000	200.00	0.00	0.00
1348.24	0.000	250.00	0.00	0.00
1348.92	0.000	300.00	0.00	0.00
1349.64	0.000	350.00	0.00	0.00
1350.43	0.000	400.00	0.00	0.00
1355.83	0.000	450.00	0.00	0.00
1359.08	0.000	500.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010   <2> TOLERANCE (%) = 1.000

Culvert Rating Curve
67th Avenue - Station 22+52

Discharge	0	36	81	157	230	306	373	433
Elevation	1344	1345	1346	1347	1348	1349	1350	1351

67TH AVENUE
Station 22+52
1 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 06-01-2001 FILE DATE: 06-01-2001
CURRENT TIME: 14:46:06 FILE NAME: 67TH2252

PERFORMANCE CURVE FOR CULVERT 1 - 1(10.00 (ft) BY 4.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1344.00	0.00	-6.00	0-NF	0.00	0.00	0.00	%-1338.00	0.00	0.00
50.00	1345.37	1.37	-3.37	1-S2n	0.91	0.92	0.82	%-1335.01	6.09	3.67
100.00	1346.18	2.18	-2.59	1-S2n	1.44	1.46	1.36	%-1334.19	7.34	4.31
150.00	1346.91	2.91	-1.50	1-S2n	1.89	1.92	1.82	%-1333.61	8.26	4.75
200.00	1347.58	3.58	-0.11	1-S2n	2.30	2.32	2.22	%-1333.14	9.01	5.10
250.00	1348.24	4.24	1.62	1-S2n	2.69	2.69	2.59	%-1332.75	9.64	5.38
300.00	1348.92	4.92	4.85	2-M2c	3.05	3.04	3.04	%-1332.39	9.86	5.63
350.00	1349.64	5.64	5.38	2-M2c	3.41	3.37	3.37	%-1332.09	10.38	5.84
400.00	1350.43	6.43	5.87	2-M2c	4.00	3.68	3.68	%-1332.00	10.86	5.90
450.00	1355.84	7.29	11.84	2-M2c	4.00	3.99	3.99	%-1332.00	11.29	5.90
500.00	1359.08	8.24	15.08	6-FFc	4.00	4.00	4.00	%-1332.00	12.50	5.90

El. inlet face invert 1344.00 ft El. outlet invert 1338.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION	3252.00 ft
INLET ELEVATION	1344.00 ft
OUTLET STATION	2252.00 ft
OUTLET ELEVATION	1338.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0060
CULVERT LENGTH ALONG SLOPE	1000.02 ft

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.018
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	BEVELED EDGE (1.5:1)
INLET DEPRESSION	NONE

67TH AVENUE
Station 22+52
1 Barrel - 10'x4' Concrete Box Culvert


```
CURRENT DATE: 06-01-2001                              FILE DATE: 06-01-2001
CURRENT TIME: 14:46:06                                FILE NAME: 67TH2252

*******************************************************************************
*************************         TAILWATER          *************************
*******************************************************************************

***** USER DEFINED CHANNEL CROSS-SECTION              FILE NAME: 67TH2252
      MAIN CHANNEL                                    FILE DATE: 6/1/01
      LEFT CHANNEL BOUNDARY          0
      RIGHT CHANNEL BOUNDARY         0
      MANNING n LEFT OVER BANK       0.000
      MANNING n MAIN CHANNEL         0.029
      MANNING n RIGHT OVER BANK       0.000
      SLOPE OF CHANNEL               0.0035 ft/ft

      CROSS-SECTION     X          Y
        COORD. NO.     (ft)       (ft)
            1           0.00       6.00
            2          16.00       2.00
            3          22.00       0.00
            4          30.00       0.00
            5          36.00       2.00
            6          46.00       2.00
            7          63.00       6.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

        FLOW     W.S.E.  FROUDE   DEPTH     VEL.   SHEAR
        (cfs)     (ft)   NUMBER    (ft)    (f/s)   (psf)
         0.00     0.00   0.000  %-1338.00    0.00    0.00
        50.00     2.99   0.000  %-1335.01    3.67    0.29
       100.00     3.81   0.000  %-1334.19    4.31    0.37
       150.00     4.39   0.000  %-1333.61    4.75    0.43
       200.00     4.86   0.000  %-1333.14    5.10    0.48
       250.00     5.25   0.000  %-1332.75    5.38    0.52
       300.00     5.61   0.000  %-1332.39    5.63    0.55
       350.00     5.91   0.000  %-1332.09    5.84    0.58
       400.00     6.00   0.000  %-1332.00    5.90    0.59
       450.00     6.00   0.000  %-1332.00    5.90    0.59
       500.00     6.00   0.000  %-1332.00    5.90    0.59
Note: Shear stress was calculated using R.

*******************************************************************************
*************************  ROADWAY OVERTOPPING DATA  *************************
*******************************************************************************

      ROADWAY SURFACE                           PAVED
      EMBANKMENT TOP WIDTH                      40.00 ft
      CREST LENGTH                             100.00 ft
      OVERTOPPING CREST ELEVATION             1350.00 ft

*******************************************************************************
```

67TH AVENUE
Station 14+10
1 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001 FILE DATE: 05-29-2001
CURRENT TIME: 14:20:11 FILE NAME: 67TH1410

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1334.00	1333.82	50.00	1 RCB	10.00	4.00	.018	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 67TH1410 DATE: 05-29-2001

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1335.47	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1336.34	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1337.06	150.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1337.69	200.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1338.30	250.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1338.93	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1339.65	350.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1340.43	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1341.29	450.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1342.24	500.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 67TH1410 DATE: 05-29-2001

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
0.00	0.000	0.00	0.00	0.00
1335.47	0.000	50.00	0.00	0.00
1336.34	0.000	100.00	0.00	0.00
1337.06	0.000	150.00	0.00	0.00
1337.69	0.000	200.00	0.00	0.00
1338.30	0.000	250.00	0.00	0.00
1338.93	0.000	300.00	0.00	0.00
1339.65	0.000	350.00	0.00	0.00
1340.43	0.000	400.00	0.00	0.00
1341.29	0.000	450.00	0.00	0.00
1342.24	0.000	500.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

67TH AVENUE
Station 14+10
1 Barrel - 10'x4' Concrete Box Culvert

CURRENT DATE: 05-29-2001 FILE DATE: 05-29-2001
CURRENT TIME: 14:20:11 FILE NAME: 67TH1410

****

PERFORMANCE CURVE FOR CULVERT 1 - 1(10.00 (ft) BY 4.00 (ft)) RCB

****

DIS- CHARGE FLOW (cfs)	HEAD- WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1334.00	0.00	-0.18	0-NF	0.00	0.00	0.00	%-1333.82	0.00	0.00
50.00	1335.47	1.37	1.47	2-M2c	1.08	0.92	0.92	%-1330.83	5.43	3.67
100.00	1336.34	2.18	2.34	2-M2c	1.71	1.46	1.46	%-1330.01	6.84	4.31
150.00	1337.06	2.91	3.06	2-M2c	2.25	1.92	1.92	%-1329.43	7.83	4.75
200.00	1337.69	3.59	3.69	2-M2c	2.75	2.32	2.32	%-1328.96	8.62	5.10
250.00	1338.30	4.25	4.30	2-M2c	3.22	2.69	2.69	%-1328.57	9.28	5.38
300.00	1338.93	4.93	4.85	2-M2c	4.00	3.04	3.04	%-1328.21	9.86	5.63
350.00	1339.65	5.65	5.38	2-M2c	4.00	3.37	3.37	%-1327.91	10.38	5.84
400.00	1340.43	6.43	5.97	2-M2c	4.00	3.68	3.68	%-1327.82	10.86	5.90
450.00	1341.29	7.29	6.75	2-M2c	4.00	3.99	3.99	%-1327.82	11.29	5.90
500.00	1342.24	8.24	7.44	6-FFc	4.00	4.00	3.99	%-1327.82	12.55	5.90

****

El. inlet face invert 1334.00 ft El. outlet invert 1333.82 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

****

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION	1460.00 ft
INLET ELEVATION	1334.00 ft
OUTLET STATION	1410.00 ft
OUTLET ELEVATION	1333.82 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0036
CULVERT LENGTH ALONG SLOPE	50.00 ft

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.018
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	BEVELED EDGE (1.5:1)
INLET DEPRESSION	NONE

****

67TH AVENUE
Station 14+10
1 Barrel - 10'x4' Concrete Box Culvert


```
CURRENT DATE: 05-29-2001                                   FILE DATE: 05-29-2001
CURRENT TIME: 14:20:11                                     FILE NAME: 67TH1410

********************************************************************************
**************************          TAILWATER          **************************
********************************************************************************

***** USER DEFINED CHANNEL CROSS-SECTION                   FILE NAME: 67TH1410
      MAIN CHANNEL                                         FILE DATE: 5/29/01
      LEFT CHANNEL BOUNDARY          0
      RIGHT CHANNEL BOUNDARY         0
      MANNING n LEFT OVER BANK       0.000
      MANNING n MAIN CHANNEL         0.029
      MANNING n RIGHT OVER BANK       0.000
      SLOPE OF CHANNEL               0.0035 ft/ft

      CROSS-SECTION     X          Y
        COORD. NO.     (ft)       (ft)
            1           0.00       6.00
            2          16.00       2.00
            3          22.00       0.00
            4          30.00       0.00
            5          36.00       2.00
            6          46.00       2.00
            7          63.00       6.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

        FLOW     W.S.E.  FROUDE   DEPTH     VEL.   SHEAR
        (cfs)     (ft)   NUMBER    (ft)    (f/s)   (psf)
         0.00     0.00    0.000  %-1333.82    0.00    0.00
        50.00     2.99    0.000  %-1330.83    3.67    0.29
       100.00     3.81    0.000  %-1330.01    4.31    0.37
       150.00     4.39    0.000  %-1329.43    4.75    0.43
       200.00     4.86    0.000  %-1328.96    5.10    0.48
       250.00     5.25    0.000  %-1328.57    5.38    0.52
       300.00     5.61    0.000  %-1328.21    5.63    0.55
       350.00     5.91    0.000  %-1327.91    5.84    0.58
       400.00     6.00    0.000  %-1327.82    5.90    0.59
       450.00     6.00    0.000  %-1327.82    5.90    0.59
       500.00     6.00    0.000  %-1327.82    5.90    0.59
Note: Shear stress was calculated using R.

********************************************************************************
**************************  ROADWAY OVERTOPPING DATA  **************************
********************************************************************************

      ROADWAY SURFACE                                 PAVED
      EMBANKMENT TOP WIDTH                            40.00 ft
      CREST LENGTH                                    75.00 ft
      OVERTOPPING CREST ELEVATION                   1342.00 ft

********************************************************************************
```

Level III: Hydraulic Calculations
Grand Avenue Channel

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

CHECK ______ DATE ______

CLIENT FCD 99-44

JOB NAME Glendale Peoria ADMP

JOB NO. 310.017

Figure Grand-I : Level 3 Hydraulic Analysis of Grand Avenue Channel

LEGEND

- - - Channel

Analyzed Culvert

Cross Section Used For Normal Depth Calculations

CN27 Concentration Point

Floodway or Floodplain

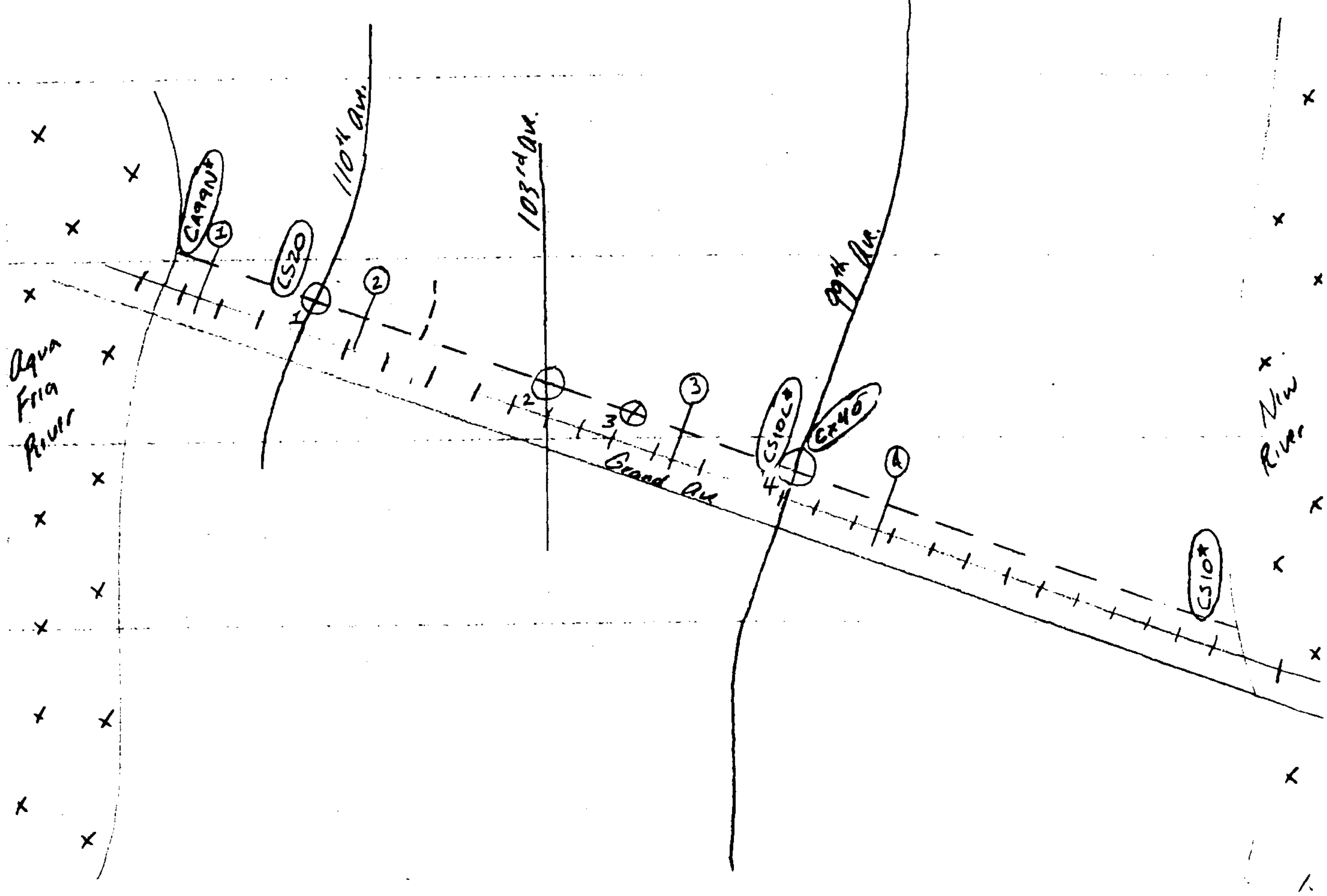
Railroad Tracks

N

Not To Scale

HYDROLOGY*

Concentration Point	Flow (cfs)
CA99N*	750
CS20	470
CS10C*	1380
CX40	2540
CS10*	3050



* see Glendale Peoria ADMP Hydrology - Volume HY

Glendale Peoria ADMP
Grand Ave Culvert Analysis: Elevations
Table Grand-2.2

Culvert# [1]	Culvert Log # [2]	Cross Street	Size	Cross Section Geometry Used [1,3]	End of Culvert invert Elevation [4]	Beginning of Culvert invert Elevation [4]	Estimated Roadway Crest [4]	Headwater Elevation*	Top of Roadway Width [ft]
1	199.35	110th Ave	2 60" RCP Storm Drains	1	1138.8	1139.0	1148.2	1148.8	63.5
2	199.36	103rd Ave	3 48" RCP Storm Drains	3	1140.2	1140.6	1146.3	1147.4	71
3	200.86	100th Ave	3 48" RCP Storm Drains	3	1138.5	1138.9	1144.0	1146.4	31
4	199.2	99th Ave	Single 4 x10 CBC	4	1134.9	1135.2	1142.8	1143.4	100

* Elevations were found using attached calculations
[1] See Figure Grand-1
[2] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC
[3] The tailwater XS geometry, along with the culvert outlet elevation were used to create the tailwater rating curve using HY8
[4] Elevations referenced from field survey information found in the Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

Glendale Peoria ADMP
Grand Ave Culvert Analysis: General
Table Grand-2.1

Culvert# [1]	Culvert Log # [2]	Cross Street	Size	Estimated Length [ft]	Slope [ft/ft]	HEC-1 Flow Parameter [3] [cfs]	100yr 6hr Flow [3] [cfs]
1	199.35	110th Ave	2 60" RCP Storm Drains	87.5	0.003	CS20	750
2	199.36	103rd Ave	3 48" RCP Storm Drains	82.3	0.005	CS10C*	1380
3	200.86	100th Ave	3 48" RCP Storm Drains	56	0.008	CS10C*	1380
4	199.2	Grand Ave and 99th Ave	Single 4 x10 CBC	127	0.002	CS10C*	1380

[1] See Figure Grand-1

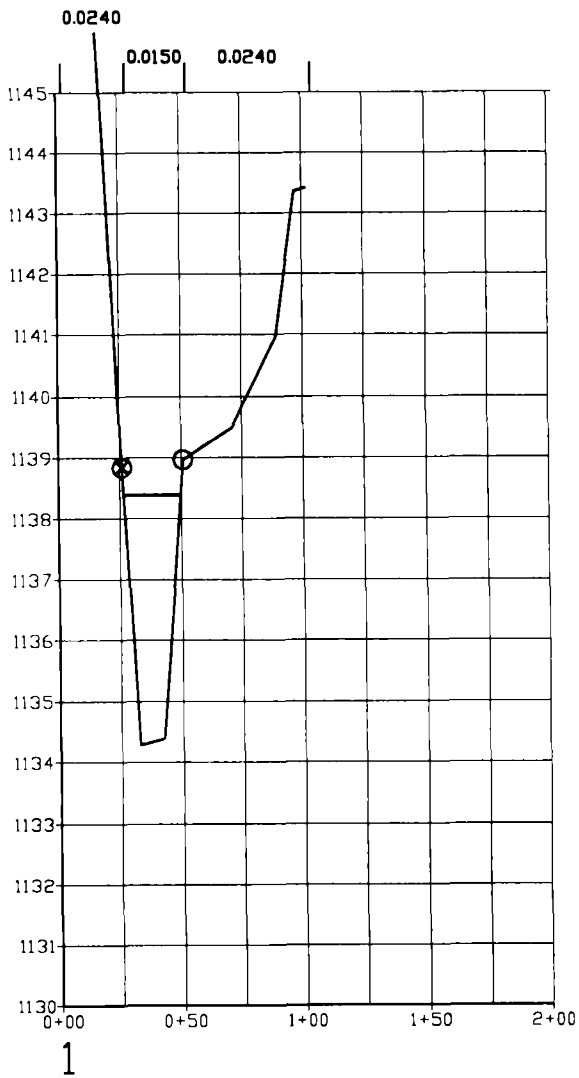
[2] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[3] Referenced from Glendale Peoria Area Drainage Master Plan Update- Hydrology- Volume HY

Glendale Peoria ADMP
Grand Ave Surveyed Cross Sections
Table Grand-1

Channel XS #	Cross Street	Slope [ft/ft]	HEC-1 Flow Parameter	100yr 6hr Flow [cfs]	*Hydrology Modification	Invert Elevation [ft]	WS Elevation [ft]	Embankment Elevation [1] [ft]
1	West of Del Webb between 111th Ave and Aqua Fria	0.00353	CA99N*	750	Exclude RA05A	1134.3	1138.8	1142
2	West of Del Webb between Del Webb and 111th Ave	0.00353	CS20	470	none	1139.9	1143.1	1144.3
3	East of Del Webb between Del Webb and 99th Ave	0.00257	CS10C*	1380	Exclude route RX40S	1136.7	1142.6	1150.5
4	East of Del Webb between 99th Ave and New River	0.00257	CS10*	3050	Exclude RS10B and S10A	1133	1140.2	1143.5

[1] Last Survey Shot Nearest to Roadway



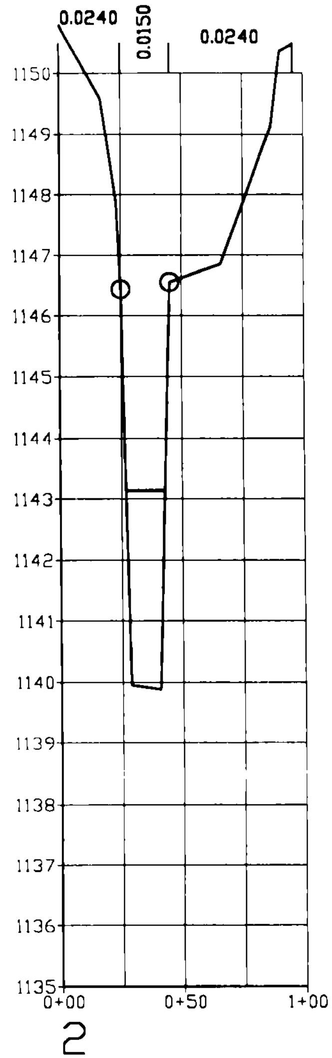
Normal Depth Results

Cross-Section:	1	
Elevation:	1138.39	ft MSL
Depth:	4.11	ft
Discharge:	750.00	cfs
Energy Gradient:	0.0035	ft/ft
Froude Number:	0.975	
Flow Regime:	Critical	
Flow Area:	66.88	sq ft
Average Velocity:	11.18	ft/s
Maximum Velocity:	11.18	ft/s
Composite n:	0.015	
Hydraulic Radius:	2.63	ft
Wetted Perimeter:	25.47	ft
Wetted Top Width:	23.19	ft
Critical Slope:	0.0037	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™



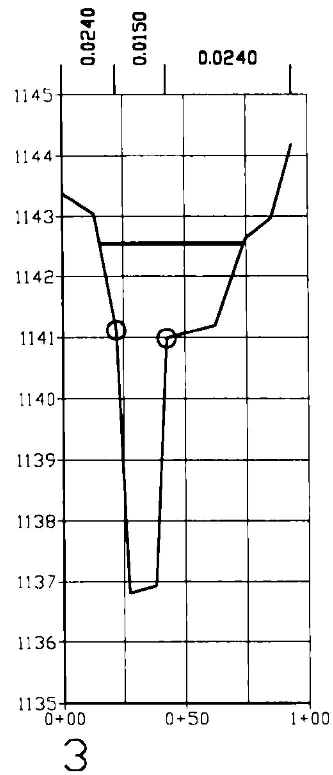
Normal Depth Results

Cross-Section:	2	
Elevation:	1143.14	ft MSL
Depth:	3.26	ft
Discharge:	470.00	cfs
Energy Gradient:	0.0037	ft/ft
Froude Number:	1.0245	
Flow Regime:	Critical	
Flow Area:	44.80	sq ft
Average Velocity:	10.52	ft/s
Maximum Velocity:	10.52	ft/s
Composite n:	0.015	
Hydraulic Radius:	2.3	ft
Wetted Perimeter:	19.49	ft
Wetted Top Width:	15.89	ft
Critical Slope:	0.0035	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™



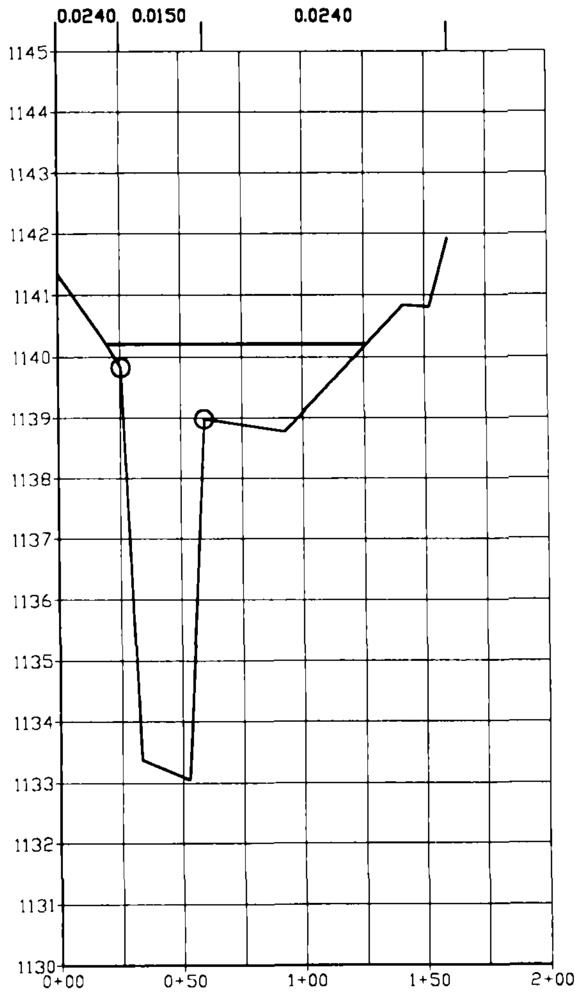
Normal Depth Results

Cross-Section:	3	
Elevation:	1142.55	ft MSL
Depth:	5.74	ft
Discharge:	1380.00	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7387	
Flow Regime:	Subcritical	
Flow Area:	137.52	sq ft
Average Velocity:	10.06	ft/s
Maximum Velocity:	12.91	ft/s
Composite n:	0.0208	
Hydraulic Radius:	2.22	ft
Wetted Perimeter:	61.92	ft
Wetted Top Width:	58.58	ft
Critical Slope:	0.0124	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™



4

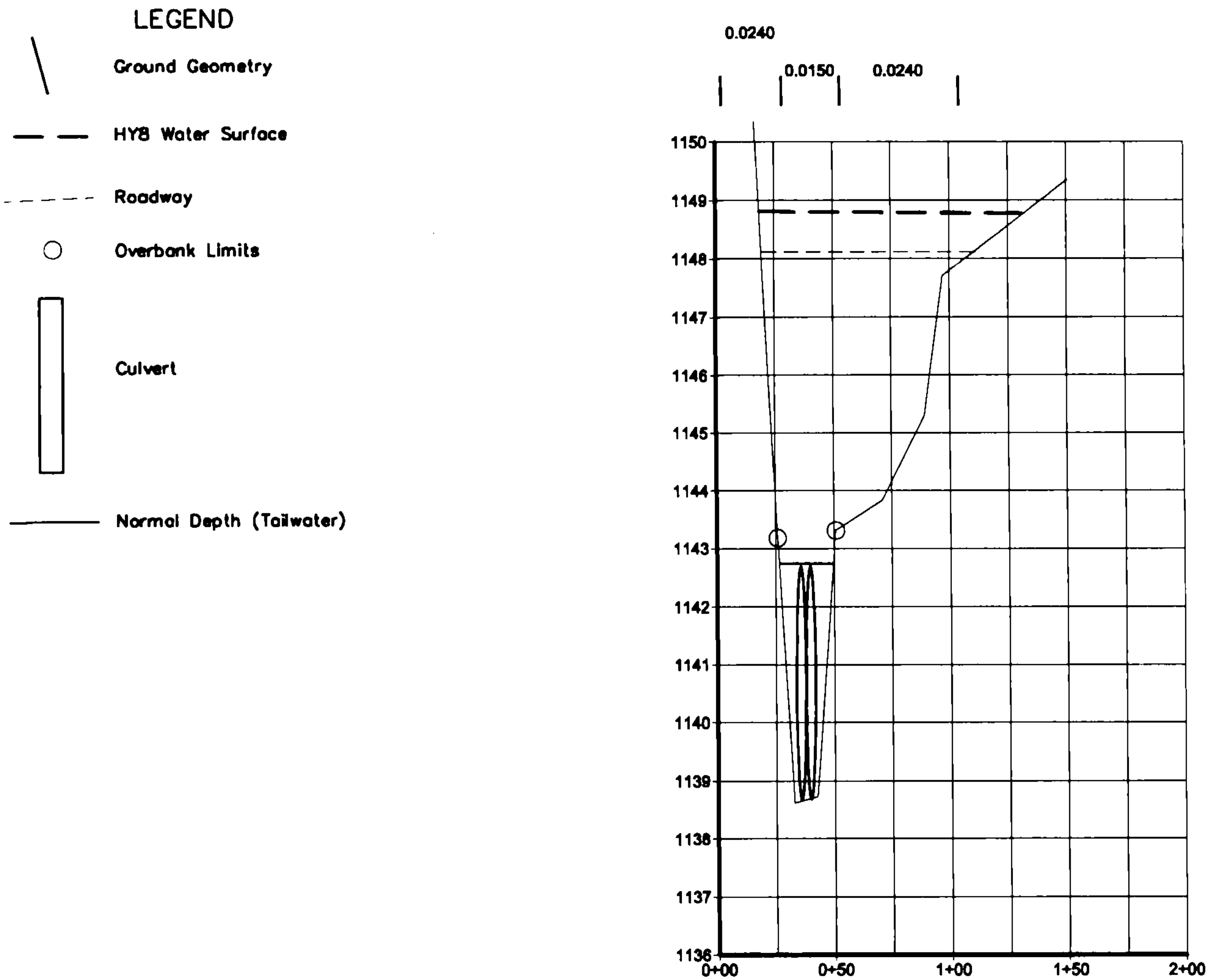
Normal Depth Results

Cross-Section:	4	
Elevation:	1140.20	ft MSL
Depth:	7.15	ft
Discharge:	3070.00	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7732	
Flow Regime:	Subcritical	
Flow Area:	261.76	sq ft
Average Velocity:	11.75	ft/s
Maximum Velocity:	14.80	ft/s
Composite n:	0.021	
Hydraulic Radius:	2.35	ft
Wetted Perimeter:	111.17	ft
Wetted Top Width:	106.57	ft
Critical Slope:	0.0147	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™



Culvert 1

Normal Depth Results

Cross-Section:	199.35	
Elevation:	1142.94	ft MSL
Depth:	4.11	ft
Discharge:	750.00	cfs
Energy Gradient:	0.0035	ft/ft
Froude Number:	0.975	
Flow Regime:	Critical	
Flow Area:	66.88	sq ft
Average Velocity:	10.60	ft/s
Maximum Velocity:	11.18	ft/s
Composite n:	0.015	
Hydraulic Radius:	2.63	ft
Wetted Perimeter:	25.47	ft
Wetted Top Width:	23.19	ft
Critical Slope:	0.0037	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

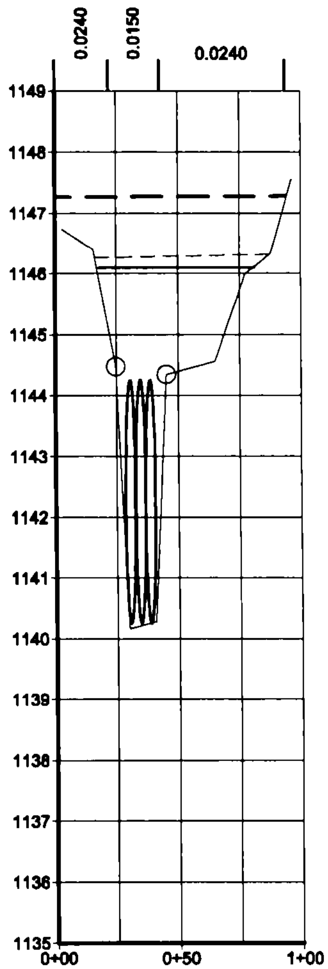
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Culvert 2

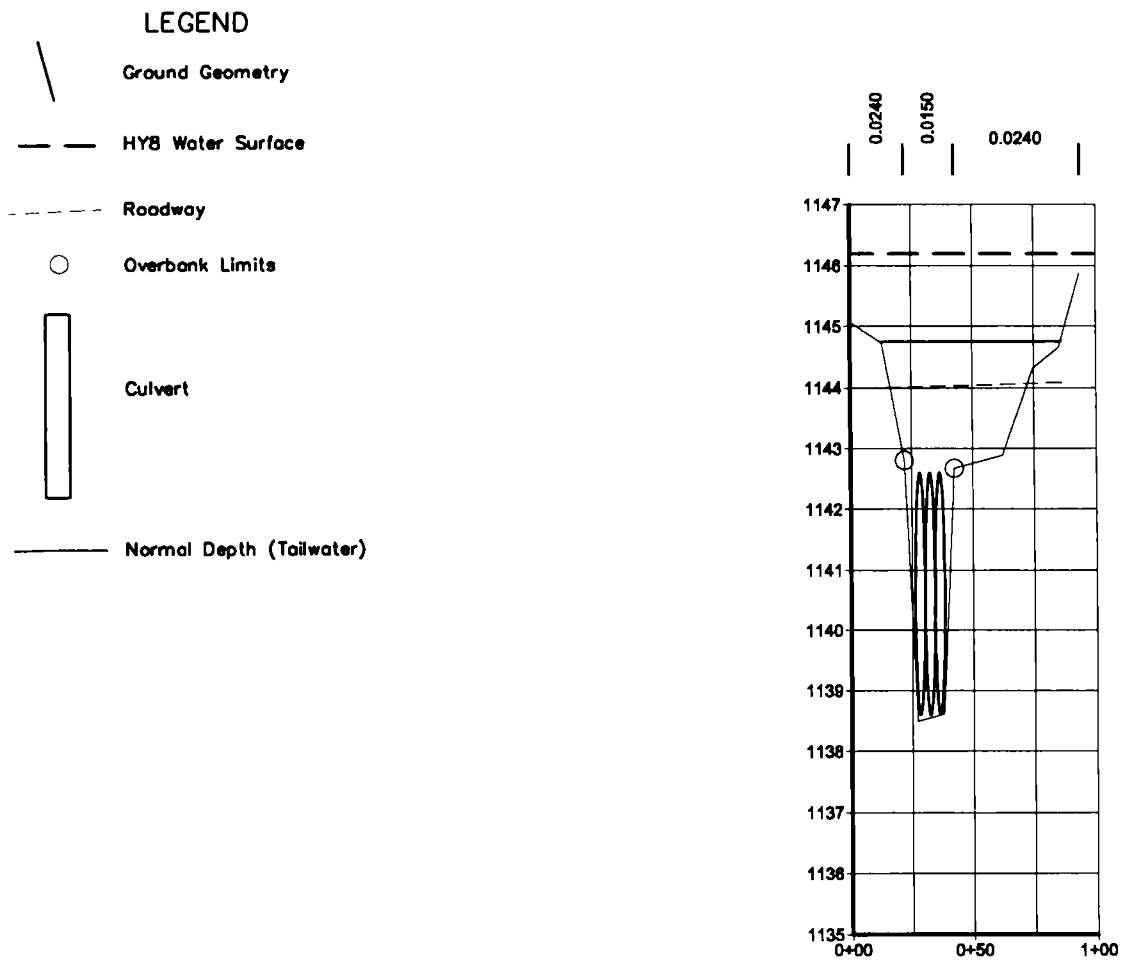
Normal Depth Results

Cross-Section:	199.36	
Elevation:	1146.03	ft MSL
Depth:	5.83	ft
Discharge:	1380.00	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7387	
Flow Regime:	Subcritical	
Flow Area:	137.52	sq ft
Average Velocity:	7.69	ft/s
Maximum Velocity:		ft/s
Composite n:	0.0208	
Hydraulic Radius:	2.22	ft
Wetted Perimeter:	61.92	ft
Wetted Top Width:	58.58	ft
Critical Slope:	0.0124	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™



Culvert 3

Normal Depth Results		
Cross-Section:	3	
Elevation:	1144.79	ft MSL
Depth:	6.29	ft
Discharge:	1380.00	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7367	
Flow Regime:	Subcritical	
Flow Area:	137.52	sq ft
Average Velocity:	12.37	ft/s
Maximum Velocity:		ft/s
Composite n:	0.0208	
Hydraulic Radius:	2.22	ft
Wetted Perimeter:	61.92	ft
Wetted Top Width:	58.58	ft
Critical Slope:	0.0124	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

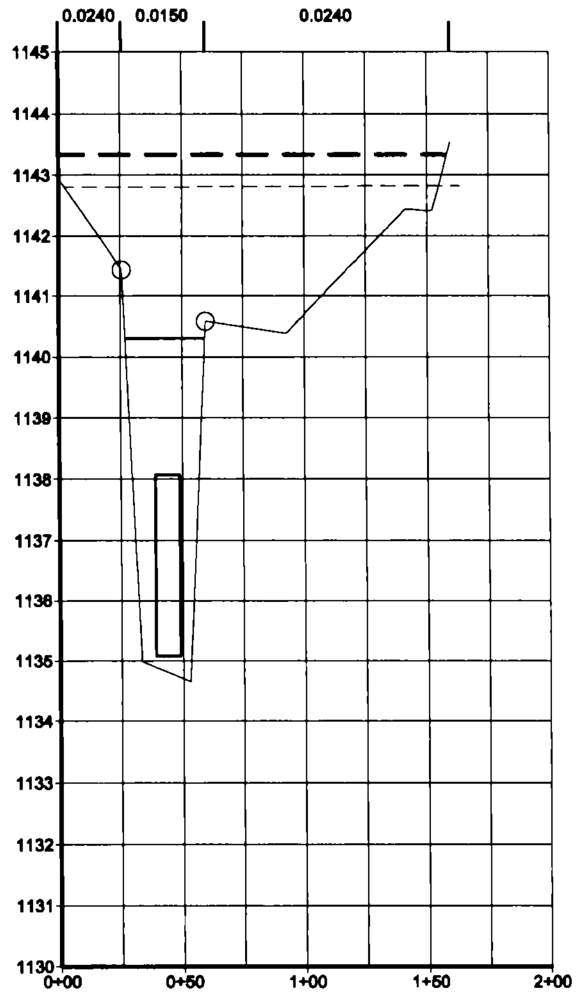
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Normal Depth Results

Cross-Section:	199.20	
Elevation:	1140.14	ft MSL
Depth:	5.24	ft
Discharge:	1360	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7732	
Flow Regime:	Subcritical	
Flow Area:	261.76	sq ft
Average Velocity:	11.07	ft/s
Maximum Velocity:		ft/s
Composite n:	0.021	
Hydraulic Radius:	2.35	ft
Wetted Perimeter:	111.17	ft
Wetted Top Width:	106.57	ft
Critical Slope:	0.0147	ft/ft

Culvert 4

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Grand Ave Channel (100yr 6hr)

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SHEET 1 OF 3

BY JS DATE 1/9/01

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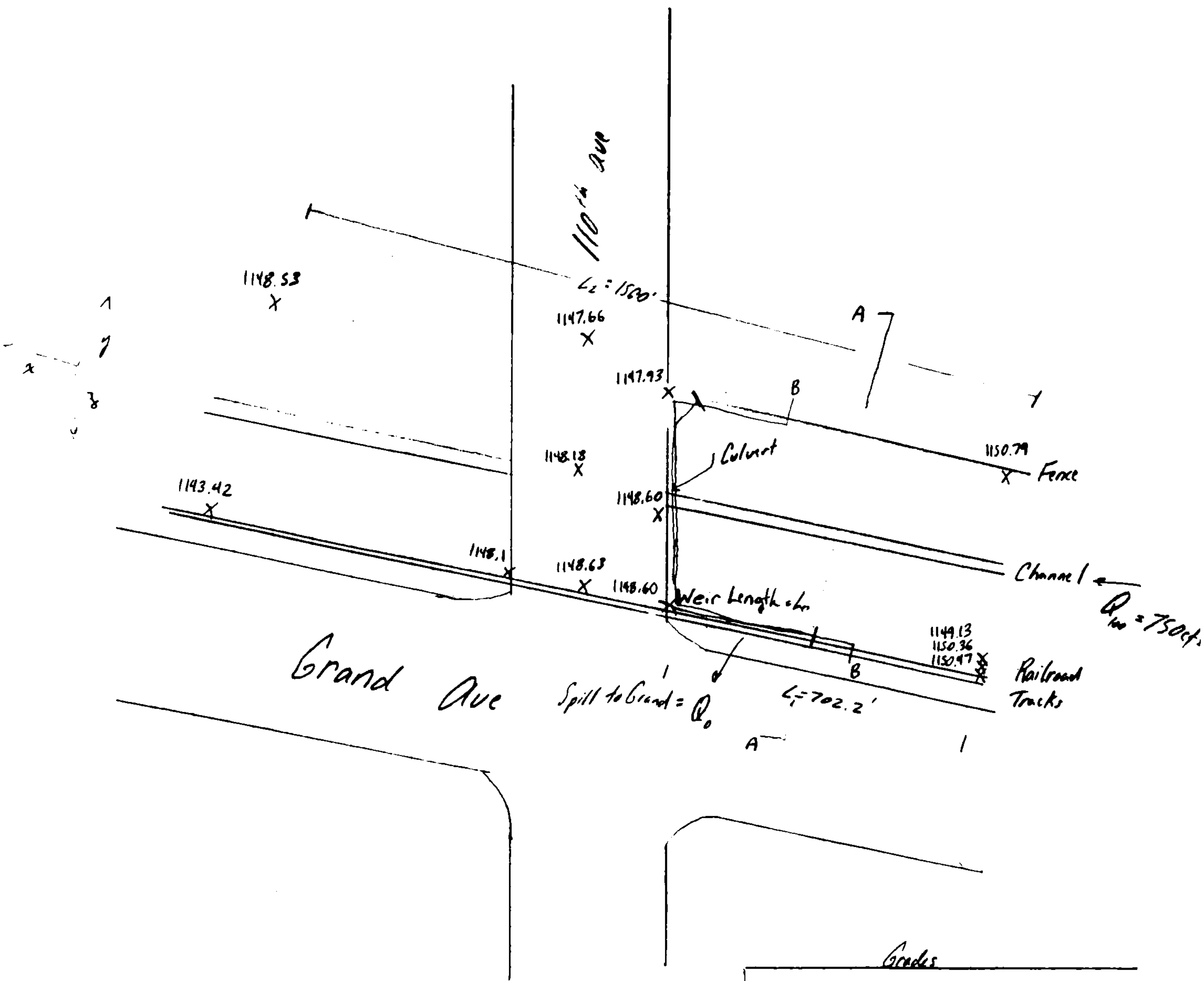
JOB NAME Glendale/Peoria ADMP

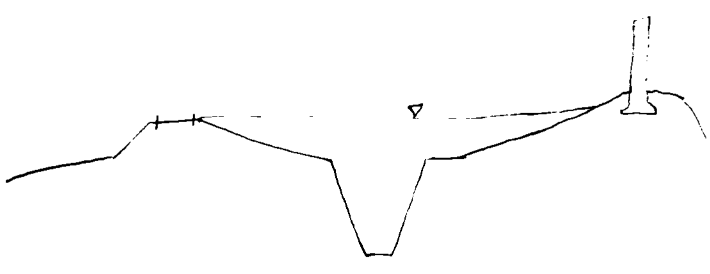
JOB NO. 310.017

Culvert #1

Hydraulic Analysis of Grand Ave Channel

110th ave (Culvert # 199.35)





Section A-A

Grades

$$\text{Fence Slope} = \frac{(1150.79 - 1148.53)}{1560} = .00145$$

$$\text{RailRoad} = \frac{(1150.47 - 1145.52)}{1560} = .00446$$

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JOB NAME Glendale / Peoria ADMP

Grand Ave @ 110th Ave. (Culvert #1)

JOB NO. 310.017

SHEET 2 OF 3

BY JS DATE 1/9/01

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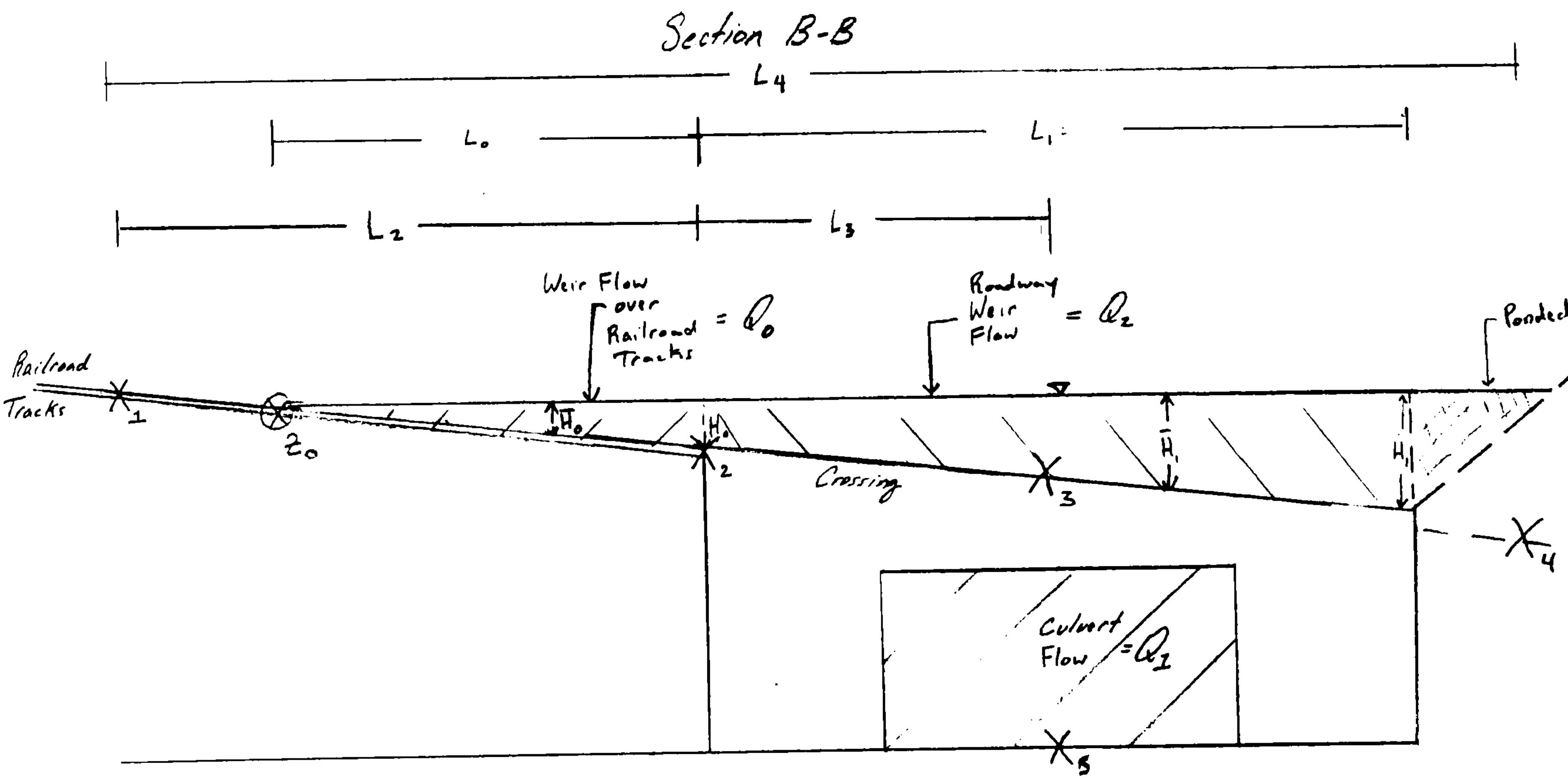


Z_0 is iterated using the attached spreadsheet.

$Q_{100yr} = Q_0 + Q_1 + Q_2 = 750\,cfs$

$\downarrow$

$\bar{H}_1$ = Average Depth Over Culvert Crossing = 1.3ft

Q_0 = Flow over railroad, to Grand ave roadway = 6cfs

Z_0 = Estimated water surface elevation = 1148.83

Glendale Peoria ADMP
Hydraulic Analyis of Grand Ave
Culvert # 199.35 at 110th Ave

Iterative Data	
Zo	1148.836
Target Q	750
Q Total	750.134138
Difference	-0.13413838

Calculations	
Railroad Slope	0.00445513
Lo	46.2388489
Ho	0.206
Avg Ho	0.13733333
Qo	6.35381726
Roadway Slope	0.01190476
Z1	1147.52286
H1	1.31314286
Avg H1	0.92608344
Q2	223.780321
HW/D	2.01121669
Q from Nomo	260
Q1	520

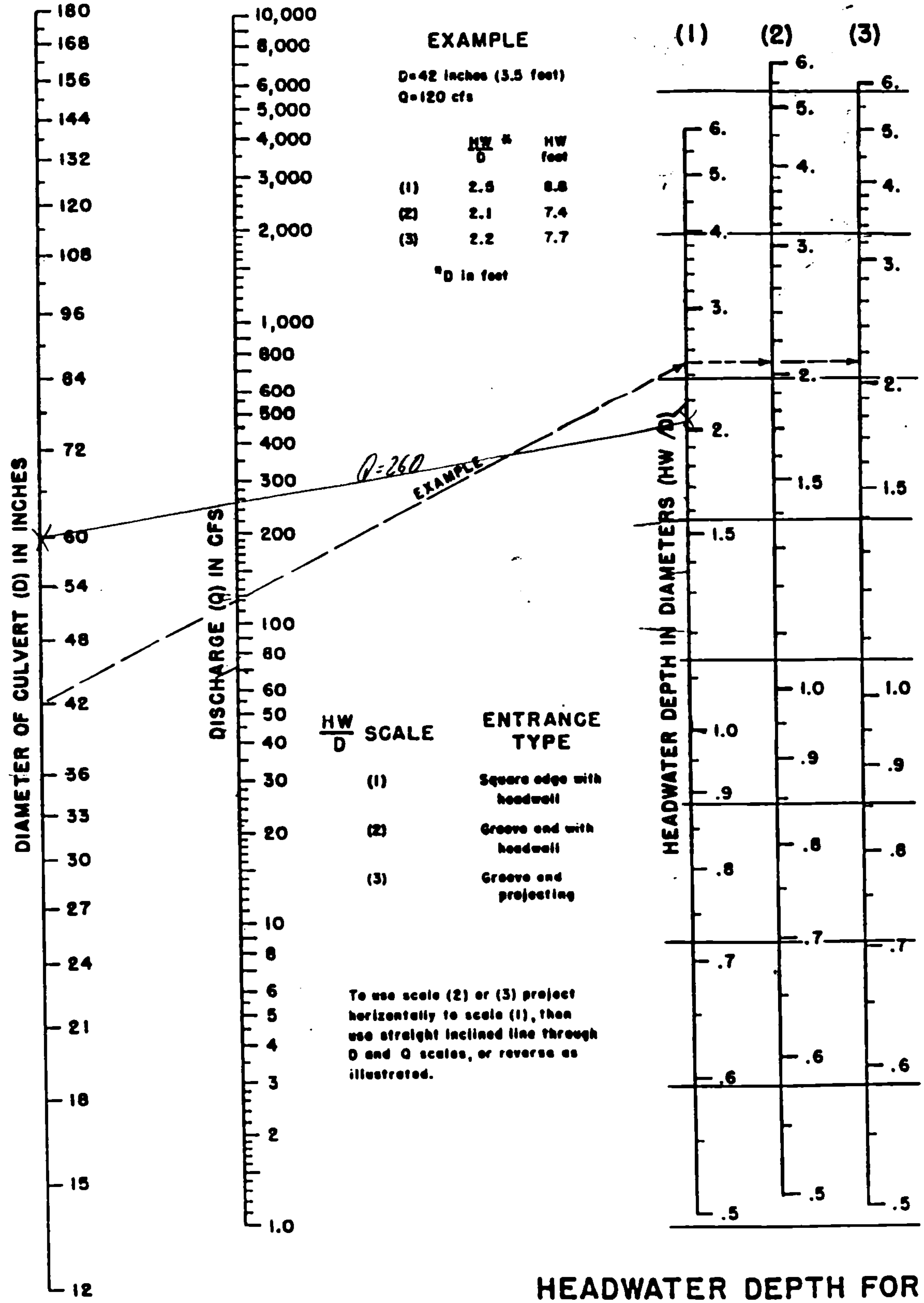
Survey Data	
Spot Elevations	
<u>Upstream</u>	
Roadway [X_2]	1148.63
Railroad [X_1]	1150.47
<u>Downstream</u>	
Roadway [X_3]	1148.13
Railroad [X_4]	1143.52
Distances (Upstream to Downstream)	
Roadway [L_3]	42
Railroad [L_4]	1560
Other Distances	
Upstream Railroad to Upstream Roadway [L_2]	702.2
Roadway Crest [L_1]	93
Culvert Diameter	60
Invert Elevation [X_5]	1139

Constants	
Wier Coefficent	2.7
# of Culverts	2

Sheet 5 of 5
By JJS, 1/9/01

Culvert #1
@ 110th ave and Grand

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

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SHEET 1 OF 4
BY JS DATE 1/9/01
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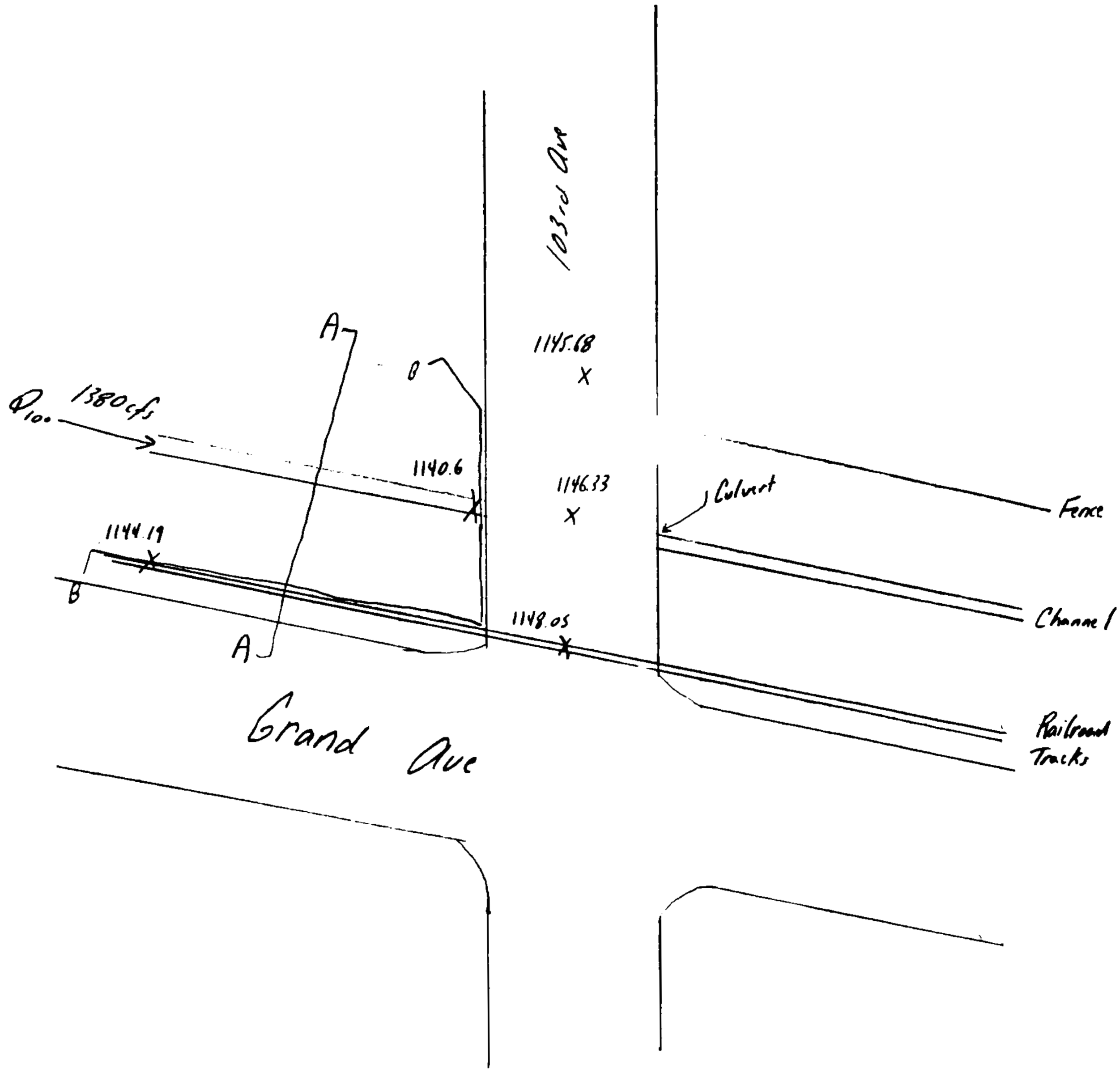
CLIENT FCD

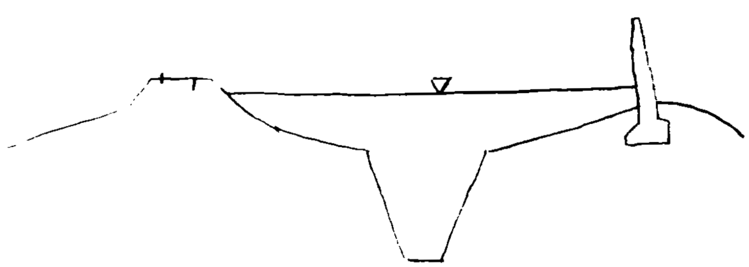
JOB NAME Glendale/Peoria ADMP

JOB NO. 310.017

Culvert #2
Hydraulic Analysis of Grand Ave Channel
103rd ave (Culvert # 199.36)



Section A-A



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JOB NAME Glendale / Peoria ADMP

Grand Ave @ 103rd Ave (Culvert #2)

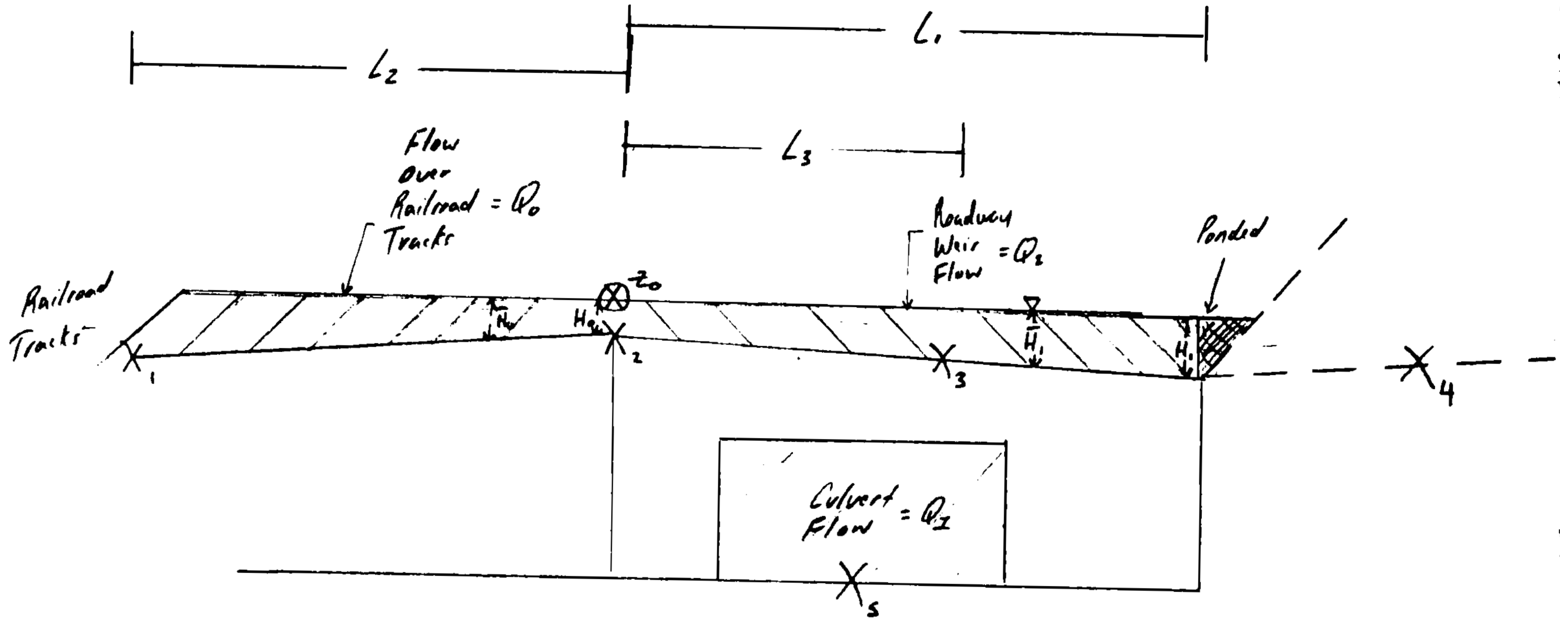
SHEET 1 OF 4

BY JJ DATE 1/9/01

CHECK ___ DATE ___

JOB NO. 210.017

Section B-B



Z_0 is set to X_2, so $L_0 = 0$, $H_0 = 0$, if $Q_1 + Q_2 <$ Target Flow, the remaining flow spills over the tracks to Grand Ave.
See attached spreadsheet for calculations.

$Q_{100\,year} = 1380$

$\bar{H}_1$ = Average Depth Over Culvert Crossing = 2.17 ft.

Q = Flow Over Railroad, to Grand Ave = 0 cfs

Z_0 = Estimated Water Surface Elevation = 1147.36

Glendale Peoria ADMP
Hydraulic Analyis of Grand Ave
Culvert # 199.36 at 103rd Ave

Iterative Data	
Zo	1147.363
Target Q	1380
Q Total	1380.25979
Difference	-0.25978717

Calculations	
Railroad Slope	-0.01953441
Lo	0
Ho	0
Avg Ho	0
Qo	0
Roadway Slope	0.03714903
Z1	1143.91048
H1	3.4525162
Avg H1	2.16778013
Q2	960.259787
HW/D	1.97444503
Q from Nomo	140
Q1	420

Survey Data	
Spot Elevations	
Upstream	
Roadway [X_2]	1148.05
Railroad [X_1]	1144.19
Downstream	
Roadway [X_3]	1146.33
Railroad [X_4]	1148.05
Distances (Upstream to Downstream)	
Roadway [L_3]	46.3
Railroad [L_4]	197.6
Other Distances	
Upstream Railroad to Upstream Roadway [L_2]	197.6
Roadway Crest [L_1]	111.43
Culvert Diameter	48
Invert Elevation [X_5]	1140.6

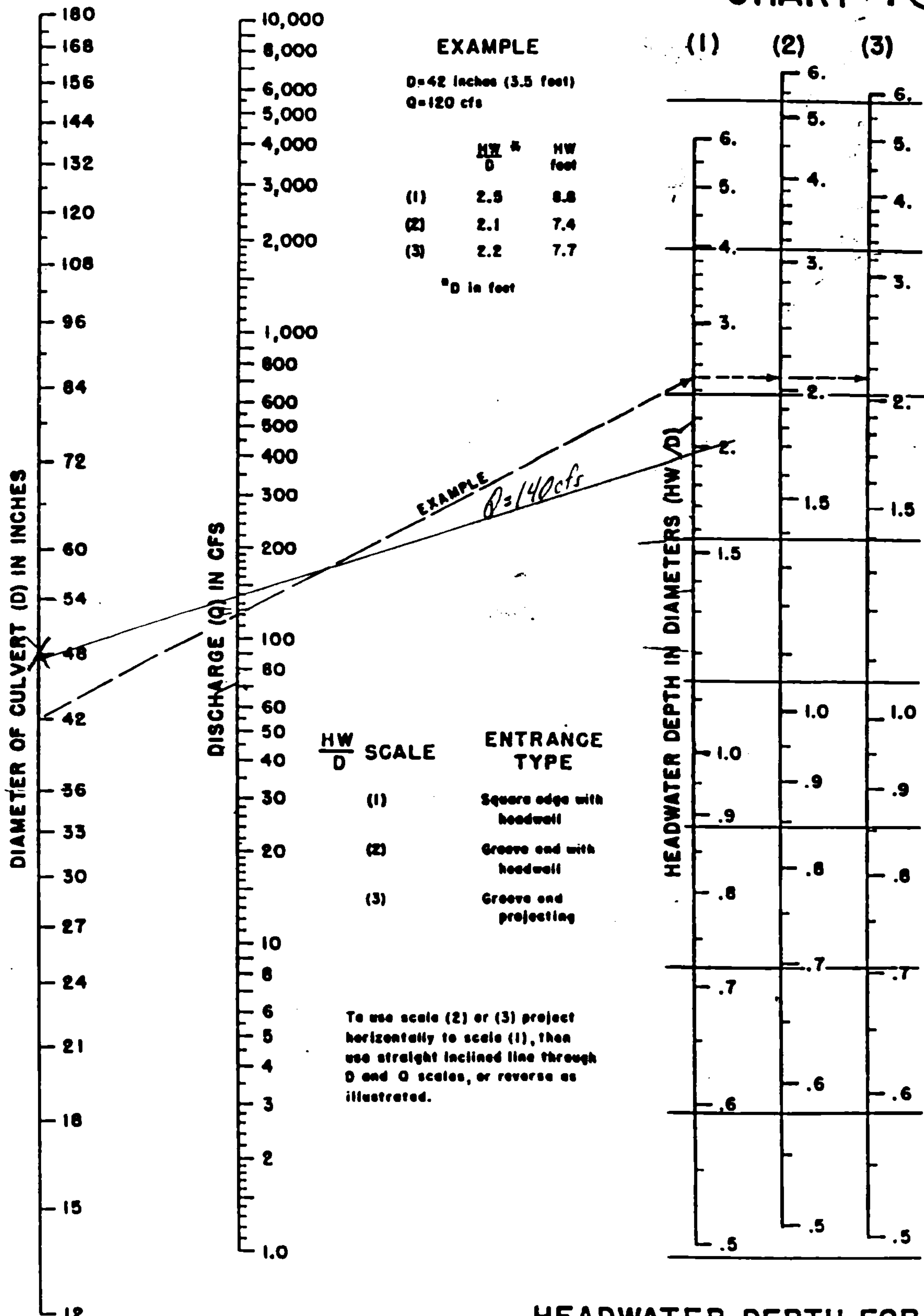
Constants	
Wier Coefficent	2.7
# of Culverts	3

Sheet 3 of 4
By JS 1/9/01
310017

Culvert #2
@ 103rd ave and Grand Ave.

Sheet 4 of 4
By JS 1/9/..
310.017

CHART 1



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

Entellus™

SHEET 1 OF 4

BY JS DATE 1/9/01

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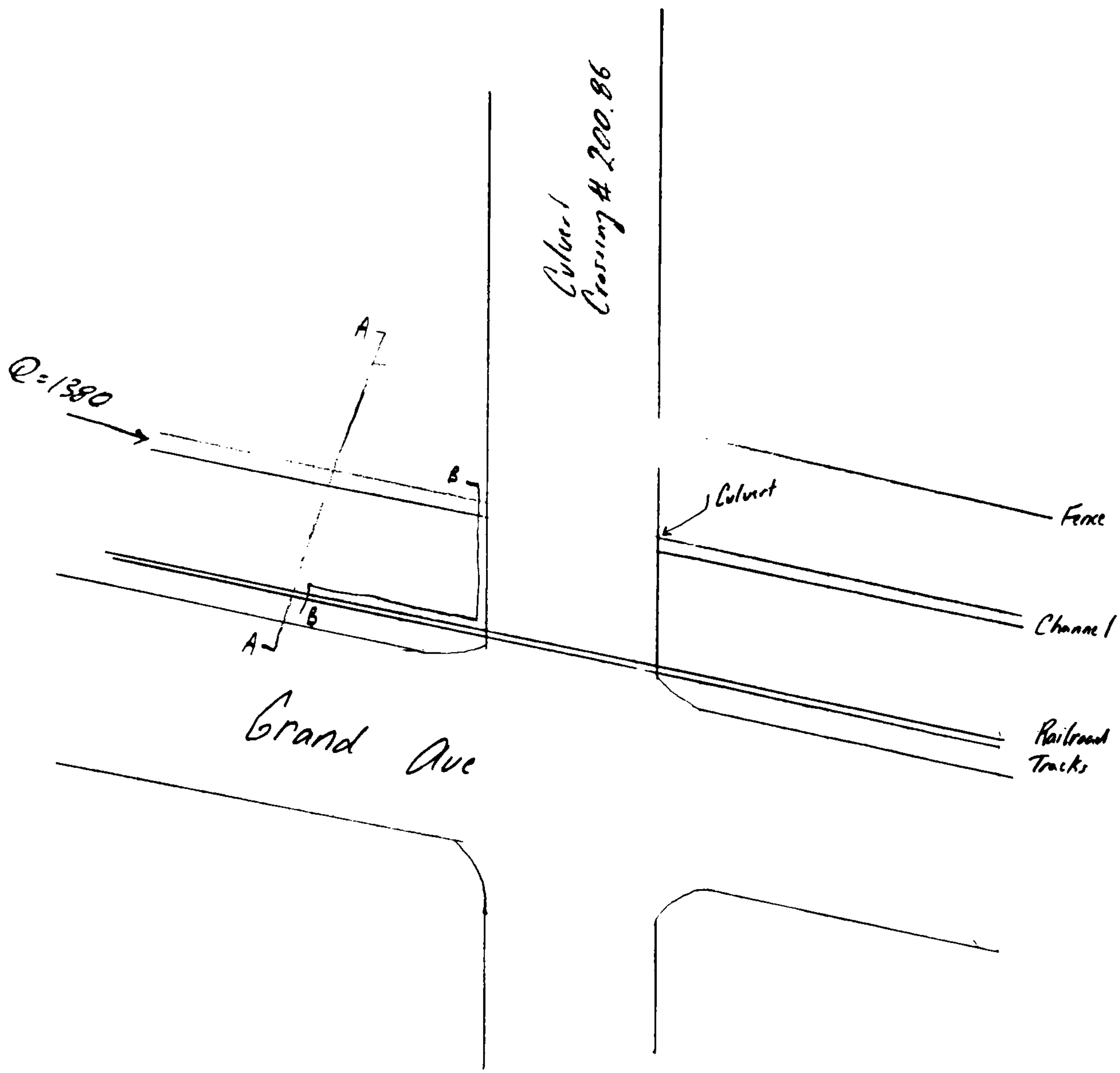
JOB NAME Glendale / Peoria ADMP

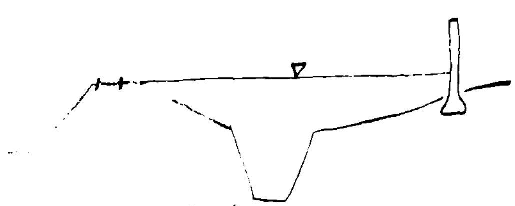
JOB NO. 310017

Culvert #3

Hydraulic Analysis of Grand Ave Channel

Culvert Crossing # 20086





Section A-A

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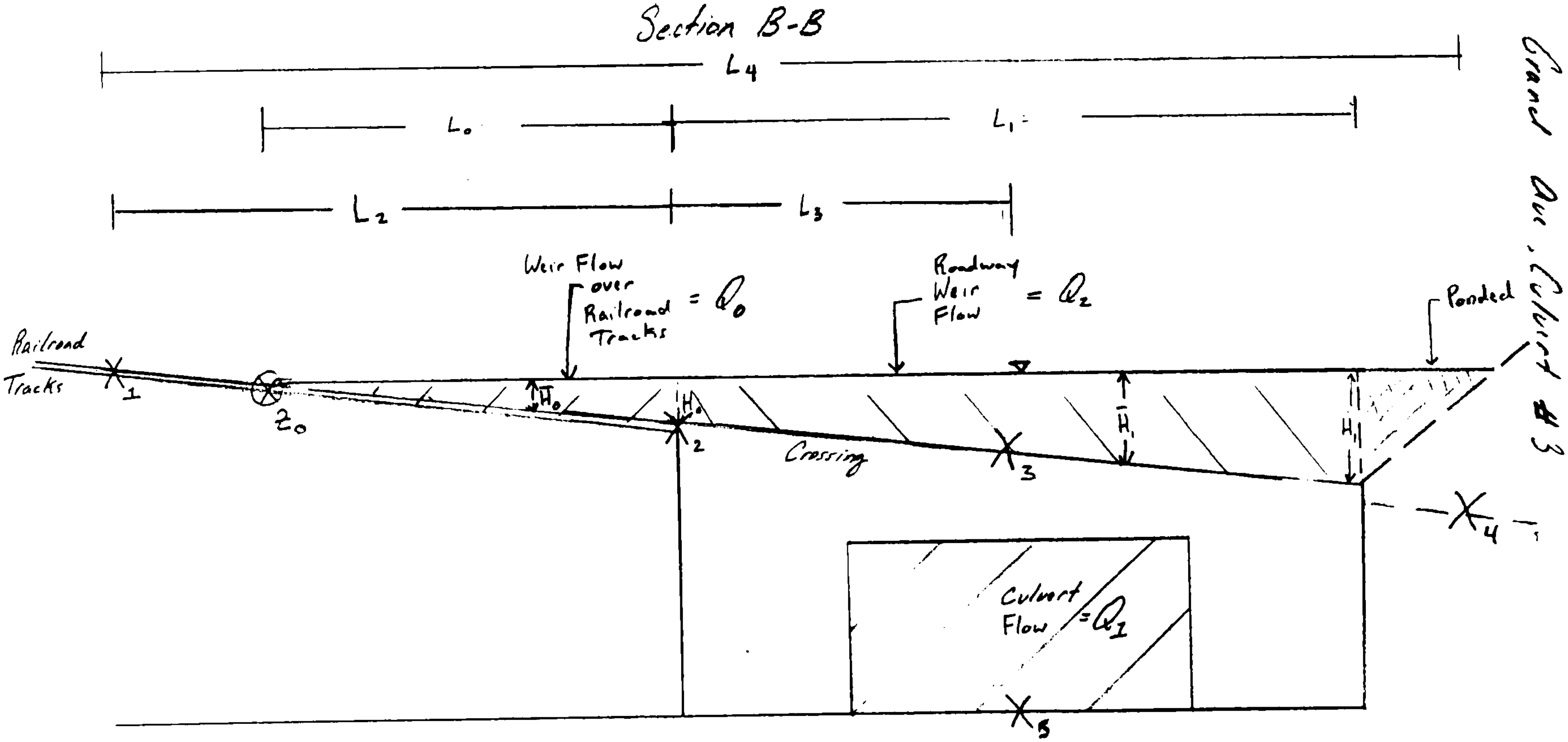
JOB NAME Glendale / Peoria ADMP
Grand Ave, Culvert #3

JOB NO. 310.017

SHEET 2 OF 4
BY ds DATE 1/9/01
CHECK ___ DATE ___



Z_0 is iterated using the attached spreadsheet.

$$Q_{100yr} = Q_0 + Q_1 + Q_2 = 1380$$

↓

$\bar{H}_1$ = Average Depth Over Culvert Crossing = 1.9 ft.

Q_0 = Flow over railroad, to Grand Ave roadway = 19 cfs

Z_0 = Estimated water surface elevation = 1146.49

Glendale Peoria ADMP
Hydraulic Analyis of Grand Ave
Culvert # 200.86

Iterative Data	
Zo	1146.493
Target Q	1380
Q Total	1380.38543
Difference	-0.3854337

Calculations	
Railroad Slope	0.00160886
Lo	132.391948
Ho	0.213
Avg Ho	0.142
Qo	19.1274843
Roadway Slope	0.01792871
Z1	1143.73
H1	2.763
Avg H1	1.89435195
Q2	1001.25795
HW/D	1.68108799
Q from Nomo	120
Q1	360

Survey Data	
Spot Elevations	
Upstream	
Roadway [X_2]	1146.28
Railroad [X_1]	1148.04
Downstream	
Roadway [X_3]	1143.73
Railroad [X_4]	1144.19
Distances (Upstream to Downstream)	
Roadway [L_3]	142.23
Railroad [L_4]	2393
Other Distances	
Upstream Railroad to Upstream Roadway [L_2]	1682
Roadway Crest [L_1]	142.23
Culvert Diameter	48
Invert Elevation [X_5]	1138.9

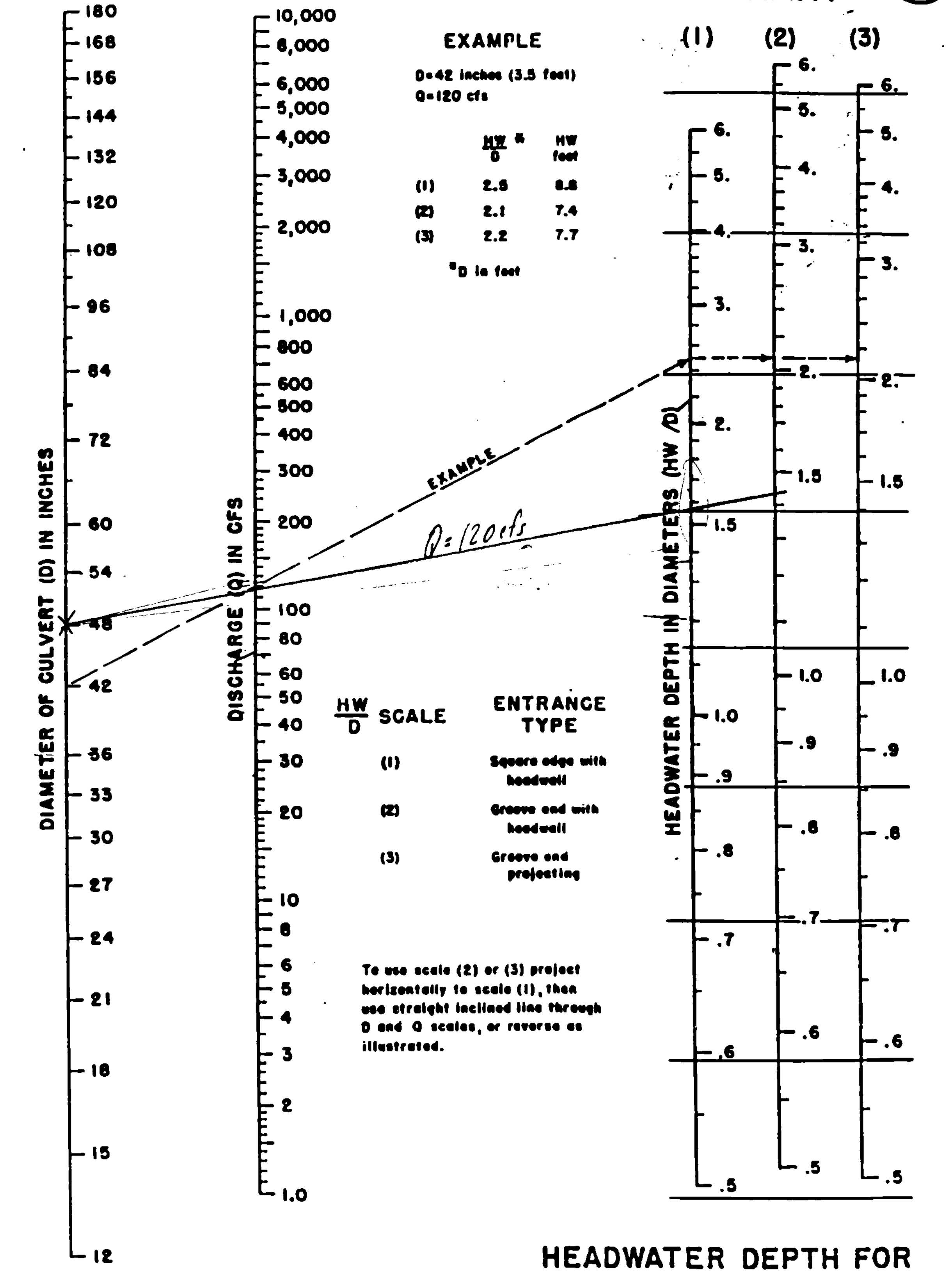
Constants	
Wier Coefficent	2.7
# of Culverts	3

Sheet 3 of 4
JS 1/9/01
310.017

Grand Ave
Culvert # 3

Sheet 4 of 4
JS 1/9/01
310.017

CHART 1



HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

Entellus™

SHEET ______ OF ______

BY ______ DATE ______

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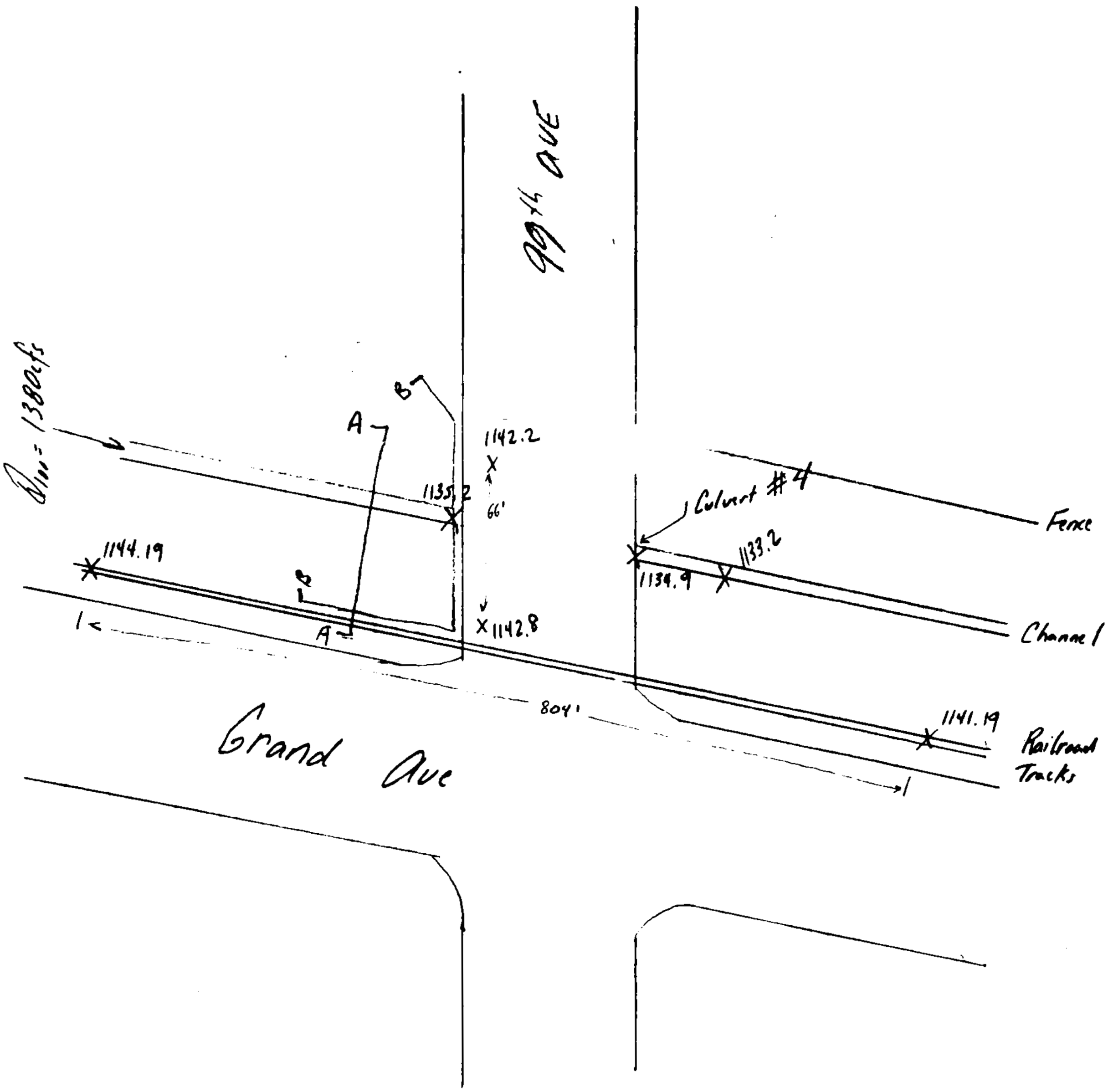
JOB NAME Glendale / Peoria ADMP

JOB NO. 310.017

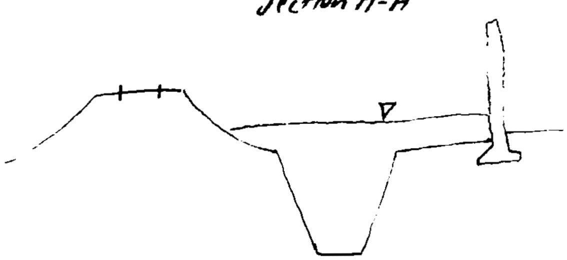
Culvert #4

Hydraulic Analysis of Grand Ave Channel

99th Ave (Culvert # 199.20)



Section A-A



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JOB NAME Glendale / Peoria ADMP

Grand Ave & 99th Ave

JOB NO. 310.017

SHEET ___ OF ___

BY ___ DATE ___

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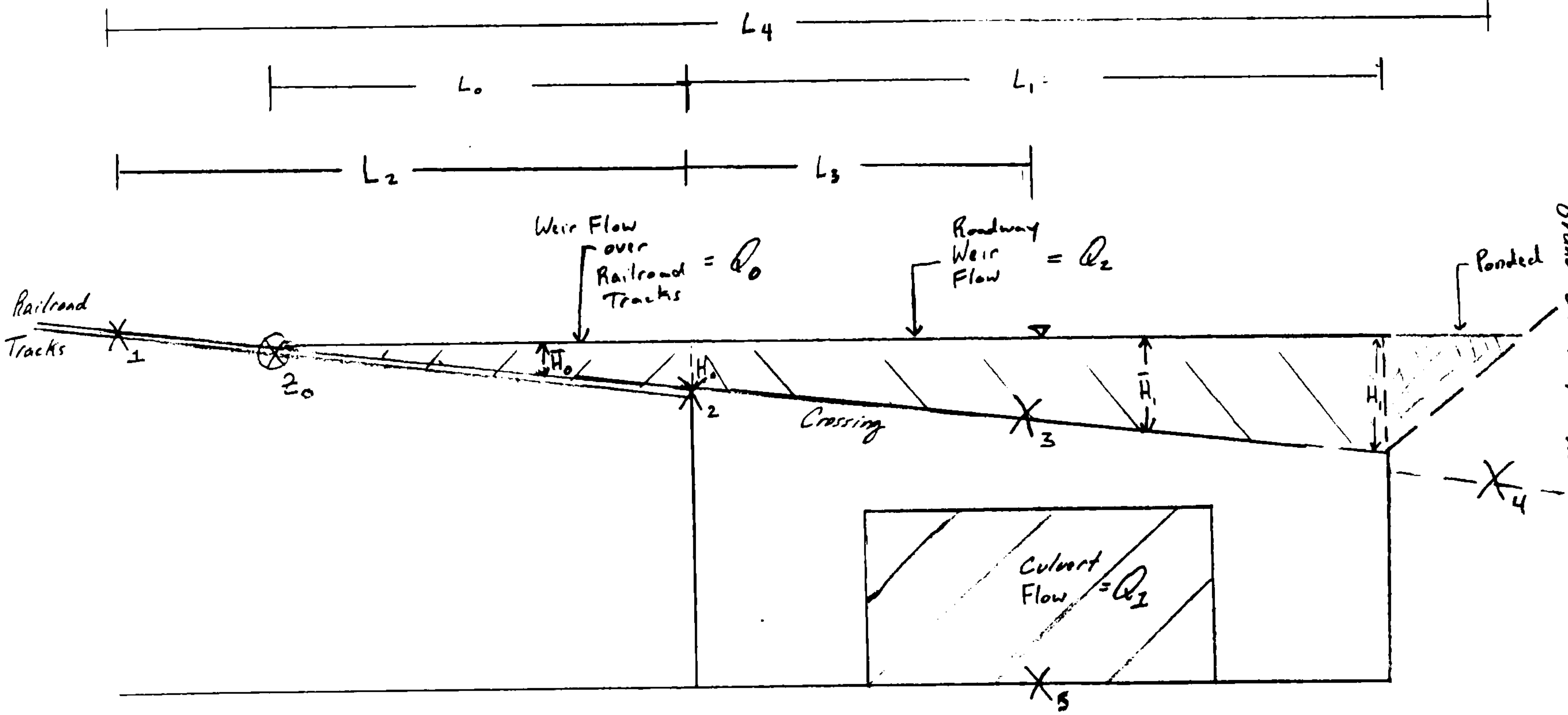
Section B-B



Z_0 is iterated using the attached spreadsheet.

$Q_{100yr} = Q_0 + Q_1 + Q_2 =$

$\downarrow$

$\bar{H}_1$ = Average Depth Over Culvert Crossing =

Q_0 = Flow over railroad, to Grand Ave roadway =

Z_0 = Estimated water surface elevation =

Glendale Peoria ADMP
Hydraulic Analyis of Grand Ave
Culvert # 199.2 at 99th Ave

Iterative Data	
Zo	1143.47
Target Q	1380
Q Total	1382.13927
Difference	-2.13926549

Calculations	
Railroad Slope	0.00373134
Lo	179.56
Ho	0.67
Avg Ho	0.44666667
Qo	144.726706
Roadway Slope	0.006
Z1	1141.72
H1	1.75
Avg H1	1.33827853
Q2	752.41256
HW/D	2.08456963
Q from Nomo	48.5
Q1	485

Survey Data	
Spot Elevations	
<u>Upstream</u>	
Roadway [X_2]	1142.8
Railroad [X_1]	1144.19
<u>Downstream</u>	
Roadway [X_3]	1142.2
Railroad [X_4]	1141.19
Distances (Upstream to Downstream)	
Roadway [L_3]	100
Railroad [L_4]	804
Other Distances	
Upstream Railroad to Upstream Roadway [L_2]	550
Roadway Crest [L_1]	180
Culvert Span [ft]	10
Invert Elevation [X_5]	1135.2
Culvet Rise [ft]	4

Constants	
Wier Coefficent	2.7
# of Culverts	1

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CHECK ___ DATE ___

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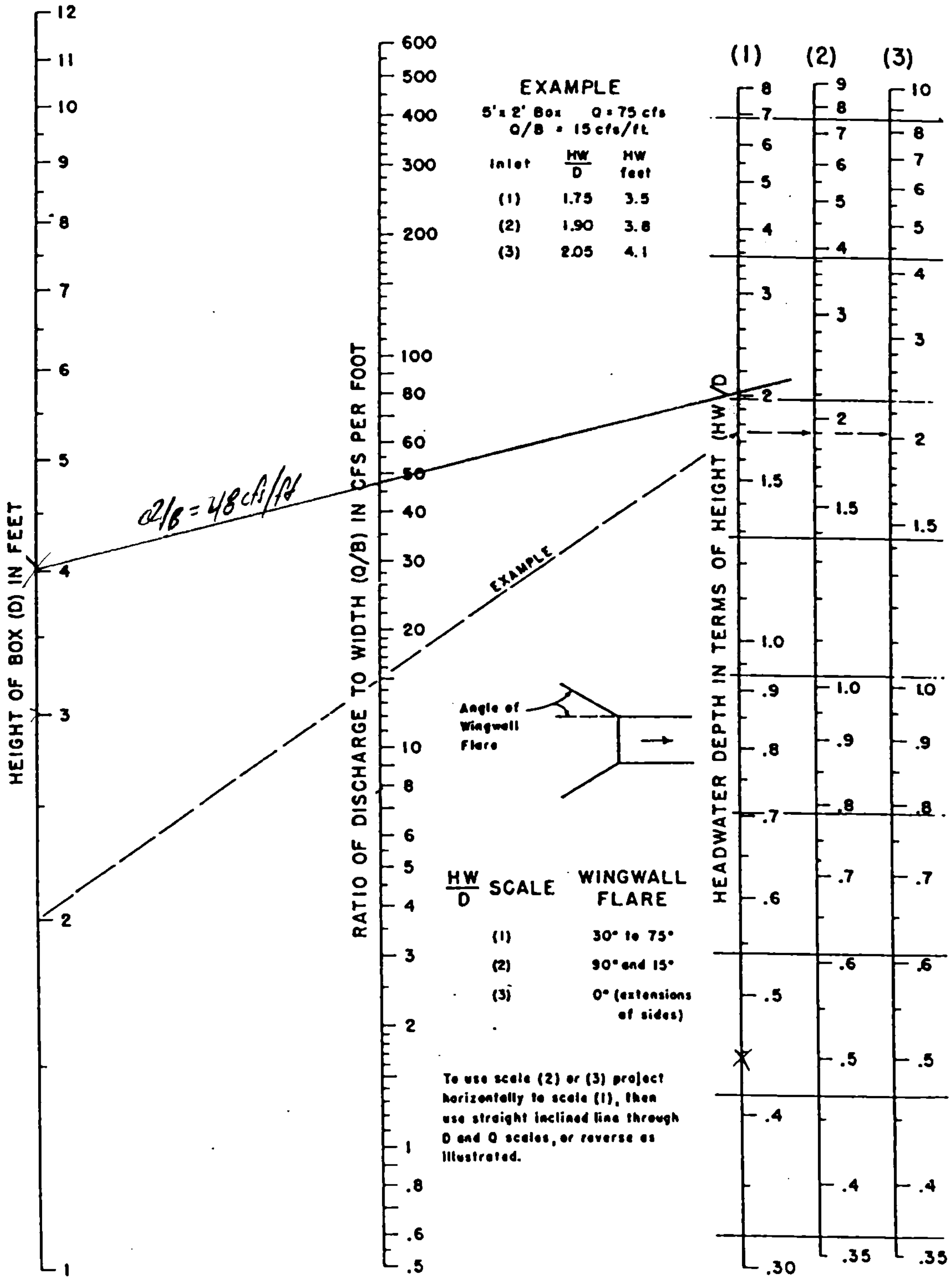
JOB NAME Glendale Peoria ADMP
JOB NO. 310.017

Culvert #4
199.20

CHART 8



HEADWATER DEPTH
FOR BOX CULVERTS
WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Level III: Hydraulic Calculations
99^{th} Ave. Channel

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CLIENT FCD 99-44

JOB NAME Glendale Peoria ADMP

JOB NO. 310.017

Figure 99th-1 : Level 3 Hydraulic Analysis of 99th Ave

LEGEND

- - - Channel

1 ⊗ Analyzed Culvert

① Cross Section Used For Normal Depth Calculations

(CN27) Concentration Point

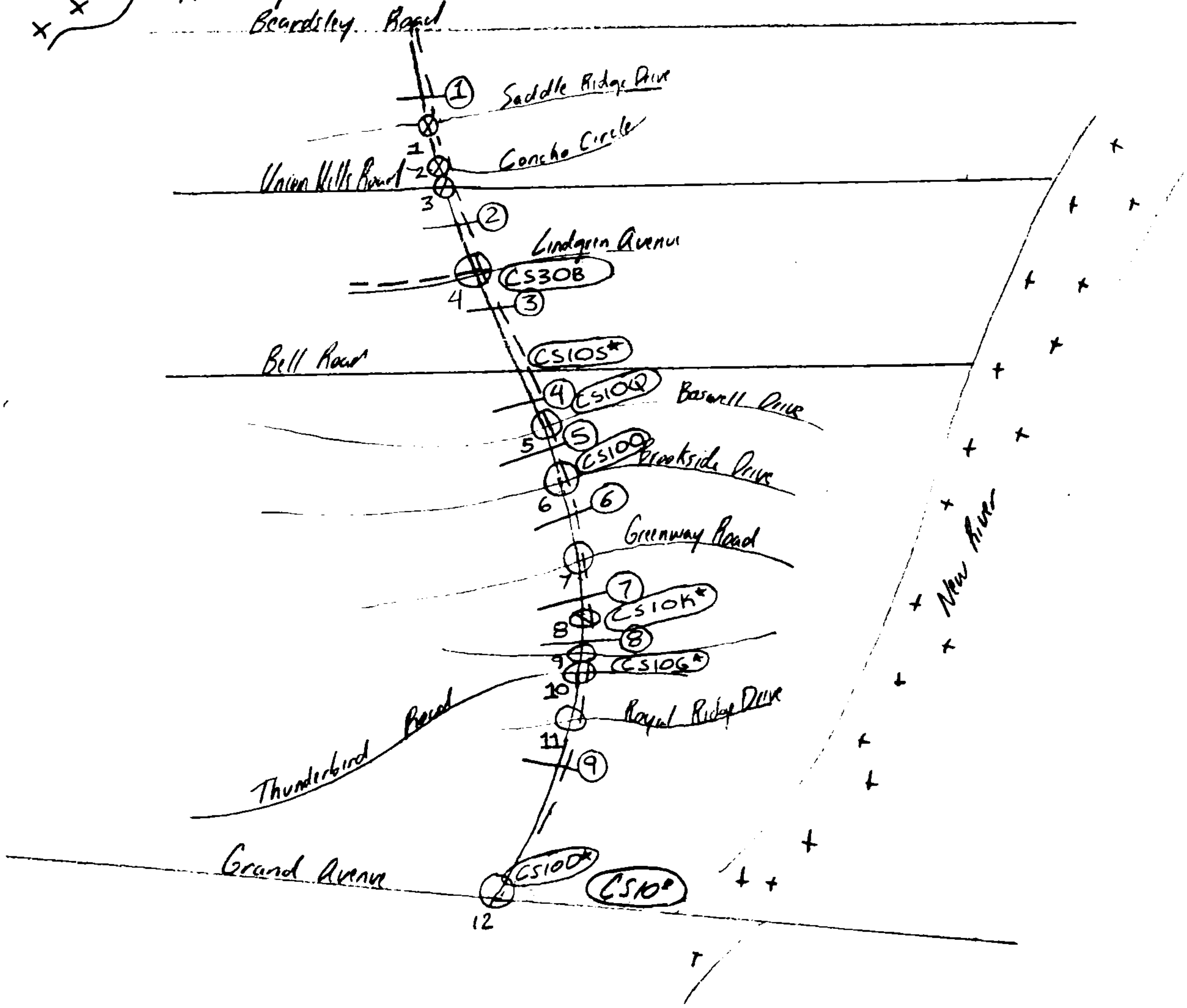
x x x Floodway or Floodplain

N

(Not To Scale)

HYDROLOGY*

Concentration Point	Flow (cfs)
CS30B	860
CS105*	660
CS10Q	1370
CS100	1980
CS10K*	2300
CS10G*	2540
CS10*	3050
CS10D*	2690



* see Glendale Peoria ADMP Hydrology - Volume HY

Glendale Peoria ADMP
99th Ave Surveyed Cross Sections
Table 99th-1

Channel XS #	Cross Street	Slope [ft/ft]	HEC-1 Flow Parameter	100yr 6hr Flow [cfs]	*Hydrology Modification	Invert Elevation [ft]	WS Elevation [ft]	Roadway Elevation [ft]
1	Approx 165ft N of Sombrero Circle	0.0041	CS30B	860	None	1221.8	1226.28	1227
2	Approx 990ft S. of Union Hills Dr.	0.0048	CS30B	860	None	1216.2	1220.65	1221.5
3	Approx 720ft S. of Del Webb	0.0042	CS10S*	660	Route RS10T Excluded	1204.4	1205.8	1205
4	Approx 220ft N. of Boswell Dr.	0.0021	CS10Q	1370	No Changes	1184.5	1189.6	1188.3
5	Approx 1100ft N. of Brookside Dr.	0.0061	CS10O*	1980	Diversion RS10RW Excluded	1181.4	1183.7	1181.7
6	Approx 1150ft N. of Greenway Rd.	0.0045	CS10K*	2300	Route RS10RW Excluded	1168.7	1174.7	1173.5
7	Approx 1250ft S. of Greenway Rd.	0.0039	CS10K*	2300	Route RS10RW Excluded	1158	1164.2	1163
8	Approx 1560ft N. of Thunderbird Rd.	0.0042	CS10G*	2540	Route RS10NS Excluded	1150.4	1156.4	1155
9	Approx 630ft S. of Royal Ridge Dr.	0.0042	CX40 (CS10D)	2540	Route RS10NS Excluded	1140.3	1146.6	1145.5

Glendale Peoria ADMP
99th Ave Culvert Analysis: General
Table 99th-2.1

Culvert ID	Culvert Log # [1]	Cross Street	Size	Estimated Length [ft]	Slope [ft/ft]	HEC-1 Flow Parameter [2] [cfs]	100yr 6hr Flow [cfs]
1	199.2	Saddle Ridge Dr.	single 4' x 10'	70	0.0041	CS30B	860
2	199.19	Concho Circle	single 3' x 10'	60	0.0048	CS30B	860
3	199.18	Union Hills Rd.	double 3' x 8'	80	0.0048	CS30B	860
4	50.14	Del Webb Blvd.	5 48"	120	0.0048	CS30B	860
5	199.16	Boswell Blvd.	double 4' x 10'	60	0.0021	CS10Q	1370
6	199.15	Brookside Dr.	double 4' x 10'	60	0.0061	CS10O	1990
7	199.14	Greenway Blvd.	double 4' x 10'	150	0.0045	CS10KM	2060
8	199.13	Boswell Blvd.	double 4' x 10'	60	0.0039	CS10KM	2060
9	199.12	Unk.	double 4' x 10'	50	0.0042	CS10G*	2540
10	199.10	Thunderbird Rd.	double 4' x 10'	750	0.0042	CS10G*	2540
11	199.9	Royal Ridge Dr.	double 4' x 10'	80	0.0042	CS10G*	2540
12	199.1	Grand Ave.	double 4' x 10' & single 5'x10'	85	0.0042	CS10D*	2690 [3]

[1] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[2] See Glendale Peoria Area Drainage Master Plan Update- Hydrology- Volume HY

[3] 150cfs additional flow from Grand Ave Channel Spillover

* Original Concentration Point Slightly Modified to Show Channel Flow Only (See Surveyed XS Table)

Glendale Peoria ADMP
99th Ave Culvert Analysis: Elevations
Table 99th-2.2

Culvert ID	Culvert Log # [1]	Cross Street	Size	Distance from tailwater XS [ft]	Tailwater XS [2]	End of Culvert invert Elevation	Beginning of Culvert invert Elevation	Estimated Roadway Crest	Headwater Elevation [3]	Overtopping Depth [ft]
1	199.2	Saddle Ridge Dr.	single 4' x 10'	3431	2	1224.3	1224.6	1227.5	1228.2	0.7
2	199.19	Concho Circle	single 3' x 10'	2036	2	1217.6	1217.9	1221.8	1222.5	0.8
3	199.18	Union Hills Rd.	double 3' x 8'	1001	2	1212.6	1213.0	1217.5	1217.6	0.1
4	50.14	Del Webb Blvd.	5 48"	n/a	3 [5]	Unk.	n/a	n/a	See Note [4]	
5	199.16	Boswell Blvd.	double 4' x 10'	3333	6	1183.7	1184.0	1188.8	1189.9	1.2
6	199.15	Brookside Dr.	double 4' x 10'	1022	6	1173.3	1173.6	1178.0	1179.5	1.5
7	199.14	Greenway Blvd.	double 4' x 10'	1305	7	1163.1	1163.7	1169.3	1170.2	0.9
8	199.13	Boswell Blvd.	double 4' x 10'	1214	8	1155.5	1155.8	1160.6	1162.3	1.7
9	199.12	Unk.	double 4' x 10'	2596	9	1151.2	1151.4	1154.7	1156.9	2.2
10	199.10	Thunderbird Rd.	double 4' x 10'	1403	9	1146.2	1149.3	1150.5	1152.7	2.2
11	199.9	Royal Ridge Dr.	double 4' x 10'	635	9	1143.0	1143.3	1148.1	1149.7	1.6
12	199.1	Grand Ave.	double 4' x 10' & single 5'x10'	220	4(Grand Ave)	1133.24	1133.45	1141.43	1142.6	1.2

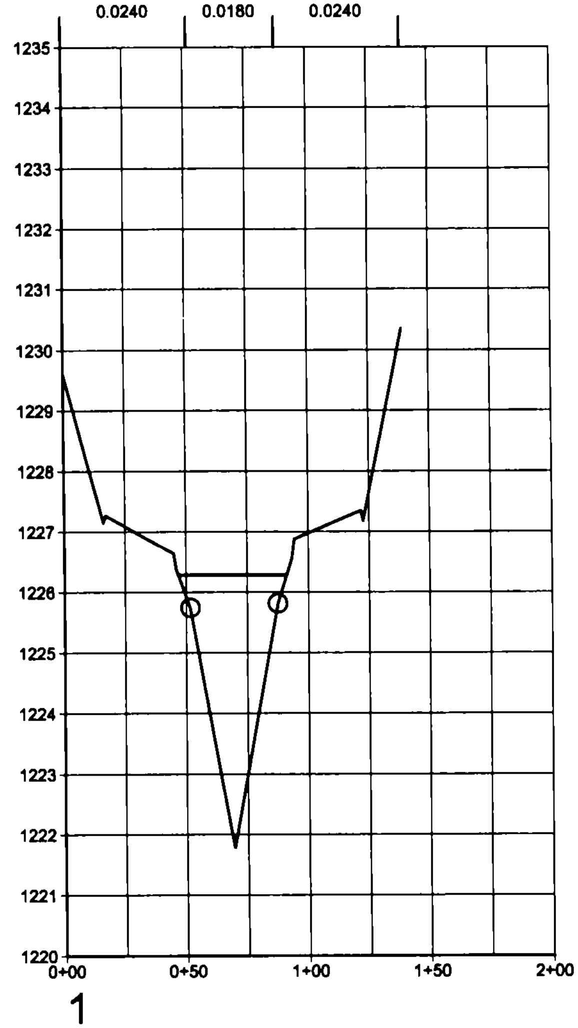
[1] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[2] Tailwater Normal Depth Used (See Surveyed XS Table For Cross Section Details)

[3] Water Surface Elevation Found Using HY8

[4] Culvert bends 90 degrees into the channel along Del Webb Blvd. From the Glendale Peoria Area Drainage Master Plan Update- Hydrology- Volume HY, 230cfs overtops 99th Ave

[5] Downstream Cross Section Geomoetry Used to Determine Overtopping Depth



Normal Depth Results

Cross-Section:	1	
Elevation:	1226.28	ft MSL
Depth:	4.50	ft
Discharge:	860.00	cfs
Energy Gradient:	0.0041	ft/ft
Froude Number:	0.7813	
Flow Regime:	Subcritical	
Flow Area:	91.43	sq ft
Average Velocity:	9.42	ft/s
Maximum Velocity:	9.61	ft/s
Composite n:	0.0192	
Hydraulic Radius:	2.02	ft
Wetted Perimeter:	45.16	ft
Wetted Top Width:	44.21	ft
Critical Slope:	0.0094	ft/ft

File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 1 at: 165ft N. of Sombrero Circle

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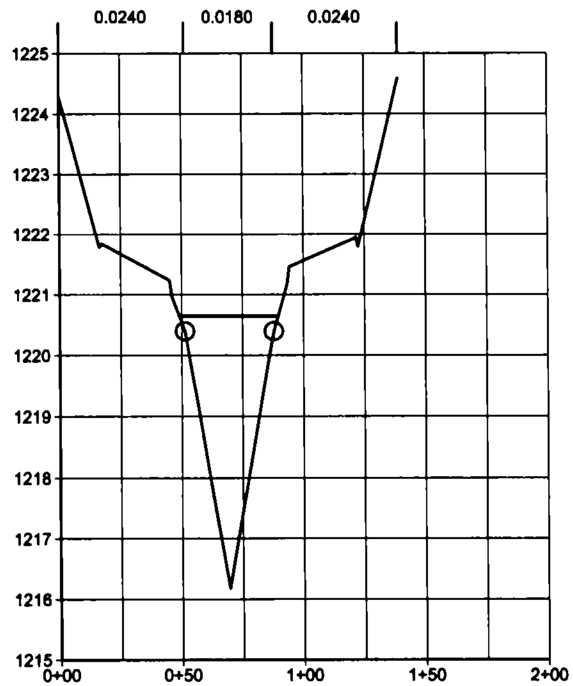


2

Normal Depth Results

Cross-Section:	2	
Elevation:	1220.65	
Depth:	4.47	ft
Discharge:	860.00	cfs
Energy Gradient:	0.0048	ft/ft
Froude Number:	0.8287	
Flow Regime:	Subcritical	
Flow Area:	86.55	sq ft
Average Velocity:	9.93	ft/s
Maximum Velocity:	9.98	ft/s
Composite n:	0.0186	
Hydraulic Radius:	2.08	ft
Wetted Perimeter:	41.59	ft
Wetted Top Width:	40.60	ft
Critical Slope:	0.0084	ft/ft

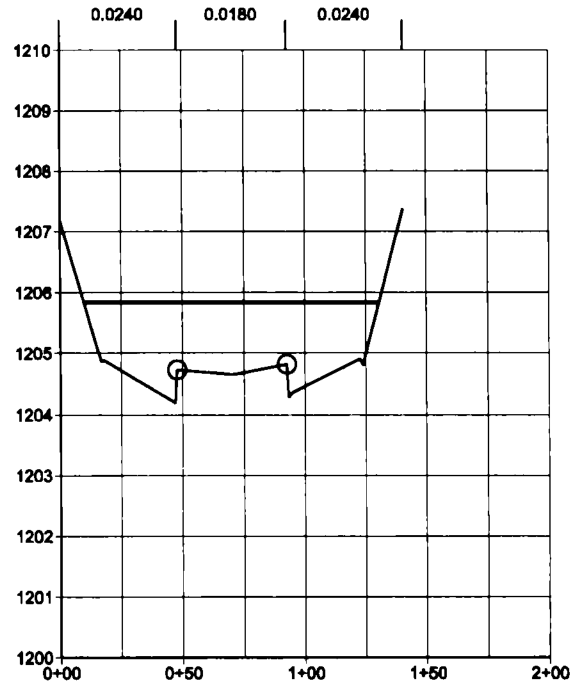
File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 2 at: 990ft S. of Union Hills Dr.

Entellus™



3

Normal Depth Results

Cross-Section:	3	
Elevation:	1205.84	ft MSL
Depth:	1.65	ft
Discharge:	660.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.6719	
Flow Regime:	Subcritical	
Flow Area:	134.99	sq ft
Average Velocity:	4.86	ft/s
Maximum Velocity:	5.80	ft/s
Composite n:	0.0218	
Hydraulic Radius:	1.11	ft
Wetted Perimeter:	121.34	ft
Wetted Top Width:	120.82	ft
Critical Slope:	0.0098	ft/ft

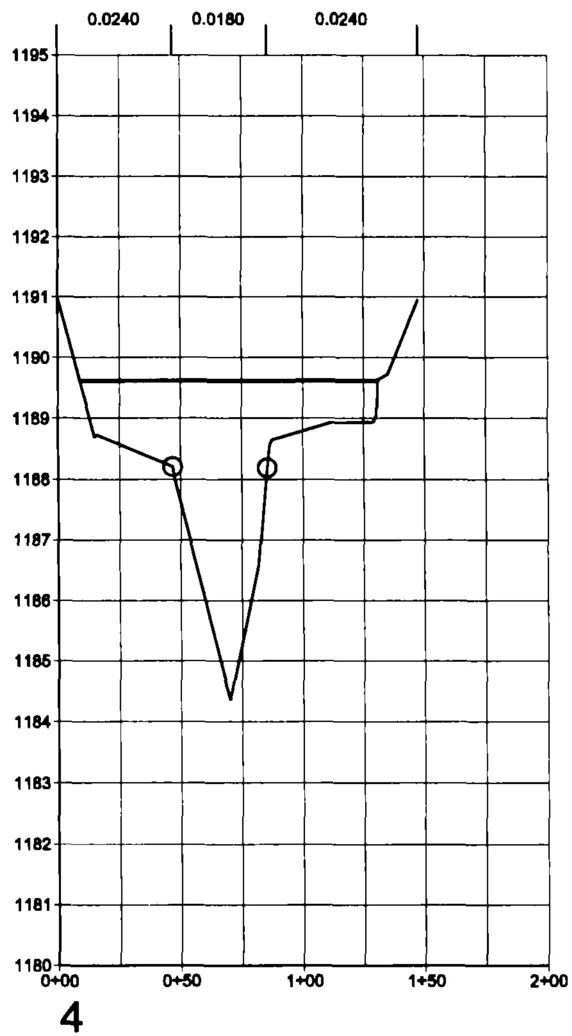
File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 3 at: 720ft S. of Del Webb Dr.

Entellus™



Normal Depth Results

Cross-Section:	4	
Elevation:	1189.62	ft MSL
Depth:	5.27	ft
Discharge:	1370.00	cfs
Energy Gradient:	0.0021	ft/ft
Froude Number:	0.5014	
Flow Regime:	Subcritical	
Flow Area:	209.80	sq ft
Average Velocity:	6.50	ft/s
Maximum Velocity:	8.62	ft/s
Composite n:	0.0221	
Hydraulic Radius:	1.7	ft
Wetted Perimeter:	123.23	ft
Wetted Top Width:	121.98	ft
Critical Slope:	0.0184	ft/ft

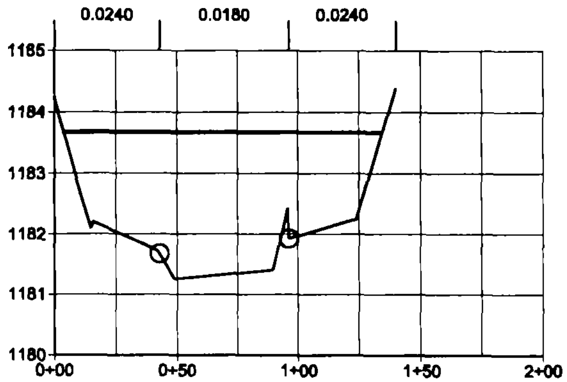
File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 4 at: 220ft N. of Boswell Dr.

Entellus™



5

Normal Depth Results		
Cross-Section:	5	
Elevation:	1183.67	ft MSL
Depth:	2.41	ft
Discharge:	1980.00	cfs
Energy Gradient:	0.0061	ft/ft
Froude Number:	0.99	
Flow Regime:	Critical	
Flow Area:	227.11	sq ft
Average Velocity:	8.67	ft/s
Maximum Velocity:	11.04	ft/s
Composite n:	0.0216	
Hydraulic Radius:	1.73	ft
Wetted Perimeter:	131.16	ft
Wetted Top Width:	130.55	ft
Critical Slope:	0.0078	ft/ft

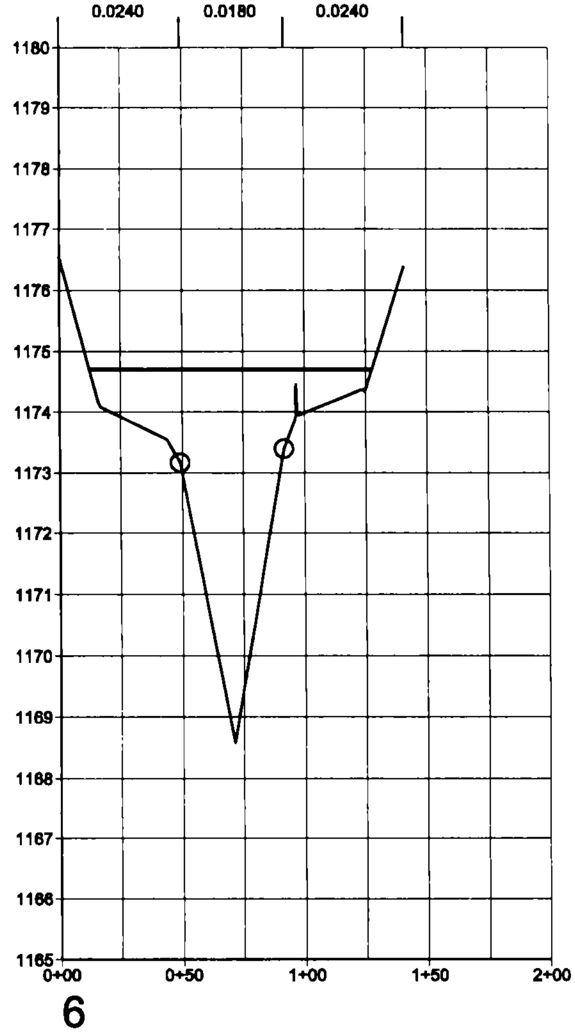
File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 5 at: 1100ft N. of Brookside Dr.

Entellus™



Normal Depth Results

Cross-Section:	6	
Elevation:	1174.70	ft MSL
Depth:	6.12	ft
Discharge:	2300.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.7681	
Flow Regime:	Subcritical	
Flow Area:	213.36	sq ft
Average Velocity:	10.79	ft/s
Maximum Velocity:	13.24	ft/s
Composite n:	0.0218	
Hydraulic Radius:	1.82	ft
Wetted Perimeter:	117.09	ft
Wetted Top Width:	115.41	ft
Critical Slope:	0.019	ft/ft

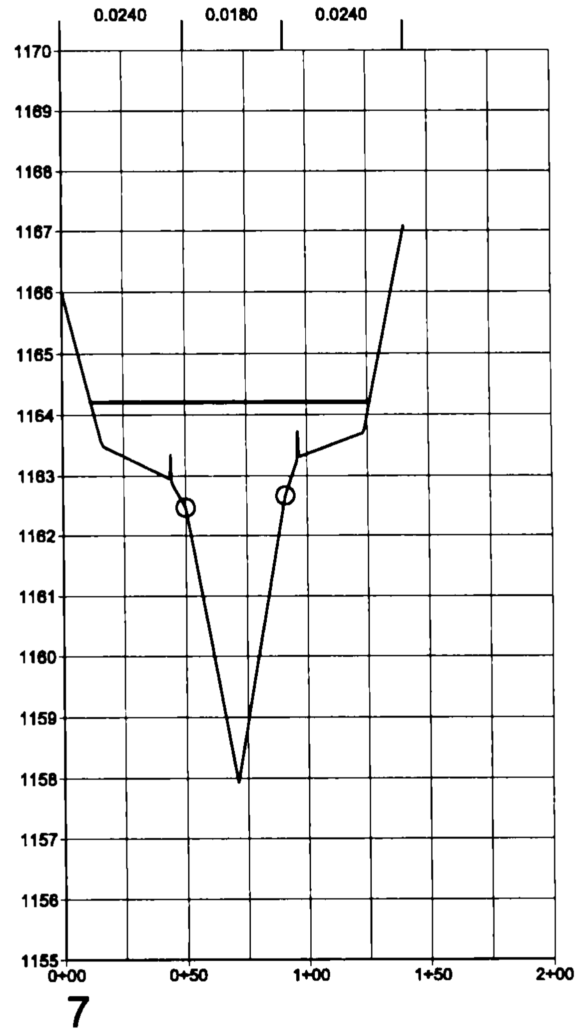
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 6 at: 1150ft N. of Greenway Rd.

Entellus™

File: BORDERED-XS.dwg Date: 12/11/00



Normal Depth Results

Cross-Section:	7	
Elevation:	1164.21	ft MSL
Depth:	6.28	ft
Discharge:	2300.00	cfs
Energy Gradient:	0.0039	ft/ft
Froude Number:	0.7153	
Flow Regime:	Subcritical	
Flow Area:	226.25	sq ft
Average Velocity:	10.12	ft/s
Maximum Velocity:	12.72	ft/s
Composite n:	0.0219	
Hydraulic Radius:	1.94	ft
Wetted Perimeter:	116.40	ft
Wetted Top Width:	114.41	ft
Critical Slope:	0.018	ft/ft

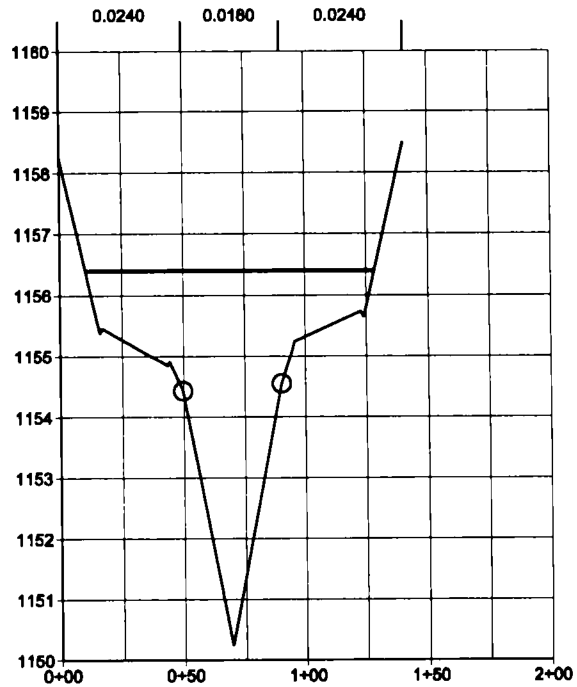
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 7 at: 1250ft S. of Greenway Rd.

Entellus™

File: BORDERED-XS.dwg Date: 12/11/00



8

Normal Depth Results

Cross-Section:	8	
Elevation:	1156.40	ft MSL
Depth:	6.16	ft
Discharge:	2540.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.733	
Flow Regime:	Subcritical	
Flow Area:	246.16	sq ft
Average Velocity:	10.31	ft/s
Maximum Velocity:	13.40	ft/s
Composite n:	0.022	
Hydraulic Radius:	2.07	ft
Wetted Perimeter:	119.12	ft
Wetted Top Width:	117.99	ft
Critical Slope:	0.0164	ft/ft

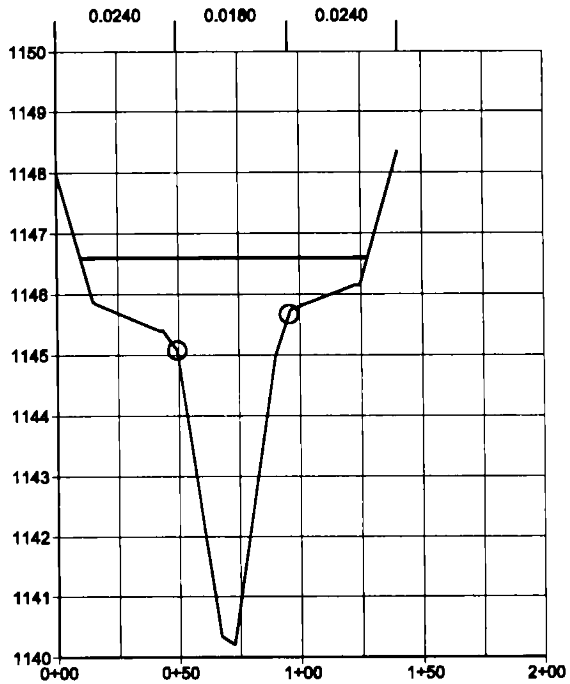
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 8 at: 1560ft N. of Thunderbird Rd.

Entellus™

File: BORDERED-XS.dwg Date: 12/11/00



9

Normal Depth Results

Cross-Section:	9	
Elevation:	1146.59	ft MSL
Depth:	6.38	ft
Discharge:	2540.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.7502	
Flow Regime:	Subcritical	
Flow Area:	238.25	sq ft
Average Velocity:	10.73	ft/s
Maximum Velocity:	13.01	ft/s
Composite n:	0.0217	
Hydraulic Radius:	1.98	ft
Wetted Perimeter:	119.22	ft
Wetted Top Width:	117.81	ft
Critical Slope:	0.0175	ft/ft

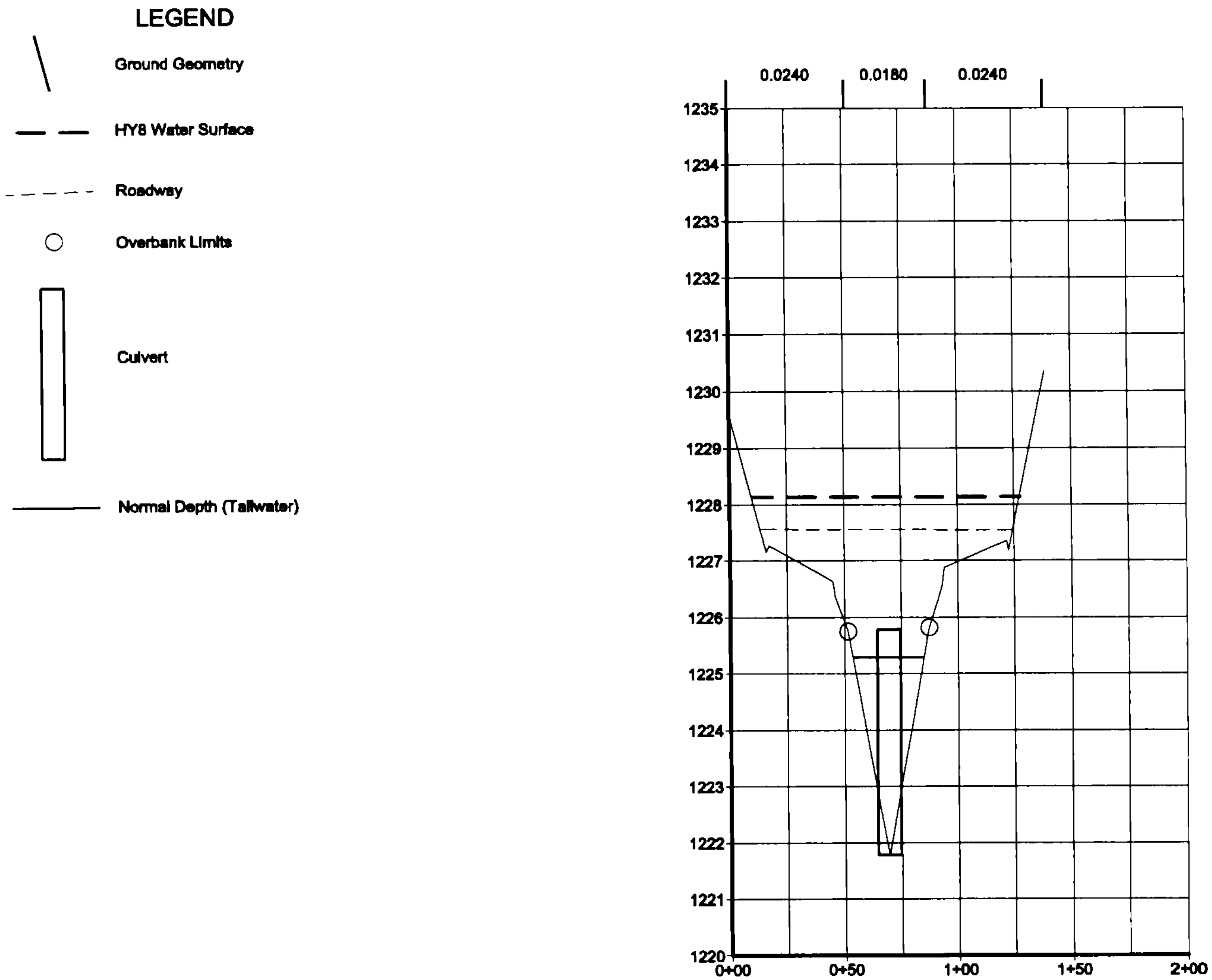
File: BORDERED-XS.dwg Date: 12/11/00

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Cross Section 9 at: 630ft. S. of Royal Ridge Dr.

Entellus™



Culvert 1

Normal Depth Results

Cross-Section:	199.20	
Elevation:	1225.29	ft MSL
Depth:	3.51	ft
Discharge:	450.00	cfs
Energy Gradient:	0.0048	ft/ft
Froude Number:	0.7727	
Flow Regime:	Subcritical	
Flow Area:	54.82	sq ft
Average Velocity:	8.20	ft/s
Maximum Velocity:	8.20	ft/s
Composite n:	0.018	
Hydraulic Radius:	1.71	ft
Wetted Perimeter:	32.04	ft
Wetted Top Width:	31.26	ft
Critical Slope:	0.008	ft/ft
Back Water Elevation:	1227.88	ft MSL

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

LEGEND

Ground Geometry

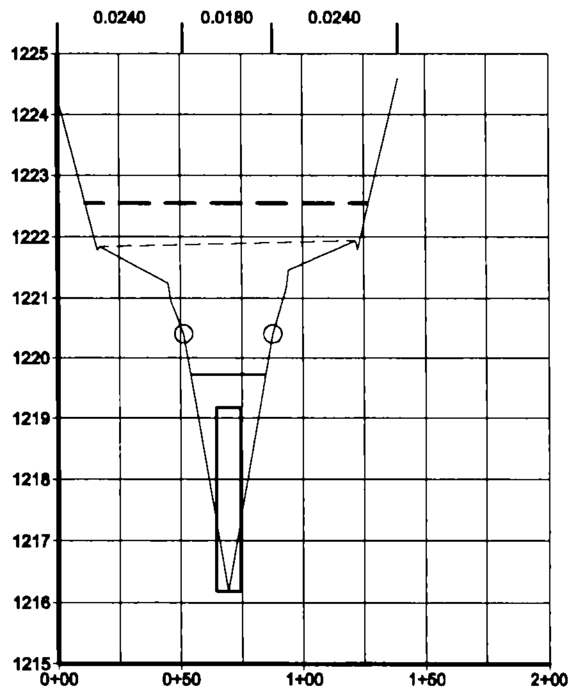
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Normal Depth Results

Cross-Section:	199.19	
Elevation:	1219.73	ft MSL
Depth:	3.55	ft
Discharge:	450.00	cfs
Energy Gradient:	0.0048	ft/ft
Froude Number:	0.7717	
Flow Regime:	Subcritical	
Flow Area:	54.55	sq ft
Average Velocity:	8.27	ft/s
Maximum Velocity:	8.27	ft/s
Composite n:	0.018	
Hydraulic Radius:	1.73	ft
Wetted Perimeter:	31.53	ft
Wetted Top Width:	30.72	ft
Critical Slope:	0.008	ft/ft
Back Water Elevation:	1222.56	ft MSL

Culvert 2

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

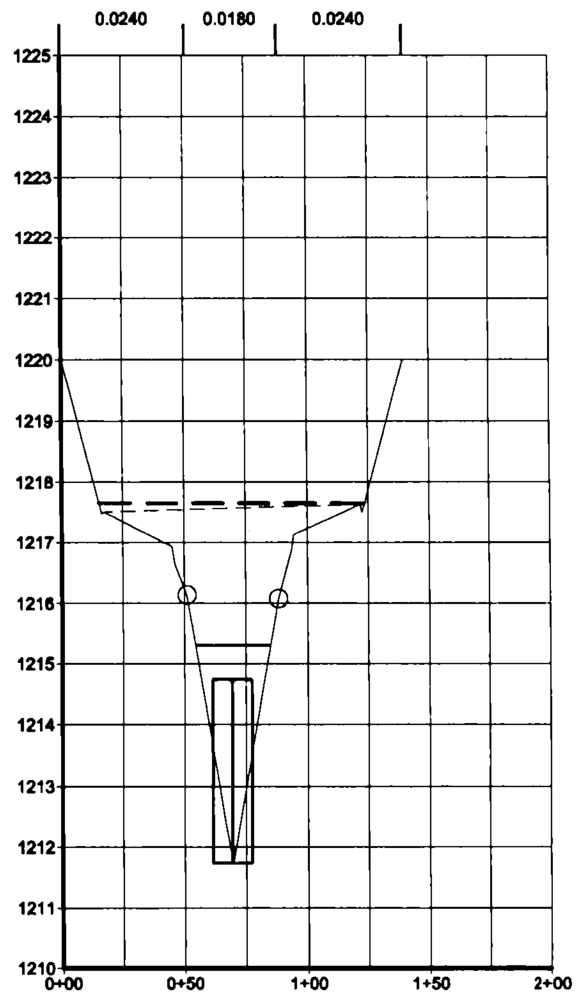
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Normal Depth Results

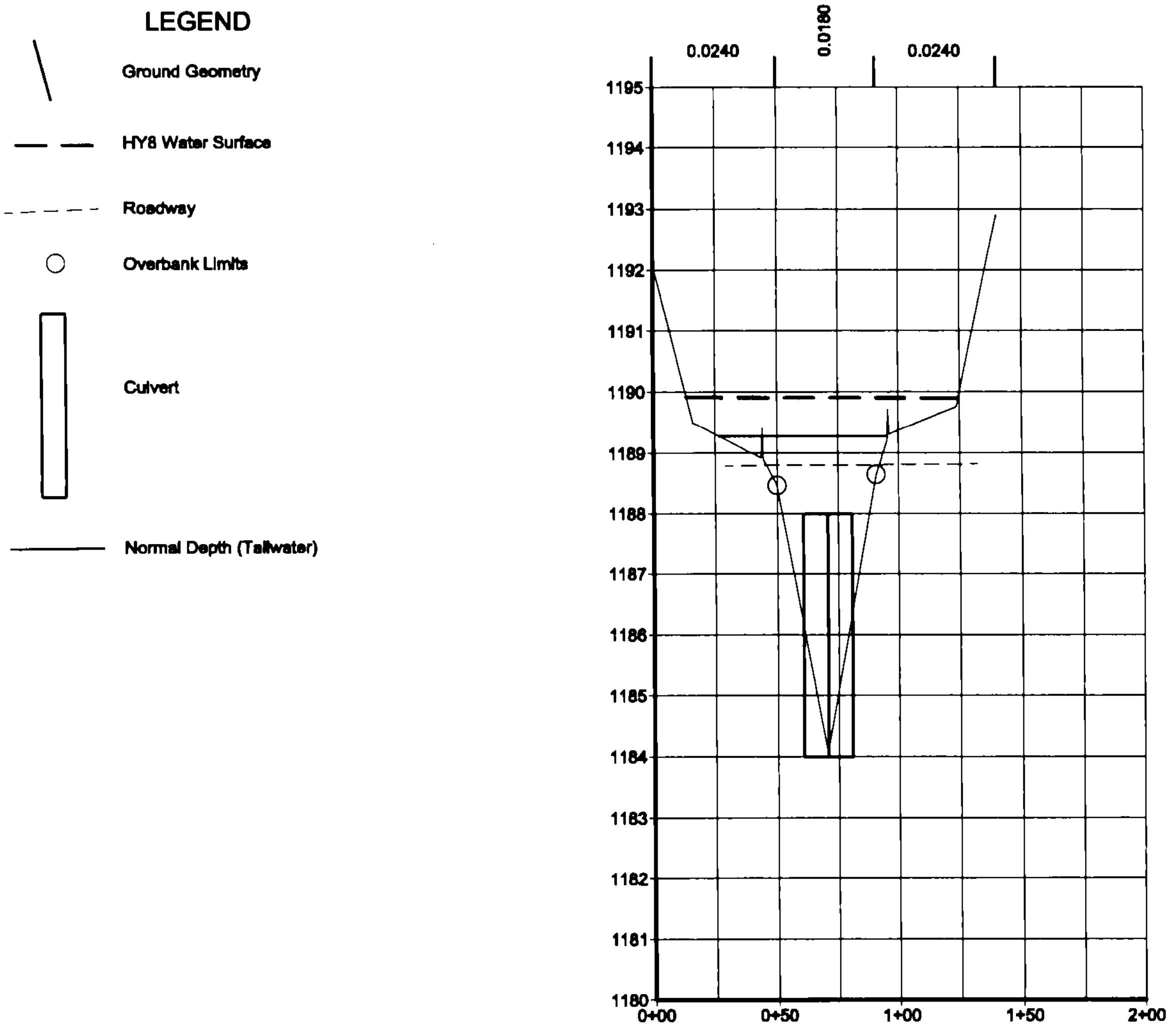
Cross-Section:	199.18	
Elevation:	1215.30	ft MSL
Depth:	3.58	ft
Discharge:	450.00	cfs
Energy Gradient:	0.0048	ft/ft
Froude Number:	0.7718	
Flow Regime:	Subcritical	
Flow Area:	54.32	sq ft
Average Velocity:	8.30	ft/s
Maximum Velocity:	8.30	ft/s
Composite n:	0.018	
Hydraulic Radius:	1.74	ft
Wetted Perimeter:	31.18	ft
Wetted Top Width:	30.35	ft
Critical Slope:	0.008	ft/ft
Back Water Elevation:	1217.56	ft MSL

Culvert 3

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™



Normal Depth Results

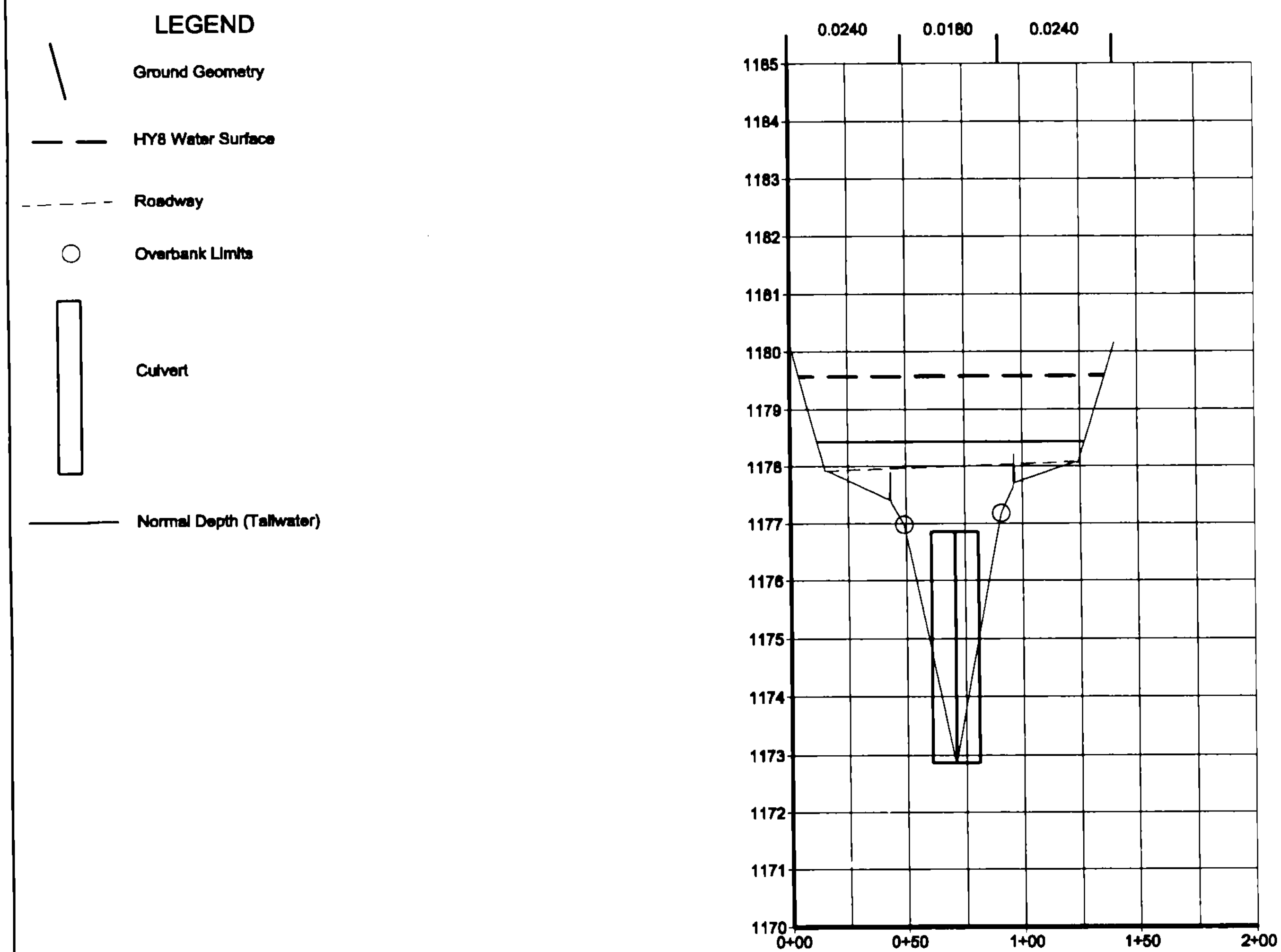
Cross-Section:	6	
Elevation:	1189.28	ft MSL
Depth:	5.22	ft
Discharge:	1370.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.8221	
Flow Regime:	Subcritical	
Flow Area:	128.63	sq ft
Average Velocity:	10.69	ft/s
Maximum Velocity:	11.28	ft/s
Composite n:	0.0205	
Hydraulic Radius:	1.84	ft
Wetted Perimeter:	69.98	ft
Wetted Top Width:	68.56	ft
Critical Slope:	0.0141	ft/ft

Culvert 5

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™



Normal Depth Results

Cross-Section:	199.15	
Elevation:	1178.44	ft MSL
Depth:	5.60	ft
Discharge:	1990.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.7586	
Flow Regime:	Subcritical	
Flow Area:	195.46	sq ft
Average Velocity:	10.16	ft/s
Maximum Velocity:	12.58	ft/s
Composite n:	0.0219	
Hydraulic Radius:	1.66	ft
Wetted Perimeter:	117.43	ft
Wetted Top Width:	115.29	ft
Critical Slope:	0.0197	ft/ft
Back Water Elevation:	1179.69	ft MSL

Culvert 6

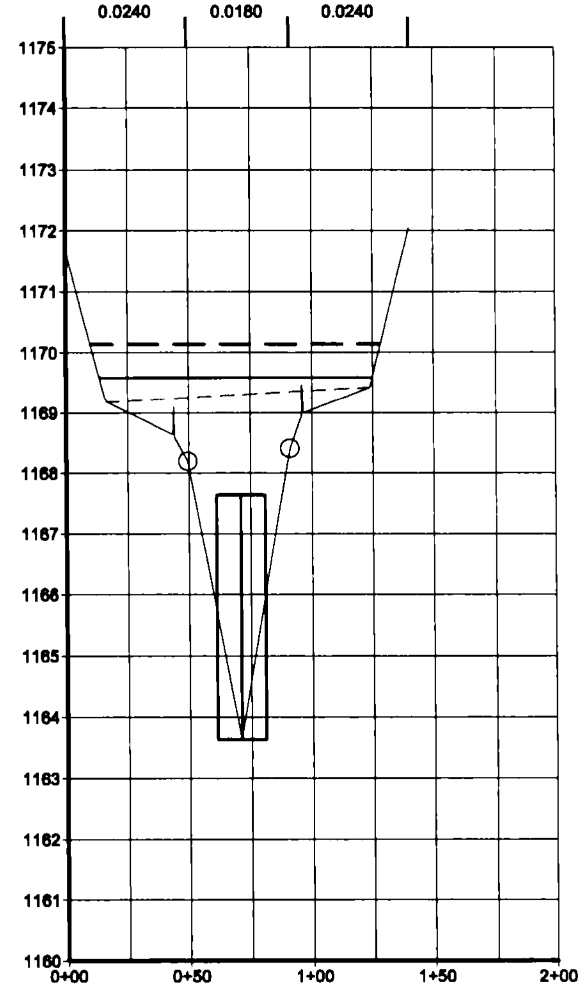
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

- Ground Geometry
- HY8 Water Surface
- Roadway
- Overbank Limits
- Culvert
- Normal Depth (Tailwater)



Normal Depth Results

Cross-Section:	199.14	
Elevation:	1169.58	ft MSL
Depth:	5.95	ft
Discharge:	2060.00	cfs
Energy Gradient:	0.0045	ft/ft
Froude Number:	0.7787	
Flow Regime:	Subcritical	
Flow Area:	191.14	sq ft
Average Velocity:	10.77	ft/s
Maximum Velocity:	12.87	ft/s
Composite n:	0.0218	
Hydraulic Radius:	1.69	ft
Wetted Perimeter:	113.37	ft
Wetted Top Width:	111.23	ft
Critical Slope:	0.0205	ft/ft
Back Water Elevation:	1170.20	ft MSL

Culvert 7

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

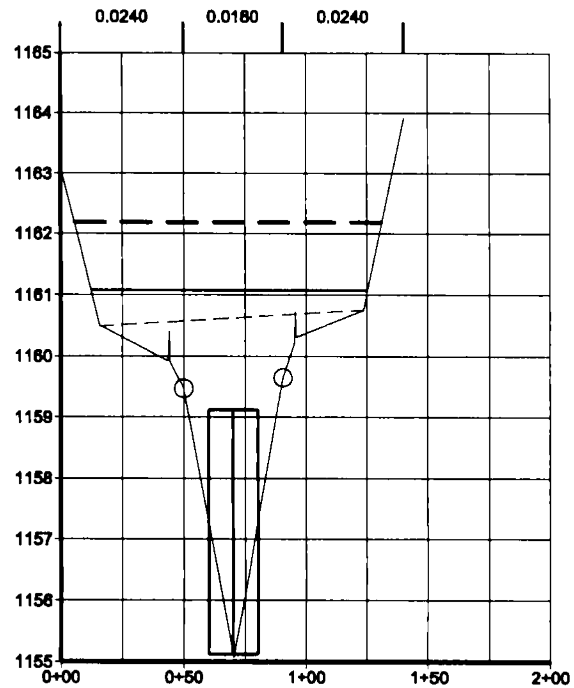
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Culvert 8

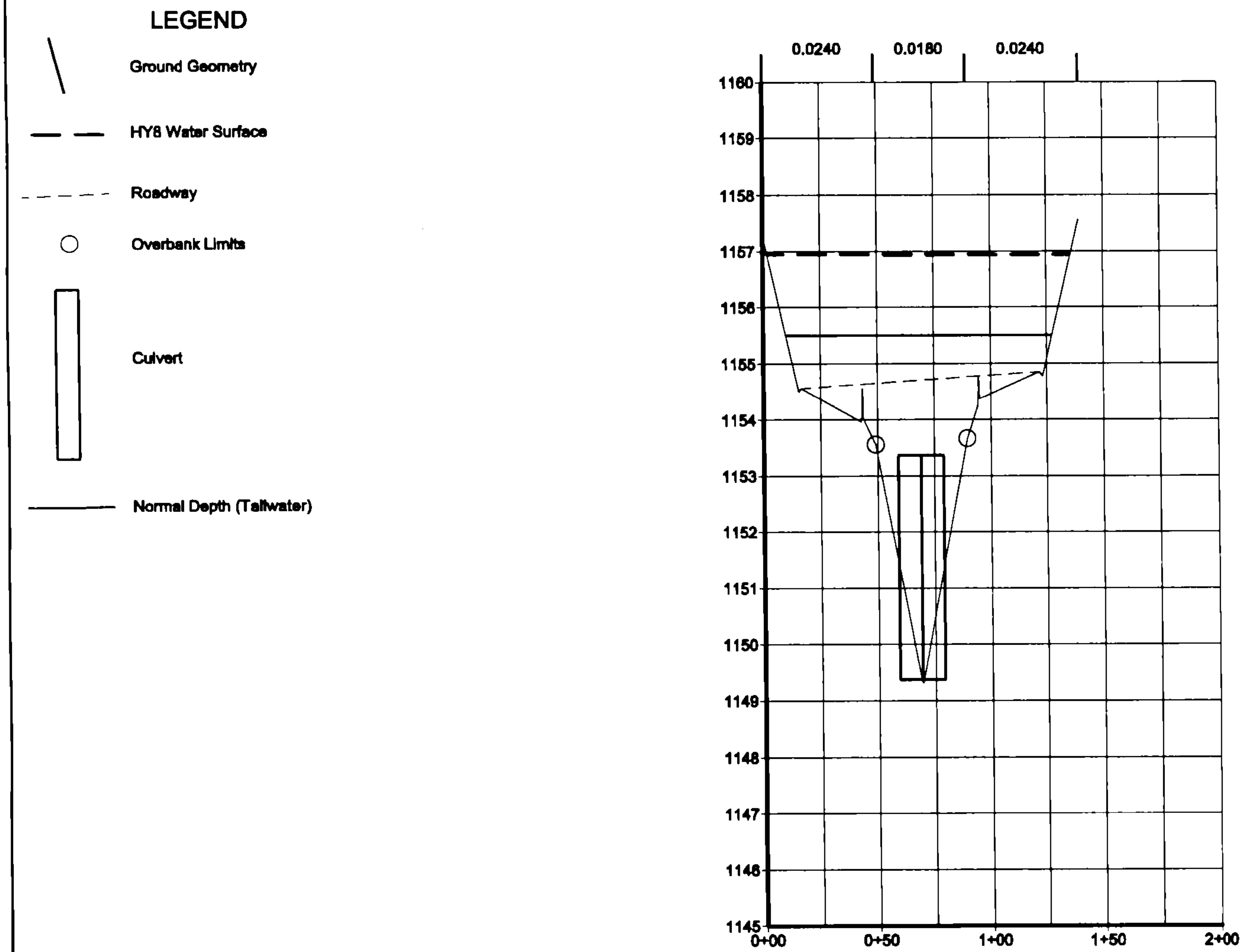
Normal Depth Results

Cross-Section:	199.13	
Elevation:	1161.08	ft MSL
Depth:	6.02	ft
Discharge:	2060.00	cfs
Energy Gradient:	0.0039	ft/ft
Froude Number:	0.7122	
Flow Regime:	Subcritical	
Flow Area:	207.67	sq ft
Average Velocity:	9.93	ft/s
Maximum Velocity:	12.32	ft/s
Composite n:	0.0219	
Hydraulic Radius:	1.81	ft
Wetted Perimeter:	115.09	ft
Wetted Top Width:	113.04	ft
Critical Slope:	0.019	ft/ft
Back Water Elevation:	1162.27	ft MSL

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™



Normal Depth Results

Cross-Section:	199.12	
Elevation:	1155.50	ft MSL
Depth:	6.19	ft
Discharge:	2540.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.7347	
Flow Regime:	Subcritical	
Flow Area:	244.91	sq ft
Average Velocity:	10.37	ft/s
Maximum Velocity:	13.45	ft/s
Composite n:	0.022	
Hydraulic Radius:	2.05	ft
Wetted Perimeter:	119.55	ft
Wetted Top Width:	117.37	ft
Critical Slope:	0.0167	ft/ft
Back Water Elevation	1156.98	ft MSL

Culvert 9

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

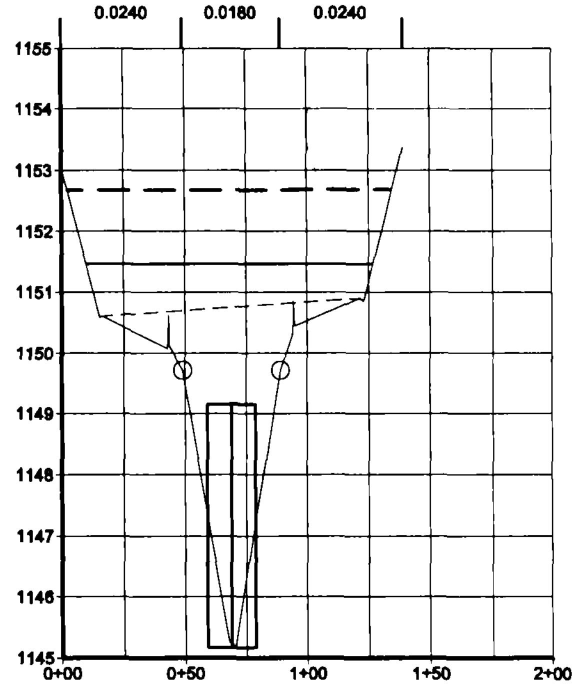
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Normal Depth Results

Cross-Section:	199.10	
Elevation:	1151.46	ft MSL
Depth:	6.28	ft
Discharge:	2540.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.7499	
Flow Regime:	Subcritical	
Flow Area:	238.33	sq ft
Average Velocity:	10.62	ft/s
Maximum Velocity:	13.58	ft/s
Composite n:	0.022	
Hydraulic Radius:	2	ft
Wetted Perimeter:	119.19	ft
Wetted Top Width:	116.92	ft
Critical Slope:	0.0175	ft/ft
Back Water Elevation:	1152.88	ft MSL

Culvert 10

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

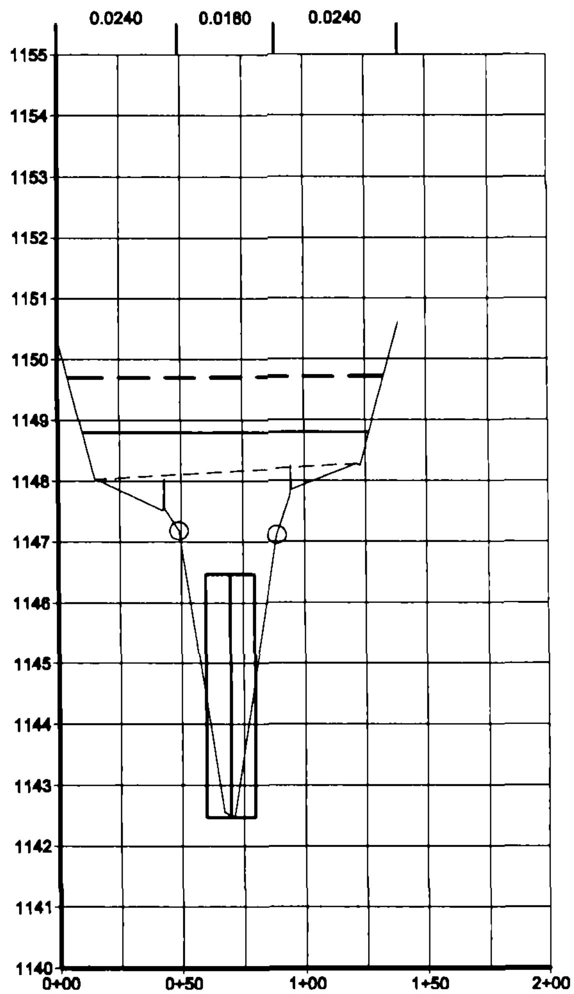
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Culvert 11

Normal Depth Results

Cross-Section:	199.9	
Elevation:	1148.80	ft MSL
Depth:	6.34	ft
Discharge:	2540.00	cfs
Energy Gradient:	0.0042	ft/ft
Froude Number:	0.7558	
Flow Regime:	Subcritical	
Flow Area:	235.32	sq ft
Average Velocity:	10.81	ft/s
Maximum Velocity:	13.70	ft/s
Composite n:	0.022	
Hydraulic Radius:	1.98	ft
Wetted Perimeter:	118.98	ft
Wetted Top Width:	116.61	ft
Critical Slope:	0.0179	ft/ft
Back Water Elevation:	1149.75	ft MSL

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

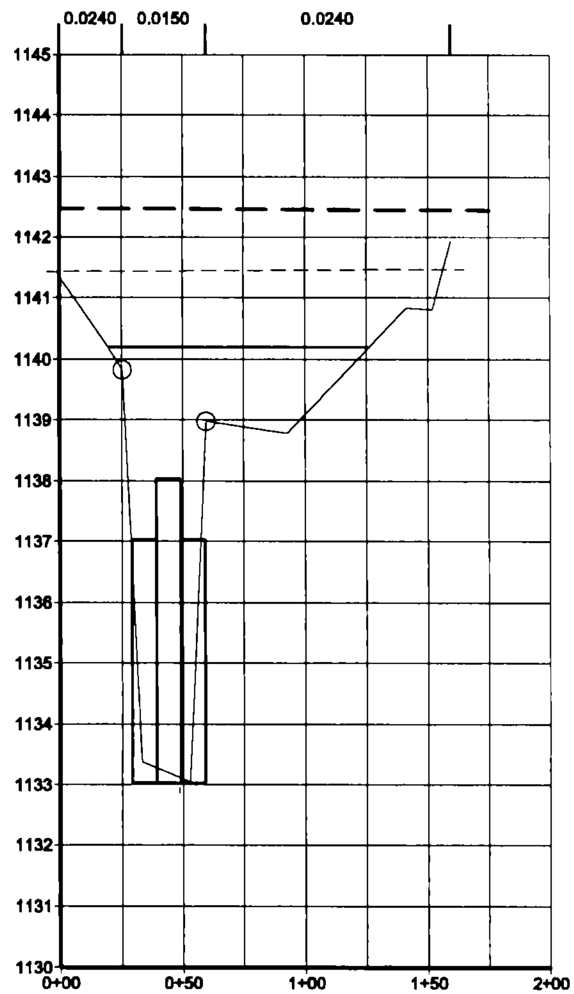
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth (Tailwater)



Normal Depth Results

Cross-Section:	4	
Elevation:	1140.20	ft MSL
Depth:	7.15	ft
Discharge:	3070.00	cfs
Energy Gradient:	0.0026	ft/ft
Froude Number:	0.7732	
Flow Regime:	Subcritical	
Flow Area:	261.76	sq ft
Average Velocity:	11.75	ft/s
Maximum Velocity:	14.80	ft/s
Composite n:	0.021	
Hydraulic Radius:	2.35	ft
Wetted Perimeter:	111.17	ft
Wetted Top Width:	106.57	ft
Critical Slope:	0.0147	ft/ft

Culvert 12

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: 99th Ave Channel (100yr 6hr)

Entellus™

Level III: Hydraulic Calculations
Greenway Channel

Entellus™

SHEET 2 OF 9
BY JS DATE 2/7/01
CHECK ______ DATE ______

CLIENT FCD 99-44
JOB NAME Glendale Peoria ADMP
JOB NO. 310.017

Figure Greenway-I : Level 3 Hydraulic Analysis of Greenway Channel
See Attached Sheets for HEC-RAS-RMS Results

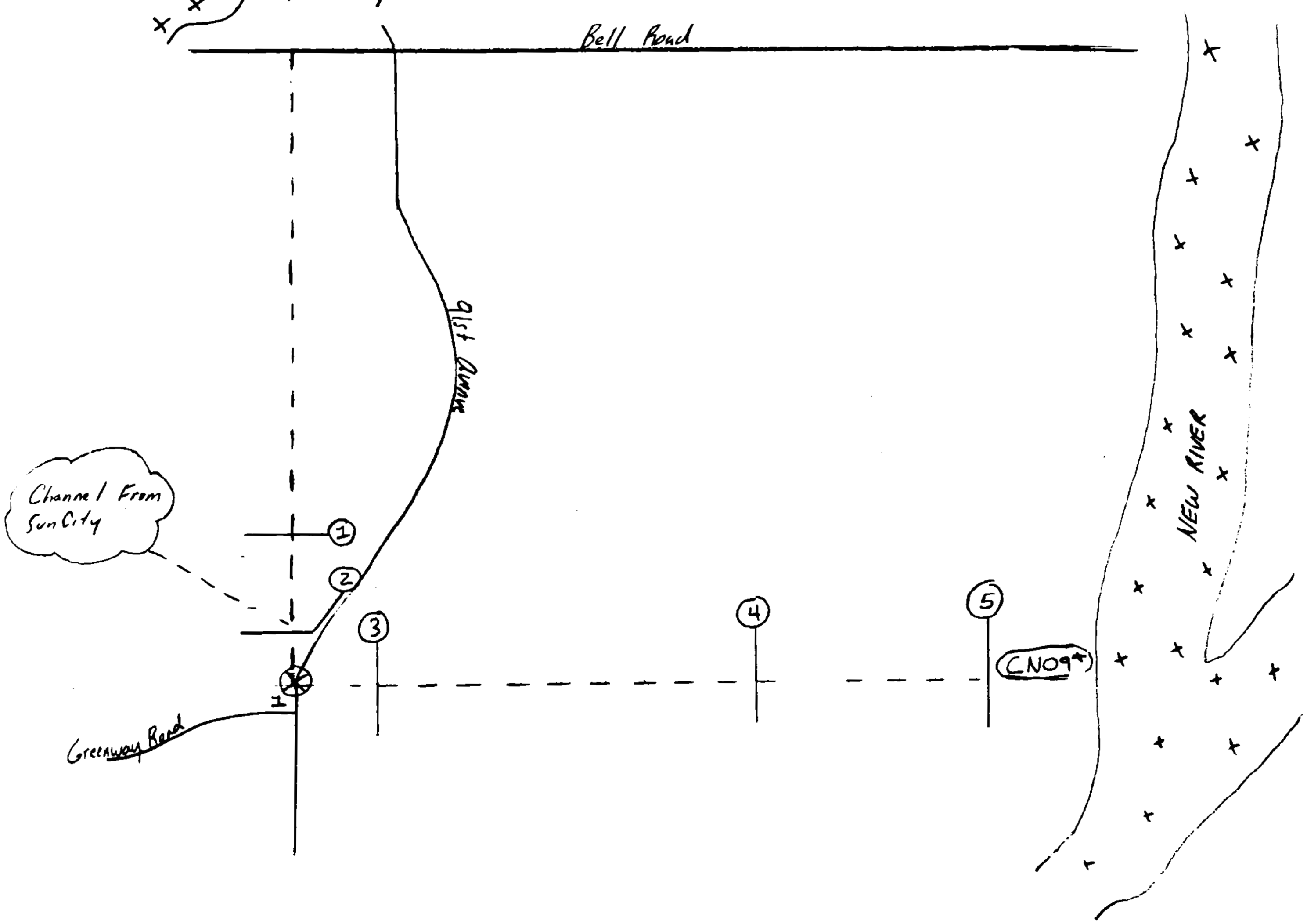
LEGEND

- - - Channel
⊗ Analyzed Culvert
① — Cross Section
(CN27) Concentration Point
x x x Floodway or Floodplain

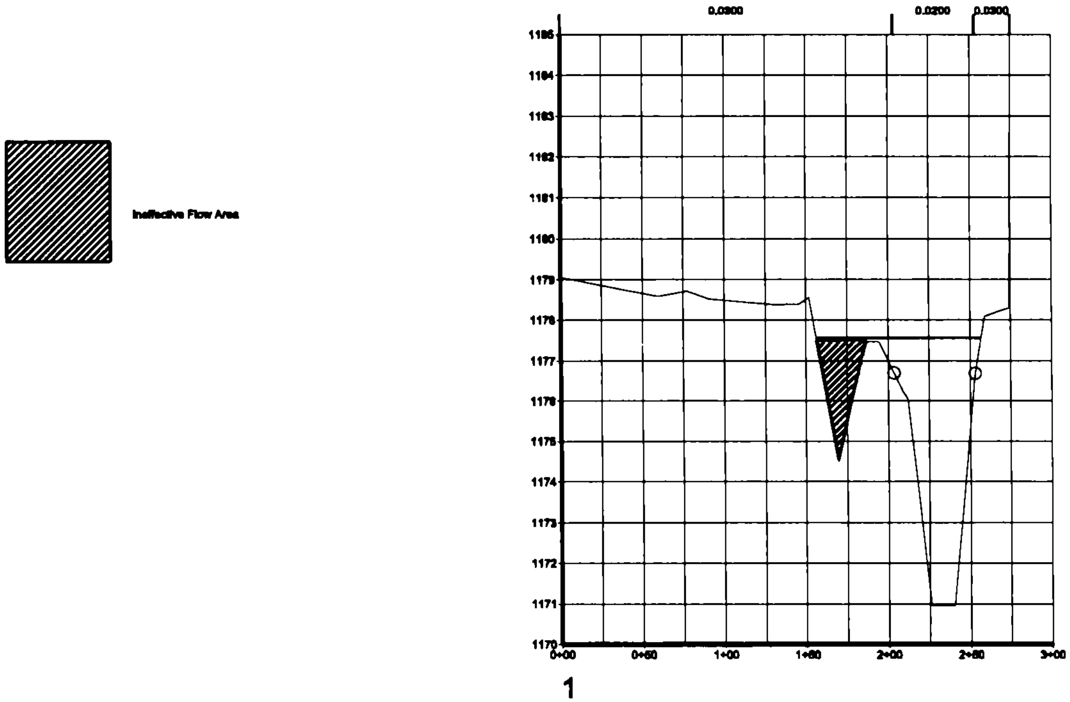
N
(Not To Scale)

HYDROLOGY*

Concentration Pt.	Flow (cfs)
CN09*	1360



* See Glendale Peoria ADMP Hydrology - Volume HY

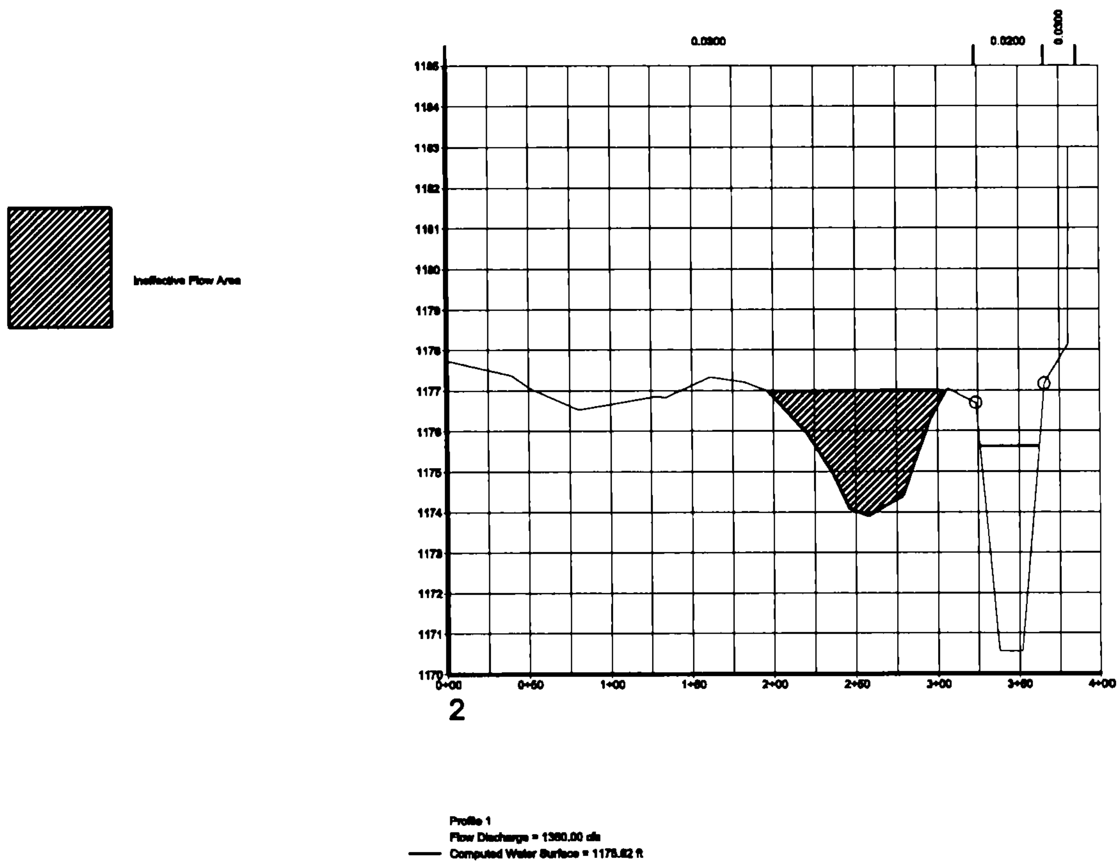


Profile 1
Flow Discharge = 1360.00 cfs
—— Computed Water Surface = 1177.56 ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

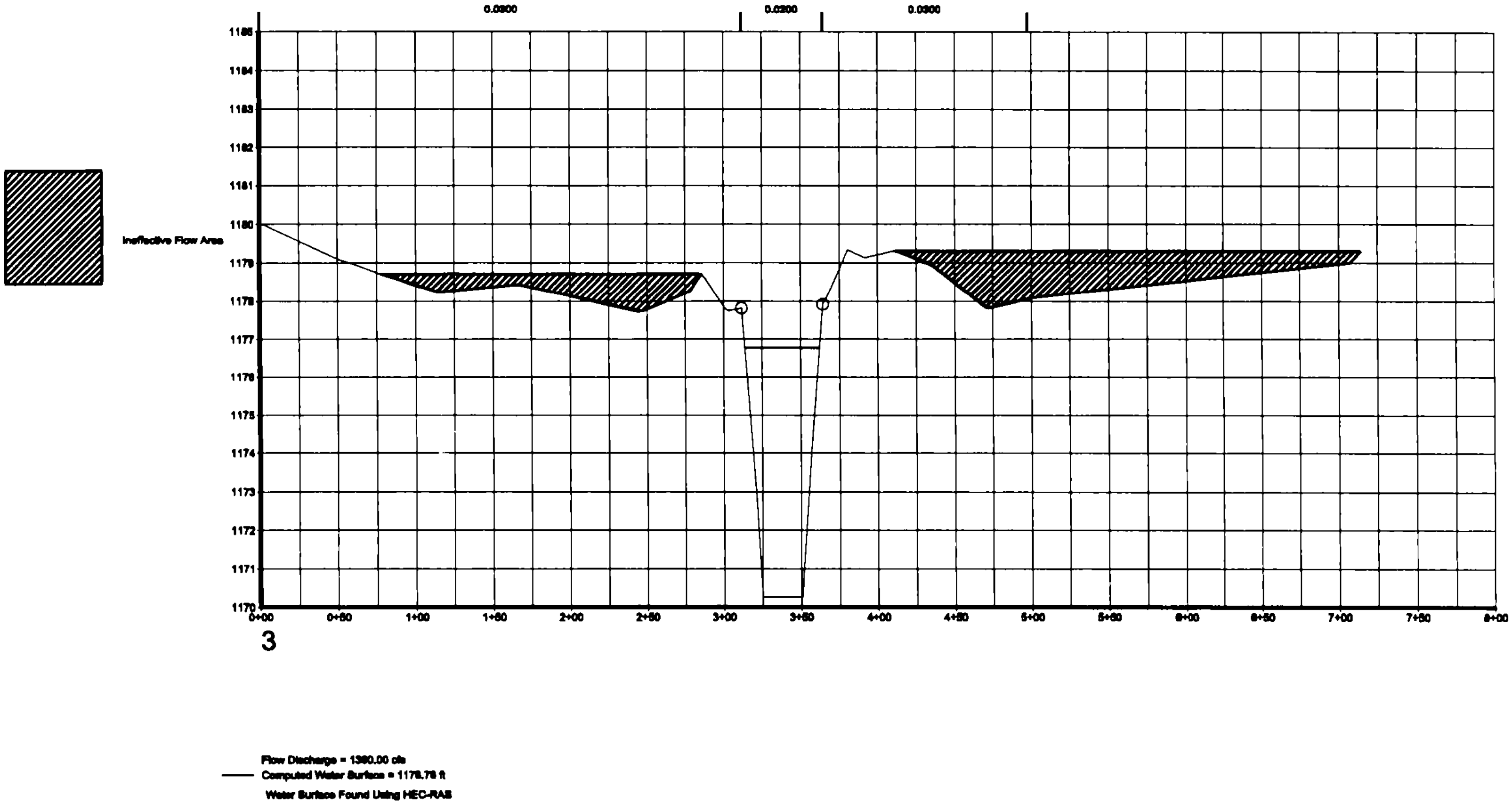
Entellus™



GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

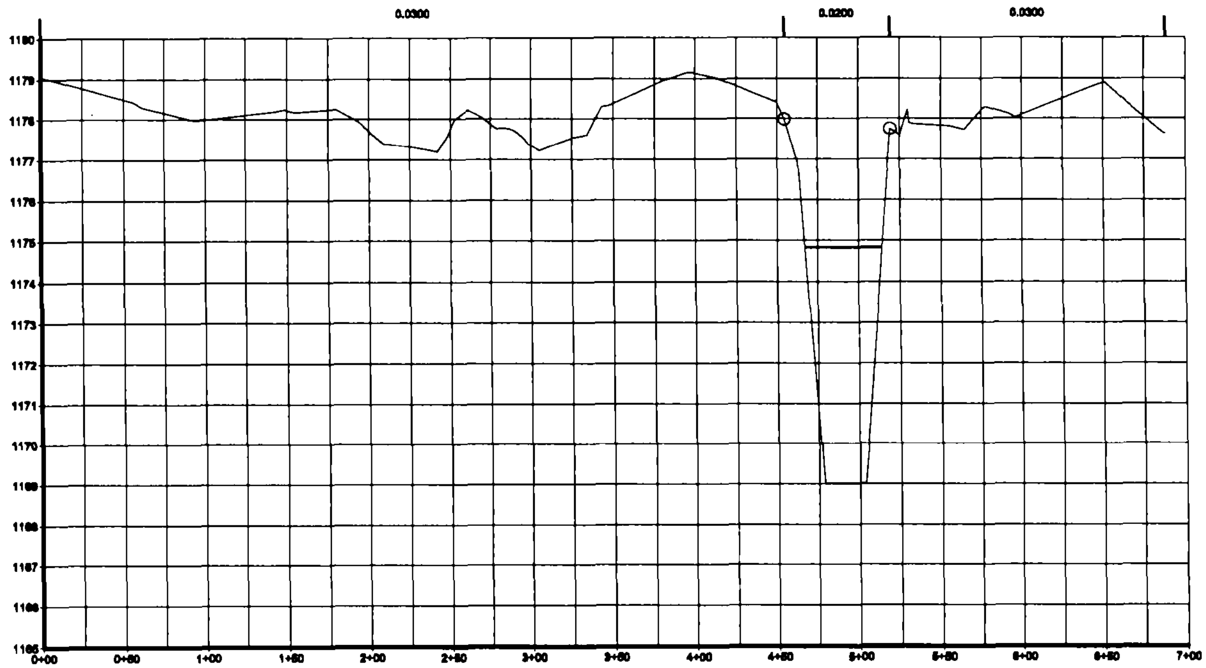
Entellus™



GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

Entellus™



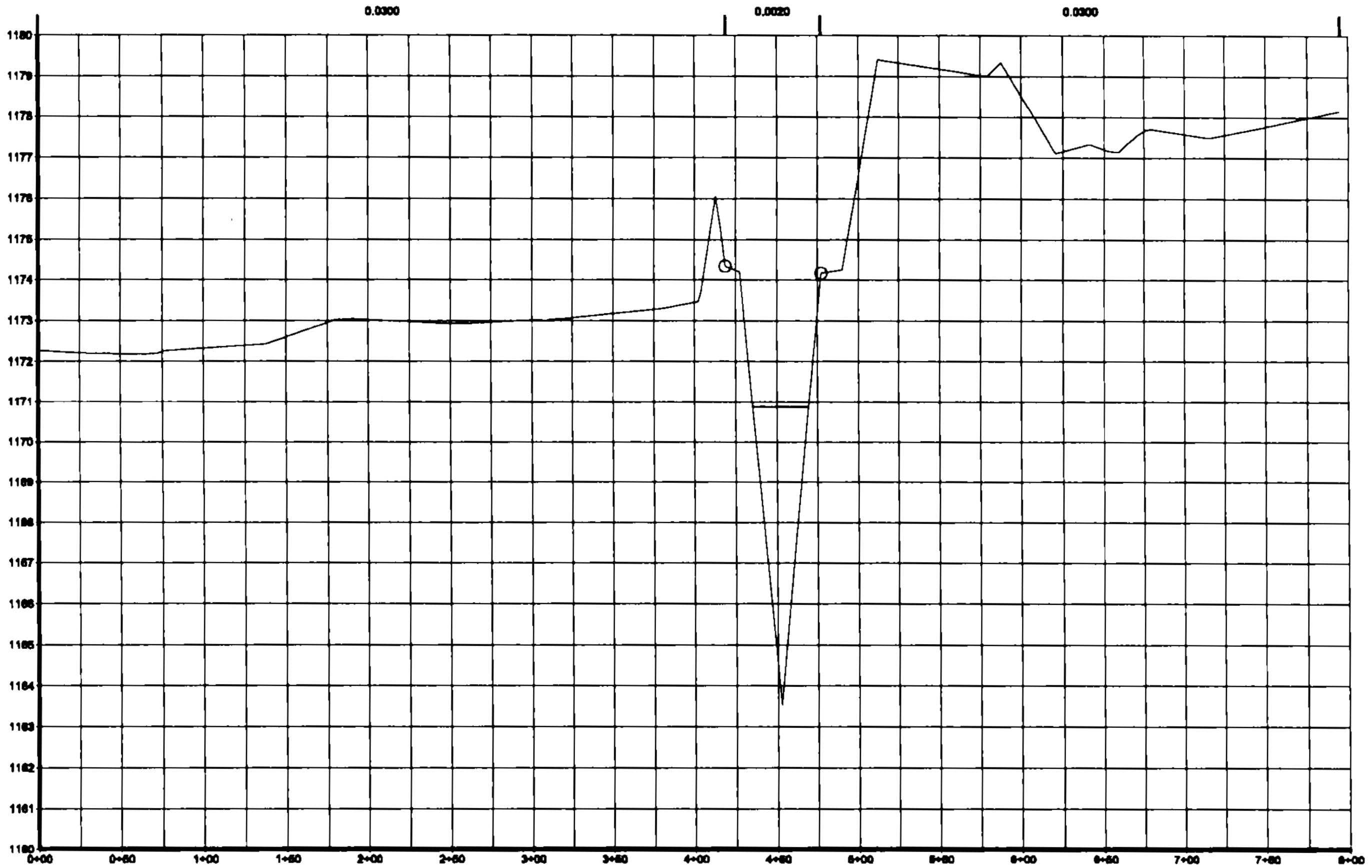
4

Flow Discharge = 1360.00 cfs
Computed Water Surface = 1174.82 ft
Water Surface Found Using HEC-RAS

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

Entellus™



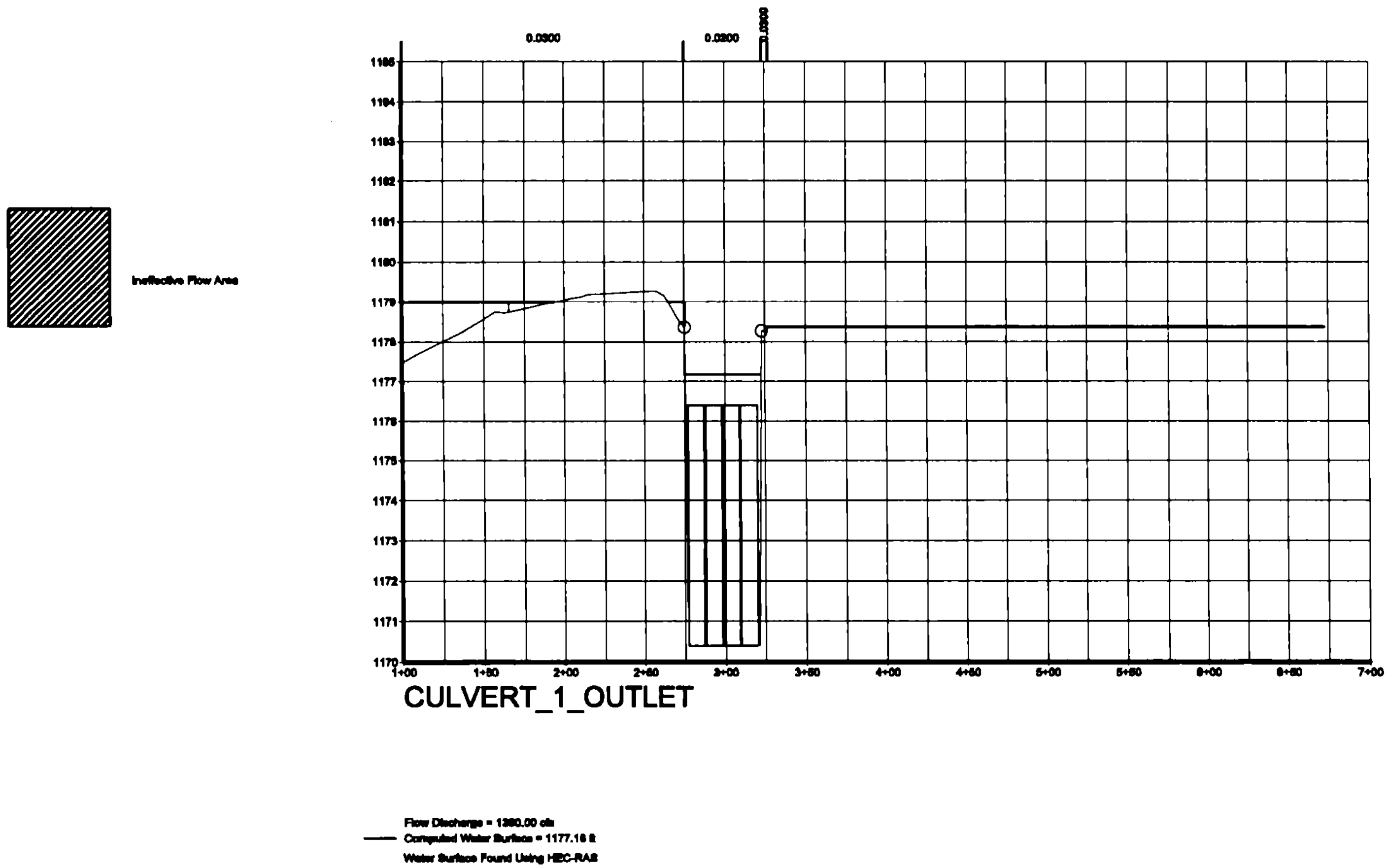
5

Flow Discharge = 1360.00 cfs
Computed Water Surface = 1170.86 ft
Water Surface Found Using HEC-RAS

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

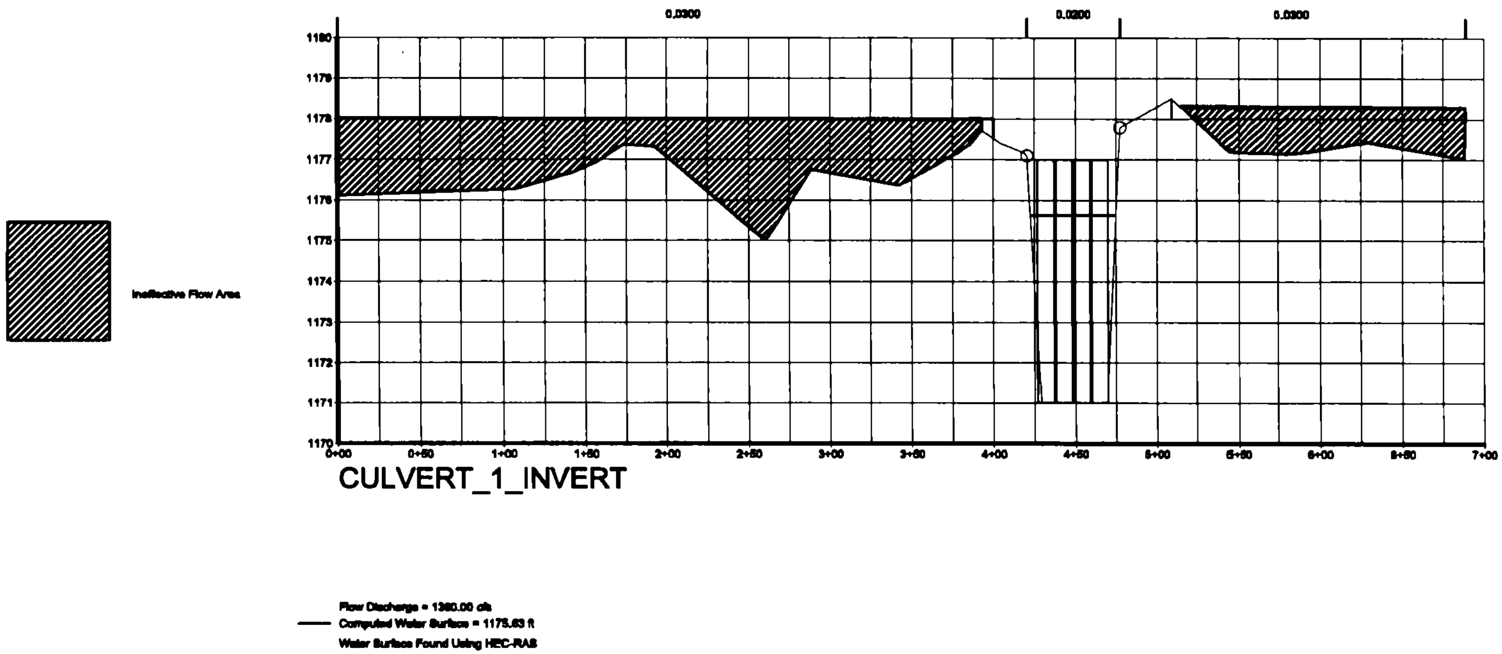
Entellus™



GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

Entellus™



GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Greenway Channel (100yr 6hr)

Entellus™

Level III: Hydraulic Calculations
Weir Wash

Entellus™

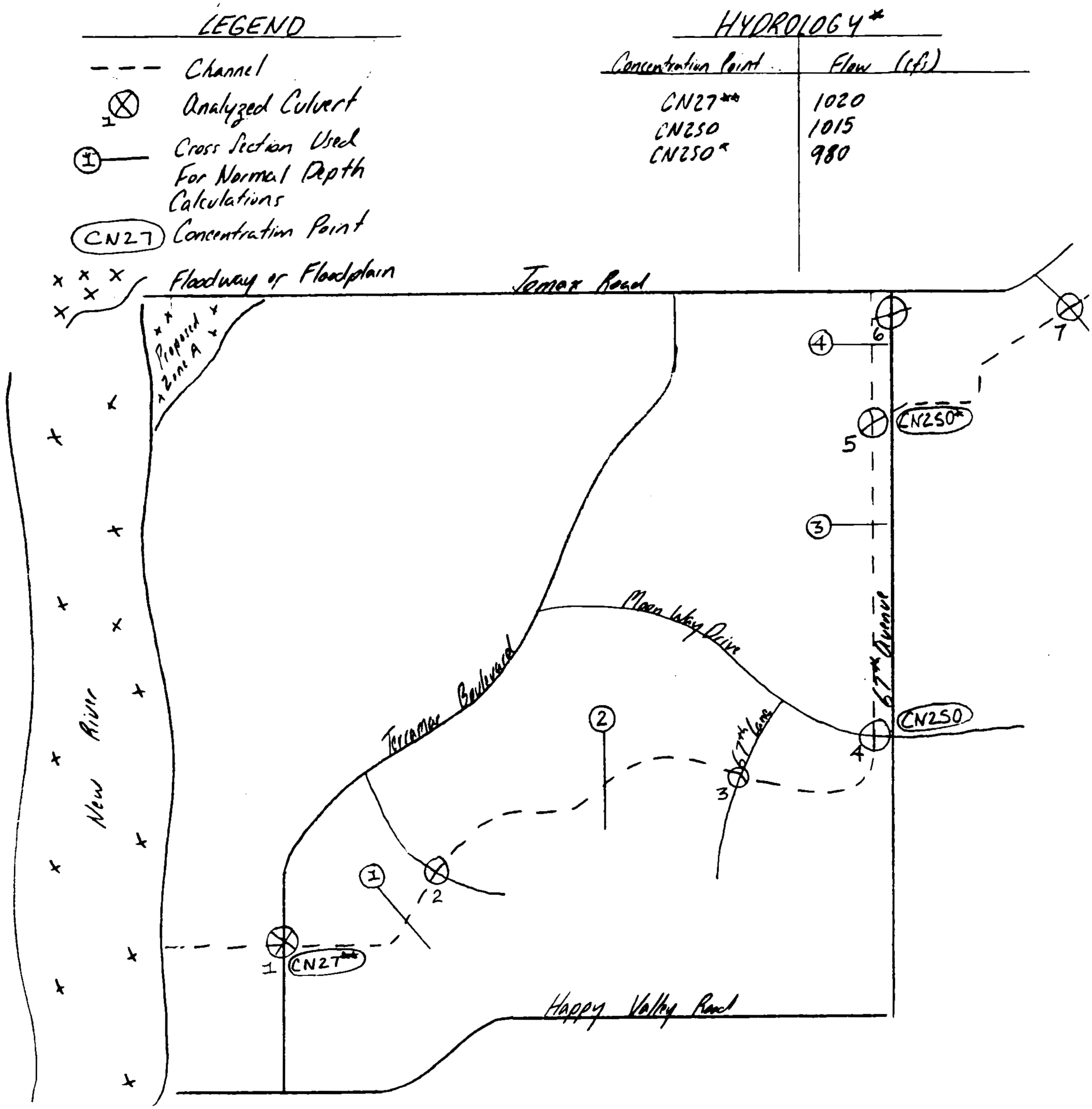
SHEET ______ OF ______
BY ______ DATE ______
CHECK ______ DATE ______

CLIENT FCD 99-44

JOB NAME Glendale Peoria ADMP

JOB NO. 310.017

Figure Weir-1 : Level 3 Hydraulic Analysis of Weir Wash



* see Glendale Peoria ADMP Hydrology - Volume HY

Glendale Peoria ADMP
Weir Wash Channel Surveyed Cross Sections
Table Weir-1

Channel XS #	Cross Street	Slope [ft/ft]	HEC-1 Flow Parameter	100yr 6hr Flow [cfs]	*Hydrology Modification	Invert Elevation [ft]	WS Elevation [ft]
1	1/8th Mile Northwest of Channel Intersection with Terramor Blvd.	0.01433649	CN27**	1020	Only Basin N26B and Route RN25O contribute to the channel flow	1352.7	1357.3
2	South Side of Residential Lots along Parsons Rd., and 69th Ave.	0.00941326	CN27**	1020	Only Basin N26B and Route RN25O contribute to the channel flow	1381.63	1386.31
3	1/3rd Mile South of Jomax Rd., Along 67th Ave.	0.00376264	CN25O	1015	None	1403.54	1409.57
4	1/10th Mile South of Jomax Rd., Along 67th Ave.	0.00477352	CN25O*	980	None	1407.83	1413.1

Glendale Peoria ADMP
Weir Wash Channel Culvert Analysis: General
Table Weir-2.1

Culvert#[1]	Culvert Log #[2]	Cross Street	Size	Length[3] [ft]	Slope [3] [ft/ft]	HEC-1 Flow Parameter [4] [cfs]	100yr 6hr Flow [4] [cfs]
1	200.25	Under Terramar Blvd, Approx. 1/4 Mile North of Happy Valley Rd.	4- 4 x 10 Concrete Box	100	0.006000	CN27**	1020
2	200.22	Under Unidentified residential road, Approx. 1/4 Mile North of Happy Valley Rd. and 5/8 Mile West of 67th Ave.	4- 4 x 10 Concrete Box	72 [5]	0.0137 [5]	CN27**	1020
3	200.21	Under 67th Ln., at Approx. 1/4 West of 67th Ave.	4- 4 x 10 Concrete Box	75	.00653 [5]	CN27**	1020
4	200.2	Under Desert Moon Way, Along 67th Ave.	4- 4 x 10 Concrete Box	100	0.007200	CN27**	1020
5	200.17	Under 67th Ave., at Approx 3/8 Mile South of Jomax Rd.	4- 4 x 10 Concrete Box	98	0.014700	CN25O	1015
6	200.26	Under 67th Ave., at Jomax Rd.	4- 4 x 10 Concrete Box	96	0.008800	CN25O*	980
7	200.15	Under Approx. 64th Ave. Alignment and Jomax Rd. Alignment	4- 4 x 10 Concrete Box	96 [5]	.0185 [5]	CN25O*	980

[1] See Figure Weir-1

[2] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[3] Referenced from Drainage Infrastructure Report for Terramar,Coe and Van Loo Consultants Inc, 1996

[4] Referenced from Glendale Peoria Area Drainage Master Plan Update- Hydrology- Volume HY

[5] Elevations referenced from field survey information found in the Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

Glendale Peoria ADMP
Weir Wash Channel Culvert Analysis: Elevations
Table Weir-2.2

Culvert#[1]	Culvert Log #	Cross Street	Size	Cross Section Geometry Used [1,6]	Culvert Outlet Elevation [5]	Culvert Invert Elevation [5]	Estimated Roadway Crest [5]	Headwater Elevation*	Top of Roadway Width [5] [ft]
1	200.25	Under Terramar Blvd, Approx. 1/4 Mile North of Happy Valley Rd.	4- 4 x 10 Concrete Box	1	1345.66	1346.3	1352.1	1351.29	55
2	200.22	Under Unidentified residential road, Approx. 1/4 Mile North of Happy Valley Rd. and 5/8 Mile West of 67th Ave.	4- 4 x 10 Concrete Box	1	1362.43	1363.42	1369.7	1368.3	65
3	200.21	Under 67th Ln., at Approx. 1/4 West of 67th Ave.	4- 4 x 10 Concrete Box	2	1390.16	1390.65	1399.0	1396.18	46
4	200.2	Under Desert Moon Way, Along 67th Ave.	4- 4 x 10 Concrete Box	2	1396.90	1397.62	1404.6	1402.96	62
5	200.17	Under 67th Ave., at Approx 3/8 Mile South of Jomax Rd.	4- 4 x 10 Concrete Box	3**	1409.44	1410.88	1417.0	1415.12	76
6	200.26	Under 67th Ave., at Jomax Rd.	4- 4 x 10 Concrete Box	4**	1410.75	1411.6	1417.0	1415.74	75
7	200.15	Under Approx. 64th Ave. Alignment and Jomax Rd. Alignment	4- 4 x 10 Concrete Box	Not Available	1428.97	1430.7	1435.23	1435.23 [7]	70

* Elevations were found using HY8 Software

[1] See Figure Weir-1

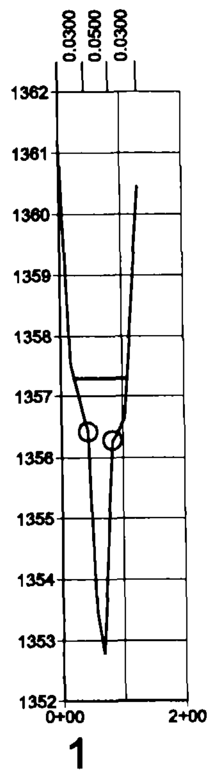
[2] See Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[5] Elevations referenced from field survey information found in the Glendale Peoria Area Drainage Master Plan Update- Data Collection- Volume DC

[6] The tailwater XS geometry, along with the culvert outlet elevation were used to create the tailwater rating curve using HY8

** Section at channel intersection used

[7] Culvert assumed to be operating under inlet control, analyzed using attached FHWA Chart 8



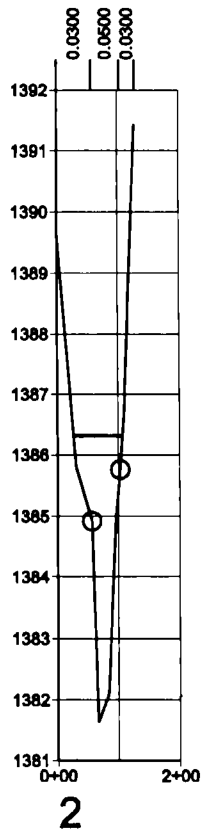
Normal Depth Results

Cross-Section:	1	
Elevation:	1357.30	ft MSL
Depth:	4.52	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0143	ft/ft
Froude Number:	0.5655	
Flow Regime:	Subcritical	
Flow Area:	149.64	sq ft
Average Velocity:	6.84	ft/s
Maximum Velocity:	7.41	ft/s
Composite n:	0.0399	
Hydraulic Radius:	1.72	ft
Wetted Perimeter:	86.92	ft
Wetted Top Width:	86.09	ft
Critical Slope:	0.0505	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™



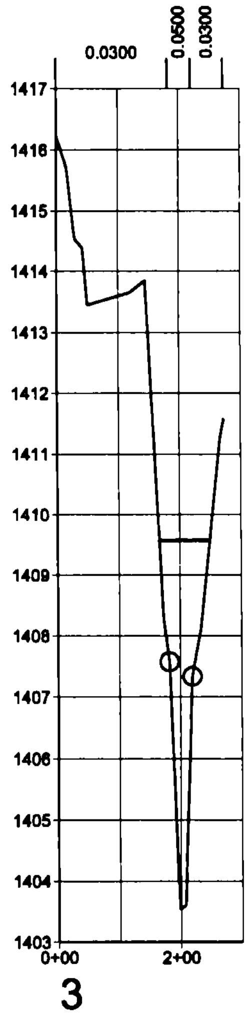
Normal Depth Results

Cross-Section:	2	
Elevation:	1386.31	ft MSL
Depth:	4.68	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0094	ft/ft
Froude Number:	0.4772	
Flow Regime:	Subcritical	
Flow Area:	174.14	sq ft
Average Velocity:	5.86	ft/s
Maximum Velocity:	6.15	ft/s
Composite n:	0.0422	
Hydraulic Radius:	2.14	ft
Wetted Perimeter:	81.38	ft
Wetted Top Width:	80.37	ft
Critical Slope:	0.0439	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

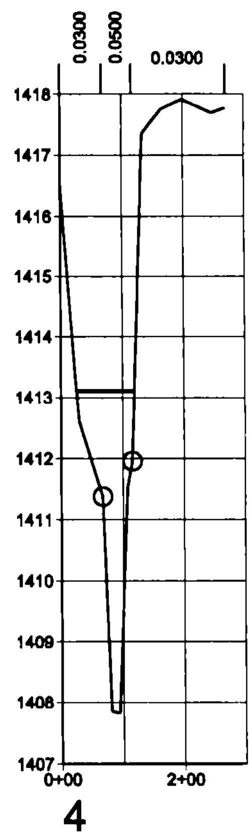


Normal Depth Results		
Cross-Section:	3	
Elevation:	1409.57	ft MSL
Depth:	6.03	ft
Discharge:	1015.00	cfs
Energy Gradient:	0.0037	ft/ft
Froude Number:	0.3246	
Flow Regime:	Subcritical	
Flow Area:	224.43	sq ft
Average Velocity:	4.52	ft/s
Maximum Velocity:	4.87	ft/s
Composite n:	0.0397	
Hydraulic Radius:	2.69	ft
Wetted Perimeter:	83.48	ft
Wetted Top Width:	82.18	ft
Critical Slope:	0.037	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

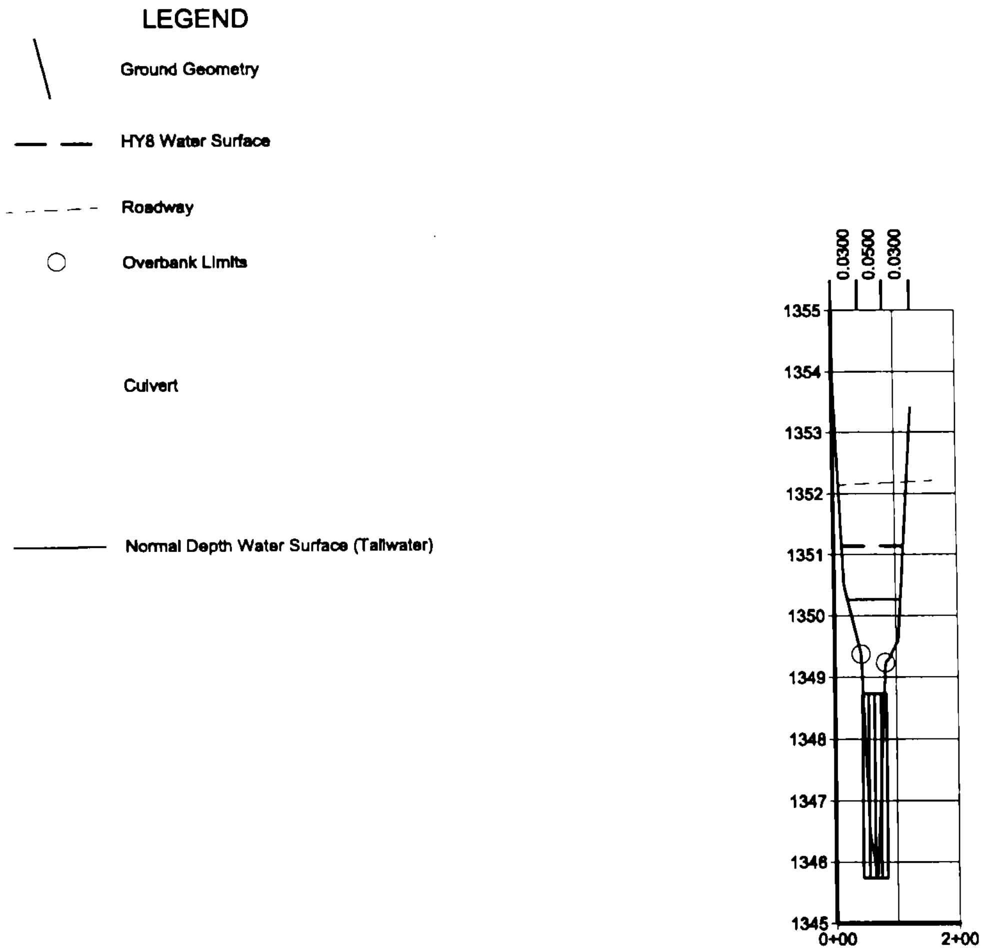


Normal Depth Results		
Cross-Section:	4	
Elevation:	1413.10	ft MSL
Depth:	5.28	ft
Discharge:	980.00	cfs
Energy Gradient:	0.0047	ft/ft
Froude Number:	0.3439	
Flow Regime:	Subcritical	
Flow Area:	218.51	sq ft
Average Velocity:	4.48	ft/s
Maximum Velocity:	4.75	ft/s
Composite n:	0.0409	
Hydraulic Radius:	2.29	ft
Wetted Perimeter:	95.44	ft
Wetted Top Width:	94.26	ft
Critical Slope:	0.0426	ft/ft

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™



Normal Depth Results

Cross-Section:	1	
Elevation:	1350.26	ft MSL
Depth:	4.52	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0143	ft/ft
Froude Number:	0.5655	
Flow Regime:	Subcritical	
Flow Area:	149.64	sq ft
Average Velocity:	6.84	ft/s
Maximum Velocity:	7.41	ft/s
Composite n:	0.0399	
Hydraulic Radius:	1.72	ft
Wetted Perimeter:	86.92	ft
Wetted Top Width:	86.09	ft
Critical Slope:	0.0505	ft/ft

Culvert 1

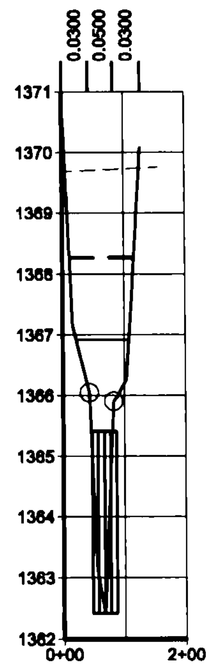
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

LEGEND

- Ground Geometry
- HY8 Water Surface
- Roadway
- Overbank Limits
- Culvert
- Normal Depth Water Surface (Tailwater)



Normal Depth Results

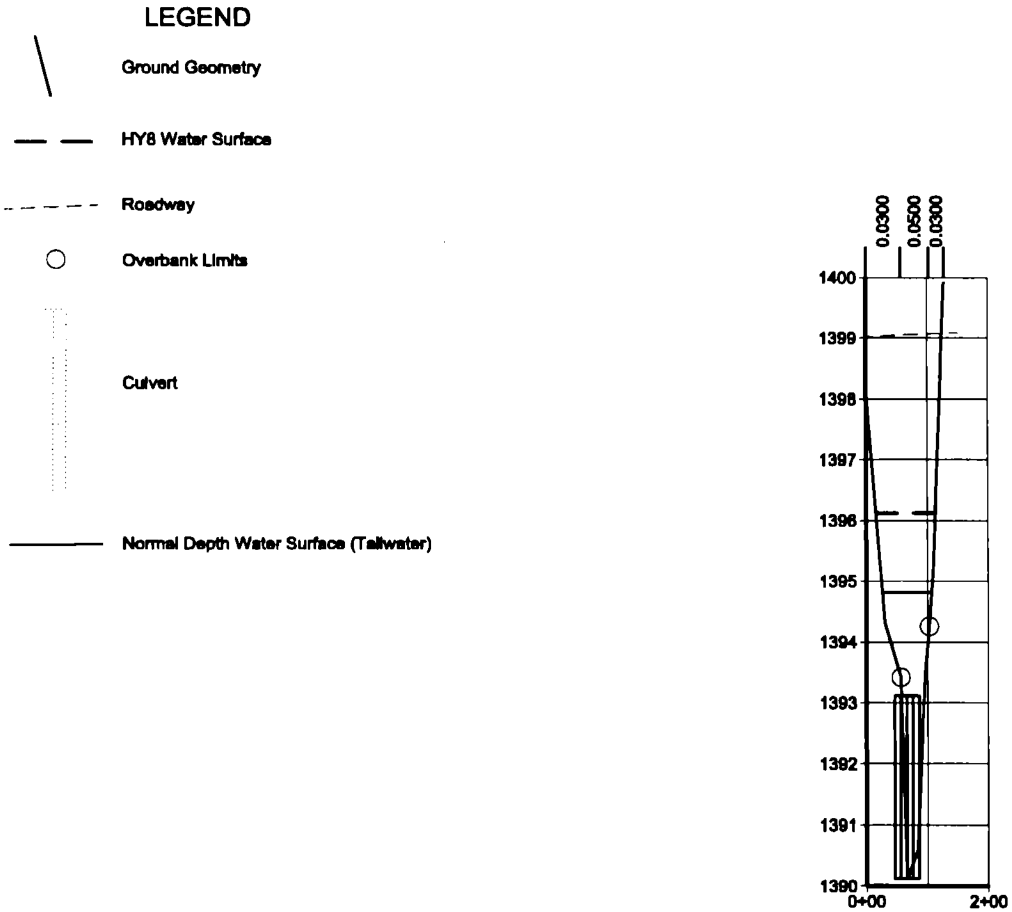
Cross-Section:	1	
Elevation:	1366.93	ft MSL
Depth:	4.52	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0143	ft/ft
Froude Number:	0.5855	
Flow Regime:	Subcritical	
Flow Area:	149.64	sq ft
Average Velocity:	6.84	ft/s
Maximum Velocity:	7.41	ft/s
Composite n:	0.0399	
Hydraulic Radius:	1.72	ft
Wetted Perimeter:	86.92	ft
Wetted Top Width:	86.09	ft
Critical Slope:	0.0505	ft/ft

Culvert 2

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™



Normal Depth Results

Cross-Section:	2	
Elevation:	1394.81	ft MSL
Depth:	4.68	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0094	ft/ft
Froude Number:	0.4772	
Flow Regime:	Subcritical	
Flow Area:	174.14	sq ft
Average Velocity:	5.86	ft/s
Maximum Velocity:	6.15	ft/s
Composite n:	0.0422	
Hydraulic Radius:	2.14	ft
Wetted Perimeter:	81.38	ft
Wetted Top Width:	80.37	ft
Critical Slope:	0.0439	ft/ft

Culvert 3

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

LEGEND

Ground Geometry

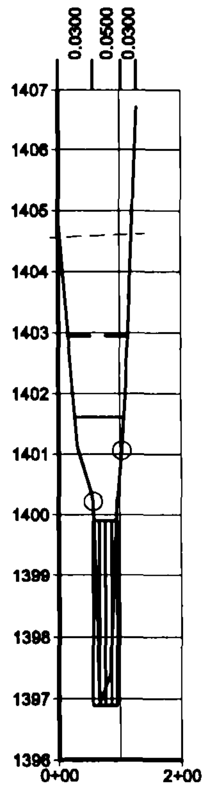
HY8 Water Surface

Roadway

Overbank Limits

Culvert

Normal Depth Water Surface (Tailwater)



Normal Depth Results

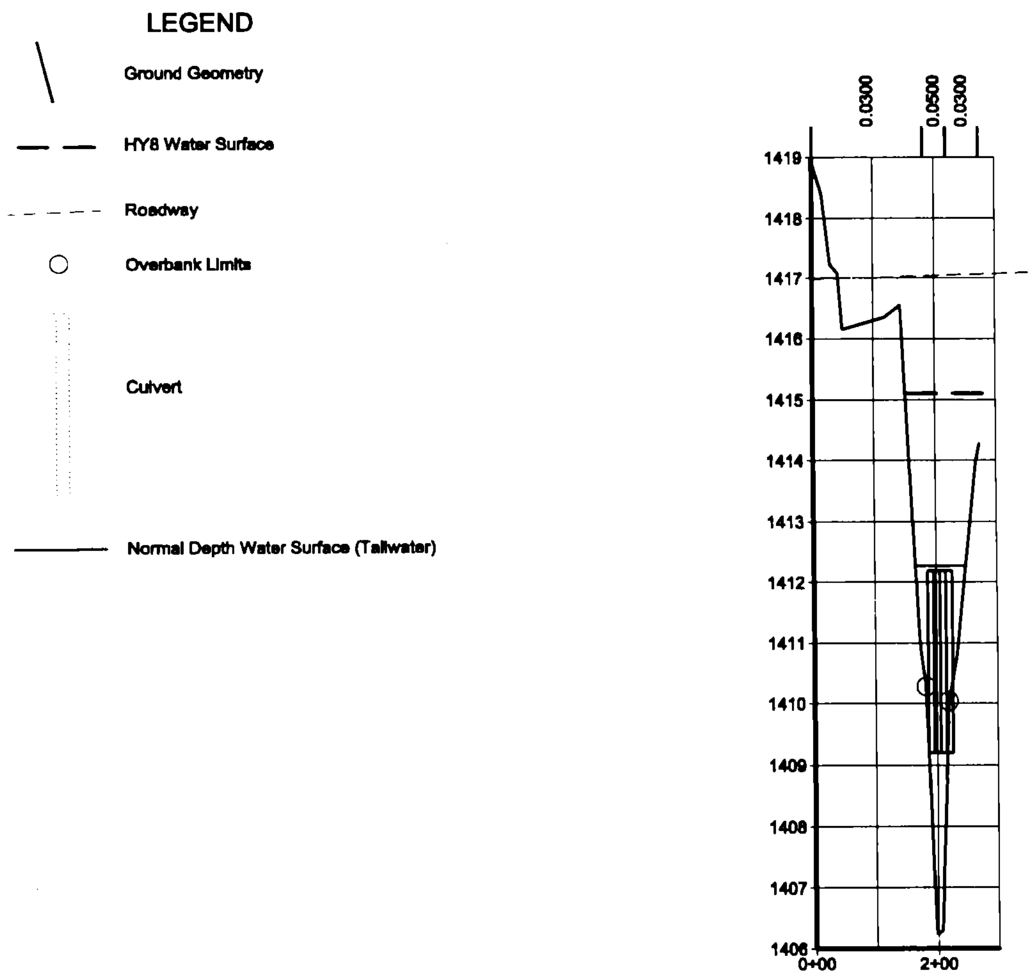
Cross-Section:	2	
Elevation:	1401.61	ft MSL
Depth:	4.68	ft
Discharge:	1020.00	cfs
Energy Gradient:	0.0094	ft/ft
Froude Number:	0.4772	
Flow Regime:	Subcritical	
Flow Area:	174.14	sq ft
Average Velocity:	5.86	ft/s
Maximum Velocity:	6.15	ft/s
Composite n:	0.0422	
Hydraulic Radius:	2.14	ft
Wetted Perimeter:	81.38	ft
Wetted Top Width:	80.37	ft
Critical Slope:	0.0439	ft/ft

Culvert 4

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™



Normal Depth Results

Cross-Section:	3	
Elevation:	1412.27	ft MSL
Depth:	6.03	ft
Discharge:	1015.00	cfs
Energy Gradient:	0.0037	ft/ft
Froude Number:	0.3246	
Flow Regime:	Subcritical	
Flow Area:	224.43	sq ft
Average Velocity:	4.52	ft/s
Maximum Velocity:	4.87	ft/s
Composite n:	0.0397	
Hydraulic Radius:	2.69	ft
Wetted Perimeter:	83.48	ft
Wetted Top Width:	82.18	ft
Critical Slope:	0.037	ft/ft

Culvert 5

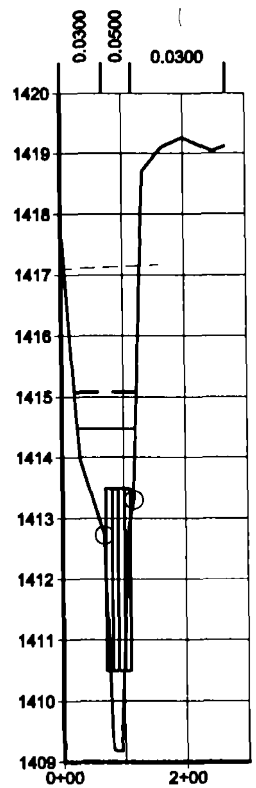
GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

LEGEND

- Ground Geometry
- HY8 Water Surface
- Roadway
- Overbank Limits
- Culvert
- Normal Depth Water Surface (Tailwater)



Normal Depth Results

Cross-Section:	4	
Elevation:	1414.47	ft MSL
Depth:	5.30	ft
Discharge:	980.00	cfs
Energy Gradient:	0.0047	ft/ft
Froude Number:	0.3411	
Flow Regime:	Subcritical	
Flow Area:	219.98	sq ft
Average Velocity:	4.46	ft/s
Maximum Velocity:	4.73	ft/s
Composite n:	0.0409	
Hydraulic Radius:	2.3	ft
Wetted Perimeter:	95.63	ft
Wetted Top Width:	94.43	ft
Critical Slope:	0.0424	ft/ft

Culvert 6

GLENDALE/ PEORIA AREA DRAINAGE MASTER PLAN UPDATE

Analysis of Existing Hydraulics: Weir Wash Channel (100yr 6hr)

Entellus™

83RD AVENUE DETENTION BASIN CALCULATIONS

Entellus

SHEET ______ OF ______

BY HAA DATE 05-Sep-01

PROJECT Glendale/Peoria ADMP Update CHECK ______ DATE ______

LOCATIO 83rd Ave. Basin outlet JOB NO. ______

Normal depth in a circular channel

Flow Q (cfs)	Manning's n	Depth Y (in)	Diameter D (in)	Theta (radians)	Area A (sqft)	Wetted Perimeter P (in)	Hydraulic Radius R	Slope S (ft/ft)	Top Width T (in)	Velocity V (fps)	Froude Number Fr	Critical Depth Yc (in)
0.000	0.015	0.00	42.0	0.006	0.00	0.01	0.00	0.004000	0.01	0.00	0.147	39.858
1.039	0.015	4.00	42.0	1.255	0.47	2.20	0.21	0.004000	2.05	2.23	0.825	39.858
4.374	0.015	8.00	42.0	1.807	1.28	3.16	0.40	0.004000	2.75	3.42	0.885	39.858
9.823	0.015	12.00	42.0	2.256	2.27	3.95	0.57	0.004000	3.16	4.33	0.901	39.858
16.988	0.015	16.00	42.0	2.661	3.37	4.66	0.72	0.004000	3.40	5.05	0.894	39.858
25.360	0.015	20.00	42.0	3.046	4.52	5.33	0.85	0.004000	3.50	5.61	0.870	39.858
34.339	0.015	24.00	42.0	3.428	5.68	6.00	0.95	0.004000	3.46	6.04	0.831	39.858
43.229	0.015	28.00	42.0	3.821	6.81	6.69	1.02	0.004000	3.30	6.34	0.778	39.858
51.200	**0.015**	**32.00**	**42.0**	**4.244**	**7.87**	**7.43**	**1.06**	**0.004000**	**2.98**	**6.51**	**0.706**	**39.858**
57.172	0.015	36.00	42.0	4.733	8.78	8.28	1.06	0.004000	2.45	6.51	0.606	39.858
59.226	0.015	40.00	42.0	5.403	9.45	9.46	1.00	0.004000	1.49	6.26	0.438	39.858
55.147	0.015	42.00	42.0	6.283	9.62	11.00	0.87	0.004000	0.00	5.73	0.000	39.858
61.656	0.015	42.00	42.0	6.283	9.62	11.00	0.87	0.005000	0.00	6.41	0.000	39.858
67.541	0.015	42.00	42.0	6.283	9.62	11.00	0.87	0.006000	0.00	7.02	0.000	39.858
78.959	0.015	42.00	42.0	6.283	9.62	11.00	0.87	0.008200	0.00	8.21	0.000	39.858

Outlet WSE	Pipe Length	Friction Losses	Minor loses K	Minor losses	Total Losses	Reservoir WSE
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2		0.00	9.20	1300.20
1291	2300	9.2	2	1.02	10.22	1301.22
1291	2300	11.5	2	1.28	12.78	1303.78
1291	2300	13.8	2	1.53	15.33	1306.33
1291	2300	18.86	2	2.09	20.95	1311.95

APPENDIX D. LEVEL II AND LEVEL III PUBLIC MEETING FLIERS

Glendale Peoria

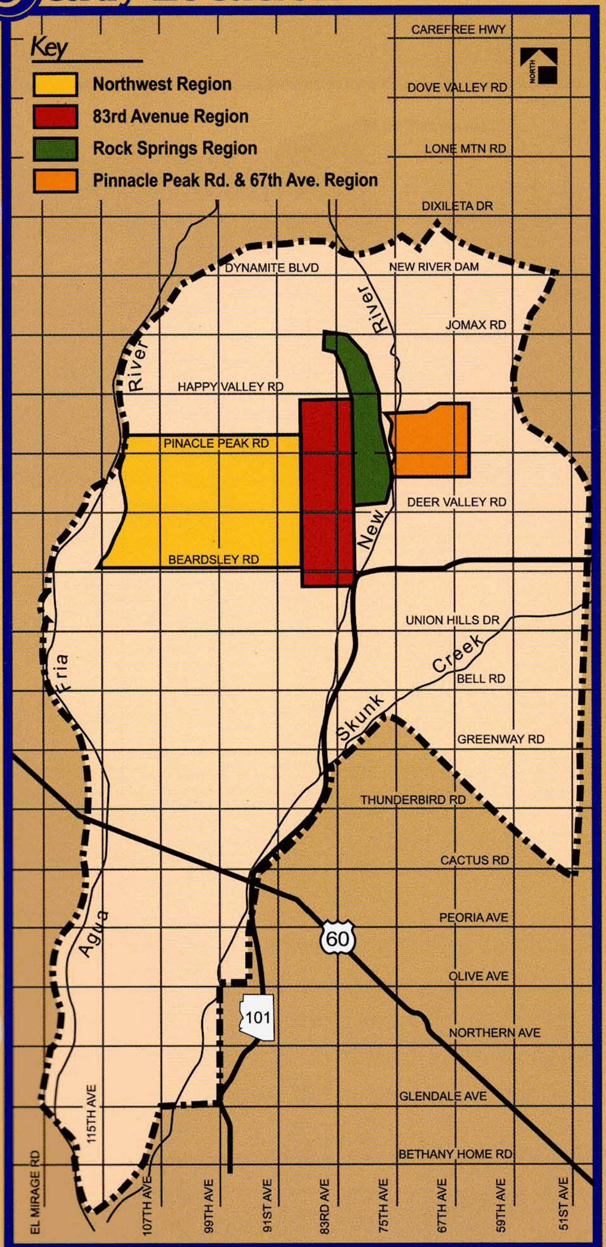
Area Drainage Master Plan Update • September '00

Study Purpose

The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of central Maricopa County. An area drainage master plan identifies drainage problems without consideration of political boundaries and develops a plan that will eliminate or minimize drainage problems. The Glendale/Peoria ADMP Update will:

- identify and evaluate existing regional and neighborhood drainage problems using "state of the art" engineering techniques;
- consider neighborhood character and community recreational needs;
- evaluate archaeological, biological, and other environmental factors;
- identify cost-effective drainage solutions that provide maximum community benefits; and
- involve the community in the development of the plan.

Study Location



Thunderbird Paseo Park, Glendale, Arizona

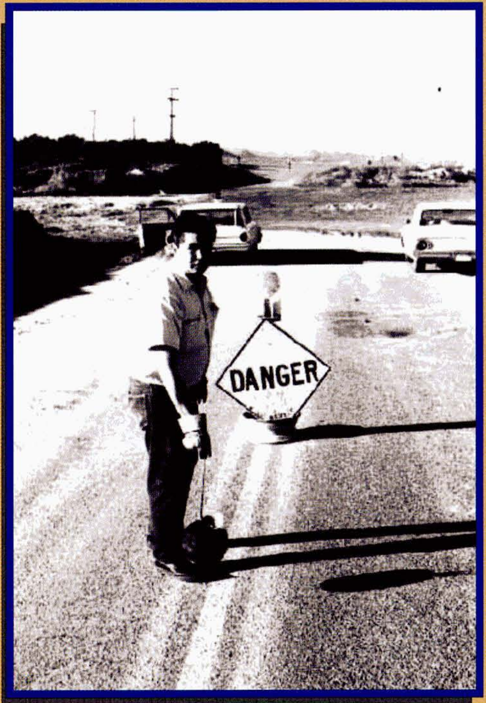
Study Goals

- **Identify and evaluate existing regional and neighborhood drainage problems within the study area.**
- **Develop cost-effective solutions to drainage problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.**

Work Underway

Your Glendale/Peoria ADMP Update study team has been very busy since the last set of public information meetings held in March 2000. The team completed the data collection phase of the project in March and has been busy compiling and analyzing the data. The team has developed a complete summary of important considerations including community needs and public opinion, existing biological and cultural resources, visual and landscape character, existing and proposed development, proposed zoning, proposed equestrian, multiple-use, and park facilities in the study area. In addition, the team analyzed how and where rainfall runoff flows within the project study area. The team has developed important hydrologic models leading to a solid understanding of the drainage characteristics of the watershed.

Analysis of all the collected data allowed the team to develop and evaluate a host of potential drainage solutions appropriate for each region of the study area. The study team has given the potential drainage solutions an initial evaluation to identify any fatal flaws and are now presenting them to the community through this second set of public meetings for additional suggestions and ideas.



Closed road during 1965 flooding of New River

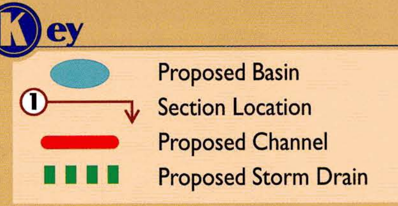
December 1965 flooding of New River at 83rd Avenue

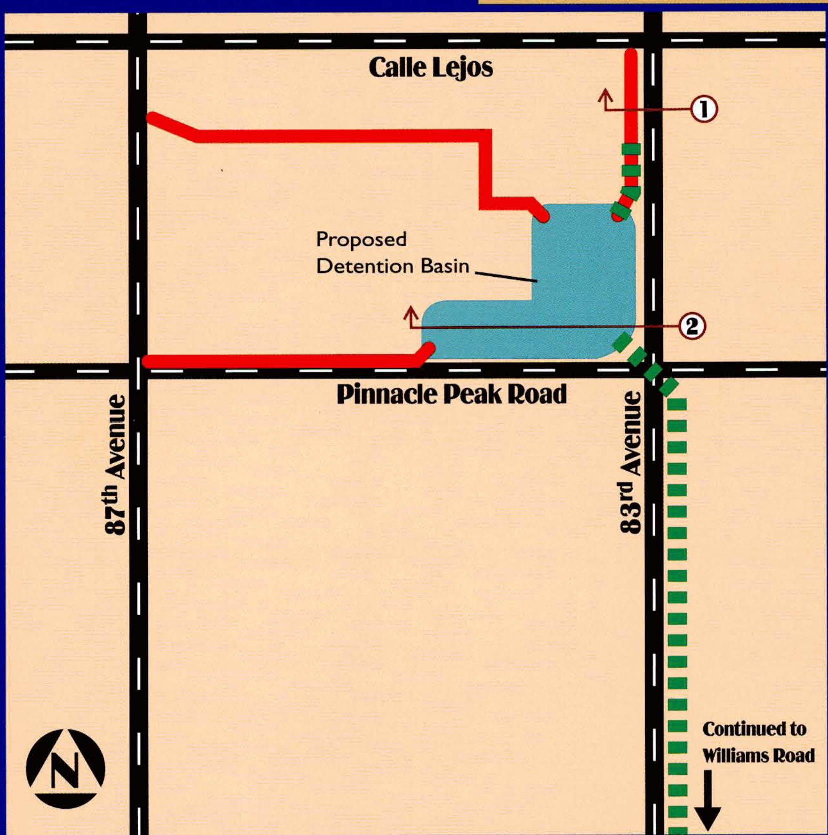
Preliminary Alternatives

Evaluation of the environmental and visual resources, analysis of the hydrologic models, and assessment of the multiple-use opportunities in the study area led the study team to focus on four subregional planning areas (shown on front cover). These areas are referred to as the 83rd Avenue Region, the Northwest Region, the Rock Springs Region, and the Pinnacle Peak Road and 67th Avenue Region.

The team spent the past several months developing and evaluating potential drainage solutions for each subregional planning area. This phase of alternatives development and evaluation focused on designing cost-effective regional drainage solutions that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community. All proposed solutions will be able to safely convey the 100-year storm event (a storm that has a 1% chance of occurring in any given year), and compliment regionally planned trails and recreational facilities. The potential drainage alternatives for each subregional planning area are further previewed in this brochure.

83rd Avenue Region





Goal

Design a regional drainage solution that will safely convey flows to the New River by making efficient use of existing drainage facilities.

Description

83rd Avenue hosts several existing drainage channels and storm drains south of Williams Road. During larger storm events these existing channels will be easily overwhelmed by flows from as far north as Jomax and Happy Valley Roads.

Proposed drainage features include:

- a regional detention basin near Pinnacle Peak Road and 83rd Avenue to reduce peak flows;
- two open collector channels from 87th Avenue to the basin to intercept flows from the north;
- an open channel or storm drain collector along 83rd Avenue to intercept flows from the north; and
- a storm drain outlet from the basin connecting with existing 83rd Avenue facilities.

Alternatives

Alternative 1 - detention basin, open channels from 87th Avenue, storm drain outlet, open channel collector along 83rd Avenue from the north.

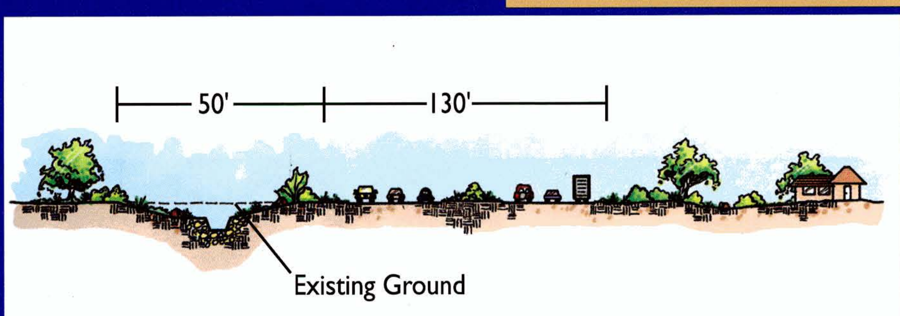
Alternative 2 - same as Alternative 1 except a combination storm drain and open channel collector along 83rd Avenue.

Alternative 3 - do nothing.

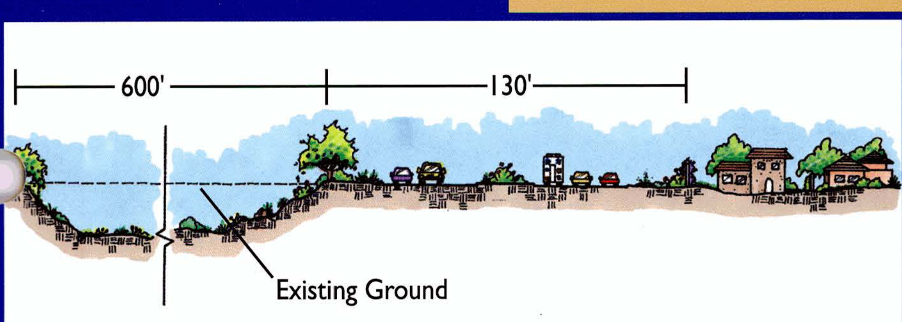
Advantages/Disadvantages

Open channels, as proposed in Alternative 1, are generally less expensive, easier to maintain, and offer multiple-use opportunities not provided by storm drains. Storm drains, as proposed in Alternative 2, can be constructed in existing rights-of-way.

Section 1



Section 2



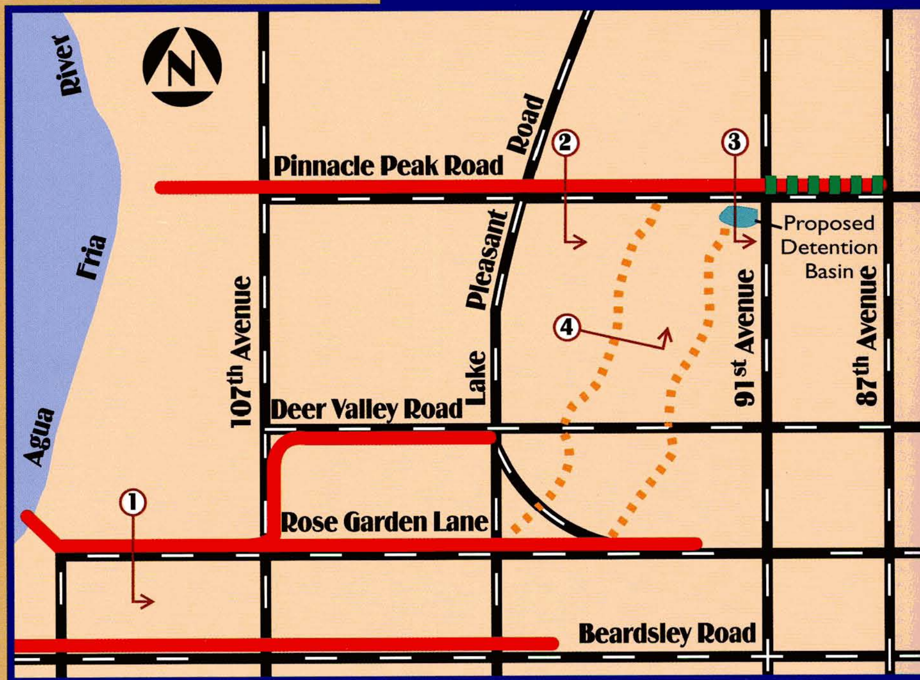
Northwest Region Alternatives 1 & 2

Key

- Proposed Basin
- Existing Natural Wash
- Section Location
- Proposed Channel
- Proposed Storm Drain

Goal

Design a regional drainage system to safely convey runoff to the Agua Fria River.



Description

Stormwater runoff from the northern portion of the subregion sheet flows south into the urbanizing areas. Runoff from larger storms will reach and overwhelm existing channels along Deer Valley and Beardsley Roads.

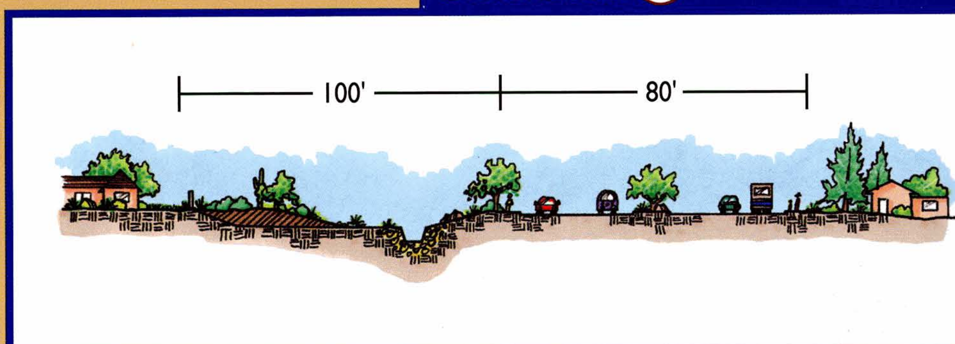
Proposed drainage features include:

- a combination storm drain and open channel along Pinnacle Peak Road from 87th Avenue to 91st Avenue, then an open channel to the Agua Fria River to intercept flow from the north;
- an open channel along Deer Valley Road to intercept flows from south of Pinnacle Peak Road;
- an open channel along Rose Garden Lane to convey flows from the Deer Valley Road channel to the Agua Fria River;
- improvements to the existing channel along Beardsley Road;
- preservation of existing natural washes between Pinnacle Peak Road and Rose Garden Lane; and
- a regional detention basin near Pinnacle Peak Road and 91st Avenue to reduce peak flows thus reducing required outlet channel sizes.

Alternatives

Alternative 1 - Pinnacle Peak Road storm drain and channel from 87th Avenue to the Agua Fria River, Deer Valley Road channel from Lake Pleasant Road to 107th Avenue then south to Rose Garden Lane, Rose Garden Lane channel from existing natural wash near 95th Avenue alignment to Agua Fria River, improvements to Beardsley Road channel, preservation of existing natural washes.

Section 1



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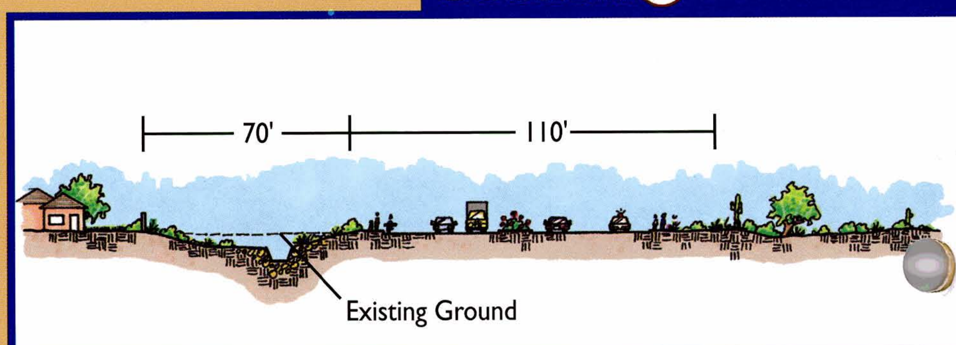
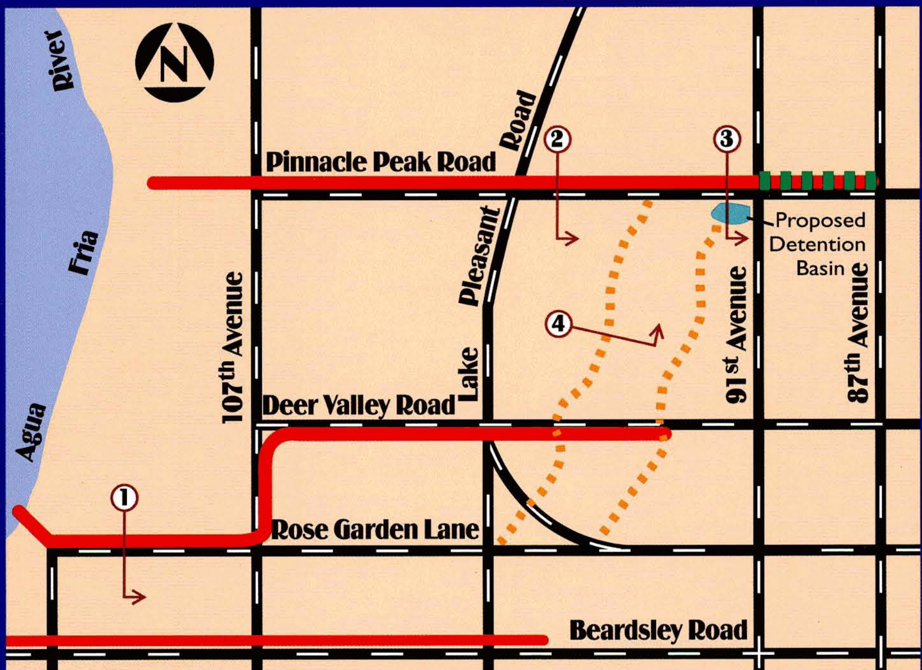


Northwest Region Alternatives 3 & 4

Key

- Proposed Basin
- Existing Natural Wash
- Section Location
- Proposed Channel
- Proposed Storm Drain



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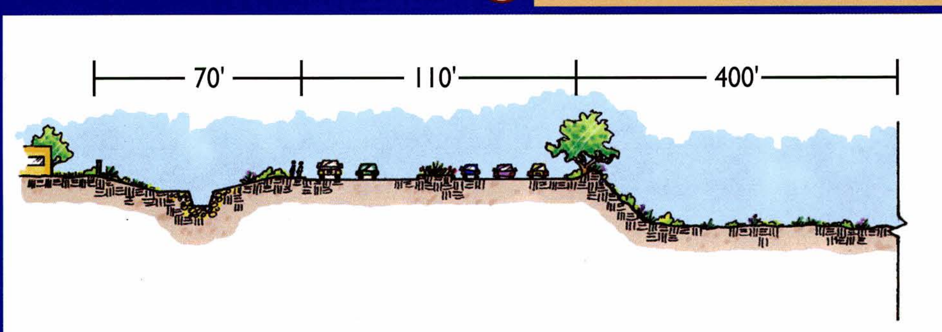

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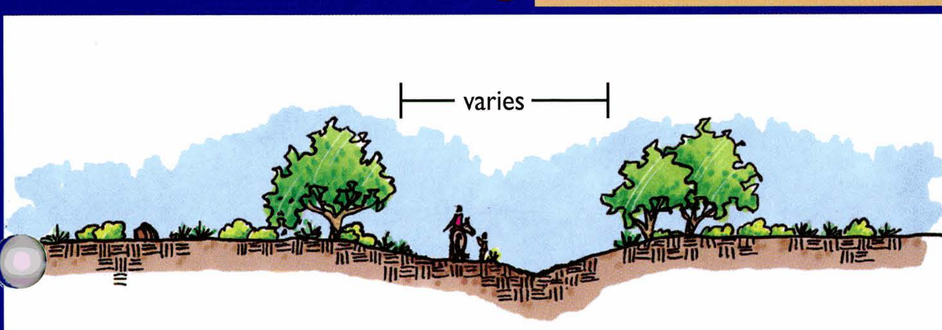


Description

Alternative 2 - same as Alternative 1 including the regional detention basin near Pinnacle Peak Road and 91st Avenue.

Alternative 3 - same as Alternative 1 except the Deer Valley Road and Rose Garden Lane channels are joined to create one long sinuous channel from the 95th Avenue alignment on Deer Valley Road to 107th Avenue then south to Rose Garden Lane and west to the Agua Fria River.

Alternative 4 - same as Alternative 3 including the regional detention basin near Pinnacle Peak Road and 91st Avenue.

Alternative 5 - do nothing.

Advantages/Disadvantages

Capturing flows slightly farther north, as proposed in Alternatives 3 and 4, has the advantage of somewhat smaller channel designs. Flow in the existing natural washes is intercepted further north. However, more flow is allowed to reach the Beardsley Road Channel and the Westbrook Village detention areas as flows south of Deer Valley Road are not collected.

The detention basin included in Alternatives 2 and 4 has the advantage of reducing the peak flows entering the system, resulting in smaller channel designs, and of providing an open space or recreational amenity for the region. All the Alternatives, with the exception of Alternative 5, have the advantage of complimenting the regionally planned equestrian trail connecting the New and Agua Fria Rivers along Pinnacle Peak Road.

Rock Springs Region

Key

- Proposed Basin
- Proposed Channel - Alt. 1 & 2
- Proposed Channel - Alt. 3 & 4
- Existing Natural Wash
- Section Location

Goal

Design a drainage solution to safely convey flows to the New River.

Description

Rock Springs Creek south of Patrick Lane has been disturbed by mining operations and residential construction leaving flows with no clearly defined outfall to the New River. Large flows in Rock Springs Creek will have no access to New River under current conditions and will flow south of Patrick Lane in an unpredictable manner.

Proposed drainage features include:

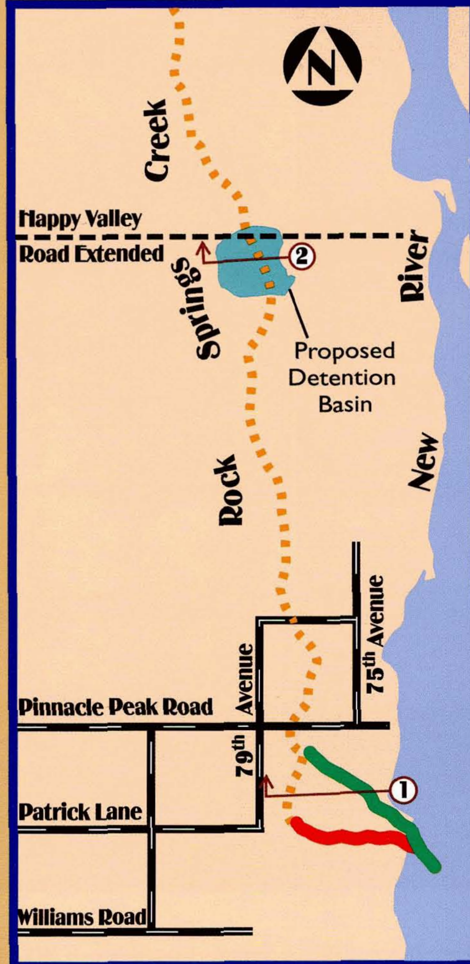
- an open channel along the Patrick Lane alignment connecting Rock Springs Creek with the New River;
- an open channel along a southeastern alignment connecting Rock Springs Creek near Pinnacle Peak Road with the New River near Patrick Lane; and
- a detention basin near the Happy Valley Road alignment to reduce peak flows.

Alternatives

Alternative 1 - open channel east to New River along Patrick Lane alignment.
Alternative 2 - same as Alternative 1 including detention basin.
Alternative 3 - open channel southeast from Pinnacle Peak Road to New River.
Alternative 4 - same as Alternative 3 including detention basin.
Alternative 5 - do nothing.

Advantages/Disadvantages

The Patrick Lane channel alignment, as proposed in Alternative 1, is the shortest route to the New River and the least disruptive of the natural watershed characteristics. The southeastern channel alignment, as proposed in Alternative 3, is slightly more disruptive of the watershed but has a more favorable slope. The detention basin included in Alternatives 2 and 4 has the advantage of reducing peak flows, resulting in smaller channel designs, and of providing a recreational amenity for the region.



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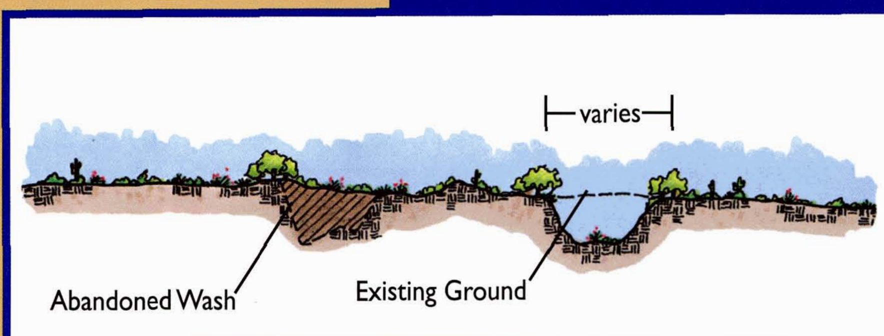

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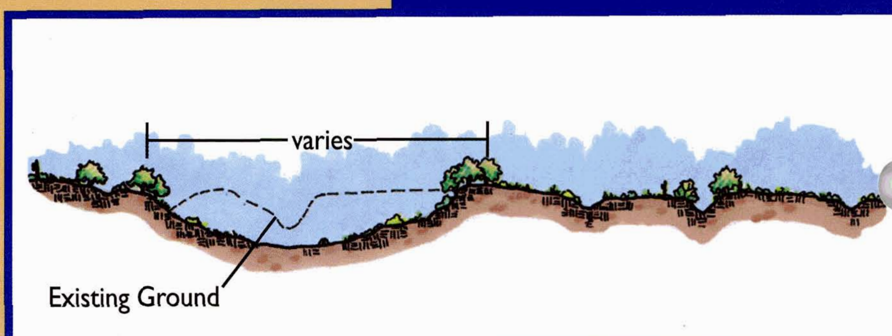
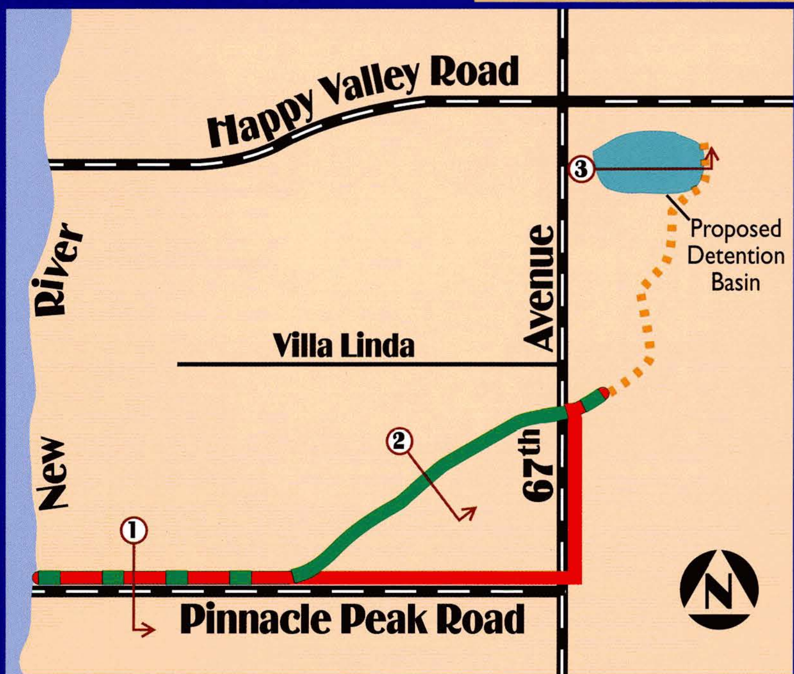


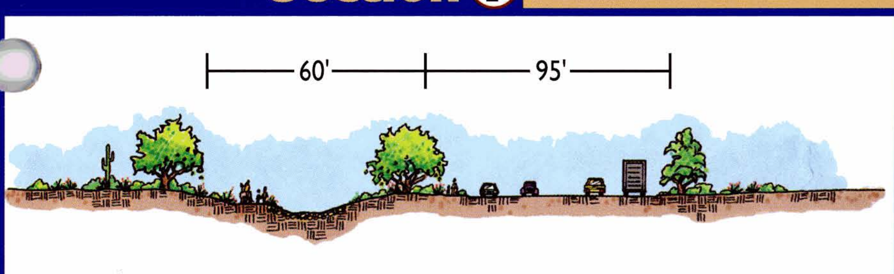
Pinnacle Peak Road and 67th Avenue Region

Key

- Proposed Basin
- Proposed Channel - Alt. 1 & 2
- Proposed Channel - Alt. 3 & 4
- Existing Natural Wash
- Section Location



Section 1



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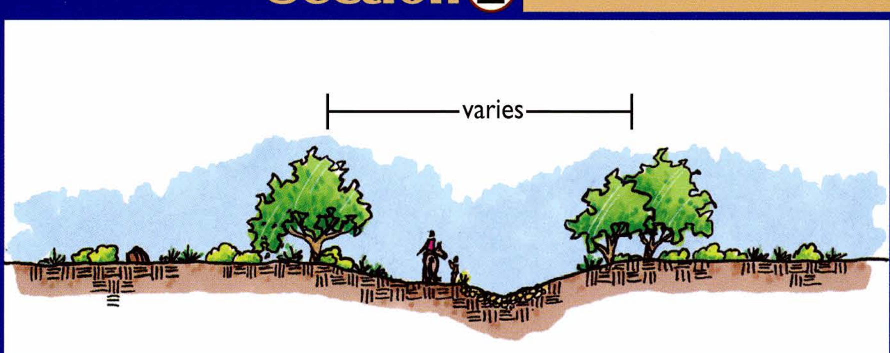

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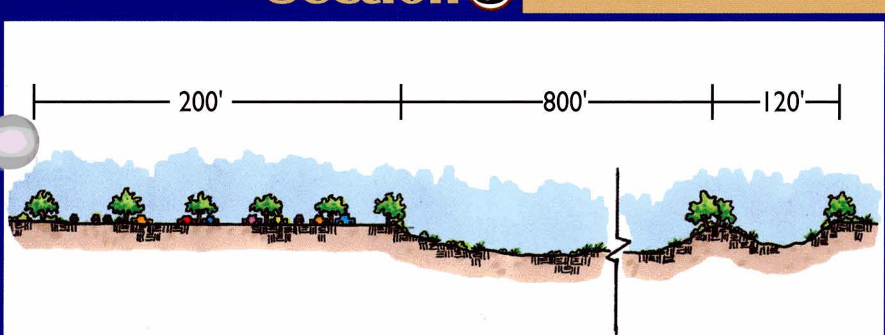


Goal

Design a regional drainage system to safely convey flows to the New River.

Description

Runoff from north of Happy Valley Road flows south in poorly defined channels, joining runoff from the east to overwhelm existing drainage facilities southwest of Pinnacle Peak Road and 67th Avenue.

Proposed drainage features include:

- a drainage channel along 67th Avenue from near Villa Linda, south to Pinnacle Peak Road then west to the New River;
- a natural-appearing channel along the existing wash alignment between 67th Avenue to Pinnacle Peak Road then west to the New River; and
- a regional detention basin near Happy Valley Road and 67th Avenue to reduce peak flows thus reducing required channel sizes.

Alternatives

Alternative 1 - drainage channel along 67th Avenue and Pinnacle Peak Road.

Alternative 2 - same as Alternative 1 including detention basin.

Alternative 3 - natural-appearing channel along existing wash alignment from 67th Avenue to Pinnacle Peak Road then west along Pinnacle Peak.

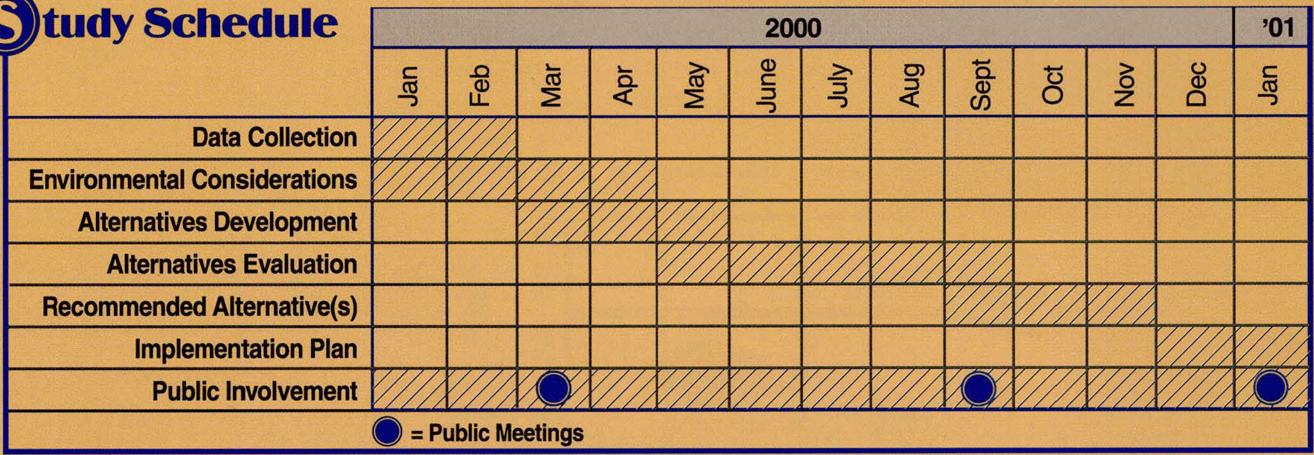
Alternative 4 - same as Alternative 3 including detention basin.

Alternative 5 - do nothing.

Advantages/Disadvantages

Alternatives 1 and 2 have the advantage of using existing rights-of-way for channel construction. Alternatives 3 and 4 have the advantage of providing additional recreational potential for the region. All the Alternatives (with the exception of Alternative 5) compliment a regionally planned equestrian trail along Pinnacle Peak Road. The optional basin included in Alternatives 2 and 4 provides an opportunity for enhanced recreational uses within Thunderbird Park.

Study Schedule



What's Next

The results of this second series of public meetings will allow the study team to finalize our alternatives evaluation for the Glendale/Peoria ADMP Update study area. Using your suggestions and ideas we will:

- reevaluate and adjust our drainage concepts;
- fine tune the hydrologic runoff model;
- refine our landscape concepts;
- develop final cost estimates; and
- complete preliminary design plans for the recommended solutions.

The Glendale/Peoria ADMP Update study team will be presenting the results of the study and the recommended drainage solutions at our third, and final, series of public information meetings scheduled for January 2001. For current project information and updates please visit our web page at **www.Entellus.com/GlendalePeoriaADMP**

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Glendale Peoria
Area Drainage Master Plan Update

Entellus, Inc.
2255 North 44th Street
Suite 125
Phoenix, Arizona 85008

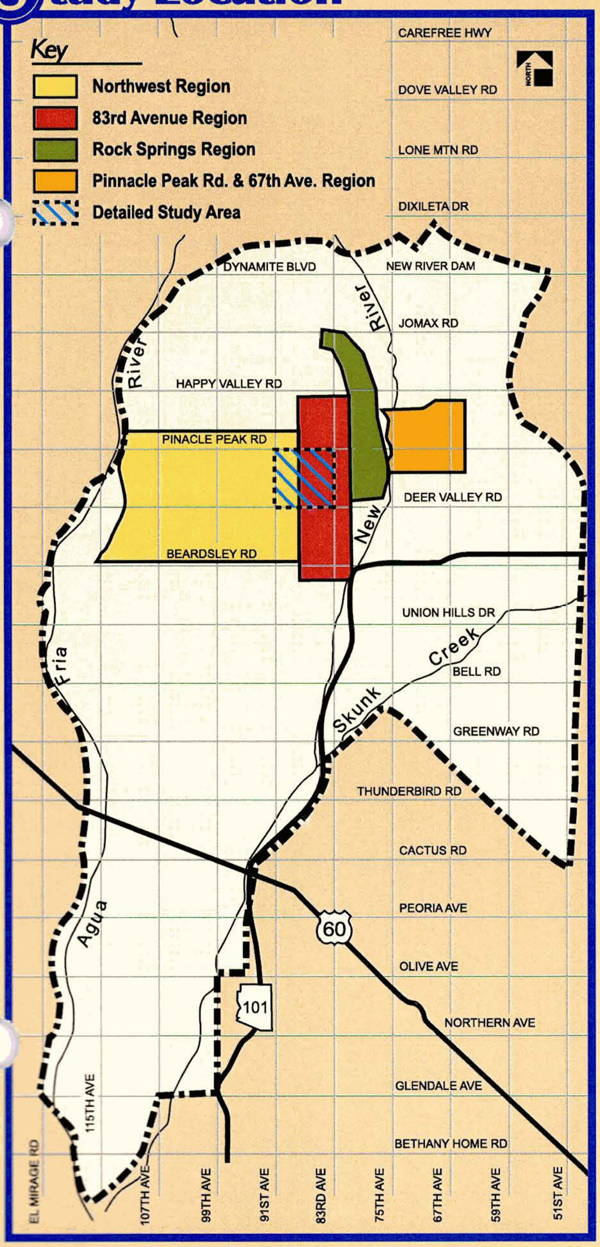
Glendale Peoria
Area Drainage Master Plan
Update • May '01

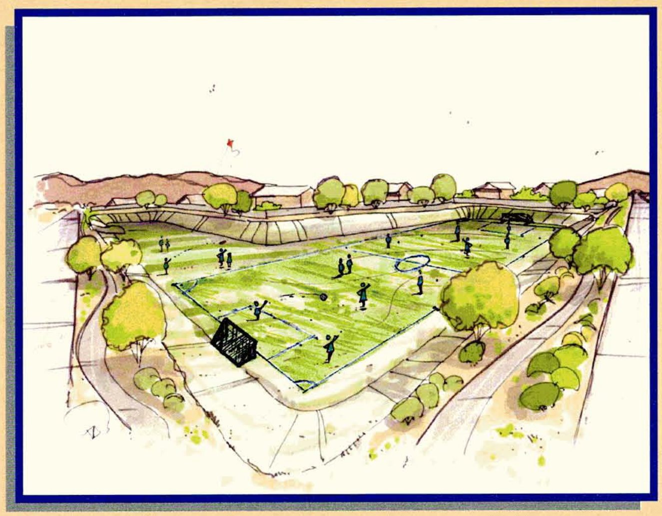
Study Purpose

The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of central Maricopa County. The area drainage master plan identifies drainage problems without consideration of political boundaries and has developed a plan that will eliminate or minimize drainage problems. The Glendale/Peoria ADMP Update:

- identifies and evaluates existing regional and neighborhood drainage problems using "state of the art" engineering techniques
- considers neighborhood character and community recreational needs
- evaluates archaeological, biological, and other environmental factors
- identifies cost-effective drainage solutions that provide maximum community benefits
- involves the community in the development of the plan

Study Location





Conceptual Sketch of Detention Basin

Study Goals

- **Identify and evaluate existing regional and neighborhood drainage problems within the study area.**
- **Develop cost-effective solutions to drainage problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.**

Public Meeting Results

Our second round of public meetings were held on September 20 and 21, 2000. At these meetings the Project Team presented several Alternative Drainage Solutions for each of the four regions. Citizens were asked to rate the alternatives and provide suggestions and feedback.

September 20, 2000 Public Meeting

In the **83rd Avenue Region**, citizens preferred a combination channel and box culvert on 83rd Avenue north of Pinnacle Peak Road, a regional detention basin at 83rd Avenue and Pinnacle Peak Road, and an outlet storm drain to the south on 83rd Avenue.

The **Northwest Region** received the most citizen feedback. Attendees preferred a channel on Pinnacle Peak Road, a regional retention basin near 91st Avenue and Pinnacle Peak Road, natural channels connecting Pinnacle Peak Road to Deer Valley Road, outfall channels on Deer Valley Road and Rose Garden Lane, and improvements to the existing Beardsley Road Channel.

In the **Rock Springs Region**, citizens favored the "Do Nothing" Alternative.

In the **Pinnacle Peak Road and 67th Avenue Region**, citizens did not favor a regional retention basin at 67th Avenue and Happy Valley Road, instead preferring drainage channels along 67th Avenue and Pinnacle Peak Road.

These suggestions and preferences were combined with other criteria to evaluate the various alternatives and ultimately make the recommended drainage solutions you will find further described in this handout.

September 21, 2000 Public Meeting

Recommended Alternatives

The ADMP Project Team used the input from citizens, along with other evaluation criteria, to identify the most cost-effective drainage alternatives that would meet the needs of the community. Evaluation criteria included:

- Public acceptance
- Benefit in solving the drainage problem
- Cost
- Multiple-use opportunity such as recreation
- Consistency with development ordinances
- Safety
- Construction impacts
- Aesthetic appeal
- Minimal impact to the surrounding environment

Ventana Lakes

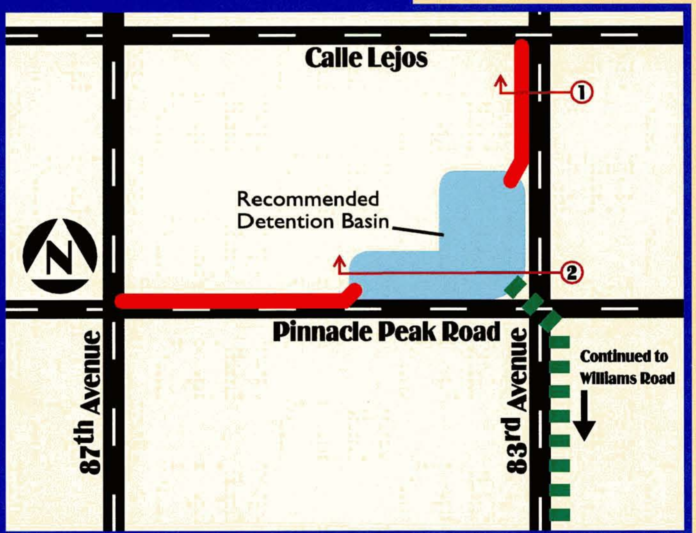
The team included representatives from the Cities of Peoria and Glendale, the Flood Control District of Maricopa County, and the Consultant Team. After careful consideration of all the evaluation criteria, the ADMP Project Team identified Recommended Alternatives for each region. With minor exceptions, the drainage solutions preferred by the citizens are the Recommended Alternatives.

A complete description of the Recommended Alternatives can be found on the following pages.

83rd Avenue Region

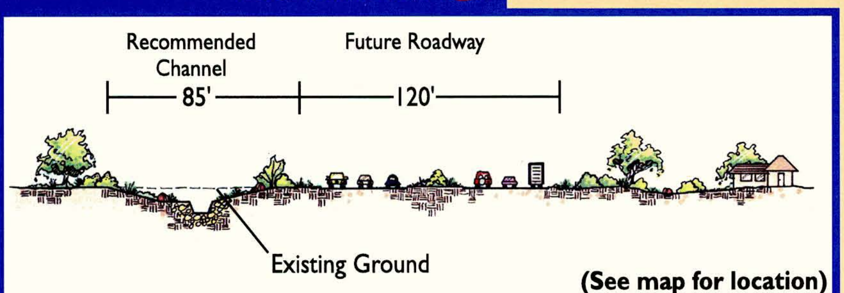
Key

- Recommended Basin
- Section Location
- Recommended Channel
- Recommended Storm Drain

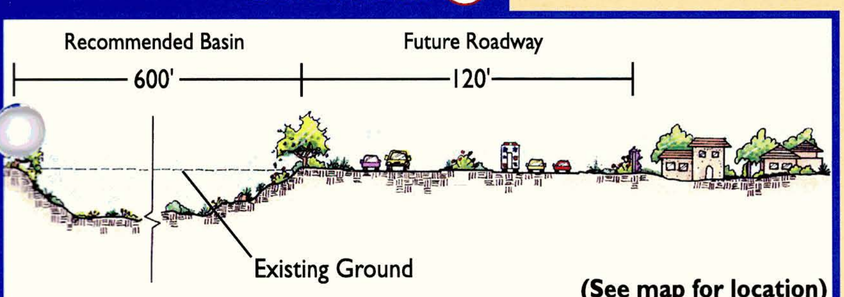


Conceptual Sketch of Detention Basin

Section 1



Section 2



Goal

Develop a regional drainage solution that will safely convey runoff to the New River by making efficient use of existing drainage facilities.

Solution

83rd Avenue hosts several existing drainage channels and storm drains south of Williams Road. During larger storm events these existing channels will be easily overwhelmed by flows from as far north as Jomax and Happy Valley roads.

Recommended Alternatives include:

- A regional detention basin near Pinnacle Peak Road and 83rd Avenue to reduce peak flows.
- An open channel collector from 87th Avenue along Pinnacle Peak Road to intercept flows from the north.
- An open channel collector from Calle Lejos along 83rd Avenue to intercept flows from the north.
- A storm drain outlet from the basin connecting with existing 83rd Avenue facilities south of Williams Road.

Note: These Recommended Alternatives would require the purchase of additional rights-of-way impacting several properties and potentially several residences along Pinnacle Peak Road and 83rd Avenue.

Estimated Costs

- Drainage Improvements Cost: $2.0 mil.
- Landscape Improvements Cost: $0.7 mil.
- Right-of-Way Cost: $2.9 mil.
- Total Cost: $6.2 mil.

Benefits

- Open channel collectors from the north and west will be generally less expensive, easier to maintain, and offer multiple-use opportunities not provided by storm drains.
- The storm drain outlet to the south can be constructed in existing rights-of-way.

Northwest Region

Goal

Develop a regional drainage system to safely convey runoff to the Agua Fria River.

Sketch of Earthen Channel (Looking West)

Solution

Stormwater runoff from the northern portion of the subregion sheet flows south into urbanizing areas. Runoff from larger storms will reach and overwhelm existing channels along Deer Valley and Beardsley Roads.

Recommended Alternatives include:

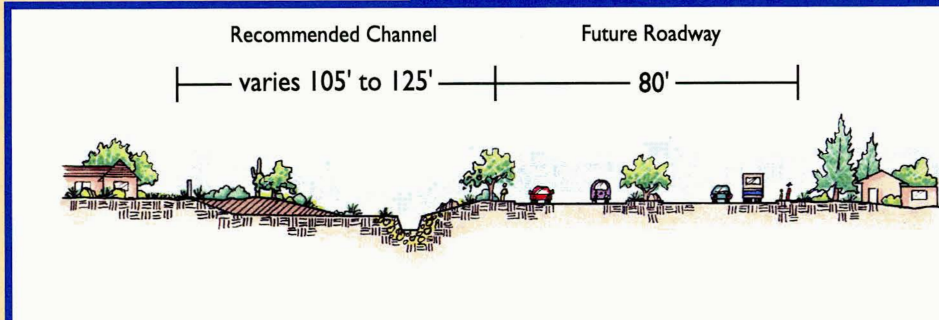
- An open channel collector or storm drain along Pinnacle Peak Road from 87th Avenue to the Agua Fria River to intercept flow from the north.
- To intercept and convey flows from south of Pinnacle Peak Road to the Agua Fria River, a long sinuous open channel collector along Deer Valley Road from near the 95th Avenue alignment, turning south along Lake Pleasant Road, then west along Rose Garden Lane to the Agua Fria River.
- Improvements to the existing open channel collector along Beardsley Road.
- Preservation of existing natural washes between Pinnacle Peak Road and Rose Garden Lane.

Note: These Recommended Alternatives would require the purchase of additional rights-of-way impacting several properties and potentially several residences along Pinnacle Peak Road and Rose Garden Lane.

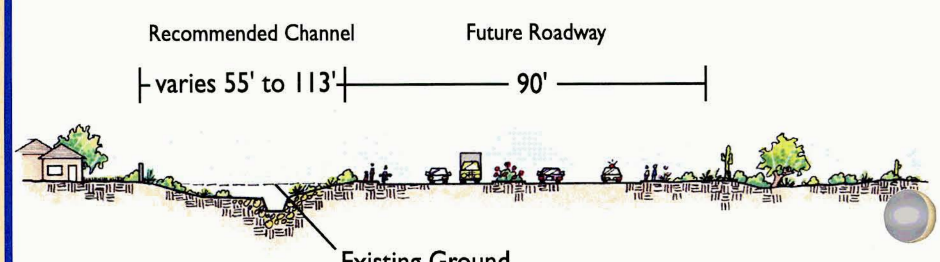
Estimated Costs

- Drainage Improvements Cost: $10.2 mil.
- Landscape Improvements Cost: $2.2 mil.
- Right-of-Way Cost: $7.3 mil.
- Total Cost: $21.8 mil.

Section 1



Section 2

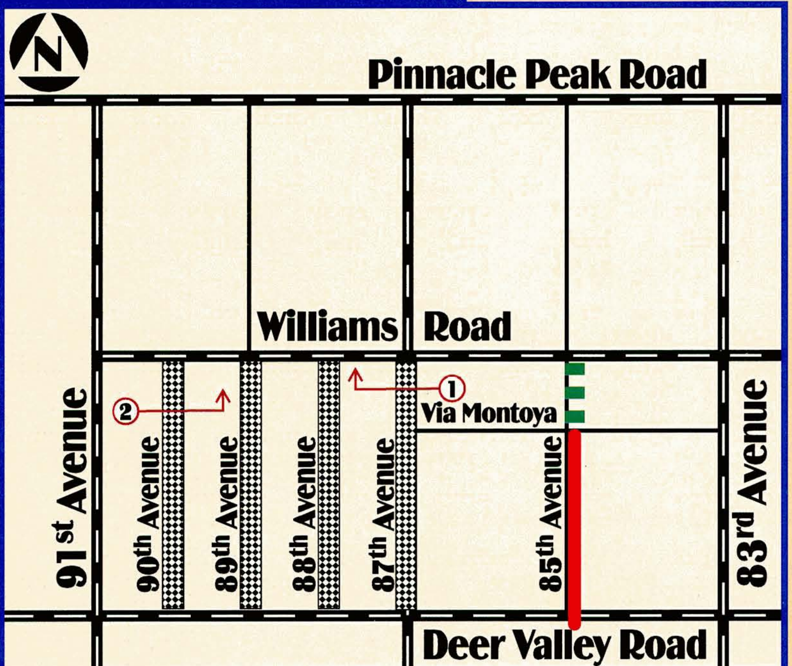


(See map for location)

Detailed Neighborhood Study

Key

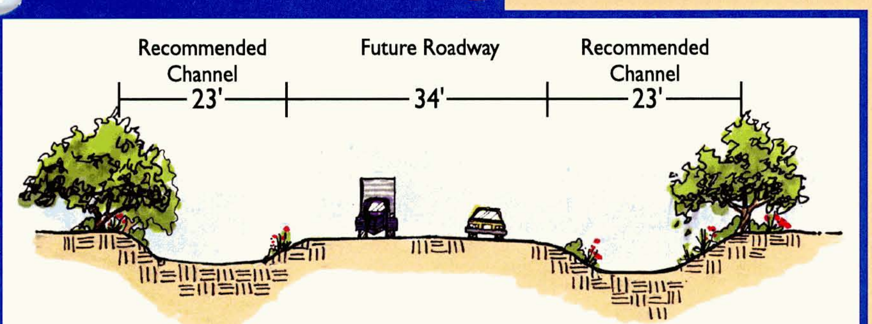
- Recommended Roadway Improvements (regrading, paving, channels)
- Recommended Channel
- Recommended Storm Drain
- Section Location



Goal

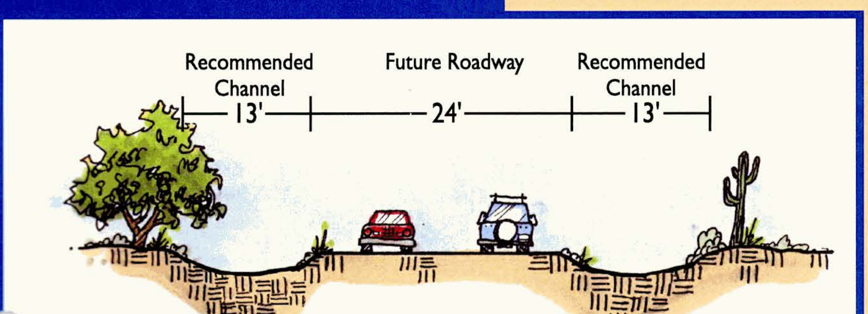
Develop a drainage system to safely convey runoff through the subdivision.

Section 1



(See map for location)

Section 2



(See map for location)

Solution

This residential community is a mixture of Peoria and Maricopa County developments that occurred independently over time. As a result there is no clearly defined drainage system. Runoff from large storm events exceeds the street capacities and ponds at several locations in this study area.

Recommended drainage features include:

- Regrading and possible paving of 85th, 87th, 88th, 89th, and 90th Avenues.
- Regrading of Williams Road and Via Montoya to prevent upstream ponding.
- New shallow Box Culvert crossings of Deer Valley Road at 85th, 87th, and 89th Avenues.
- A storm drain collector along 85th Avenue from Williams Road to Via Montoya.
- An open channel collector along 85th Avenue from Via Montoya to Deer Valley Road.

Benefits

- The system provides maximum protection available from a 10-year storm.
- This solution is the least cost solution and would have low maintenance costs.
- The improvements can be implemented in conjunction with proposed MCDOT paving projects already planned in the area.

Northwest Region

This solution will provide protection from a 100-year rainfall event for existing and proposed development in the region.

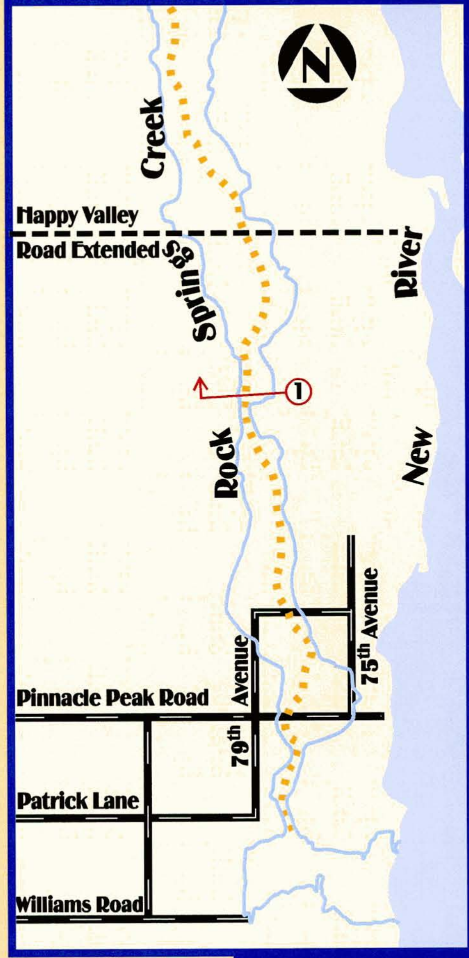
Benefits

- The overall system will provide protection from a 100-year storm.
- This alternative is one of the lower cost alternatives developed for this region. The system will be designed for relatively low maintenance cost by including natural desert landscaping.
- This solution provides an opportunity to construct a multi-use pathway/equestrian trail linking the Agua Fria River to New River along Pinnacle Peak Road. This has previously been identified in Peoria's Trails Master Plan.
- The preservation of natural washes until they can be incorporated into development ensures that adequate drainage will be maintained from now through development of the State Land.
- The majority of the recommended improvements are located away from existing development in the northwest region drainage area, minimizing impacts to existing developments, and maximizing the potential for the improvements to be incorporated into future development. This would result in an aesthetic amenity as each portion of the natural looking drainage facility is integrated with the next.
- The recommended improvements avoid cultural resource sites and would be landscaped to match the visual character of the adjacent areas.
- The recommended channel locations take advantage of existing channel and retention facilities along Deer Valley Road and Rose Garden Lane.

Rock Springs Region

Key

- Regulatory Floodplain Boundary
- Existing Natural Wash
- Section Location



Goal

Develop a drainage solution to safely convey runoff to the New River.

Solution

Rock Springs Creek south of Patrick Lane has been disturbed by mining operations and residential construction leaving flows with no clearly defined outfall to the New River. Large flows in Rock Springs Creek will have no access to New River under current conditions and will flow south of Patrick Lane in an unpredictable manner.

Recommended Alternative includes:

- Leave natural channel and manage the regulatory floodway and floodplain as recently identified.

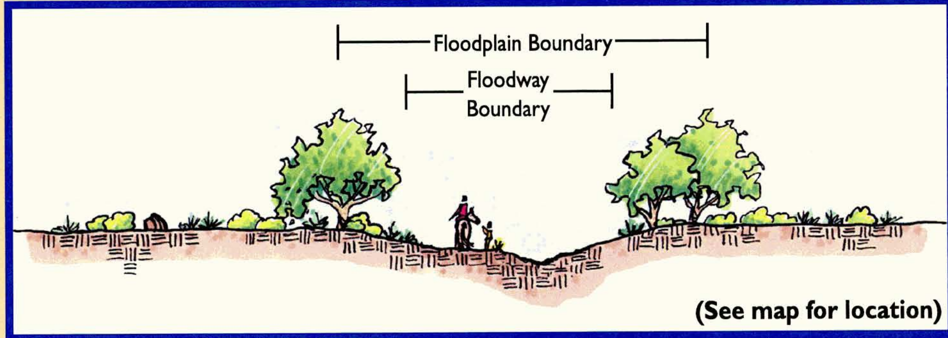
Estimated Costs

No cost anticipated.

Benefits

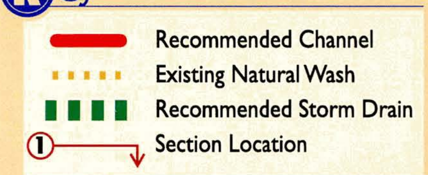
- Delineation of the floodplain allows the City of Peoria to regulate development in the area ensuring residences are safe from flood hazards.
- This non-structural solution is the lowest cost alternative.
- This alternative results in no adverse impacts to existing biological and cultural resources, and provides an opportunity to use the natural wash for recreation.

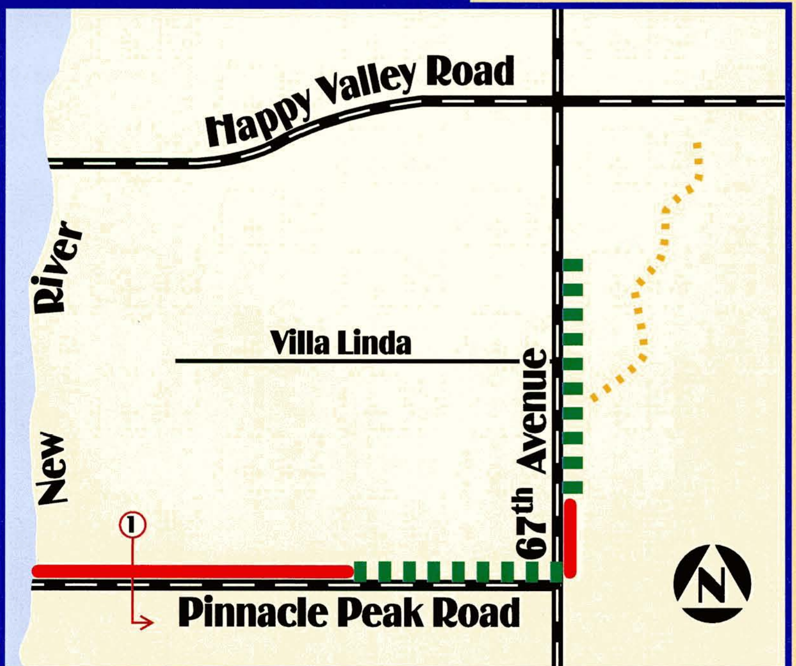
Section 1



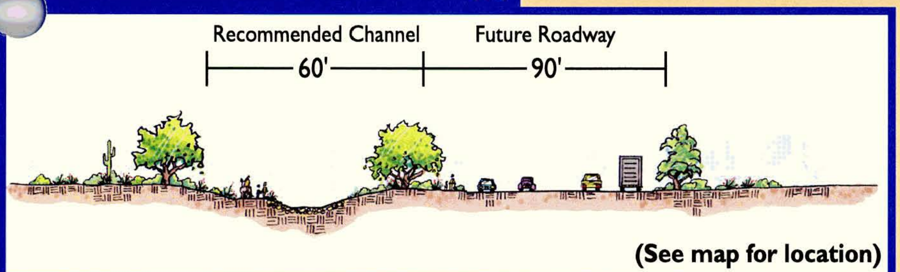
(See map for location)

Pinnacle Peak Road and 67th Avenue Region





Section 1



Sketch of Earthen Channel

Goal

Develop a regional drainage system to safely convey runoff to the New River.

Solution

Runoff from north of Happy Valley Road flows south in poorly defined channels, joining runoff from the east to overwhelm existing drainage facilities southwest of Pinnacle Peak Road and 67th Avenue.

Recommended Alternative includes:

- A drainage channel along 67th Avenue from near Villa Linda, south to Pinnacle Peak Road then west to the New River.

Note: The Recommended Alternative would require the purchase of additional rights-of-way impacting several properties and potentially several residences along Pinnacle Peak Road and 67th Avenue.

Estimated Costs

- Drainage Improvements Cost: $2.5 mil.
- Landscape Improvements Cost: $0.4 mil.
- Right-of-Way Cost: $1.4 mil.
- Total Cost: $4.3 mil.

Benefits

- The system provides protection from a 100-year storm for areas both upstream and downstream of the improvements.
- This alternative is one of the lower cost alternatives developed for this region. The system will be designed for relatively low maintenance cost by including natural desert landscaping.
- This solution provides an opportunity to extend the multi-use pathway/equestrian trail on Pinnacle Peak Road.
- The improvements can be incorporated into future roadway development which will result in an integrated natural looking drainage facility that can be considered an aesthetic amenity.
- The proposed improvements avoid cultural resource sites and will be landscaped to match the visual character of the adjacent areas.

Implementation Plan

Next Steps:

Immediately following this final public information meeting, your Glendale/Peoria ADMP Project Team will finalize the Recommended Alternatives report. This report will include detailed descriptions of the Recommended Alternatives, the benefits that each Alternative will provide, a cost estimate for construction and long-term operation and maintenance, a conceptual design for each Recommended Alternative, and an implementation and funding strategy. The plan will be submitted to the District and the Cities of Peoria and Glendale. The Project Team will also be presenting the Recommended Alternatives at the Peoria City Council's Study Session on May 22, 2001.

What Level of Flood Protection is Provided?

These improvements are designed to convey runoff from a 100-year storm. A 100-year storm means a storm that has a one percent chance of happening in any given year. This is typically the highest level of protection that regional drainage solutions are designed for.

When Will Improvements be Completed?

Completion will depend upon funding. A realistic timeframe is three to 10 years. The first and most important step is to have the plan approved and adopted by the District's Board of Directors, and the Peoria and Glendale City Councils. Once the plan has been approved and adopted, then the Recommended Alternatives identified in this study can be prioritized for funding and included in the District, and Cities of Peoria and Glendale budgeting processes.

What Can I Do?

If you feel that the drainage improvements proposed by this study are important for your neighborhood and the Cities of Peoria and Glendale, contact your City Engineering Department and let them know which Recommended Alternatives you would like to see prioritized and funded, and why.

Ventana Lakes

Thank You

We thank you for your help and participation in the development of the Glendale/Peoria ADMP Update Study. It is with your participation and continued support that we will be able to achieve effective drainage improvements that will not only provide flood protection but that will be a sustainable community asset.

Contacts

Marilyn DeRosa, Project Manager
Flood Control District of Maricopa County
Phone: (602) 506-4766
E-mail: mdr@mail.maricopa.gov

Mike Bonar, Project Manager
Entellus, Inc.
Phone: (602) 244-2566
E-mail: bonarmj@Entellus.com

Glendale Peoria
Area Drainage Master Plan Update

Entellus, Inc.
2255 North 44th Street
Suite 125
Phoenix, Arizona 85008

Comparison of Alternatives

	Alt 1	Alt 2	Alt 3	Alt 4
Cost				
Drainage Improvements	$ 2.76 M	$ 10.72 M	$ 8.27 M	$ 8.30 M
Landscape Improvements	$ 2.58 M	$ 1.51 M	$ 1.41 M	$ 1.91 M
Right-of-way	$ 2.80 M	$ 1.45 M	$ 1.33 M	$ 2.10 M
Total Cost	$ 8.14 M	$ 13.68 M	$ 11.01 M	$ 12.31 M
Residences Purchase	21	0	0	0
Reliability	Best	Poorest	Poor	Better
Maintenance Required	Low	Very High	High	Medium

Glendale Peoria
Area Drainage Master Plan

LOGAN SIMPSON DESIGN INC.

Traffic Volume Estimates

Avg. cars per hour at peak travel times

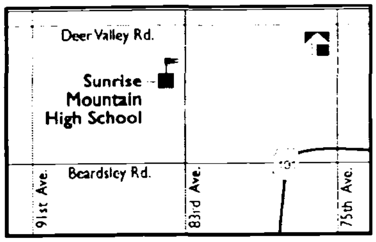
Roadway	Year 2001 (Cars/hour)	Year 2007 (Cars/hour)	Increase Factor
Pinnacle Peak Road	313	821	2.6
83rd Avenue	158	2329	14.8

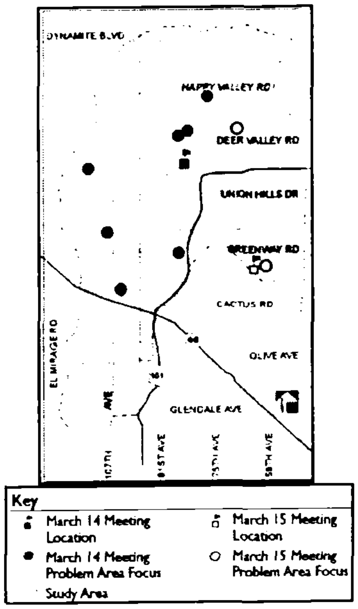
Current level of service classification	"A"	Free flow with low traffic volumes
Projected year 2007 level of service classification	"E" or "F"	Unstable traffic flow with short stoppages to forced flow at slow speeds; lines of vehicles at certain locations

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

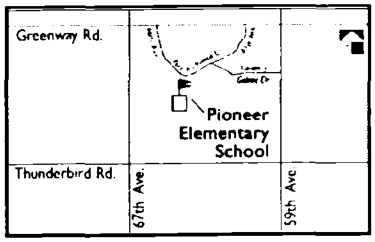
Public Meetings

Thursday, September 21, 2000
6:30pm - 8:00pm
Sunrise Mountain High School
Lecture Hall
21200 North 83rd Avenue
Peoria, Arizona 85382





Wednesday, September 20, 2000
6:30pm - 8:00pm
Pioneer Elementary School
Cafeteria
6315 West Port Au Prince
Glendale, Arizona 85306



The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of Maricopa County. An area drainage master plan identifies flood control problems without consideration of political boundaries and develops a plan that will eliminate or minimize flooding problems.

This is the second in a series of three public meetings hosted by the District. The purpose of these meetings is to inform the community about the project and seek your input.

A brief presentation will be made at 6:45pm by members of the study team. Opportunities for the public to identify issues and concerns related to the study will occur after the presentation. Each meeting will focus on the specific problem areas shown on the map and key above. We hope you can attend one of these meetings and give us your comments on the Glendale/Peoria ADMP Update.

In conformance with the Americans with Disabilities Act, requests for special needs will be addressed. For additional information or to submit comments on this project, please contact: Marilyn DeRosa, Flood Control District of Maricopa County, Phone: (602) 506-4766.

Study Goals

- Identify and evaluate existing regional and neighborhood flooding problems within the study area.
- Develop cost-effective solutions to flooding problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.

Glendale Peoria

Glendale GP Peoria

Area Drainage Master Plan Update • March '00

We're working to make your neighborhood safe!

The Flood Control District of Maricopa County

in cooperation with:

GLENDALE

Entellus, Inc.
Pentacore Arizona
Logan Simpson Design Inc.
LTM Engineering, Inc.

Study Purpose

The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of central Maricopa County. An area drainage master plan identifies flood control problems without consideration of political boundaries and develops a plan that will eliminate or minimize flooding problems. The Glendale/Peoria ADMP Update will:

- identify and evaluate existing regional and neighborhood drainage problems using "state of the art" engineering techniques;
- consider neighborhood character and community recreational needs;
- evaluate archaeological, biological, and other environmental factors;
- identify cost-effective flooding solutions that provide maximum community benefits; and
- involve the community in the development of the plan.

Study Goals

- **Identify and evaluate existing regional and neighborhood flooding problems within the study area.**
- **Develop cost-effective solutions to flooding problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.**

Study Background

The original Glendale/Peoria ADMP was completed in 1987. Since that time, development of the area has increased significantly. The population of Glendale and Peoria increased by 97% and 586%, respectively, between 1980 and 1997. Existing drainage facilities are not sufficient to meet the needs of this ever-increasing urbanized area. The Glendale/Peoria ADMP Update will reflect the combined efforts of the District and the two cities of Glendale and Peoria to cooperatively solve the area's drainage problems.

Study Location

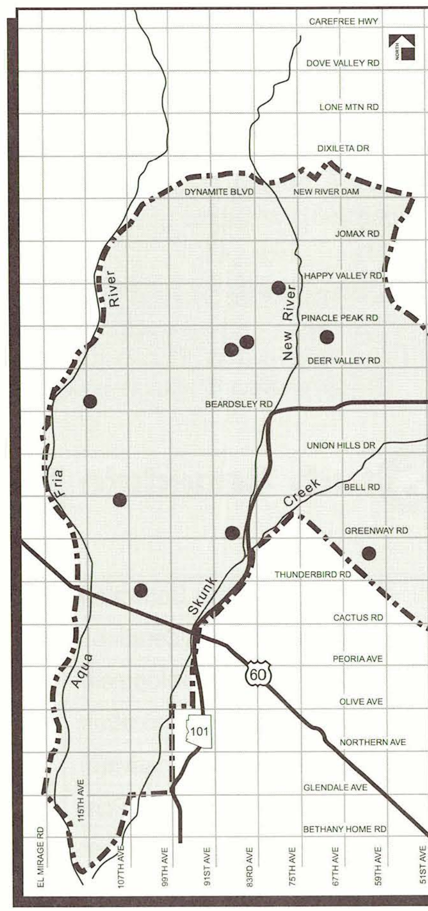
Key:

Study Area

Known Problem Areas

Miles

0 1 2 3



Get Involved

We invite you to get involved in the study process. There will be an opportunity to give your initial comments at the first series of public meetings. If you have questions about this study, please contact:

Marilyn DeRosa, Project Manager
Flood Control District of Maricopa County
Phone: (602)506-4766
E-mail: mdr@mail.maricopa.gov

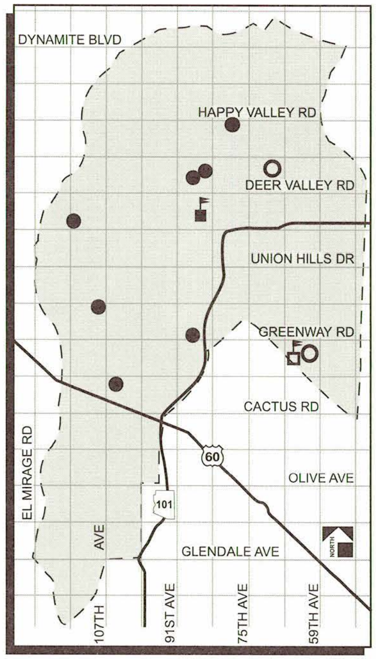
or

Mike Bonar, Project Manager
Entellus, Inc.
Phone: (602) 244-2566
E-mail: bonarmj@Entellus.com

Para información en Español, comuniquen se con:
Hernan A. Aristizabal, Entellus, Inc.
Phone: (602) 244-2566

The Flood Control District of Maricopa County has a web site with routinely updated project information. Please visit us at: www.entellus.com/GlendalePeoriaADMP

Public Meetings



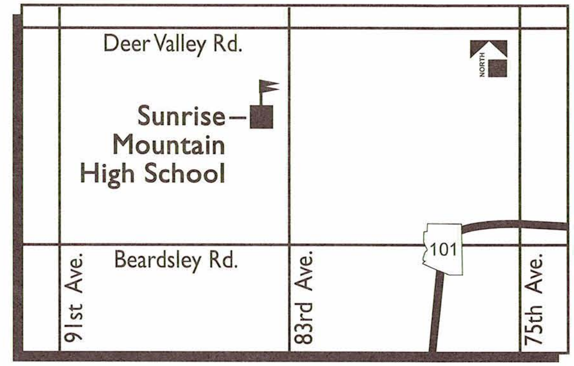
The first series of public meetings are scheduled for March 14th and 15th, 2000. The purpose of these meetings is to inform the community about the project and seek your input. Each meeting will focus on the specific problem areas shown on the map and legend below. We hope you can attend one of these meetings and give us your comments on the Glendale/Peoria ADMP Update.

Key

- March 14 Meeting Location
- ● March 14 Meeting Problem Area Focus
- Study Area
- March 15 Meeting Location
- O March 15 Meeting Problem Area Focus

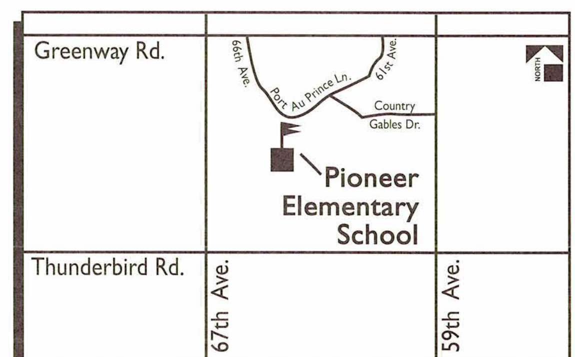
Public Meeting - March 14

Tuesday, March 14, 2000
6:30pm - 8:00pm
Sunrise Mountain High School Cafeteria
21200 North 83rd Avenue
Peoria, Arizona 85382

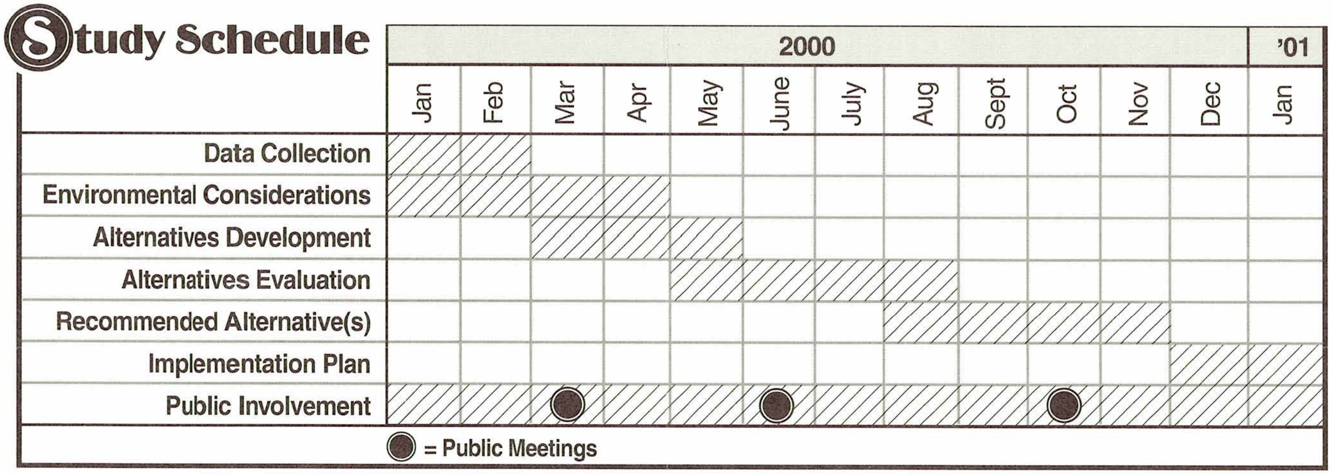


Public Meeting - March 15

Wednesday, March 15, 2000
6:30pm - 8:00pm
Pioneer Elementary School Cafeteria
6315 West Port Au Prince
Glendale, Arizona 85306



Study Schedule



Glendale Peoria

Area Drainage Master Plan Update • August '00

The Flood Control District of Maricopa County
in cooperation with:

GLENDALE

CITY OF PEORIA

Entellus, Inc.
Pentacore Arizona
Logan Simpson Design, Inc.
LTM Engineering, Inc.

Study Purpose

The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of central Maricopa County. An area drainage master plan identifies drainage problems without consideration of political boundaries and develops a plan that will eliminate or minimize drainage problems. The Glendale/Peoria ADMP Update will:

- identify and evaluate existing regional and neighborhood drainage problems using "state of the art" engineering techniques;
- consider neighborhood character and community recreational needs;
- evaluate archaeological, biological, and other environmental factors;
- identify cost-effective drainage solutions that provide maximum community benefits; and
- involve the community in the development of the plan.

Study Goals

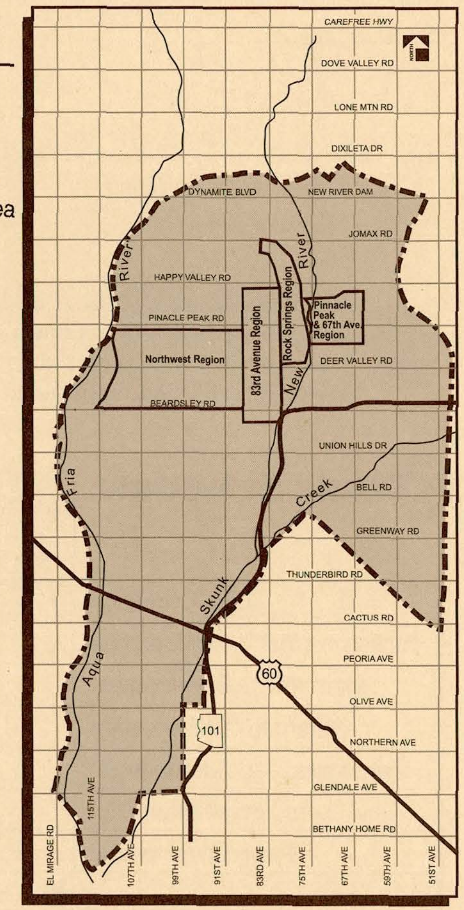
- **Identify and evaluate existing regional and neighborhood drainage problems within the study area.**
- **Develop cost-effective solutions to drainage problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.**

Study Update

Your Glendale/Peoria ADMP team has been very busy since the last public information meeting held in March 2000. We have finished data collection, our environmental and visual character study, and the hydrology model which predicts runoff in the study area. We have developed potential regional drainage solutions in subregional planning areas (see map) and would like to receive your ideas and recommendations at our next public meeting. Please join us and let us know what you think!

Study Location

Key:
Study Area
Subregional Planning Area
Miles
0 1 2 3



Glendale **Peoria**
Area Drainage Master Plan Update • August'00

Get Involved

We invite you to get involved in the study process. There will be an opportunity to give your feedback at this second series of public meetings. If you have questions about this study, please contact:

Marilyn DeRosa, Project Manager
Flood Control District of Maricopa County
Phone: (602) 506-4766
E-mail: mdr@mail.maricopa.gov

or

Mike Bonar, Project Manager
Entellus, Inc.
Phone: (602) 244-2566
E-mail: bonarmj@Entellus.com

Para información en Español, comuniquense con:
Hernan A. Aristizabal, Entellus, Inc.
Phone: (602) 244-2566

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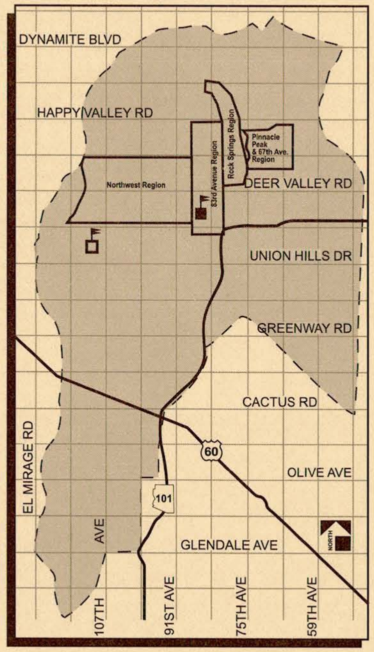
Study Schedule

	2000												'01
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
Data Collection	X	X											
Environmental Considerations	X	X	X	X									
Alternatives Development			X	X	X								
Alternatives Evaluation					X	X	X	X	X				
Recommended Alternative(s)									X	X	X		
Implementation Plan												X	X
Public Involvement	X	X	●	X	X	X	X	X	●	X	X	X	●

● = Public Meetings

Public Meetings



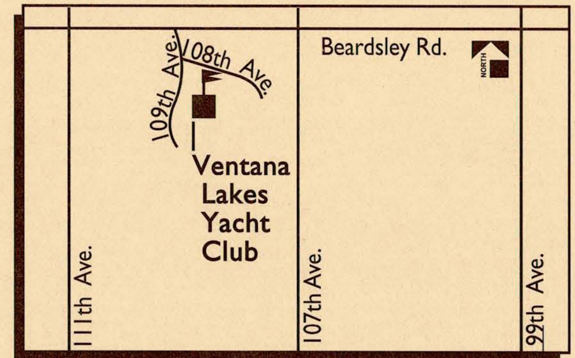
Key

Sept. 20 Meeting Location
Sept. 21 Meeting Location
Study Area
Subregional Planning Area

The second series of public meetings are scheduled for September 20th and 21st, 2000. The purpose of these meetings is to present the preliminary drainage improvement alternatives developed so far and obtain your input. We hope you can attend one of these meeting and share your ideas and suggestions as we finalize our drainage concepts.

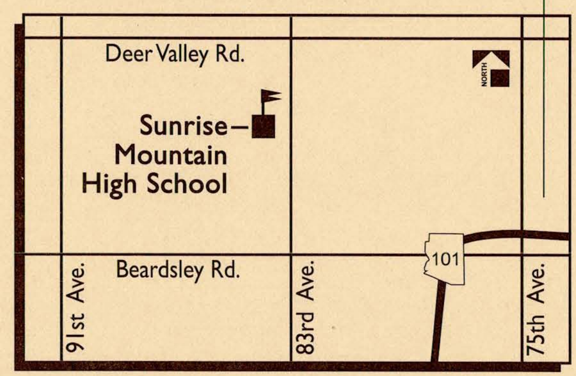
Public Meeting - Sept. 20

Wednesday, Sept. 20, 2000
6:30pm - 8:00pm
Ventana Lakes Yacht Club
20015 North 108th Avenue
Peoria, Arizona 85382



Public Meeting - Sept. 21

Thursday, Sept. 21, 2000
6:30pm - 8:00pm
Sunrise Mountain High School
Lecture Hall
21200 North 83rd Avenue
Peoria, Arizona 85382



Get Involved

We invite you to get involved in the study process. There will be an opportunity to give your feedback at this third and final public meeting. If you have questions about this study, please contact:

Marilyn DeRosa, Project Manager
Flood Control District of Maricopa County
Phone: (602) 506-4766
E-mail: mdr@mail.maricopa.gov

or

Mike Bonar, Project Manager
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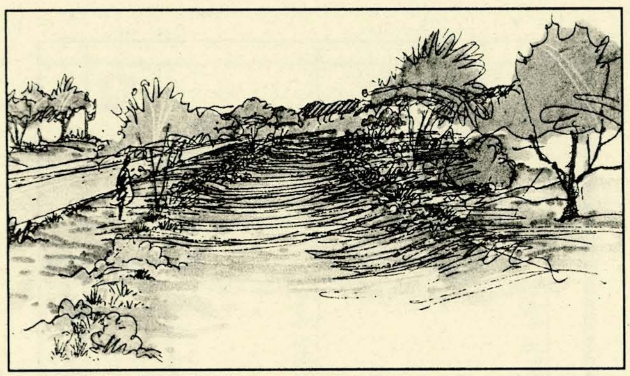


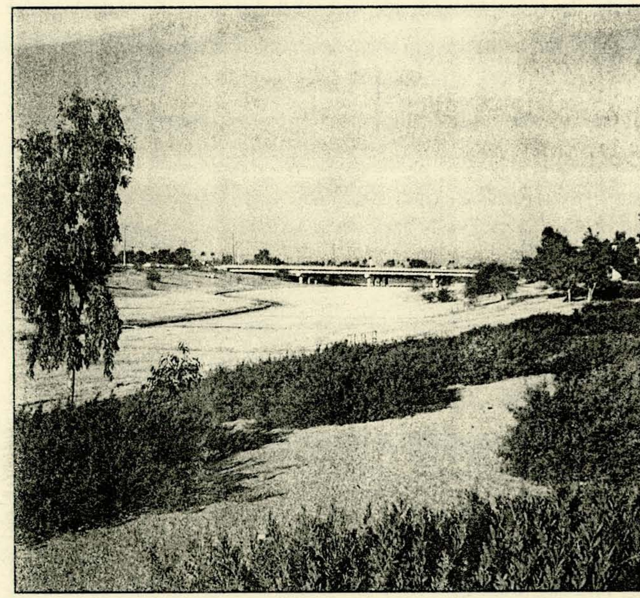
Conceptual sketch of earthen channel. We need your input on the potential recreational opportunities to be included with these facilities.

Flood Control District
of Maricopa County
2801 W. Durango Street
Phoenix, Arizona 85009-9843

Glendale Peoria

Area Drainage Master Plan Update • May '01

Solving your neighborhood drainage problems



The Flood Control District of Maricopa County

in cooperation with:

GLENDALE

CITY OF PEORIA

Entellus, Inc.
Pentacore Arizona
Logan Simpson Design, Inc.
LTM Engineering, Inc.

Glendale Peoria
Area Drainage Master Plan Update • May '01

Study Purpose

The Flood Control District (District) of Maricopa County has teamed up with the cities of Glendale and Peoria to prepare an area drainage master plan (ADMP) update for the Glendale/Peoria area of central Maricopa County. An area drainage master plan identifies drainage problems without consideration of political boundaries and develops a plan that will eliminate or minimize drainage problems. The Glendale/Peoria ADMP Update will:

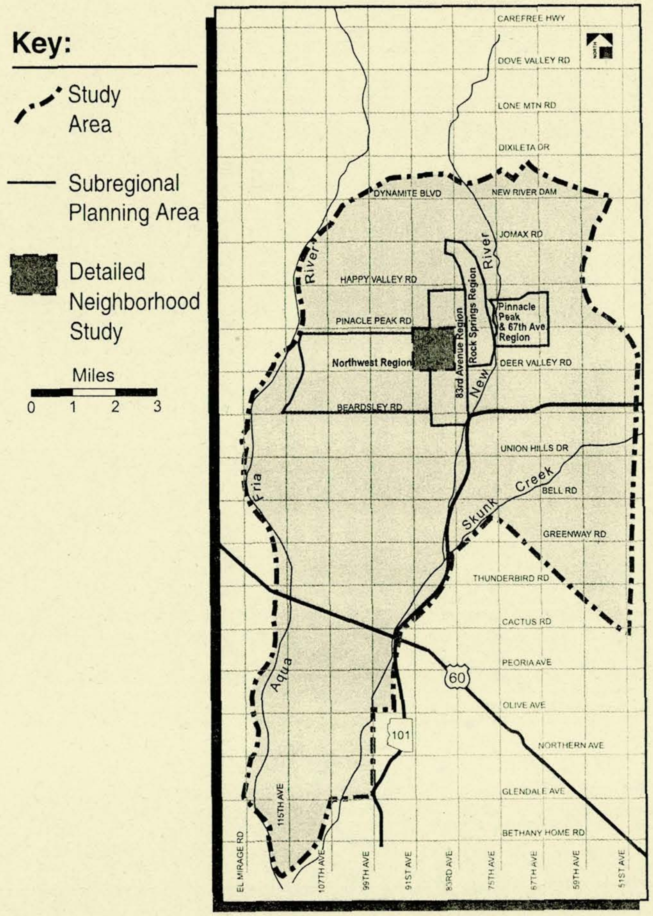
- identify and evaluate existing regional and neighborhood drainage problems using "state of the art" engineering techniques
- consider neighborhood character and community recreational needs
- evaluate archaeological, biological, and other environmental factors
- identify cost-effective drainage solutions that provide maximum community benefits
- involve the community in the development of the plan

Study Update

- Your ADMP Project Team will present the recommended alternatives for solving drainage problems at the next public meeting scheduled for May 17, 2001. We will have exhibits and conceptual design plans available for your review and input.

- We also will present the preliminary results and recommended drainage solutions from a detailed neighborhood study for the area bounded by Pinnacle Peak Rd., Deer Valley Rd., 91st Ave., and 83rd Ave.

Study Location



Study Goals

- **Identify and evaluate existing regional and neighborhood drainage problems within the study area.**

- **Develop cost-effective solutions to drainage problems that are sensitive to natural and cultural resources, enhance the neighborhood's character, and are acceptable to the community.**

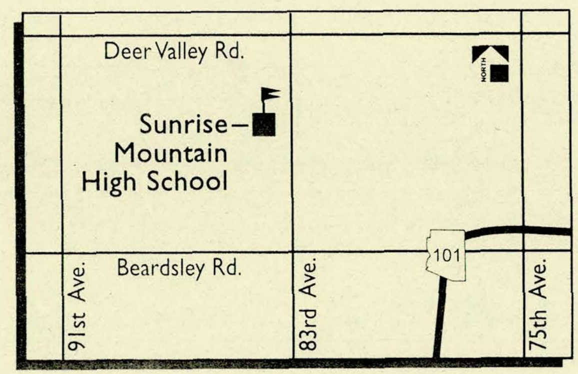
Public Meeting

The final public meeting is scheduled for May 17, 2001. The purpose of this meeting is to present the recommended drainage improvement alternatives and obtain your input.

We hope you can attend this meeting and share your ideas and suggestions as we finalize our drainage concepts. This information will also be presented on May 22nd, 2001 to the Peoria City Council at their study session.

Public Meeting - May 17

Thursday, May 17, 2001
6:30 p.m. - 8:00 p.m.
Sunrise Mountain High School Library
21200 North 83rd Avenue
Peoria, Arizona



Flood Control District of Maricopa County

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APPENDIX E. PUBLIC COMMENTS

Summary of Public Comments
August 15, 2001 Meeting

Flood Control District of Maricopa County
Glendale/Peoria ADMP Update

This is a summary of comments, alphabetized by last name, from the return postcards and meeting comment sheets:

1. Adler, Robert – 8931 W. Electra Lane, Peoria 85383:
Marked "I agree Alternative No. 4 is the best choice."

2. Bailey, Ace – 8615 W. Calle Lejos, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
Comment: "I wish not for Alt. 4, but realize I am outnumbered by about 25:1."
General Comments: "Nice effort, much more calm than City Council meetings on Tuesdays. The figure of 2329 C. P. hours on 83rd has increased 2-fold vs. what the pivotal group told us 2 years ago. This was why they felt they could omit 91st Ave. access to the Westwing Development."

3. Battilana, Ruthanna – 9014 W. Daley Lane, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
Comment: "Please answer this question: Are you putting ramadas/structures/ball fields in the drainage basin at 83rd & Pinnacle Peak? (It looks like it on the drawing.)
General Comments: "Be sure to purchase the land on Calle Lejos up to the "topo feature" so some fool doesn't build on the edge of the basin and then sue the city when something happens like an overflow! People who want to discuss roadways and street expansion should not be allowed to dominate the question period – it has nothing to do with the purpose of this meeting and they just want to bitch and complain."

4. Bolley, John & Janice – 9033 W. Country Club Trail, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "It is refreshing to have a governmental entity that is willing to listen to the residents of an area. Your presentation tonight was the best I have attended in a long time. Thanks to Marilyn DeRosa and her staff for a good job. We would appreciate any feedback and further info re this. We hope the County Supervisors approve this recommendation. It's amazing what can be accomplished when the people affected are put in the loop.

5. Butler, Dorothy – 23039 N. 90th Avenue, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

6. Cannon, Gary & Pam – 6920 W. Monte Lindo, Glendale 85310
Marked "I agree Alternative No. 4 is the best choice."

7. Clifton, Sheri – 8734 W. Canino De Oro, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "Excellent improvement in information sharing and overall communication. Your commitment to resolving planning, communication, meeting facility is appreciated. Even if people aren't satisfied with recommended solution, they cannot take issue with the approach. I

personally think you selected the most sound solution that is both community and environmentally friendly."

8. Cooper, Denis & Darlene – 9054 W. Maui Lane, Peoria 85381
Marked "I agree Alternative No. 4 is the best choice."

9. Currence, Ron & Lorraine Hall-Currence – 8512 W. Pinnacle Peak Road, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

10. Day, Jim – 8240 W. Briden Lane, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

11. Emch, Brian – 3602 W. Greeway Road, Phoenix 85053
Marked "I agree Alternative No. 4 is the best choice."

12. Fennema, Barbara – 18033 N. 83rd Drive, Peoria 85382
Marked "I agree Alternative No. 4 is the best choice."

13. Fischer, Daniel – 9212 W. Cielo Grande, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

14. Hall, Alfred & Lisa – 8504 W. Camino De Oro 85383
Marked "I agree Alternative No. 4 is the best choice."

15. Lisac, Jim – 9001 W. Electra Lane, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "1) With reference to the Cost/Phase poster, how much "fat" is incorporated into each phase cost? 2) As a member homeowner in attendance I felt more time for questions/ answers should have been permitted. 3) When should one expect to see any activity as to phase #6? 4) Please advise "daily" what Board of Supers decides."

16. Marska, Victor – 10951 N. 91st Avenue #64, Peoria 85345
Marked "I agree Alternative No. 4 is the best choice."
Comment: "Please call me for my input at 623-486-7924."

17. Mason, Jim – 8943 W. Electra Lane, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
Comment: "Please call me for my input at 623-486-7924."

18. Mikesell, Ken – 8392 W. Camino Del Oro, Peoria 85382
Marked "I agree Alternative No. 4 is the best choice."
Comment: "I preferred option 4 as best alternative. I do want to see a plan on how they will develop the drain basin to insure it is done well. The basin development needs input by neighbors."

Summary of Public Comments
August 15, 2001 Meeting

Flood Control District of Maricopa County
Glendale/Peoria ADMP Update
(continued)

19. Maya, Ricky & Minerva – 8834 W. Pinnacle Peak Road, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "1) Will we be informed on further development on the subject? 2) Is Alt. 4 the final decision? 3) So, can we continue to build around our properties?"

20. Mitchell, Gordon – 8720 W. Pinnacle Peak Road, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "General understanding that this project (looking at phasing) is probably 8-10 years away from phase #6. I would just like MCDOT to respond to the immediate problem of flooding in my driveways!"

21. Moore, Mickie – 3131 W. Pima Street, Phoenix 85009
Marked "I agree Alternative No. 4 is the best choice."

22. Ohrt, Roland – 8309 W. Marco Polo Drive, Peoria 85382
Marked "I agree Alternative No. 4 is the best choice."

23. Saueressig, Dave – 8703 W. Avenida Del Sol, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

24. Schultz, Ken – 8445 W. Pinnacle Peak Road, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

25. Schwartz, Terrie – 22512 N. 87th Avenue, Peoria 85382
Marked "I agree Alternative No. 4 is the best choice."
Comment: "I object to having an open ditch on 87th Avenue. That will make parking impossible and clean driveways impossible to maintain."

26. Shontz, David – 8935 W. Villa Linda, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."
General Comments: "In Alt. 4, which was represented at the June meeting, there was a channel north of Hatfield Road and west of 89th Ave. This channel fed into a channel east of 89th Ave. which ran to Calle Lejos and over to the detention basin. I live in the area west of 90th Ave. With the kid of rain we've had in the last 5 years, the run-off from the mountain fills the existing washes. I can't imagine what would happen in a 100-year rainfall. I urge you to consider a means of collecting the water coming off the mountain west of 89th Ave. and diverting it into the detention basin."

27. Simmons, Steve & Debet – 8420 W. Pinnacle Peak Road, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

28. Slezak, Randy & Sue – 8542 W. Calle Lejos, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

Summary of Public Comments
August 15, 2001 Meeting

Flood Control District of Maricopa County
Glendale/Peoria ADMP Update
(continued)

29. Stacy, Wayne – 8946 W. Calle Lejos, Peoria 85383
General Comments: "Something is still wrong with the notification process. I only received the single letter explaining the first mistake. I would appreciate being sent all the information."

30. Sullivan, Raymond – 8852 W. Wescott Drive, Peoria 85382
General Comments: "1) Why are City and County taxpayers required to share in the cost burden to provide drainage facilities for the benefit of land developers? Drainage is required to develop land. That drainage should be provided by the developer. But in accordance with the ADMP.
2) How can I get a copy of the current ADMP covering the area north of Bell and between the New and Agua Fria Rivers?"

31. Van Riper, Steve & Patti – 8720 W. Mariposa Grande, Peoria 85383
Marked "I agree Alternative No. 4 is the best choice."

Glendale / Peoria
Public Open House
September 20th and 21st 2000

Questionnaires Summarized

September 20th, 2000 – Ventana Lakes

Three (3) people responded to the **Rock Springs Region** Questionnaire:

Howard and Rosemary Chambers only filled out the **Meeting Survey** portion on the back side:

Heard about the meeting -- Door Hanger
Rate overall knowledge and helpfulness – Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Jackie Allen:

✓ Alt. 5 - do nothing – Leave Aqua Fria alone

Steve Campbell:

_4_ Alt 1
_3_ Alt 2
_5_ Alt 3
_2_ Alt 4
_1_ Alt 5

Two (2) people responded to the **83rd Avenue Region** Questionnaire:

Howard Chambers:

There is a flooding problem at 83rd Ave. & Union Hills (See map on back of survey)
Concerning bridge at New River, wants to know what is going to protect 83rd Ave?

Larry Moore:

_2_ Alt 1
_*1_ Alt 2
Not an option ____ Alt 3

* Because this will handle the most water volume as well as keeping as much water as possible off 83rd Ave.
Moore said his house has been flooded twice since 1994

Under other comments, Moore said, purchase the property at 85th Ave and Deer Valley Road and install a Retention Basin, pave 85 Road between Via Montoya to Deer Valley and install storm drains

Moore continued . . .

Heard about the meeting -- Door Hanger
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Ten (10) people responded to the **Northwest Region** Questionnaire:

Sheldon J Stover:

Alt 4 more cost affective and utilized current retention basins on N side of Rose Garden Lane

Heard about the meeting -- Newspaper Notice
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner
Rate facility for future meetings – Very Good

Charles F. Wackes:

_3_ Alt 1
_*1_ Alt 2
_4_ Alt 3
_2_ Alt 4
_5_ Alt 5
*Because it appears to be the best alternative presented
(#5) Not an alternative

Heard about the meeting -- Door Hanger / Newspaper Notice
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

George Horton:

_4_ Alt 1
_3_ Alt 2
_2_ Alt 3
_1_ Alt 4
_5_ Alt 5
I prefer having a detention basin and feel they are good for drainage. I also feel there is less distance for water to travel and not as much water will bet into Rose Gardens.

We need something done to prevent current problems at the corners of Rose Gardens and 111th and 111th and Beardsley.

Under other comments: When you schedule your next meetings and do door hangers, make mention the info is pertaining to the last held meeting because new people are involved, because of moving in and some of us older folks don't remember real well.

Local problem of water going over 111th and Union Hills. This may be a local problem but needs to be addressed. Looks like the Trailer Park pumps water out on road.

Thanks for giving us a chance for input.

Heard about the meeting -- Door Hanger
Rate overall knowledge and helpfulness – Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Shirley Horton:

_4_ Alt 1
_3_ Alt 2
_2_ Alt 3
_1_ Alt 4
_5_ Alt 5

Under other comments: Local problem 111th Ave & Union Hills water sits when it rains. Trailer Park pumps water across the road or into road.

Heard about the meeting
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner
Rate facility for future meetings

Charles Yankowski:

___ Alt 1
___ Alt 2
_✓_ Alt 3
_✓_ Alt 4
___ Alt 5
Because of shorter distance and retention basin

Heard about the meeting – Newspaper Notice
Rate overall knowledge and helpfulness – Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Good

Joan Yankowski:

___ Alt 1
___ Alt 2
_1_ Alt 3
_2_ Alt 4
___ Alt 5
Short distance point to point and retention basin

Under other comments: Hernan said fill channel Who should fill channel on South side of Rose Garden, this is behind my home . . . .

Heard about the meeting – Door Hanger
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Howard and Rosemary Chambers:

_✓_ Alt 3

Heard about the meeting – Door Hanger
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Kurt Herr:
_✓_ Alt 2
Beardsley Channels need Improvements!
It prevents some of the problems of large amounts of water having to make 90 degree turns at 107th Ave and Rose Garden Lane

Heard about the meeting – Other
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

Jerry Timmerman:

_2_ Alt 1
_1_ Alt 2
_4_ Alt 3
_3_ Alt 4
_5_ Alt 5
Better protection of my property and increased recreational facilities.
To do nothing about floods is stupid.

Heard about the meeting – Other/wife

Paul Powers:

X Alt 2
If draining ditch in on north side of Rose Garden as shown on sketch

Heard about the meeting – Other / VT Association

September 21st, 2000 – Sunrise Mountain High School

Two (2) people responded to the **83rd Avenue Region** Questionnaire

Thomas Bertolon:

Under other comments:

1) Drainage problem across 83rd South of Union Hills
2) Now freeway interchange for Beardsley & 83rd east to 101 – do we know of this?

Mike Meinert

1 Alt 1
2 Alt 2
3 Alt 3
To lessen the expense of this portion, may free up monies for more projects in the area. Also horse/bike/walking paths would be aesthetically good for the area, and used for recreation.

Doing nothing won't fix the existing problems

Heard about the meeting – Other/McDot
Rate overall knowledge and helpfulness – Very Good
Information presented/understandable manner – Yes
Rate facility for future meetings – Very Good

One (1) person responded to the **Rock Springs Region** Questionnaire

Howard B. Weichsel

4 Alt 1
3 Alt 2
2 Alt 3
1 Alt 4
5 Alt 5
#4 The alternative that provides aesthetics (amenities) in a package with practical solutions is biggest benefit for $ expended. However, as funding meets resistance the lessor solution may be more palatable to the residents of the community.

#5 Simple ignoring the problem is not acceptable, as cost and flood damage in the future might have been prevented.

APPENDIX F. FLOW SUMMARY

FLOW SUMMARY TABLE

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	N11P6	367.	4.10	20.	5.	4.	0.20
+	ROUTED TO	R11P6S	350.	4.17	20.	5.	4.	0.20
+	HYDROGRAPH AT	N11P5	81.	4.10	5.	1.	1.	0.05
+	ROUTED TO	R11P5S	74.	4.20	5.	1.	1.	0.05
+	HYDROGRAPH AT	N11P1	124.	4.10	7.	2.	1.	0.07
+	DIVERSION TO	N11P1I	31.	4.10	2.	0.	0.	0.07
+	HYDROGRAPH AT	DN11P1	93.	4.10	5.	1.	1.	0.07
+	ROUTED TO	R11P1E	90.	4.20	5.	1.	1.	0.07
+	HYDROGRAPH AT	N11P2	68.	4.20	6.	2.	1.	0.06
+	4 COMBINED AT	CN11P2	575.	4.17	35.	9.	6.	0.38
+	DIVERSION TO	CALLEI	575.	4.17	35.	9.	6.	0.38
	HYDROGRAPH AT	CALLE	0.	0.03	0.	0.	0.	0.38
+	DIVERSION TO	LEJOSI	0.	0.03	0.	0.	0.	0.38
+	HYDROGRAPH AT	LEJOS	0.	0.03	0.	0.	0.	0.38
+	ROUTED TO	RN11PS	0.	0.03	0.	0.	0.	0.38
+	HYDROGRAPH AT	N11L3	76.	4.13	8.	2.	1.	0.06
+	2 COMBINED AT	CN11L3	76.	4.13	8.	2.	1.	0.45
+	DIVERSION TO	N11L3I	50.	4.13	5.	1.	1.	0.45
+	HYDROGRAPH AT	DN11L3	26.	4.13	3.	1.	0.	0.45
+	ROUTED TO	R11L3W	23.	4.20	3.	1.	0.	0.45
+	HYDROGRAPH AT	N11L2	9.	4.17	1.	0.	0.	0.01
+	2 COMBINED AT	CN11L2	32.	4.20	4.	1.	1.	0.46
+	ROUTED TO	RN11L2	31.	4.23	4.	1.	1.	0.46
	HYDROGRAPH AT	N11L5	52.	4.23	8.	2.	1.	0.07
+	HYDROGRAPH AT	N11LPX	31.	4.10	2.	0.	0.	0.07
	ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+		RN11P1	28.	4.30	2.	0.	0.	0.07
	3 COMBINED AT	CN11L5	106.	4.27	13.	3.	2.	0.53
+	ROUTED TO	RN11L5	105.	4.30	13.	3.	2.	0.53
+	HYDROGRAPH AT	N11L1	65.	4.20	9.	2.	2.	0.07
+	2 COMBINED AT	CN11L1	155.	4.30	21.	5.	4.	0.61
+	DIVERSION TO	N11L1I	155.	4.30	21.	5.	4.	0.61
+	HYDROGRAPH AT	DN11L1	0.	0.03	0.	0.	0.	0.61
+	HYDROGRAPH AT	N11L3X	50.	4.13	5.	1.	1.	0.45
+	ROUTED TO	R11L3E	49.	4.17	5.	1.	1.	0.45
+	HYDROGRAPH AT	N11L4	8.	4.27	1.	0.	0.	0.01
+	2 COMBINED AT	CN11L4	56.	4.17	7.	2.	1.	0.46
+	ROUTED TO	R11L4E	55.	4.20	7.	2.	1.	0.46
+	HYDROGRAPH AT	N21I1	121.	4.17	12.	3.	2.	0.11
	2 COMBINED AT	CN21I1	166.	4.17	18.	4.	3.	0.57
+	ROUTED TO	RN21I1	164.	4.20	17.	4.	3.	0.57
+	HYDROGRAPH AT	N21I2	75.	4.17	10.	2.	2.	0.06
+	2 COMBINED AT	CN21I2	227.	4.20	26.	7.	5.	0.63
+	ROUTED TO	RN21I2	225.	4.20	26.	7.	5.	0.63
+	HYDROGRAPH AT	N11P7	234.	4.07	13.	3.	2.	0.10
+	DIVERSION TO	N11P7I	187.	4.07	10.	3.	2.	0.10
+	HYDROGRAPH AT	DN11P7	47.	4.07	3.	1.	0.	0.10
+	ROUTED TO	R11P7E	34.	4.27	3.	1.	0.	0.10
+	HYDROGRAPH AT	DN11P7	187.	4.07	10.	3.	2.	0.10
+	ROUTED TO	R11P7W	136.	4.27	10.	3.	2.	0.10
+	HYDROGRAPH AT	N11P4	172.	4.20	13.	3.	2.	0.12
	3 COMBINED AT	CN11P4	333.	4.23	26.	6.	5.	0.23
	ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		RN11P4	326.	4.27	26.	6.	5.	0.23
+	HYDROGRAPH AT	N11P3	52.	4.20	4.	1.	1.	0.04
+	2 COMBINED AT	CN11P3	371.	4.27	30.	7.	5.	0.27
+	ROUTED TO	RN11P3	370.	4.30	30.	7.	5.	0.27
+	HYDROGRAPH AT	N21J	565.	4.07	39.	10.	7.	0.23
+	DIVERSION TO	N21JI	174.	4.07	12.	3.	2.	0.23
+	HYDROGRAPH AT	DN21JO	390.	4.07	27.	7.	5.	0.23
+	ROUTED TO	RN21JS	348.	4.23	27.	7.	5.	0.23
+	HYDROGRAPH AT	N21Z	249.	4.10	22.	5.	4.	0.11
+	DIVERSION TO	LN21ZD	191.	4.00	6.	2.	1.	0.11
+	HYDROGRAPH AT	LN21Z	249.	4.10	15.	4.	3.	0.11
+	2 COMBINED AT	CN21Z	546.	4.20	42.	11.	8.	0.34
+	DIVERSION TO	N21ZI	42.	4.20	2.	0.	0.	0.34
+	HYDROGRAPH AT	DN21ZO	504.	4.20	41.	10.	7.	0.34
+	DIVERSION TO	N21ZI*	164.	4.20	5.	1.	1.	0.34
+	HYDROGRAPH AT	DN21Z*	384.	4.07	35.	9.	6.	0.34
+	ROUTED TO	RN21ZW	328.	4.37	35.	9.	6.	0.34
+	HYDROGRAPH AT	N21I3	128.	4.17	13.	3.	2.	0.12
+	4 COMBINED AT	CN21I	667.	4.33	80.	20.	14.	1.63
+	ROUTED TO	83RD	72.	5.20	67.	20.	14.	1.63
+	ROUTED TO	RN21I	72.	5.23	67.	20.	14.	1.63
+	HYDROGRAPH AT	N22B	455.	4.10	40.	10.	7.	0.19
+	DIVERSION TO	N22BI	410.	4.10	36.	9.	6.	0.19
+	HYDROGRAPH AT	DN22B	46.	4.10	4.	1.	1.	0.19
+	ROUTED TO	RN22BE	24.	4.33	4.	1.	1.	0.19
+	HYDROGRAPH AT	N21F	158.	4.23	28.	7.	5.	0.10

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
	3 COMBINED AT	CN21F	209.	4.33	95.	27.	19.	1.92
+	ROUTED TO	RN21F	208.	4.47	95.	27.	19.	1.92
+	HYDROGRAPH AT	N21G	121.	4.13	17.	4.	3.	0.06
+	HYDROGRAPH AT	DR21Z*	164.	4.20	5.	1.	1.	0.34
+	ROUTED TO	RN21ZS	102.	4.53	5.	1.	1.	0.34
+	2 COMBINED AT	CN21G	150.	4.53	21.	5.	4.	0.63
+	DIVERSION TO	N21GI	64.	4.53	3.	1.	1.	0.63
+	HYDROGRAPH AT	DN21GO	88.	4.17	18.	5.	3.	0.63
+	ROUTED TO	RN21GS	88.	4.53	18.	5.	3.	0.63
+	HYDROGRAPH AT	N21E	93.	4.23	18.	4.	3.	0.06
+	3 COMBINED AT	CN21E	361.	4.43	126.	35.	25.	1.98
+	ROUTED TO	RN21E	355.	4.63	126.	35.	25.	1.98
	HYDROGRAPH AT	N21D	152.	4.07	13.	3.	2.	0.05
+	DIVERSION TO	LN21DD	152.	4.07	10.	2.	2.	0.05
+	HYDROGRAPH AT	LN21D	95.	4.20	4.	1.	1.	0.05
+	HYDROGRAPH AT	N22BIX	410.	4.10	36.	9.	6.	0.19
+	ROUTED TO	RN22BS	385.	4.27	36.	9.	6.	0.19
+	HYDROGRAPH AT	N22A	368.	4.17	48.	12.	9.	0.18
+	2 COMBINED AT	CN22A	728.	4.23	84.	21.	15.	0.37
+	DIVERSION TO	N22AI	109.	4.23	13.	3.	2.	0.37
+	HYDROGRAPH AT	DN22A	619.	4.23	71.	18.	13.	0.37
+	ROUTED TO	RN22AE	568.	4.50	71.	18.	13.	0.37
+	3 COMBINED AT	CN21D	786.	4.53	194.	52.	38.	2.21
+	DIVERSION TO	N21DI	118.	4.53	29.	8.	6.	2.21
	HYDROGRAPH AT	DN21D	668.	4.53	165.	45.	32.	2.21
	ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		RN21DS	637.	5.00	163.	45.	32.	2.21
+	HYDROGRAPH AT	N21C	522.	4.30	95.	24.	17.	0.39
+	DIVERSION TO	LN21CD	97.	3.80	6.	2.	1.	0.39
+	HYDROGRAPH AT	LN21C	522.	4.30	90.	22.	16.	0.39
+	2 COMBINED AT	CN21C	860.	4.93	241.	65.	47.	2.61
+	ROUTED TO	RN21C	860.	4.93	241.	65.	47.	2.61
+	HYDROGRAPH AT	N24Q	100.	4.07	7.	2.	1.	0.04
+	ROUTED TO	RN24Q	66.	4.53	7.	2.	1.	0.04
+	HYDROGRAPH AT	N24R	97.	4.07	7.	2.	1.	0.03
+	ROUTED TO	RN24R	75.	4.47	7.	2.	1.	0.03
+	HYDROGRAPH AT	N24O	374.	4.13	26.	6.	5.	0.16
+	3 COMBINED AT	CN24O	401.	4.17	40.	10.	7.	0.22
+	ROUTED TO	RN24O	380.	4.23	40.	10.	7.	0.22
+	HYDROGRAPH AT	N24S	147.	4.07	10.	2.	2.	0.05
+	ROUTED TO	RN24S	93.	4.60	10.	2.	2.	0.05
+	HYDROGRAPH AT	N24T	50.	4.03	3.	1.	1.	0.02
+	ROUTED TO	RN24T	37.	4.63	3.	1.	1.	0.02
+	HYDROGRAPH AT	N24P	297.	4.13	21.	5.	4.	0.12
+	4 COMBINED AT	CN24P	615.	4.17	73.	18.	13.	0.41
+	ROUTED TO	RN24P	614.	4.20	73.	18.	13.	0.41
+	HYDROGRAPH AT	N24U	333.	4.07	21.	5.	4.	0.11
+	ROUTED TO	RN24U	293.	4.23	21.	5.	4.	0.11
+	2 COMBINED AT	CN24U*	883.	4.23	93.	23.	17.	0.52
+	ROUTED TO	RN24U*	849.	4.30	93.	23.	17.	0.52
+	HYDROGRAPH AT	N24V	116.	4.07	7.	2.	1.	0.05
+	ROUTED TO	RN24V	74.	4.50	7.	2.	1.	0.05

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	2 COMBINED AT	CN24V*	848.	4.30	100.	25.	18.	0.57
+	ROUTED TO	RN24V*	811.	4.40	100.	25.	18.	0.57
+	HYDROGRAPH AT	N24M	504.	4.20	40.	10.	7.	0.25
+	2 COMBINED AT	CN24M	996.	4.37	134.	33.	24.	0.82
+	ROUTED TO	RN24M	976.	4.43	134.	33.	24.	0.82
+	HYDROGRAPH AT	N24L	1077.	4.07	68.	17.	12.	0.38
+	ROUTED TO	RN24L	999.	4.17	68.	17.	12.	0.38
+	2 COMBINED AT	CN24I*	1211.	4.23	190.	48.	34.	1.20
+	ROUTED TO	RN24I*	1166.	4.60	190.	48.	34.	1.20
+	HYDROGRAPH AT	N24I	256.	4.50	41.	10.	7.	0.30
+	HYDROGRAPH AT	N24H	641.	4.13	59.	15.	11.	0.29
+	HYDROGRAPH AT	N24N	214.	4.20	19.	5.	3.	0.13
	ROUTED TO	RN24N	146.	4.67	19.	5.	3.	0.13
+	HYDROGRAPH AT	N24J	101.	4.43	16.	4.	3.	0.12
+	2 COMBINED AT	CN24J	227.	4.63	35.	9.	6.	0.25
+	ROUTED TO	RN24J	225.	4.67	35.	9.	6.	0.25
+	HYDROGRAPH AT	N24K	137.	4.60	29.	7.	5.	0.21
+	5 COMBINED AT	CN24I	1517.	4.63	309.	78.	56.	2.25
+	ROUTED TO	RN24I	1512.	4.73	309.	78.	56.	2.25
+	HYDROGRAPH AT	DRN21J	174.	4.07	12.	3.	2.	0.23
+	ROUTED TO	RN21JE	141.	4.43	12.	3.	2.	0.23
+	2 COMBINED AT	CN24G*	1508.	4.73	311.	79.	57.	2.71
+	ROUTED TO	RN24G*	1496.	4.83	311.	79.	57.	2.71
+	HYDROGRAPH AT	N24G	503.	4.43	63.	16.	11.	0.44
	DIVERSION TO	LN24GD	43.	4.00	1.	0.	0.	0.44
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		LN24G	503.	4.43	62.	15.	11.	0.44
	2 COMBINED AT	CN24G	1643.	4.80	348.	88.	63.	3.26
+	HYDROGRAPH AT	DRN21Z	42.	4.20	2.	0.	0.	0.34
+	ROUTED TO	RN21ZE	10.	4.33	2.	0.	0.	0.34
+	2 COMBINED AT	CN24G+	1643.	4.80	348.	88.	63.	3.26
+	ROUTED TO	RN24G	1636.	4.83	348.	88.	63.	3.26
+	HYDROGRAPH AT	N24F	194.	4.20	17.	4.	3.	0.11
+	2 COMBINED AT	CN24F	1648.	4.83	359.	91.	65.	3.37
+	HYDROGRAPH AT	N24D	184.	4.10	17.	4.	3.	0.09
+	2 COMBINED AT	CN24D	1656.	4.83	371.	94.	68.	3.45
+	ROUTED TO	LN24D	13.	9.00	12.	11.	9.	3.45
+	HYDROGRAPH AT	N21H	76.	4.07	6.	2.	1.	0.03
+	HYDROGRAPH AT	DRN21G	64.	4.53	3.	1.	1.	0.63
	ROUTED TO	RN21GE	43.	4.80	3.	1.	1.	0.63
+	2 COMBINED AT	CN21H	76.	4.07	10.	3.	2.	0.03
+	ROUTED TO	RN21H	55.	5.00	10.	3.	2.	0.03
+	HYDROGRAPH AT	N24E	24.	4.27	3.	1.	1.	0.02
+	ROUTED TO	RN24E	22.	4.47	3.	1.	1.	0.02
+	3 COMBINED AT	CN24D*	55.	4.90	19.	13.	11.	3.51
+	HYDROGRAPH AT	N27F	659.	4.10	48.	12.	9.	0.28
+	ROUTED TO	RN27F	630.	4.17	48.	12.	9.	0.28
+	HYDROGRAPH AT	N27G	498.	4.17	42.	11.	8.	0.26
+	2 COMBINED AT	CN27G	1098.	4.17	89.	22.	16.	0.55
+	ROUTED TO	RN27G	1024.	4.27	89.	22.	16.	0.55
+	HYDROGRAPH AT	N27E	287.	4.27	26.	6.	5.	0.19
	ROUTED TO	RN27E	266.	4.40	26.	6.	5.	0.19

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT	N27H	451.	4.13	33.	8.	6.	0.21
+	ROUTED TO	RN27H	394.	4.30	33.	8.	6.	0.21
+	HYDROGRAPH AT	N27C	156.	4.17	12.	3.	2.	0.09
+	4 COMBINED AT	CN27C	1412.	4.27	145.	36.	26.	1.03
+	ROUTED TO	RN27C	1375.	4.33	145.	36.	26.	1.03
+	HYDROGRAPH AT	N27I	411.	4.10	28.	7.	5.	0.17
+	ROUTED TO	RN27I	344.	4.33	28.	7.	5.	0.17
+	HYDROGRAPH AT	N27B	109.	4.23	11.	3.	2.	0.08
+	HYDROGRAPH AT	N27J	501.	4.10	32.	8.	6.	0.19
+	DIVERSION TO	N27JI	189.	4.10	9.	2.	2.	0.19
+	HYDROGRAPH AT	DN27J	312.	4.10	23.	6.	4.	0.19
+	ROUTED TO	RN27JW	270.	4.37	23.	6.	4.	0.19
	4 COMBINED AT	CN27B	1738.	4.33	193.	48.	35.	1.46
+	ROUTED TO	RN27B	1642.	4.47	193.	48.	35.	1.46
+	HYDROGRAPH AT	N27D	158.	4.10	17.	4.	3.	0.09
+	DIVERSION TO	LN27DD	158.	4.10	13.	3.	2.	0.09
+	HYDROGRAPH AT	LN27D	67.	4.43	4.	1.	1.	0.09
+	HYDROGRAPH AT	DRN27J	189.	4.10	9.	2.	2.	0.19
+	ROUTED TO	RN27JS	175.	4.17	9.	2.	2.	0.19
+	2 COMBINED AT	CN27D	175.	4.17	13.	3.	2.	0.28
+	DIVERSION TO	N27DI	86.	4.17	10.	2.	2.	0.28
+	HYDROGRAPH AT	DN27DO	89.	4.17	3.	1.	1.	0.28
+	ROUTED TO	RN27DW	41.	4.63	3.	1.	1.	0.28
+	HYDROGRAPH AT	DRN27D	86.	4.17	10.	2.	2.	0.28
	ROUTED TO	RN27DS	67.	4.70	10.	2.	2.	0.28
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		N27K	676.	4.57	105.	26.	19.	0.63
	ROUTED TO	RN27K	651.	4.77	105.	26.	19.	0.63
+	HYDROGRAPH AT	N27L	721.	4.30	80.	20.	15.	0.47
+	2 COMBINED AT	CN27L	843.	4.67	173.	43.	31.	1.09
+	ROUTED TO	RN27L	842.	4.70	173.	43.	31.	1.09
+	HYDROGRAPH AT	N25S	80.	4.07	7.	2.	1.	0.03
+	ROUTED TO	RN25S	76.	4.10	7.	2.	1.	0.03
+	2 COMBINED AT	CN25O*	847.	4.70	179.	45.	32.	1.12
+	ROUTED TO	RN25O*	843.	4.73	179.	45.	32.	1.12
+	HYDROGRAPH AT	N25O	267.	4.07	24.	6.	4.	0.13
+	DIVERSION TO	LN25OD	267.	4.07	13.	3.	2.	0.13
+	HYDROGRAPH AT	LN25O	229.	4.17	11.	3.	2.	0.13
+	2 COMBINED AT	CN25O	854.	4.73	186.	47.	34.	1.25
	ROUTED TO	RN25O	848.	4.87	186.	47.	34.	1.25
+	4 COMBINED AT	CN27*	1839.	4.53	342.	86.	62.	3.27
+	HYDROGRAPH AT	N27	243.	4.37	38.	10.	7.	0.28
+	HYDROGRAPH AT	N27A	160.	4.27	17.	4.	3.	0.11
+	HYDROGRAPH AT	N26B	317.	4.17	41.	10.	7.	0.22
+	DIVERSION TO	LN26BD	317.	4.17	28.	7.	5.	0.22
+	HYDROGRAPH AT	LN26B	164.	4.53	13.	3.	2.	0.22
+	4 COMBINED AT	CN27	1966.	4.50	374.	94.	68.	3.89
+	ROUTED TO	RN27	1939.	4.63	374.	94.	68.	3.89
+	HYDROGRAPH AT	N26	79.	4.13	5.	1.	1.	0.04
+	HYDROGRAPH AT	N26A	476.	4.17	57.	14.	10.	0.35
+	DIVERSION TO	LN26AD	476.	4.17	27.	7.	5.	0.35
	HYDROGRAPH AT	LN26A	399.	4.33	30.	7.	5.	0.35

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	3 COMBINED AT	CN26*	2029.	4.63	386.	97.	70.	4.29
+	HYDROGRAPH AT	N25R	290.	4.07	25.	6.	5.	0.09
+	ROUTED TO	RN25R	277.	4.10	25.	6.	5.	0.09
+	HYDROGRAPH AT	N25Q	88.	4.07	8.	2.	1.	0.03
+	ROUTED TO	RN25Q	83.	4.13	8.	2.	1.	0.03
+	HYDROGRAPH AT	N25P	498.	4.07	44.	11.	8.	0.17
+	ROUTED TO	RN25P	470.	4.13	44.	11.	8.	0.17
+	HYDROGRAPH AT	N25M	592.	4.07	55.	14.	10.	0.24
+	DIVERSION TO	LN25MD	592.	4.07	35.	9.	6.	0.24
+	HYDROGRAPH AT	LN25M	464.	4.17	21.	5.	4.	0.24
+	4 COMBINED AT	CN25M	1230.	4.17	97.	24.	18.	0.53
+	DIVERSION TO	N25MI	1053.	4.17	90.	23.	16.	0.53
	HYDROGRAPH AT	DN25M	178.	4.17	7.	2.	1.	0.53
+	ROUTED TO	RN25MW	124.	4.33	7.	2.	1.	0.53
+	HYDROGRAPH AT	N25N	49.	4.07	5.	1.	1.	0.03
+	DIVERSION TO	LN25ND	49.	4.07	3.	1.	1.	0.03
+	HYDROGRAPH AT	LN25N	32.	4.27	2.	0.	0.	0.03
+	ROUTED TO	RN25N	27.	4.37	2.	0.	0.	0.03
+	2 COMBINED AT	CX3	143.	4.37	8.	2.	2.	0.55
+	DIVERSION TO	X3I	79.	4.37	5.	1.	1.	0.55
+	HYDROGRAPH AT	DX3O	64.	4.37	4.	1.	1.	0.55
+	ROUTED TO	RX3W	39.	4.87	4.	1.	1.	0.55
+	2 COMBINED AT	CN26	2016.	4.63	386.	97.	70.	4.84
+	ROUTED TO	RN26	1943.	4.73	379.	96.	69.	4.84
	HYDROGRAPH AT	N25L	133.	4.13	10.	2.	2.	0.06
	DIVERSION TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		N25LI	72.	4.13	5.	1.	1.	0.06
	HYDROGRAPH AT	DN25L	61.	4.13	5.	1.	1.	0.06
+	ROUTED TO	RN25LW	56.	4.37	5.	1.	1.	0.06
+	HYDROGRAPH AT	N25K	216.	4.10	15.	4.	3.	0.09
+	2 COMBINED AT	CN25K	219.	4.10	20.	5.	4.	0.15
+	DIVERSION TO	N25KI	189.	4.10	14.	3.	3.	0.15
+	HYDROGRAPH AT	DN25K	30.	3.90	6.	2.	1.	0.15
+	ROUTED TO	RN25KW	30.	4.43	6.	2.	1.	0.15
+	HYDROGRAPH AT	N25J	194.	4.17	13.	3.	2.	0.10
+	3 COMBINED AT	CN25J	1958.	4.73	391.	99.	71.	5.09
+	ROUTED TO	RN25J	1882.	4.97	391.	99.	71.	5.09
+	HYDROGRAPH AT	N25G	115.	4.17	10.	2.	2.	0.06
+	HYDROGRAPH AT	DRN25K	189.	4.10	14.	3.	3.	0.15
.	ROUTED TO	RN25KS	139.	4.67	14.	3.	3.	0.15
+	2 COMBINED AT	CN25G	160.	4.67	24.	6.	4.	0.21
+	ROUTED TO	RN25G	128.	5.43	24.	6.	4.	0.21
+	HYDROGRAPH AT	N25I	219.	4.20	17.	4.	3.	0.12
+	3 COMBINED AT	CN25I	1913.	4.97	419.	106.	76.	4.99
+	ROUTED TO	RN25I	1864.	5.13	418.	106.	76.	4.99
+	HYDROGRAPH AT	N25E	303.	4.37	42.	11.	8.	0.27
+	HYDROGRAPH AT	DRN25M	1053.	4.17	90.	23.	16.	0.53
+	ROUTED TO	RN25MS	837.	4.37	90.	23.	16.	0.53
+	HYDROGRAPH AT	DRX3	79.	4.37	5.	1.	1.	0.55
+	ROUTED TO	RX3S	59.	4.67	5.	1.	1.	0.55
+	3 COMBINED AT	CN25E	992.	4.37	131.	33.	24.	0.82
.	DIVERSION TO	N25EI	496.	4.37	66.	16.	12.	0.82

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	DN25E	496.	4.37	66.	16.	12.	0.82
+	ROUTED TO	RN25EW	459.	4.60	66.	16.	12.	0.82
+	HYDROGRAPH AT	N25D	580.	4.03	35.	9.	6.	0.20
+	HYDROGRAPH AT	DRN25E	496.	4.37	66.	16.	12.	0.82
+	ROUTED TO	RN25ES	434.	4.73	66.	16.	12.	0.82
+	2 COMBINED AT	CN25D	580.	4.03	102.	26.	19.	1.03
+	DIVERSION TO	N25DI	143.	4.03	29.	7.	5.	1.03
+	HYDROGRAPH AT	DN25D	335.	4.03	68.	17.	12.	1.03
+	ROUTED TO	RN25DW	304.	4.13	68.	17.	12.	1.03
+	HYDROGRAPH AT	N25C	294.	4.23	28.	7.	5.	0.17
+	3 COMBINED AT	CN25C	677.	4.63	155.	39.	28.	1.20
+	DIVERSION TO	N25CI	0.	4.63	0.	0.	0.	1.20
+	HYDROGRAPH AT	DN25C	677.	4.63	155.	39.	28.	1.20
+	ROUTED TO	RN25CW	677.	4.67	155.	39.	28.	1.20
+	HYDROGRAPH AT	N25F	195.	4.13	14.	3.	2.	0.09
+	HYDROGRAPH AT	DRN25L	72.	4.13	5.	1.	1.	0.06
+	ROUTED TO	RN25LS	46.	4.83	5.	1.	1.	0.06
+	2 COMBINED AT	CN25F	195.	4.13	19.	5.	3.	0.15
+	ROUTED TO	RN25F	160.	4.43	19.	5.	3.	0.15
+	HYDROGRAPH AT	N25B	158.	4.27	19.	5.	3.	0.11
+	3 COMBINED AT	CN25B	836.	4.53	184.	46.	33.	1.46
+	DIVERSION TO	N25BI	0.	4.47	0.	0.	0.	1.46
+	HYDROGRAPH AT	DN25B	836.	4.53	184.	46.	33.	1.46
+	ROUTED TO	RN25BW	832.	4.60	184.	46.	33.	1.46
+	HYDROGRAPH AT	N25A	163.	4.20	15.	4.	3.	0.09
	2 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CN25A	881.	4.53	196.	49.	36.	1.55
	DIVERSION TO	N25AI	0.	4.47	0.	0.	0.	1.55
+	HYDROGRAPH AT	DN25A	881.	4.53	196.	49.	36.	1.55
+	HYDROGRAPH AT	N25	200.	4.47	30.	7.	5.	0.24
+	HYDROGRAPH AT	N25H	78.	4.27	10.	2.	2.	0.07
+	4 COMBINED AT	CN25	2199.	5.13	574.	146.	105.	6.85
+	ROUTED TO	RN25	2095.	5.40	574.	146.	105.	6.85
+	HYDROGRAPH AT	N24B	129.	4.13	12.	3.	2.	0.07
+	HYDROGRAPH AT	DRN25D	143.	4.03	29.	7.	5.	1.03
+	ROUTED TO	RN25DS	122.	4.33	29.	7.	5.	1.03
+	2 COMBINED AT	CN24B	238.	4.23	43.	11.	8.	0.27
+	ROUTED TO	RN24B	236.	4.33	43.	11.	8.	0.27
+	HYDROGRAPH AT	DRN25C	0.	4.63	0.	0.	0.	1.20
	ROUTED TO	RN25CS	0.	4.80	0.	0.	0.	1.20
+	2 COMBINED AT	CN24B*	236.	4.33	43.	11.	8.	0.64
+	DIVERSION TO	N24BI	0.	4.30	0.	0.	0.	0.64
+	HYDROGRAPH AT	DN24B*	223.	4.33	42.	11.	8.	0.64
+	ROUTED TO	RN24BW	219.	4.40	42.	11.	8.	0.64
+	HYDROGRAPH AT	DRN25B	0.	4.47	0.	0.	0.	1.46
+	ROUTED TO	RN25BS	0.	4.87	0.	0.	0.	1.46
+	2 COMBINED AT	CN24C*	219.	4.40	42.	11.	8.	2.09
+	ROUTED TO	RN24C*	162.	4.47	37.	9.	7.	2.09
+	HYDROGRAPH AT	DRN25A	0.	4.47	0.	0.	0.	1.55
+	ROUTED TO	RN25AS	0.	4.70	0.	0.	0.	1.55
+	HYDROGRAPH AT	N24C	404.	4.10	38.	10.	7.	0.19
	3 COMBINED AT	CN24C	298.	4.33	66.	17.	12.	3.73

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	ROUTED TO							
+		RN24C	295.	4.37	66.	17.	12.	3.73
	HYDROGRAPH AT							
+		N24	153.	4.27	14.	4.	3.	0.11
	HYDROGRAPH AT							
+		N24A	356.	4.20	53.	13.	10.	0.24
	DIVERSION TO							
+		LN24AD	339.	4.13	18.	5.	3.	0.24
	HYDROGRAPH AT							
+		LN24A	356.	4.20	35.	9.	6.	0.24
	HYDROGRAPH AT							
+		DRN24B	0.	4.30	0.	0.	0.	0.64
	ROUTED TO							
+		RN24BS	0.	4.43	0.	0.	0.	0.64
	DIVERSION TO							
+		X30I	0.	4.43	0.	0.	0.	0.64
	HYDROGRAPH AT							
+		DX30	0.	0.03	0.	0.	0.	0.64
	ROUTED TO							
+		RX30W	0.	0.03	0.	0.	0.	0.64
	6 COMBINED AT							
+		CN24	2021.	5.43	626.	167.	123.	10.60
	ROUTED TO							
+		RN24	1991.	5.63	625.	167.	123.	10.60
	HYDROGRAPH AT							
+		DRX30	0.	4.43	0.	0.	0.	0.64
	ROUTED TO							
+		RX30S	0.	4.73	0.	0.	0.	0.64
	HYDROGRAPH AT							
+		N23A	1012.	4.13	106.	27.	19.	0.49
	DIVERSION TO							
+		LN23AD	728.	4.00	32.	8.	6.	0.49
	HYDROGRAPH AT							
+		LN23A	1012.	4.13	74.	19.	13.	0.49
	2 COMBINED AT							
+		CN23A	1013.	4.13	74.	19.	13.	0.49
	DIVERSION TO							
+		N23AI	242.	4.13	18.	5.	3.	0.49
	HYDROGRAPH AT							
+		DN23A	771.	4.13	56.	14.	10.	0.49
	ROUTED TO							
+		RN23AW	703.	4.33	56.	14.	10.	0.49
	HYDROGRAPH AT							
+		N23	390.	4.33	66.	17.	12.	0.39
	HYDROGRAPH AT							
+		DRN21D	118.	4.53	29.	8.	6.	2.21
	ROUTED TO							
+		RN21DE	111.	5.13	29.	8.	6.	2.21
	4 COMBINED AT							
+		CN23	2009.	5.63	692.	185.	136.	13.79
	ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		RN23	1940.	5.97	691.	185.	136.	13.79
	HYDROGRAPH AT	N21B	2824.	4.10	356.	89.	64.	1.66
+	DIVERSION TO	LN21BD	2824.	4.10	234.	58.	42.	1.66
+	HYDROGRAPH AT	LN21B	1879.	4.33	124.	31.	22.	1.66
+	ROUTED TO	RN21B	1300.	4.73	124.	31.	22.	1.66
+	HYDROGRAPH AT	DRN23A	242.	4.13	18.	5.	3.	0.49
+	ROUTED TO	RN23AS	179.	4.77	18.	5.	3.	0.49
+	HYDROGRAPH AT	N21A	964.	4.40	209.	53.	38.	0.93
+	DIVERSION TO	LN21AD	964.	4.40	150.	37.	27.	0.93
+	HYDROGRAPH AT	LN21A	431.	5.17	61.	15.	11.	0.93
+	3 COMBINED AT	CN21A	1327.	4.77	180.	45.	32.	3.07
+	ROUTED TO	RN21A	1161.	4.87	172.	43.	31.	3.07
+	HYDROGRAPH AT	N21	626.	4.40	132.	33.	24.	0.62
	4 COMBINED AT	CN21	2629.	5.10	1045.	279.	203.	17.39
+	HYDROGRAPH AT	A09U	454.	4.10	31.	8.	6.	0.17
+	DIVERSION TO	A09UI	91.	4.10	6.	2.	1.	0.17
+	HYDROGRAPH AT	DA09U	364.	4.10	25.	6.	4.	0.17
+	ROUTED TO	RA09US	309.	4.33	25.	6.	4.	0.17
+	HYDROGRAPH AT	N11N	700.	4.03	42.	11.	8.	0.26
+	DIVERSION TO	N11NI	661.	4.03	39.	10.	7.	0.26
+	HYDROGRAPH AT	DN11N	39.	4.03	3.	1.	1.	0.26
+	ROUTED TO	RN11NW	32.	4.57	3.	1.	1.	0.26
+	HYDROGRAPH AT	N11O	119.	4.13	8.	2.	1.	0.05
+	DIVERSION TO	N11OI	12.	4.13	1.	0.	0.	0.05
+	HYDROGRAPH AT	DN11O	107.	4.13	7.	2.	1.	0.05
	ROUTED TO	RN11OS	85.	4.50	7.	2.	1.	0.05

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	N11M	234.	4.13	14.	3.	2.	0.10
+	4 COMBINED AT	CN11M	410.	4.27	48.	12.	9.	0.33
+	DIVERSION TO	N11MI	102.	4.27	12.	3.	2.	0.33
+	HYDROGRAPH AT	DN11M	307.	4.27	36.	9.	7.	0.33
+	ROUTED TO	RN11MS	294.	4.53	36.	9.	7.	0.33
+	HYDROGRAPH AT	N11J	492.	4.10	40.	10.	7.	0.24
+	DIVERSION TO	LN11JD	137.	3.87	5.	1.	1.	0.24
+	HYDROGRAPH AT	LN11J	492.	4.10	36.	9.	6.	0.24
+	2 COMBINED AT	CN11J	515.	4.13	71.	18.	13.	0.57
+	DIVERSION TO	N11JI	257.	4.13	36.	9.	6.	0.57
+	HYDROGRAPH AT	DN11J	257.	4.13	35.	9.	6.	0.57
+	ROUTED TO	RN11JS	228.	4.67	35.	9.	6.	0.57
+	HYDROGRAPH AT	N11G	716.	4.37	73.	18.	13.	0.52
+	HYDROGRAPH AT	N11K	301.	4.17	31.	8.	6.	0.19
+	DIVERSION TO	LN11KD	68.	3.87	3.	1.	0.	0.19
+	HYDROGRAPH AT	LN11K	301.	4.17	29.	7.	5.	0.19
+	HYDROGRAPH AT	DRN11N	661.	4.03	39.	10.	7.	0.26
+	ROUTED TO	RN11NS	546.	4.23	39.	10.	7.	0.26
+	HYDROGRAPH AT	DN11LI	155.	4.30	21.	5.	4.	0.61
+	ROUTED TO	RN11L1	152.	4.30	21.	5.	4.	0.61
+	3 COMBINED AT	CN11K	751.	4.23	77.	19.	14.	1.13
+	DIVERSION TO	LN11K1	209.	3.97	6.	2.	1.	1.13
+	HYDROGRAPH AT	LN11KX	751.	4.23	71.	18.	13.	1.13
+	ROUTED TO	RN11K	714.	4.43	71.	18.	13.	1.13
+	HYDROGRAPH AT	N11H	603.	4.37	64.	16.	11.	0.44
	2 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+		CN11H	1053.	4.40	119.	30.	21.	1.56
	ROUTED TO	RN11H	979.	4.67	119.	30.	21.	1.56
+	3 COMBINED AT	CN11G	1386.	4.63	199.	50.	36.	2.09
+	DIVERSION TO	N11GI	1386.	4.63	199.	50.	36.	2.09
+	HYDROGRAPH AT	DN11G	0.	0.03	0.	0.	0.	2.09
+	ROUTED TO	RN11GS	0.	0.03	0.	0.	0.	2.09
+	HYDROGRAPH AT	N11F	452.	4.23	35.	9.	6.	0.24
+	2 COMBINED AT	CN11F	452.	4.23	35.	9.	6.	0.24
+	ROUTED TO	RN11F	394.	4.50	35.	9.	6.	0.24
+	HYDROGRAPH AT	N11C	398.	4.20	51.	13.	9.	0.25
+	DIVERSION TO	LN11CD	398.	4.20	31.	8.	6.	0.25
+	HYDROGRAPH AT	LN11C	277.	4.43	20.	5.	4.	0.25
+	2 COMBINED AT	CN11C	641.	4.47	55.	14.	10.	0.50
	DIVERSION TO	N11CWI	36.	4.47	1.	0.	0.	0.50
+	HYDROGRAPH AT	DN11CW	604.	4.47	53.	13.	10.	0.50
+	DIVERSION TO	N11CEI	21.	4.47	4.	1.	1.	0.50
+	HYDROGRAPH AT	DN11CE	583.	4.47	49.	12.	9.	0.50
+	HYDROGRAPH AT	DRN11C	36.	4.47	1.	0.	0.	0.50
+	ROUTED TO	LN11CW	0.	4.83	0.	0.	0.	0.50
+	HYDROGRAPH AT	DR11C*	21.	4.47	4.	1.	1.	0.50
+	ROUTED TO	LN11CE	3.	6.30	3.	1.	1.	0.50
+	3 COMBINED AT	CN11C*	586.	4.47	53.	14.	10.	0.50
+	HYDROGRAPH AT	N11D	662.	4.23	98.	25.	18.	0.51
+	DIVERSION TO	LN11DD	662.	4.23	73.	18.	13.	0.51
+	HYDROGRAPH AT	LN11D	315.	4.73	26.	6.	5.	0.51
	DIVERSION TO	N11DI	32.	4.73	3.	1.	0.	0.51

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	DN11D	284.	4.73	23.	6.	4.	0.51
+	2 COMBINED AT	CN11D	573.	4.73	71.	18.	13.	1.01
+	ROUTED TO	RWBW1	366.	5.00	64.	16.	12.	1.01
+	HYDROGRAPH AT	WBW	831.	4.77	214.	55.	39.	1.00
+	2 COMBINED AT	CWBW	979.	4.93	257.	66.	48.	2.01
+	ROUTED TO	RBWB	25.	5.00	25.	25.	22.	2.01
+	ROUTED TO	RWBW2	25.	9.03	25.	25.	21.	2.01
+	HYDROGRAPH AT	N11I	1112.	4.17	133.	33.	24.	0.62
+	HYDROGRAPH AT	DRN22A	109.	4.23	13.	3.	2.	0.37
+	ROUTED TO	RN22AW	100.	4.50	13.	3.	2.	0.37
+	2 COMBINED AT	CN11I	1112.	4.20	144.	36.	26.	0.98
+	DIVERSION TO	N11II	519.	4.20	71.	18.	13.	0.98
+	HYDROGRAPH AT	DN11I	519.	4.20	71.	18.	13.	0.98
+	ROUTED TO	RN11IS	506.	4.30	70.	18.	13.	0.98
+	HYDROGRAPH AT	DRN11I	519.	4.20	71.	18.	13.	0.98
+	ROUTED TO	RN11IW	505.	4.40	70.	18.	13.	0.98
+	2 COMBINED AT	CX50	991.	4.37	141.	35.	25.	0.98
+	ROUTED TO	LX50	867.	4.53	232.	166.	160.	0.98
+	DIVERSION TO	DX50I	627.	4.53	198.	153.	149.	0.98
+	HYDROGRAPH AT	DX50	240.	4.53	34.	13.	11.	0.98
+	ROUTED TO	RX50E	234.	4.70	34.	13.	11.	0.98
+	HYDROGRAPH AT	N22	579.	4.37	121.	31.	22.	0.47
+	DIVERSION TO	LN22D	579.	4.37	76.	19.	14.	0.47
+	HYDROGRAPH AT	LN22	397.	4.87	46.	12.	8.	0.47
+	2 COMBINED AT	CN22	518.	4.97	76.	23.	18.	1.46
	DIVERSION TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		N22I	500.	4.97	75.	23.	18.	1.46
	HYDROGRAPH AT	DN22	48.	4.87	1.	0.	0.	1.46
+	ROUTED TO	RN22W	24.	5.10	1.	0.	0.	1.46
+	HYDROGRAPH AT	DRX50I	627.	4.53	198.	153.	149.	0.98
+	ROUTED TO	RX50W	619.	4.67	198.	153.	148.	0.98
+	HYDROGRAPH AT	N11E	762.	4.23	112.	28.	20.	0.49
+	2 COMBINED AT	CN11E1	1012.	4.53	300.	179.	166.	1.47
+	DIVERSION TO	LN11ED	169.	3.43	79.	20.	14.	1.47
+	HYDROGRAPH AT	LN11E	1012.	4.53	295.	178.	152.	1.47
+	HYDROGRAPH AT	DRN11D	32.	4.73	3.	1.	0.	0.51
+	ROUTED TO	RN11DE	20.	5.13	3.	1.	0.	0.51
+	DIVERSION TO	X1I	0.	0.03	0.	0.	0.	0.51
+	HYDROGRAPH AT	DX1	20.	5.13	3.	1.	0.	0.51
	ROUTED TO	RX1E	18.	5.33	3.	1.	0.	0.51
+	3 COMBINED AT	CN11E	1012.	4.53	297.	178.	153.	1.47
+	ROUTED TO	R-WBE1	1012.	4.53	297.	178.	153.	1.47
+	HYDROGRAPH AT	WB1	285.	4.20	32.	8.	6.	0.12
+	2 COMBINED AT	CPWB1	1126.	4.50	325.	185.	158.	1.59
+	ROUTED TO	R-R3	1125.	4.50	318.	183.	156.	1.59
+	HYDROGRAPH AT	WB2	156.	4.47	28.	7.	5.	0.10
+	2 COMBINED AT	CPWB2	1242.	4.50	342.	189.	160.	1.69
+	ROUTED TO	R-4-5	1133.	4.70	272.	172.	144.	1.69
+	HYDROGRAPH AT	WB3	35.	4.10	3.	1.	1.	0.01
+	2 COMBINED AT	CPWB3	1135.	4.70	272.	172.	145.	1.71
+	ROUTED TO	R-6	1089.	4.73	271.	172.	144.	1.71
	HYDROGRAPH AT	DRN22	500.	4.97	75.	23.	18.	1.46

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	WB4	161.	4.13	16.	4.	3.	0.06
+	2 COMBINED AT	CPWB4	511.	4.97	90.	27.	21.	1.52
+	ROUTED TO	R-R1	526.	5.00	83.	27.	21.	1.52
+	HYDROGRAPH AT	WB5	178.	4.17	20.	5.	4.	0.08
+	2 COMBINED AT	CPWB5	544.	5.00	99.	31.	24.	1.60
+	ROUTED TO	R-R2	208.	5.53	45.	27.	22.	1.60
+	2 COMBINED AT	CPR6	1068.	4.80	308.	197.	165.	2.33
+	ROUTED TO	RCR26	1000.	4.93	306.	196.	164.	2.33
+	HYDROGRAPH AT	WB7	97.	4.10	10.	2.	2.	0.03
+	2 COMBINED AT	CR6W7	1006.	4.90	307.	196.	166.	2.36
+	ROUTED TO	R-R7	1007.	4.93	305.	196.	164.	2.36
+	HYDROGRAPH AT	WB6	178.	4.27	23.	6.	4.	0.08
+	ROUTED TO	R-R8	21.	5.10	18.	6.	4.	0.08
+	2 COMBINED AT	C7R8	1023.	4.93	321.	200.	168.	2.45
+	ROUTED TO	RC78	1015.	4.97	320.	200.	167.	2.45
+	HYDROGRAPH AT	WB8	103.	4.07	10.	3.	2.	0.03
+	2 COMBINED AT	CP-678	1019.	4.97	321.	200.	169.	2.48
+	HYDROGRAPH AT	WB10	139.	4.17	14.	4.	3.	0.06
+	ROUTED TO	R-R9	24.	4.63	14.	4.	3.	0.06
+	2 COMBINED AT	WBEOT	1040.	4.97	330.	203.	171.	2.50
+	DIVERSION TO	TONRI	100.	4.77	75.	59.	50.	2.50
+	HYDROGRAPH AT	DVNR	940.	4.97	254.	144.	122.	2.50
+	DIVERSION TO	DCLUB	204.	4.97	41.	15.	12.	2.50
+	HYDROGRAPH AT	CCLUB	736.	4.97	213.	129.	110.	2.50
+	ROUTED TO	RR287	735.	5.00	213.	129.	110.	2.50
	DIVERSION TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		DV87SI	212.	5.00	43.	16.	12.	2.50
	HYDROGRAPH AT	DV87S	523.	5.00	170.	113.	97.	2.50
+	ROUTED TO	RR289	518.	5.03	170.	113.	97.	2.50
+	DIVERSION TO	DV89I	186.	5.03	26.	7.	5.	2.50
+	HYDROGRAPH AT	DS89	331.	5.03	144.	106.	92.	2.50
+	ROUTED TO	TODET	328.	5.10	144.	106.	92.	2.50
+	DIVERSION TO	DV91I	206.	5.10	40.	10.	7.	2.50
+	HYDROGRAPH AT	DV91	123.	5.17	104.	96.	85.	2.50
+	HYDROGRAPH AT	WB9	627.	4.10	71.	18.	13.	0.28
+	ROUTED TO	R-R10	331.	4.37	23.	6.	4.	0.28
+	HYDROGRAPH AT	DRX1I	0.	0.03	0.	0.	0.	0.51
+	ROUTED TO	RX1S	0.	0.03	0.	0.	0.	0.51
+	4 COMBINED AT	CN11B	363.	4.63	169.	138.	119.	4.79
	ROUTED TO	RCP91	212.	4.67	159.	135.	117.	4.79
+	HYDROGRAPH AT	SB-G4a	142.	4.07	13.	3.	2.	0.06
+	HYDROGRAPH AT	DR91	206.	5.10	40.	10.	7.	2.50
+	ROUTED TO	R2DET	205.	5.13	40.	10.	7.	2.50
+	3 COMBINED AT	CPDET	357.	5.20	198.	145.	125.	4.94
+	ROUTED TO	S-DET	249.	6.07	190.	144.	129.	4.94
+	ROUTED TO	RDET	249.	6.13	190.	144.	129.	4.94
+	ROUTED TO	RN11BS	249.	6.43	190.	144.	128.	4.94
+	HYDROGRAPH AT	N11	1231.	4.30	223.	56.	40.	0.90
+	HYDROGRAPH AT	DRV87	212.	5.00	43.	16.	12.	2.50
+	ROUTED TO	RDV87S	209.	5.07	43.	16.	12.	2.50
+	ROUTED TO	R-G1	205.	5.13	43.	16.	12.	2.50
	DIVERSION TO	DX55I	150.	5.00	40.	15.	12.	2.50

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	DX55	55.	5.13	3.	1.	1.	2.50
+	DIVERSION TO	DX56I	43.	5.13	2.	1.	0.	2.50
+	HYDROGRAPH AT	DX56	11.	5.13	1.	0.	0.	2.50
+	ROUTED TO	DX56W	4.	5.37	1.	0.	0.	2.50
+	HYDROGRAPH AT	DRV89	186.	5.03	26.	7.	5.	2.50
+	ROUTED TO	RDV89S	130.	5.37	26.	7.	5.	2.50
+	ROUTED TO	RDV89E	104.	5.73	26.	7.	5.	2.50
+	4 COMBINED AT	CN11	1231.	4.37	452.	213.	181.	5.69
+	ROUTED TO	RN11	989.	4.53	381.	194.	167.	5.69
+	HYDROGRAPH AT	N10	614.	4.30	115.	29.	21.	0.49
+	HYDROGRAPH AT	S10R	37.	4.23	8.	2.	1.	0.03
+	DIVERSION TO	S10RI	24.	4.23	4.	1.	1.	0.03
+	HYDROGRAPH AT	DS10RO	13.	4.23	3.	1.	1.	0.03
+	ROUTED TO	RS10RS	9.	4.70	3.	1.	1.	0.03
+	3 COMBINED AT	CN10	1382.	4.50	470.	217.	185.	6.22
+	DIVERSION TO	N10I	632.	4.50	73.	19.	14.	6.22
+	HYDROGRAPH AT	DN10	750.	4.27	396.	198.	171.	6.22
+	ROUTED TO	RN10E	750.	4.53	396.	198.	170.	6.22
+	HYDROGRAPH AT	DR56	43.	5.13	2.	1.	0.	2.50
+	ROUTED TO	RDR56	11.	5.40	2.	1.	0.	2.50
+	HYDROGRAPH AT	N09	1068.	4.23	170.	43.	31.	0.65
+	3 COMBINED AT	CN09*	1431.	4.30	530.	234.	197.	6.87
+	HYDROGRAPH AT	CN21	2629.	5.10	1045.	279.	203.	17.39
+	ROUTED TO	RN21	2548.	5.37	1041.	279.	203.	17.39
+	HYDROGRAPH AT	DRTONR	100.	4.77	75.	59.	50.	2.50
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+		N20	472.	4.27	83.	21.	15.	0.36
	3 COMBINED AT	CN20	2709.	5.37	1144.	346.	262.	17.74
+	ROUTED TO	RN20	2654.	5.60	1143.	345.	261.	17.74
+	HYDROGRAPH AT	N12	475.	4.50	123.	31.	23.	0.51
+	DIVERSION TO	LN12D	21.	3.37	6.	1.	1.	0.51
+	HYDROGRAPH AT	LN12	475.	4.50	120.	30.	22.	0.51
+	HYDROGRAPH AT	N13	184.	5.10	112.	34.	25.	0.50
+	3 COMBINED AT	CN12	2891.	5.60	1290.	392.	296.	18.75
+	ROUTED TO	RN12	2825.	5.83	1289.	392.	295.	18.75
+	2 COMBINED AT	CN09+	2974.	5.83	1630.	585.	464.	26.16
+	ROUTED TO	RN09*	2952.	5.93	1629.	584.	462.	26.16
+	HYDROGRAPH AT	N19E	726.	4.60	123.	31.	22.	0.70
+	HYDROGRAPH AT	N19F	323.	4.63	58.	14.	10.	0.37
	2 COMBINED AT	CN19E	937.	4.63	169.	43.	31.	1.08
+	ROUTED TO	RN19E	853.	4.80	169.	43.	31.	1.08
+	HYDROGRAPH AT	N19D	575.	4.33	75.	19.	14.	0.39
+	2 COMBINED AT	CN19D	1029.	4.70	230.	58.	42.	1.47
+	ROUTED TO	RN19D	1013.	4.97	230.	58.	42.	1.47
+	HYDROGRAPH AT	N19C	1498.	4.10	141.	35.	26.	0.76
+	2 COMBINED AT	CN19C	1082.	4.13	344.	88.	63.	2.23
+	ROUTED TO	RN19C	1070.	4.30	344.	88.	63.	2.23
+	HYDROGRAPH AT	N19B	808.	4.07	61.	15.	11.	0.32
+	2 COMBINED AT	CN19B	1321.	4.23	390.	100.	72.	2.54
+	ROUTED TO	RN19B	1244.	4.60	390.	100.	72.	2.54
+	HYDROGRAPH AT	N19A	1061.	4.07	97.	24.	17.	0.47
	2 COMBINED AT	CN19A	1382.	4.57	461.	119.	86.	3.02

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
				6-HOUR	24-HOUR	72-HOUR	
+ ROUTED TO	397RR	1261.	4.70	460.	119.	86.	3.02
+ HYDROGRAPH AT	398AS	718.	4.20	60.	15.	11.	0.30
+ ROUTED TO	398ARR	564.	4.27	39.	10.	7.	0.30
+ HYDROGRAPH AT	398BS	618.	4.77	216.	56.	40.	0.90
+ 3 COMBINED AT	HC398	1881.	4.70	669.	174.	125.	4.22
+ ROUTED TO	398BR1	1610.	5.03	663.	174.	125.	4.22
+ ROUTED TO	398BR2	1219.	6.03	631.	174.	125.	4.22
+ ROUTED TO	398BR3	792.	7.30	533.	172.	125.	4.22
+ ROUTED TO	398BR4	708.	8.17	500.	172.	125.	4.22
+ ROUTED TO	RM399	705.	8.30	498.	172.	125.	4.22
+ HYDROGRAPH AT	N18	788.	4.20	103.	26.	19.	0.50
+ 2 COMBINED AT	CN18	704.	8.30	497.	191.	140.	4.73
+ ROUTED TO	RN18	693.	8.53	489.	189.	138.	4.73
+ HYDROGRAPH AT	N17	546.	4.23	85.	21.	15.	0.41
+ 2 COMBINED AT	CN17	794.	4.43	489.	206.	151.	5.14
+ ROUTED TO	RN17	760.	4.67	483.	204.	150.	5.14
+ HYDROGRAPH AT	N16	1155.	4.30	201.	50.	36.	0.92
+ 2 COMBINED AT	CN16	1415.	4.63	553.	244.	179.	6.06
+ ROUTED TO	RN16	1405.	4.73	552.	244.	179.	6.06
+ HYDROGRAPH AT	N15B	792.	4.37	161.	41.	29.	0.75
+ ROUTED TO	RN15B	753.	4.90	160.	41.	29.	0.75
+ HYDROGRAPH AT	N15A	948.	4.37	193.	49.	35.	0.80
+ DIVERSION TO	LN15AD	948.	4.37	151.	38.	27.	0.80
+ HYDROGRAPH AT	LN15A	333.	5.03	43.	11.	8.	0.80
+ 2 COMBINED AT	CN15A	882.	5.27	192.	48.	35.	1.54
ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		RN15A	808.	5.47	191.	48.	35.	1.54
	HYDROGRAPH AT	N15	546.	4.40	121.	31.	22.	0.54
+	3 COMBINED AT	CN15	1990.	4.80	762.	301.	220.	8.14
+	ROUTED TO	RN15	1978.	4.87	761.	301.	220.	8.14
+	HYDROGRAPH AT	N14A	458.	4.40	102.	26.	19.	0.44
+	ROUTED TO	RN14A	454.	4.50	102.	26.	19.	0.44
+	HYDROGRAPH AT	N14	195.	4.07	24.	6.	4.	0.08
+	3 COMBINED AT	CN14	2265.	4.87	835.	326.	238.	8.66
+	ROUTED TO	RN14	2112.	5.17	818.	325.	238.	8.66
+	HYDROGRAPH AT	N08B	750.	4.40	165.	42.	30.	0.70
+	DIVERSION TO	LN08BD	750.	4.40	116.	29.	21.	0.70
+	HYDROGRAPH AT	LN08B	373.	4.97	51.	13.	9.	0.70
+	ROUTED TO	RN08B	260.	5.87	51.	13.	9.	0.70
	HYDROGRAPH AT	N08A	702.	4.43	174.	44.	32.	0.74
+	DIVERSION TO	LN08AD	702.	4.43	109.	27.	20.	0.74
+	HYDROGRAPH AT	LN08A	432.	5.07	69.	17.	12.	0.74
+	2 COMBINED AT	CN08A	420.	5.07	109.	27.	20.	1.43
+	ROUTED TO	RN08A	334.	6.07	108.	27.	20.	1.43
+	HYDROGRAPH AT	N08	918.	4.30	183.	46.	33.	0.79
+	3 COMBINED AT	CN08	2321.	5.17	946.	372.	272.	10.88
+	ROUTED TO	RN08	2317.	5.20	946.	372.	272.	10.88
+	2 COMBINED AT	CN09	3936.	5.87	2239.	855.	661.	37.04
+	ROUTED TO	RN09	3902.	6.00	2235.	855.	658.	37.04
+	HYDROGRAPH AT	DRN10	632.	4.50	73.	19.	14.	6.22
+	ROUTED TO	RN10S	625.	4.60	73.	19.	14.	6.22
	DIVERSION TO	DX26I	590.	4.60	66.	17.	12.	6.22

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	DX26O	35.	4.33	7.	2.	1.	6.22
+	ROUTED TO	RX26S	35.	5.40	7.	2.	1.	6.22
+	HYDROGRAPH AT	DRX26	590.	4.60	66.	17.	12.	6.22
+	HYDROGRAPH AT	N07A	809.	4.13	81.	20.	15.	0.36
+	DIVERSION TO	LN07AD	809.	4.13	56.	14.	10.	0.36
+	HYDROGRAPH AT	LN07A	531.	4.30	26.	6.	5.	0.36
+	2 COMBINED AT	CN07A	1456.	4.43	149.	37.	27.	0.36
+	HYDROGRAPH AT	N07	962.	4.27	160.	40.	29.	0.75
+	4 COMBINED AT	CN07	3925.	6.00	2325.	885.	681.	38.15
+	ROUTED TO	RN07	3906.	6.27	2320.	884.	675.	38.15
+	HYDROGRAPH AT	A11L	662.	4.20	62.	15.	11.	0.25
+	ROUTED TO	RA11L	607.	4.37	62.	15.	11.	0.25
+	HYDROGRAPH AT	A11M	722.	4.10	55.	14.	10.	0.26
+	ROUTED TO	RA11M	670.	4.20	55.	14.	10.	0.26
+	HYDROGRAPH AT	A11J	181.	4.17	16.	4.	3.	0.08
+	HYDROGRAPH AT	A11N	210.	4.10	14.	4.	3.	0.08
+	ROUTED TO	RA11N	200.	4.13	14.	4.	3.	0.08
+	HYDROGRAPH AT	A11O	146.	4.07	10.	2.	2.	0.06
+	ROUTED TO	RA11O	136.	4.17	10.	2.	2.	0.06
+	2 COMBINED AT	CX21	334.	4.17	24.	6.	4.	0.14
+	ROUTED TO	RX21	290.	4.33	24.	6.	4.	0.14
+	3 COMBINED AT	CA11K*	1046.	4.23	95.	24.	17.	0.47
+	HYDROGRAPH AT	A11K	777.	4.10	46.	12.	8.	0.30
+	HYDROGRAPH AT	A11G	189.	4.03	13.	3.	2.	0.07
+	DIVERSION TO	A11GI	0.	4.03	0.	0.	0.	0.07
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		DA11G	189.	4.03	13.	3.	2.	0.07
	ROUTED TO	RA11GN	178.	4.10	13.	3.	2.	0.07
+	4 COMBINED AT	CA11K	1803.	4.17	205.	51.	37.	1.09
+	ROUTED TO	RA11K	1735.	4.27	205.	51.	37.	1.09
+	HYDROGRAPH AT	DRA11G	0.	4.03	0.	0.	0.	0.07
+	ROUTED TO	RA11GW	0.	4.20	0.	0.	0.	0.07
+	HYDROGRAPH AT	A11I	884.	4.07	58.	14.	10.	0.28
+	4 COMBINED AT	CA11I	3887.	6.27	2387.	923.	703.	39.52
+	ROUTED TO	RA11I	3861.	6.47	2386.	923.	701.	39.52
+	HYDROGRAPH AT	A11E	542.	4.20	44.	11.	8.	0.30
+	HYDROGRAPH AT	A11F	898.	4.20	79.	20.	14.	0.47
+	DIVERSION TO	A11FI	1.	4.20	0.	0.	0.	0.47
+	HYDROGRAPH AT	DA11F	897.	4.20	79.	20.	14.	0.47
	ROUTED TO	RA11FN	866.	4.23	78.	20.	14.	0.47
+	3 COMBINED AT	CA11E	3842.	6.47	2410.	932.	709.	40.28
+	ROUTED TO	RA11E	3836.	6.53	2409.	932.	707.	40.28
+	HYDROGRAPH AT	A11H	188.	4.07	10.	2.	2.	0.07
+	ROUTED TO	RA11H	149.	4.37	10.	2.	2.	0.07
+	HYDROGRAPH AT	DRA09U	91.	4.10	6.	2.	1.	0.17
+	ROUTED TO	RA09UW	67.	4.33	6.	2.	1.	0.17
+	HYDROGRAPH AT	A09T	348.	4.17	26.	7.	5.	0.18
+	2 COMBINED AT	CA09T	407.	4.17	32.	8.	6.	0.18
+	DIVERSION TO	A09TI	197.	4.17	8.	2.	1.	0.18
+	HYDROGRAPH AT	DA09T	210.	4.03	24.	6.	4.	0.18
+	ROUTED TO	RA09TW	210.	4.37	24.	6.	4.	0.18
	HYDROGRAPH AT	DRA11F	1.	4.20	0.	0.	0.	0.47

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	ROUTED TO	RA11FS	0.	4.63	0.	0.	0.	0.47
+	2 COMBINED AT	CX22	210.	4.37	25.	6.	4.	0.18
+	ROUTED TO	RX22	210.	4.43	25.	6.	4.	0.18
+	3 COMBINED AT	CX23	3830.	6.53	2420.	935.	709.	40.53
+	ROUTED TO	RX23	3827.	6.70	2417.	935.	706.	40.53
+	HYDROGRAPH AT	A99Z	333.	4.17	32.	8.	6.	0.16
+	ROUTED TO	RA99Z	302.	4.43	32.	8.	6.	0.16
+	HYDROGRAPH AT	A11D	313.	4.13	20.	5.	4.	0.15
+	2 COMBINED AT	CA11D	397.	4.17	51.	13.	9.	0.30
+	ROUTED TO	RA11D	357.	4.97	51.	13.	9.	0.30
+	HYDROGRAPH AT	A11B	196.	4.23	21.	5.	4.	0.15
+	HYDROGRAPH AT	A11A	659.	4.43	93.	23.	17.	0.59
+	4 COMBINED AT	CA11A	3822.	6.70	2456.	948.	715.	41.58
+	ROUTED TO	RA11A	3819.	6.73	2455.	948.	715.	41.58
+	HYDROGRAPH AT	A11C	152.	4.33	16.	4.	3.	0.12
+	ROUTED TO	RA11C	140.	4.60	16.	4.	3.	0.12
+	2 COMBINED AT	CA11*	3816.	6.73	2457.	948.	715.	41.70
+	ROUTED TO	RA11*	3805.	6.80	2456.	948.	714.	41.70
+	HYDROGRAPH AT	A11	254.	4.30	22.	6.	4.	0.16
+	2 COMBINED AT	CA11	3801.	6.80	2455.	949.	715.	41.86
+	HYDROGRAPH AT	DRN11O	12.	4.13	1.	0.	0.	0.05
+	ROUTED TO	RN11OW	3.	4.40	1.	0.	0.	0.05
+	HYDROGRAPH AT	DRA09T	197.	4.17	8.	2.	1.	0.18
+	ROUTED TO	RA09TS	69.	5.23	8.	2.	1.	0.18
+	HYDROGRAPH AT	A09R	173.	4.33	20.	5.	4.	0.14
	3 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CA09R	176.	4.33	28.	7.	5.	0.32
	DIVERSION TO	A09RI	0.	4.33	0.	0.	0.	0.32
+	HYDROGRAPH AT	DA09R	176.	4.33	28.	7.	5.	0.32
+	ROUTED TO	RA09RS	161.	4.67	28.	7.	5.	0.32
+	HYDROGRAPH AT	DRN11M	102.	4.27	12.	3.	2.	0.33
+	ROUTED TO	RN11MW	93.	4.80	12.	3.	2.	0.33
+	HYDROGRAPH AT	DRN11J	257.	4.13	36.	9.	6.	0.57
+	ROUTED TO	RN11JW	234.	4.27	36.	9.	6.	0.57
+	2 COMBINED AT	CX4	252.	4.63	48.	12.	9.	0.57
+	ROUTED TO	RX4	250.	4.80	48.	12.	9.	0.57
+	HYDROGRAPH AT	A09O	200.	4.43	29.	7.	5.	0.19
+	3 COMBINED AT	CA09O	474.	4.67	92.	23.	17.	1.09
+	DIVERSION TO	A09OI	474.	4.67	92.	23.	17.	1.09
.	HYDROGRAPH AT	DA090	0.	0.03	0.	0.	0.	1.09
+	ROUTED TO	RA09OS	0.	0.03	0.	0.	0.	1.09
+	HYDROGRAPH AT	DRN11G	1386.	4.63	199.	50.	36.	2.09
+	ROUTED TO	RN11GW	1257.	4.73	199.	50.	36.	2.09
+	HYDROGRAPH AT	A09K	524.	4.40	59.	15.	11.	0.41
+	2 COMBINED AT	CA09K	1402.	4.70	237.	59.	43.	2.50
+	DIVERSION TO	A09KI	1.	4.70	0.	0.	0.	2.50
+	HYDROGRAPH AT	DA09K	1401.	4.70	237.	59.	43.	2.50
+	ROUTED TO	RA09KW	1377.	4.80	237.	59.	43.	2.50
+	2 COMBINED AT	CX7	1377.	4.80	237.	59.	43.	2.50
+	ROUTED TO	RX7S	1348.	4.90	237.	59.	43.	2.50
+	HYDROGRAPH AT	A09G	406.	4.23	31.	8.	6.	0.22
	DIVERSION TO	A09GI	203.	4.23	15.	4.	3.	0.22

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+	HYDROGRAPH AT	DA09G	203.	4.23	15.	4.	3.	0.22
+	ROUTED TO	RA09GW	192.	4.33	15.	4.	3.	0.22
+	2 COMBINED AT	CX8	1357.	4.90	244.	61.	44.	2.72
+	ROUTED TO	RX8W	1332.	5.03	244.	61.	44.	2.72
+	HYDROGRAPH AT	A09J	243.	4.30	24.	6.	4.	0.17
+	DIVERSION TO	A09JI	121.	4.30	12.	3.	2.	0.17
+	HYDROGRAPH AT	DA09J	121.	4.30	12.	3.	2.	0.17
+	ROUTED TO	RA09JS	111.	4.53	12.	3.	2.	0.17
+	HYDROGRAPH AT	A09H	403.	4.30	36.	9.	7.	0.25
+	3 COMBINED AT	CA09H	1360.	5.00	272.	68.	49.	3.13
+	ROUTED TO	RA09H	1356.	5.03	272.	68.	49.	3.13
+	HYDROGRAPH AT	A09S	142.	4.17	11.	3.	2.	0.07
.	HYDROGRAPH AT	DRA09R	0.	4.33	0.	0.	0.	0.32
+	ROUTED TO	RA09RW	0.	5.60	0.	0.	0.	0.32
+	2 COMBINED AT	CA09S	142.	4.17	11.	3.	2.	0.07
+	DIVERSION TO	A09SI	1.	4.17	0.	0.	0.	0.07
+	HYDROGRAPH AT	DA09S	142.	4.17	11.	3.	2.	0.07
+	ROUTED TO	RA09SS	119.	4.53	11.	3.	2.	0.07
+	HYDROGRAPH AT	A09Q	327.	4.30	32.	8.	6.	0.22
+	HYDROGRAPH AT	A09P	189.	4.40	27.	7.	5.	0.18
+	HYDROGRAPH AT	DRA09O	474.	4.67	92.	23.	17.	1.09
+	ROUTED TO	RA09OW	466.	4.73	92.	23.	17.	1.09
+	2 COMBINED AT	CA09P	563.	4.67	113.	28.	20.	1.27
+	ROUTED TO	RA09P	562.	4.70	113.	28.	20.	1.27
.	3 COMBINED AT	CA09Q	729.	4.60	145.	36.	26.	1.56
	DIVERSION TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		A09QI	729.	4.60	145.	36.	26.	1.56
	HYDROGRAPH AT	DA09Q	0.	0.03	0.	0.	0.	1.56
+	ROUTED TO	RA09QS	0.	0.03	0.	0.	0.	1.56
+	HYDROGRAPH AT	A09M	540.	4.10	42.	10.	8.	0.25
+	DIVERSION TO	LA09MD	503.	4.03	17.	4.	3.	0.25
+	HYDROGRAPH AT	LA09M	540.	4.10	24.	6.	4.	0.25
+	2 COMBINED AT	CA09M	317.	4.17	18.	5.	3.	1.80
+	ROUTED TO	RA09M	263.	4.27	18.	5.	3.	1.80
+	HYDROGRAPH AT	A09N	146.	4.47	22.	5.	4.	0.11
+	DIVERSION TO	LA09ND	146.	4.47	14.	3.	2.	0.11
+	HYDROGRAPH AT	LA09N	96.	4.77	8.	2.	1.	0.11
+	2 COMBINED AT	CA09N	451.	4.20	32.	8.	6.	0.36
+	ROUTED TO	RA09N	284.	4.53	32.	8.	6.	0.36
	HYDROGRAPH AT	DRA09J	121.	4.30	12.	3.	2.	0.17
+	ROUTED TO	RA09JW	112.	4.37	12.	3.	2.	0.17
+	HYDROGRAPH AT	A09L	188.	4.20	28.	7.	5.	0.14
+	DIVERSION TO	LA09LD	188.	4.20	19.	5.	3.	0.14
+	HYDROGRAPH AT	LA09L	101.	4.63	9.	2.	2.	0.14
+	3 COMBINED AT	CA09L	373.	4.63	50.	12.	9.	0.66
+	ROUTED TO	RA09LS	343.	4.80	50.	12.	9.	0.66
+	HYDROGRAPH AT	A09I	335.	4.13	37.	9.	7.	0.17
+	DIVERSION TO	LA09ID	335.	4.13	23.	6.	4.	0.17
+	HYDROGRAPH AT	LA09I	251.	4.30	14.	4.	3.	0.17
+	3 COMBINED AT	CX10	1494.	5.03	305.	77.	55.	3.79
+	ROUTED TO	RX10	1469.	5.17	304.	77.	55.	3.79
	HYDROGRAPH AT	A99V	396.	4.23	35.	9.	6.	0.21

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	2 COMBINED AT	CA99V	1462.	5.17	327.	83.	59.	4.00
+	HYDROGRAPH AT	DRA09G	203.	4.23	15.	4.	3.	0.22
+	ROUTED TO	RA09GS	167.	4.67	15.	4.	3.	0.22
+	HYDROGRAPH AT	A09F	577.	4.20	76.	19.	14.	0.37
+	DIVERSION TO	LA09FD	577.	4.20	34.	9.	6.	0.37
+	HYDROGRAPH AT	LA09F	542.	4.30	42.	11.	8.	0.37
+	2 COMBINED AT	CA09F	492.	4.30	56.	14.	10.	0.59
+	ROUTED TO	RA09FW	432.	4.67	56.	14.	10.	0.59
+	HYDROGRAPH AT	A09E	159.	4.30	32.	8.	6.	0.15
+	DIVERSION TO	LA09ED	159.	4.30	21.	5.	4.	0.15
+	HYDROGRAPH AT	LA09E	101.	4.80	12.	3.	2.	0.15
+	2 COMBINED AT	CA09E	457.	4.80	66.	16.	12.	0.73
+	ROUTED TO	RA09E	429.	4.90	66.	16.	12.	0.73
+	HYDROGRAPH AT	A09D	745.	4.07	62.	15.	11.	0.25
+	DIVERSION TO	LA09DD	745.	4.07	39.	10.	7.	0.25
+	HYDROGRAPH AT	LA09D	642.	4.13	23.	6.	4.	0.25
+	2 COMBINED AT	CA09C*	426.	4.87	84.	21.	15.	0.99
+	ROUTED TO	RA09C*	425.	4.87	84.	21.	15.	0.99
+	HYDROGRAPH AT	A09C	120.	4.20	11.	3.	2.	0.07
+	2 COMBINED AT	CA09C	436.	4.87	94.	23.	17.	1.06
+	ROUTED TO	RA09C	436.	4.90	94.	23.	17.	1.06
+	HYDROGRAPH AT	A09B	130.	4.00	10.	3.	2.	0.04
+	ROUTED TO	RA09B	106.	4.43	10.	3.	2.	0.04
+	HYDROGRAPH AT	A09A	80.	4.30	15.	4.	3.	0.08
+	3 COMBINED AT	CA09A	527.	4.37	115.	29.	21.	1.19
	DIVERSION TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		DA09I	158.	4.37	31.	8.	6.	1.19
	HYDROGRAPH AT	DA09	370.	4.37	84.	21.	15.	1.19
+	ROUTED TO	RA09AW	320.	5.63	84.	21.	15.	1.19
+	HYDROGRAPH AT	A99T	73.	4.03	3.	1.	1.	0.03
+	DIVERSION TO	LA99TD	68.	3.97	2.	0.	0.	0.03
+	HYDROGRAPH AT	LA99T	73.	4.03	2.	0.	0.	0.03
+	ROUTED TO	RA99T	42.	4.27	2.	0.	0.	0.03
+	HYDROGRAPH AT	A09	339.	4.23	23.	6.	4.	0.18
+	3 COMBINED AT	CA09	312.	5.67	100.	26.	19.	1.39
+	3 COMBINED AT	DUMMYZ	3853.	6.33	2557.	975.	734.	47.25
+	HYDROGRAPH AT	S30D	271.	4.17	33.	8.	6.	0.13
+	ROUTED TO	RS30D	183.	4.40	32.	8.	6.	0.13
+	HYDROGRAPH AT	S30C	591.	4.30	119.	30.	22.	0.46
	2 COMBINED AT	XX1	753.	4.33	151.	38.	28.	0.59
+	HYDROGRAPH AT	S30B	373.	4.40	88.	22.	16.	0.40
+	2 COMBINED AT	CS30B	1035.	4.37	232.	59.	43.	0.98
+	DIVERSION TO	DS30BI	485.	4.37	49.	12.	9.	0.98
+	HYDROGRAPH AT	DS30BO	550.	4.20	184.	47.	34.	0.98
+	ROUTED TO	RS30BW	550.	4.43	184.	47.	34.	0.98
+	HYDROGRAPH AT	S30A	637.	4.33	121.	30.	22.	0.53
+	2 COMBINED AT	CS30A	1085.	4.40	298.	76.	55.	1.52
+	DIVERSION TO	DS30AI	535.	4.40	74.	19.	13.	1.52
+	HYDROGRAPH AT	DS30AO	550.	4.20	224.	57.	41.	1.52
+	ROUTED TO	RS30AW	550.	4.53	224.	57.	41.	1.52
+	HYDROGRAPH AT	S30	418.	4.23	65.	16.	12.	0.32
	2 COMBINED AT	CS30	857.	4.30	281.	72.	52.	1.84

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	ROUTED TO	RS30	857.	4.33	281.	72.	52.	1.84
+	HYDROGRAPH AT	A07G	685.	4.07	63.	16.	11.	0.26
+	DIVERSION TO	LA07GD	685.	4.07	32.	8.	6.	0.26
+	HYDROGRAPH AT	LA07G	643.	4.13	31.	8.	6.	0.26
+	ROUTED TO	RA07G	625.	4.27	31.	8.	6.	0.26
+	HYDROGRAPH AT	A07F	232.	4.33	50.	13.	9.	0.23
+	ROUTED TO	RA07F	230.	4.43	50.	13.	9.	0.23
+	HYDROGRAPH AT	A07E	524.	4.13	62.	15.	11.	0.23
+	3 COMBINED AT	CA07E	1066.	4.27	139.	35.	25.	0.72
+	ROUTED TO	RA07E	907.	4.43	139.	35.	25.	0.72
+	HYDROGRAPH AT	A07C	298.	4.27	28.	7.	5.	0.17
+	2 COMBINED AT	CA07C	1073.	4.40	163.	41.	30.	0.89
+	ROUTED TO	RA07C	1071.	4.43	163.	41.	30.	0.89
+	HYDROGRAPH AT	A07H	268.	4.03	19.	5.	3.	0.09
+	ROUTED TO	RA07H	254.	4.17	19.	5.	3.	0.09
+	HYDROGRAPH AT	DRA09A	158.	4.37	31.	8.	6.	1.19
+	HYDROGRAPH AT	A08B	149.	4.17	17.	4.	3.	0.10
+	2 COMBINED AT	CA08B	245.	4.37	45.	11.	8.	1.29
+	ROUTED TO	RA08B	209.	4.63	45.	11.	8.	1.29
+	HYDROGRAPH AT	A07D	129.	4.60	40.	10.	7.	0.23
+	4 COMBINED AT	CA07D	1151.	4.47	239.	61.	44.	2.50
+	ROUTED TO	RA07D	1081.	4.67	239.	61.	44.	2.50
+	ROUTED TO	LA07D	1082.	4.67	203.	51.	37.	2.50
+	HYDROGRAPH AT	A07B	936.	4.20	123.	31.	22.	0.65
+	DIVERSION TO	LA07BD	921.	4.17	48.	12.	9.	0.65
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+		LA07B	863.	4.30	76.	19.	14.	0.65
	3 COMBINED AT	CA07B	2126.	4.53	509.	131.	94.	4.99
+	ROUTED TO	RA07B	2029.	4.63	509.	131.	94.	4.99
+	HYDROGRAPH AT	A06A	541.	4.13	54.	14.	10.	0.28
+	2 COMBINED AT	CA06A	2130.	4.63	548.	141.	101.	5.27
+	HYDROGRAPH AT	A07A	103.	4.30	21.	5.	4.	0.12
+	ROUTED TO	RA07A	103.	4.37	21.	5.	4.	0.12
+	HYDROGRAPH AT	A07	319.	4.03	15.	4.	3.	0.12
+	2 COMBINED AT	CA07	349.	4.03	36.	9.	7.	0.24
+	ROUTED TO	RA07	260.	4.20	36.	9.	7.	0.24
+	HYDROGRAPH AT	A06	605.	4.17	34.	9.	6.	0.28
+	3 COMBINED AT	CA06	2201.	4.60	584.	150.	108.	5.79
+	ROUTED TO	RA06	2165.	4.77	584.	150.	108.	5.79
	HYDROGRAPH AT	A99Q	345.	4.00	15.	4.	3.	0.12
+	2 COMBINED AT	CA99Q	2158.	4.77	591.	152.	109.	5.90
+	2 COMBINED AT	DUMMY1	4320.	5.77	2846.	1052.	794.	53.15
+	DIVERSION TO	DUMMYO	4320.	5.77	2846.	1052.	794.	53.15
+	HYDROGRAPH AT	DUMMY	0.	0.03	0.	0.	0.	53.15
+	ROUTED TO	EMPTY	0.	0.03	0.	0.	0.	53.15
+	HYDROGRAPH AT	S10V	303.	4.20	46.	12.	8.	0.20
+	ROUTED TO	RS10V	289.	4.40	46.	12.	8.	0.20
+	HYDROGRAPH AT	S10U	136.	4.20	21.	5.	4.	0.11
+	2 COMBINED AT	CS10U	406.	4.37	67.	17.	12.	0.30
+	ROUTED TO	RS10U	396.	4.50	67.	17.	12.	0.30
+	HYDROGRAPH AT	S10T	470.	4.27	79.	20.	14.	0.34
	2 COMBINED AT	CS10T	762.	4.43	143.	36.	26.	0.64

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	ROUTED TO	RS10T	754.	4.50	143.	36.	26.	0.64
+	HYDROGRAPH AT	DS30BX	485.	4.37	49.	12.	9.	0.98
+	ROUTED TO	RS30BS	466.	4.60	49.	12.	9.	0.98
+	HYDROGRAPH AT	S10S	973.	4.20	136.	34.	25.	0.49
+	2 COMBINED AT	XX2	884.	4.57	175.	44.	32.	1.47
+	2 COMBINED AT	CS10S	1429.	4.57	301.	76.	55.	2.11
+	ROUTED TO	RS10S	1390.	4.67	301.	76.	55.	2.11
+	HYDROGRAPH AT	S10Q	369.	4.27	69.	17.	13.	0.25
+	2 COMBINED AT	CS10Q	1590.	4.63	363.	92.	66.	2.37
+	ROUTED TO	RS10Q	1568.	4.73	363.	92.	66.	2.37
+	HYDROGRAPH AT	DRS10R	24.	4.23	4.	1.	1.	0.03
+	ROUTED TO	RS10RW	22.	4.87	4.	1.	1.	0.03
+	HYDROGRAPH AT	S10O	1089.	4.27	179.	45.	32.	0.79
+	3 COMBINED AT	CS10O	2169.	4.50	523.	132.	95.	3.19
+	HYDROGRAPH AT	S10J	163.	4.10	18.	4.	3.	0.08
+	DIVERSION TO	S10JI	96.	4.10	10.	2.	2.	0.08
+	HYDROGRAPH AT	DS10JO	68.	4.10	8.	2.	1.	0.08
+	ROUTED TO	RS10JW	67.	4.13	8.	2.	1.	0.08
+	2 COMBINED AT	CS10KN	2187.	4.50	528.	134.	96.	3.27
+	ROUTED TO	RS10KN	2181.	4.53	528.	134.	96.	3.27
+	HYDROGRAPH AT	S10JX	96.	4.10	10.	2.	2.	0.08
+	ROUTED TO	RS10JS	93.	4.17	10.	2.	2.	0.08
+	HYDROGRAPH AT	S10I	211.	4.17	30.	7.	5.	0.13
+	2 COMBINED AT	CS10I	303.	4.17	40.	10.	7.	0.21
+	DIVERSION TO	S10II	178.	4.17	23.	6.	4.	0.21
	HYDROGRAPH AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA
					6-HOUR	24-HOUR	72-HOUR	
+		DS10IO	126.	4.17	17.	4.	3.	0.21
	ROUTED TO	RS10IW	124.	4.20	17.	4.	3.	0.21
+	2 COMBINED AT	CS10KM	2232.	4.53	541.	137.	99.	3.40
+	ROUTED TO	RS10KM	2211.	4.60	541.	137.	99.	3.40
+	HYDROGRAPH AT	S10IX	178.	4.17	23.	6.	4.	0.21
+	ROUTED TO	RS10IS	173.	4.30	23.	6.	4.	0.21
+	HYDROGRAPH AT	S10N	210.	4.20	32.	8.	6.	0.14
+	2 COMBINED AT	CS10N	373.	4.27	55.	14.	10.	0.34
+	DIVERSION TO	S10NI	187.	4.27	27.	7.	5.	0.34
+	HYDROGRAPH AT	DS10NO	187.	4.27	27.	7.	5.	0.34
+	ROUTED TO	RS10NW	187.	4.27	27.	7.	5.	0.34
+	HYDROGRAPH AT	S10K	499.	4.27	87.	22.	16.	0.34
+	3 COMBINED AT	CS10K	2583.	4.53	639.	162.	117.	3.87
	ROUTED TO	RS10K	2559.	4.63	639.	162.	117.	3.87
+	HYDROGRAPH AT	S10NX	187.	4.27	27.	7.	5.	0.34
+	ROUTED TO	RS10NS	180.	4.47	27.	7.	5.	0.34
+	HYDROGRAPH AT	S10G	592.	4.17	68.	17.	12.	0.28
+	3 COMBINED AT	CS10G	2836.	4.60	719.	182.	131.	4.16
+	ROUTED TO	RS10G	2819.	4.67	718.	182.	131.	4.16
+	DIVERSION TO	X40I	916.	4.70	279.	71.	51.	4.16
+	HYDROGRAPH AT	DX40	1903.	4.67	440.	111.	80.	4.16
+	ROUTED TO	RX40S	1887.	4.77	440.	111.	80.	4.16
+	HYDROGRAPH AT	S10D	550.	4.33	114.	29.	21.	0.46
+	2 COMBINED AT	CS10D	2189.	4.73	535.	135.	98.	4.61
+	HYDROGRAPH AT	DS30X	535.	4.40	74.	19.	13.	1.52
	ROUTED TO	RS30AS	515.	4.73	74.	19.	13.	1.52

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	S10P	439.	4.27	78.	20.	14.	0.33
+	2 COMBINED AT	CS10P	739.	4.70	145.	36.	26.	1.84
+	ROUTED TO	RS10P	689.	5.03	145.	36.	26.	1.84
+	HYDROGRAPH AT	S10E	369.	4.77	141.	37.	27.	0.63
+	2 COMBINED AT	CS10E	985.	5.07	273.	71.	51.	2.47
+	ROUTED TO	RS10E	974.	5.13	273.	71.	51.	2.47
+	HYDROGRAPH AT	S10M	722.	4.17	95.	24.	17.	0.35
+	ROUTED TO	RS10M	673.	4.40	95.	24.	17.	0.35
+	2 COMBINED AT	CS10E*	1160.	5.13	358.	93.	67.	2.83
+	ROUTED TO	RS10E*	1156.	5.17	358.	93.	67.	2.83
+	HYDROGRAPH AT	S10F	345.	4.37	76.	19.	14.	0.33
+	ROUTED TO	RS10F	337.	4.63	76.	19.	14.	0.33
+	2 COMBINED AT	CS10F*	1335.	5.13	421.	109.	79.	3.16
+	ROUTED TO	RS10F*	1323.	5.23	421.	109.	79.	3.16
+	HYDROGRAPH AT	S10C	330.	4.57	106.	28.	20.	0.37
+	3 COMBINED AT	CS10C	3283.	4.77	976.	253.	182.	8.15
+	ROUTED TO	RS10C	3270.	4.83	975.	253.	182.	8.15
+	HYDROGRAPH AT	S10	149.	4.27	29.	7.	5.	0.11
+	2 COMBINED AT	XX3	3333.	4.83	999.	259.	187.	8.26
+	HYDROGRAPH AT	DRX40	916.	4.70	279.	71.	51.	4.16
+	ROUTED TO	RX40E	916.	4.77	279.	71.	51.	4.16
+	HYDROGRAPH AT	S10B	197.	4.23	35.	9.	6.	0.14
+	2 COMBINED AT	CS10B	1103.	4.40	315.	80.	58.	0.14
+	ROUTED TO	RS10B	1097.	4.47	315.	80.	58.	0.14
+	HYDROGRAPH AT	S10A	46.	4.30	11.	3.	2.	0.05
	3 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CS10	4333.	4.83	1304.	337.	243.	8.44
	ROUTED TO	RS10	4331.	4.83	1304.	337.	243.	8.44
+	HYDROGRAPH AT	N06	952.	4.20	135.	34.	25.	0.59
+	4 COMBINED AT	CN06	4611.	5.03	1818.	495.	359.	52.61
+	ROUTED TO	RN06	4562.	5.10	1817.	495.	359.	52.61
+	HYDROGRAPH AT	N05C	357.	4.27	60.	15.	11.	0.28
+	2 COMBINED AT	CN05C	4622.	5.10	1848.	504.	366.	52.89
+	ROUTED TO	RN05C	4579.	5.17	1847.	504.	365.	52.89
+	HYDROGRAPH AT	N05B	221.	4.53	69.	18.	13.	0.31
+	DIVERSION TO	DN05BI	199.	4.53	62.	16.	12.	0.31
+	HYDROGRAPH AT	DN05B	22.	4.53	7.	2.	1.	0.31
+	ROUTED TO	RN05BE	22.	4.67	7.	2.	1.	0.31
+	HYDROGRAPH AT	N05A	330.	4.17	41.	10.	7.	0.17
	HYDROGRAPH AT	N05	393.	4.27	73.	18.	13.	0.28
+	4 COMBINED AT	CN05	4681.	5.17	1916.	524.	380.	53.65
+	ROUTED TO	RN05	4672.	5.23	1915.	524.	380.	53.65
+	HYDROGRAPH AT	DN05BX	199.	4.53	62.	16.	12.	0.31
+	ROUTED TO	RN05BS	198.	4.70	62.	16.	12.	0.31
+	HYDROGRAPH AT	N04A	101.	4.17	17.	4.	3.	0.07
+	3 COMBINED AT	CN04A	4777.	5.23	1963.	537.	389.	53.72
+	ROUTED TO	RN04A	4695.	5.37	1958.	537.	389.	53.72
+	HYDROGRAPH AT	N04	1090.	4.30	198.	50.	36.	0.83
+	DIVERSION TO	LN04D	574.	4.03	37.	9.	7.	0.83
+	HYDROGRAPH AT	LN04	1090.	4.30	162.	40.	29.	0.83
+	2 COMBINED AT	CN04	4854.	5.33	2055.	561.	407.	54.54
	ROUTED TO	RN04	4850.	5.33	2055.	561.	407.	54.54

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT							
+		S01G	469.	4.23	74.	18.	13.	0.28
	ROUTED TO							
+		RS01G	446.	4.53	74.	18.	13.	0.28
	HYDROGRAPH AT							
+		S01D	569.	4.43	138.	35.	25.	0.63
	2 COMBINED AT							
+		CS01D	941.	4.53	207.	52.	38.	0.91
	ROUTED TO							
+		RS01D	925.	4.70	207.	52.	38.	0.91
	HYDROGRAPH AT							
+		S01H	329.	4.33	69.	17.	13.	0.32
	ROUTED TO							
+		RS01H	323.	4.53	69.	17.	13.	0.32
	HYDROGRAPH AT							
+		S01E	342.	4.20	49.	12.	9.	0.23
	2 COMBINED AT							
+		CS01E	575.	4.40	117.	30.	21.	0.55
	ROUTED TO							
+		RS01E	566.	4.53	117.	30.	21.	0.55
	HYDROGRAPH AT							
+		S01C	526.	4.30	93.	23.	17.	0.40
	3 COMBINED AT							
+		CS01C	1599.	4.67	390.	99.	72.	1.87
	ROUTED TO							
+		RS01C	1596.	4.70	390.	99.	72.	1.87
	HYDROGRAPH AT							
+		S01I	333.	4.23	54.	14.	10.	0.23
	ROUTED TO							
+		RS01I	323.	4.37	54.	14.	10.	0.23
	HYDROGRAPH AT							
+		S01F	184.	4.23	30.	7.	5.	0.15
	2 COMBINED AT							
+		CS01F	494.	4.33	83.	21.	15.	0.38
	ROUTED TO							
+		RS01F	483.	4.53	83.	21.	15.	0.38
	HYDROGRAPH AT							
+		S01B	468.	4.23	73.	18.	13.	0.31
	3 COMBINED AT							
+		CS01B	2085.	4.67	522.	133.	96.	2.56
	ROUTED TO							
+		RS01B	2077.	4.73	522.	133.	96.	2.56
	HYDROGRAPH AT							
+		S01A	342.	4.33	71.	18.	13.	0.35
	2 COMBINED AT							
+		CS01A	2254.	4.73	578.	147.	106.	2.91
	ROUTED TO							
+		RS01A	2244.	4.77	578.	147.	106.	2.91
	HYDROGRAPH AT							
+		S01	221.	4.40	56.	14.	10.	0.26
	2 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CS01	2374.	4.77	623.	159.	115.	3.16
	ROUTED TO	RS01	2373.	4.77	623.	159.	115.	3.16
+	2 COMBINED AT	CN03*	5826.	5.27	2443.	667.	483.	57.71
+	ROUTED TO	RN03*	5812.	5.40	2443.	667.	483.	57.71
+	HYDROGRAPH AT	N03A	351.	4.40	82.	21.	15.	0.39
+	ROUTED TO	RN03A	347.	4.50	82.	21.	15.	0.39
+	HYDROGRAPH AT	N03B	723.	4.40	146.	37.	26.	0.63
+	ROUTED TO	RN03B	720.	4.43	146.	37.	26.	0.63
+	HYDROGRAPH AT	N03	464.	4.50	119.	30.	22.	0.60
+	4 COMBINED AT	CN03	6186.	5.37	2632.	719.	520.	59.33
+	ROUTED TO	RN03	6183.	5.43	2632.	719.	520.	59.33
+	HYDROGRAPH AT	N02B	183.	4.27	30.	8.	6.	0.15
+	DIVERSION TO	LN02BD	153.	4.13	7.	2.	1.	0.15
	HYDROGRAPH AT	LN02B	183.	4.27	24.	6.	4.	0.15
+	2 COMBINED AT	CN02B	6196.	5.43	2639.	721.	522.	59.48
+	ROUTED TO	RN02B	6189.	5.50	2639.	721.	522.	59.48
+	HYDROGRAPH AT	N02	994.	4.47	150.	37.	27.	0.76
+	HYDROGRAPH AT	N02A	361.	4.20	35.	9.	6.	0.18
+	3 COMBINED AT	CN02	6266.	5.50	2721.	744.	539.	60.42
+	HYDROGRAPH AT	S20A	247.	4.23	44.	11.	8.	0.16
+	ROUTED TO	RS20A	245.	4.30	44.	11.	8.	0.16
+	HYDROGRAPH AT	S20	231.	4.20	38.	10.	7.	0.14
+	2 COMBINED AT	CS20	466.	4.27	82.	21.	15.	0.30
+	ROUTED TO	RS20	464.	4.30	82.	21.	15.	0.30
+	HYDROGRAPH AT	A05A	260.	4.17	37.	9.	7.	0.14
	ROUTED TO	RA05A	249.	4.43	37.	9.	7.	0.14

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	A99N	341.	4.13	41.	10.	7.	0.16
+	3 COMBINED AT	CA99N	875.	4.37	159.	40.	29.	0.60
+	HYDROGRAPH AT	DRA09S	1.	4.17	0.	0.	0.	0.07
+	ROUTED TO	RA09SW	0.	4.77	0.	0.	0.	0.07
+	HYDROGRAPH AT	A99Y	410.	4.37	45.	11.	8.	0.32
+	2 COMBINED AT	CA99Y	410.	4.37	45.	11.	8.	0.32
+	HYDROGRAPH AT	A10	551.	4.10	33.	8.	6.	0.21
+	HYDROGRAPH AT	DRA09Q	729.	4.60	145.	36.	26.	1.56
+	ROUTED TO	RA09QW	727.	4.67	145.	36.	26.	1.56
+	HYDROGRAPH AT	A10A	423.	4.17	32.	8.	6.	0.19
+	2 COMBINED AT	CA10A	772.	4.57	170.	43.	31.	1.75
+	ROUTED TO	RA10A	772.	4.63	170.	43.	31.	1.75
+	HYDROGRAPH AT	A99X	723.	4.07	58.	14.	10.	0.26
+	2 COMBINED AT	CA99X	805.	4.57	215.	55.	39.	2.01
+	5 COMBINED AT	DUMMY2	6496.	5.43	2906.	798.	577.	63.56
+	HYDROGRAPH AT	A99W	312.	4.23	44.	11.	8.	0.22
+	DIVERSION TO	LA99WD	312.	4.23	17.	4.	3.	0.22
+	HYDROGRAPH AT	LA99W	305.	4.30	27.	7.	5.	0.22
+	HYDROGRAPH AT	A99U	100.	4.20	9.	2.	2.	0.07
+	HYDROGRAPH AT	A99S	66.	4.43	10.	2.	2.	0.08
+	HYDROGRAPH AT	A08A	86.	4.43	22.	6.	4.	0.14
+	ROUTED TO	RA08A	85.	4.60	22.	6.	4.	0.14
+	HYDROGRAPH AT	A99R	88.	4.07	6.	1.	1.	0.04
+	ROUTED TO	RA99R	73.	4.30	6.	1.	1.	0.04
+	HYDROGRAPH AT	A08	218.	4.00	11.	3.	2.	0.08
	3 COMBINED AT							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		CA08	227.	4.00	38.	10.	7.	0.25
	6 COMBINED AT	DUMMY3	6507.	5.43	2916.	801.	579.	64.78
+	HYDROGRAPH AT	A99P	959.	4.17	123.	31.	22.	0.57
+	HYDROGRAPH AT	A05	368.	4.03	23.	6.	4.	0.13
+	HYDROGRAPH AT	A99O	299.	4.03	22.	5.	4.	0.10
+	HYDROGRAPH AT	A99M	193.	4.00	17.	4.	3.	0.06
+	HYDROGRAPH AT	A99L	255.	4.00	18.	4.	3.	0.08
+	6 COMBINED AT	DUMMY4	6543.	5.43	3003.	828.	599.	65.73
+	HYDROGRAPH AT	A99K	240.	4.07	25.	6.	5.	0.11
+	HYDROGRAPH AT	A99J	242.	4.13	33.	8.	6.	0.14
+	HYDROGRAPH AT	A99I	319.	4.10	32.	8.	6.	0.14
+	HYDROGRAPH AT	A04A	412.	4.17	51.	13.	9.	0.22
+	ROUTED TO	RA04A	392.	4.30	51.	13.	9.	0.22
	HYDROGRAPH AT	A04	124.	4.20	9.	2.	2.	0.08
+	2 COMBINED AT	CA04	499.	4.23	61.	15.	11.	0.30
+	ROUTED TO	RA04	463.	4.53	60.	15.	11.	0.30
+	HYDROGRAPH AT	A03D	96.	4.50	14.	3.	2.	0.13
+	2 COMBINED AT	CA03D	557.	4.53	74.	19.	13.	0.43
+	ROUTED TO	RA03D	520.	4.80	74.	19.	13.	0.43
+	HYDROGRAPH AT	A03E	216.	4.17	29.	7.	5.	0.15
+	ROUTED TO	RA03E	208.	4.30	29.	7.	5.	0.15
+	HYDROGRAPH AT	A03B	153.	4.10	10.	2.	2.	0.07
+	2 COMBINED AT	CA03B	304.	4.17	39.	10.	7.	0.23
+	ROUTED TO	RA03B	267.	4.70	39.	10.	7.	0.23
+	HYDROGRAPH AT	A03A	249.	4.20	19.	5.	3.	0.14
	2 COMBINED AT	CA03A	308.	4.57	58.	15.	11.	0.37

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	ROUTED TO	RA03A	303.	4.73	58.	15.	11.	0.37
+	HYDROGRAPH AT	A03	179.	4.67	32.	8.	6.	0.28
+	3 COMBINED AT	CA03	824.	4.77	145.	37.	26.	1.07
+	5 COMBINED AT	DUMMY5	6684.	5.40	3087.	853.	617.	67.18
+	HYDROGRAPH AT	A99G	63.	4.00	3.	1.	0.	0.02
+	DIVERSION TO	LA99GD	62.	3.93	2.	0.	0.	0.02
+	HYDROGRAPH AT	LA99G	63.	4.00	1.	0.	0.	0.02
+	HYDROGRAPH AT	A99H	35.	4.90	10.	3.	2.	0.10
+	DIVERSION TO	LA99HD	35.	4.90	8.	2.	1.	0.10
+	HYDROGRAPH AT	LA99H	10.	6.60	2.	1.	0.	0.10
+	ROUTED TO	RA99H	5.	7.43	2.	1.	0.	0.10
+	HYDROGRAPH AT	A02D	154.	4.00	6.	2.	1.	0.06
+	DIVERSION TO	LA02DD	152.	3.97	5.	1.	1.	0.06
+	HYDROGRAPH AT	LA02D	146.	4.03	1.	0.	0.	0.06
+	ROUTED TO	RA02D	46.	4.20	1.	0.	0.	0.06
+	HYDROGRAPH AT	A99F	37.	5.03	12.	3.	2.	0.11
+	3 COMBINED AT	CA99F	48.	4.20	15.	4.	3.	0.28
+	HYDROGRAPH AT	A02	32.	4.10	2.	0.	0.	0.02
+	HYDROGRAPH AT	A01H	195.	4.00	9.	2.	2.	0.07
+	DIVERSION TO	LA01HD	193.	3.93	6.	2.	1.	0.07
+	HYDROGRAPH AT	LA01H	195.	4.00	2.	1.	0.	0.07
+	HYDROGRAPH AT	A99E	74.	4.00	4.	1.	1.	0.02
+	DIVERSION TO	LA99ED	74.	4.00	3.	1.	1.	0.02
+	HYDROGRAPH AT	LA99E	37.	4.07	0.	0.	0.	0.02
+	6 COMBINED AT	DUMMY6	6683.	5.40	3087.	853.	617.	67.59
	HYDROGRAPH AT							

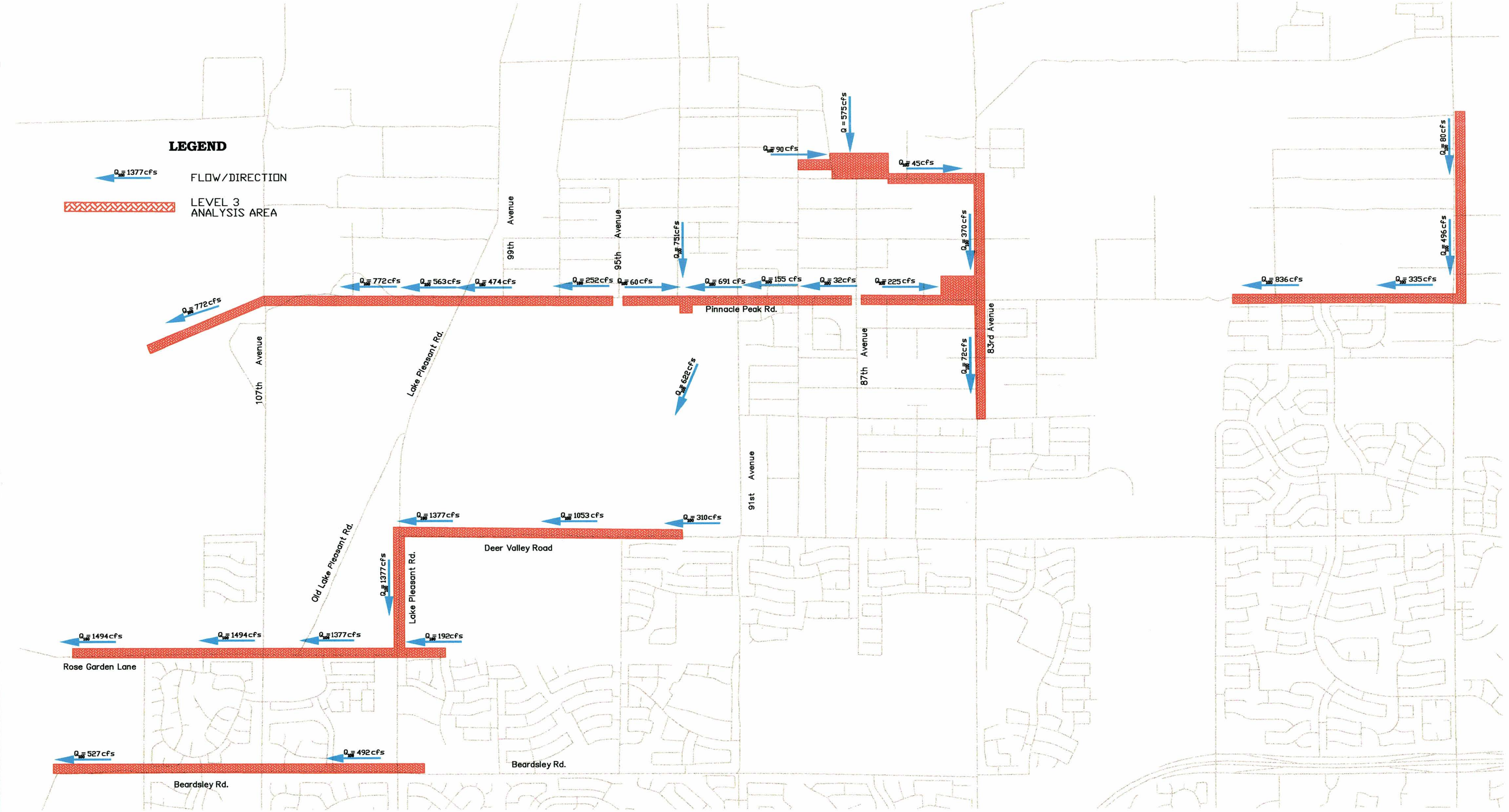
	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		A99B	143.	4.03	7.	2.	1.	0.05
	HYDROGRAPH AT	A99C	74.	4.00	3.	1.	1.	0.03
+	DIVERSION TO	LA99CD	74.	4.00	3.	1.	1.	0.03
+	HYDROGRAPH AT	LA99C	2.	4.10	0.	0.	0.	0.03
+	HYDROGRAPH AT	A99D	91.	4.00	4.	1.	1.	0.03
+	DIVERSION TO	LA99DD	91.	3.97	3.	1.	1.	0.03
+	HYDROGRAPH AT	LA99D	86.	4.03	1.	0.	0.	0.03
+	HYDROGRAPH AT	A01A	97.	4.13	7.	2.	1.	0.05
+	ROUTED TO	RA01A	82.	4.40	7.	2.	1.	0.05
+	HYDROGRAPH AT	A01	274.	4.27	27.	7.	5.	0.20
+	2 COMBINED AT	CA01	337.	4.30	34.	9.	6.	0.25
+	HYDROGRAPH AT	A99A	366.	4.07	25.	6.	5.	0.13
+	DIVERSION TO	LA99AD	366.	4.07	18.	4.	3.	0.13
	HYDROGRAPH AT	LA99A	280.	4.13	8.	2.	1.	0.13
+	HYDROGRAPH AT	A99	161.	4.27	16.	4.	3.	0.14
+	7 COMBINED AT	DUMMY7	6669.	5.40	3086.	853.	617.	68.21
+	HYDROGRAPH AT	A01E	218.	4.07	21.	5.	4.	0.08
+	DIVERSION TO	A01EI	131.	4.07	13.	3.	2.	0.08
+	HYDROGRAPH AT	DA01E	87.	4.07	9.	2.	2.	0.08
+	ROUTED TO	RA01ES	49.	5.13	9.	2.	2.	0.08
+	HYDROGRAPH AT	N01A	570.	4.33	56.	14.	10.	0.41
+	ROUTED TO	RN01A	534.	4.50	56.	14.	10.	0.41
+	HYDROGRAPH AT	N01	951.	4.20	136.	34.	25.	0.65
+	3 COMBINED AT	CN01	1019.	4.43	185.	47.	34.	1.14
+	HYDROGRAPH AT	A03C	529.	4.17	61.	15.	11.	0.33
	ROUTED TO	RA03C	501.	4.33	61.	15.	11.	0.33

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+	HYDROGRAPH AT	A02B	760.	4.03	51.	13.	9.	0.27
+	ROUTED TO	RA02B	702.	4.10	51.	13.	9.	0.27
+	2 COMBINED AT	CA02A*	941.	4.17	110.	28.	20.	0.60
+	ROUTED TO	RA02A*	869.	4.30	110.	28.	20.	0.60
+	HYDROGRAPH AT	A02A	530.	4.70	91.	23.	16.	0.61
+	HYDROGRAPH AT	A01G	599.	4.00	35.	9.	6.	0.19
+	DIVERSION TO	LA01GD	595.	3.93	26.	6.	5.	0.19
+	HYDROGRAPH AT	LA01G	599.	4.00	9.	2.	2.	0.19
+	3 COMBINED AT	CA01G	932.	4.50	187.	47.	34.	1.39
+	ROUTED TO	RA01G	901.	4.63	187.	47.	34.	1.39
+	HYDROGRAPH AT	A02C	462.	4.23	68.	17.	12.	0.33
+	DIVERSION TO	LA02CD	462.	4.23	32.	8.	6.	0.33
+	HYDROGRAPH AT	LA02C	418.	4.37	36.	9.	7.	0.33
+	ROUTED TO	RA02C	284.	4.97	36.	9.	7.	0.33
+	HYDROGRAPH AT	A01F	436.	4.17	57.	14.	10.	0.28
+	DIVERSION TO	LA01FD	365.	4.07	17.	4.	3.	0.28
+	HYDROGRAPH AT	LA01F	436.	4.17	40.	10.	7.	0.28
+	2 COMBINED AT	CA01F	416.	4.17	74.	19.	13.	0.61
+	ROUTED TO	RA01F	369.	4.40	74.	19.	13.	0.61
+	HYDROGRAPH AT	A01D	520.	4.13	45.	11.	8.	0.21
+	DIVERSION TO	LA01DD	520.	4.13	32.	8.	6.	0.21
+	HYDROGRAPH AT	LA01D	275.	4.30	12.	3.	2.	0.21
+	HYDROGRAPH AT	DRA01E	131.	4.07	13.	3.	2.	0.08
+	ROUTED TO	RA01EW	124.	4.13	13.	3.	2.	0.08
+	3 COMBINED AT	CA01D	521.	4.37	94.	24.	17.	0.82
	ROUTED TO							

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
+		RA01D	442.	4.63	94.	24.	17.	0.82
	HYDROGRAPH AT	A01C	472.	4.13	56.	14.	10.	0.22
+	DIVERSION TO	LA01CD	472.	4.13	39.	10.	7.	0.22
+	HYDROGRAPH AT	LA01C	294.	4.33	17.	4.	3.	0.22
+	HYDROGRAPH AT	A01B	357.	4.10	19.	5.	3.	0.15
+	DIVERSION TO	LA01BD	357.	4.10	15.	4.	3.	0.15
+	HYDROGRAPH AT	LA01B	190.	4.20	5.	1.	1.	0.15
+	4 COMBINED AT	CA01B	1222.	4.70	260.	66.	47.	2.58

*** NORMAL END OF HEC-1 ***

APPENDIX G. HYDROLOGIC DATA

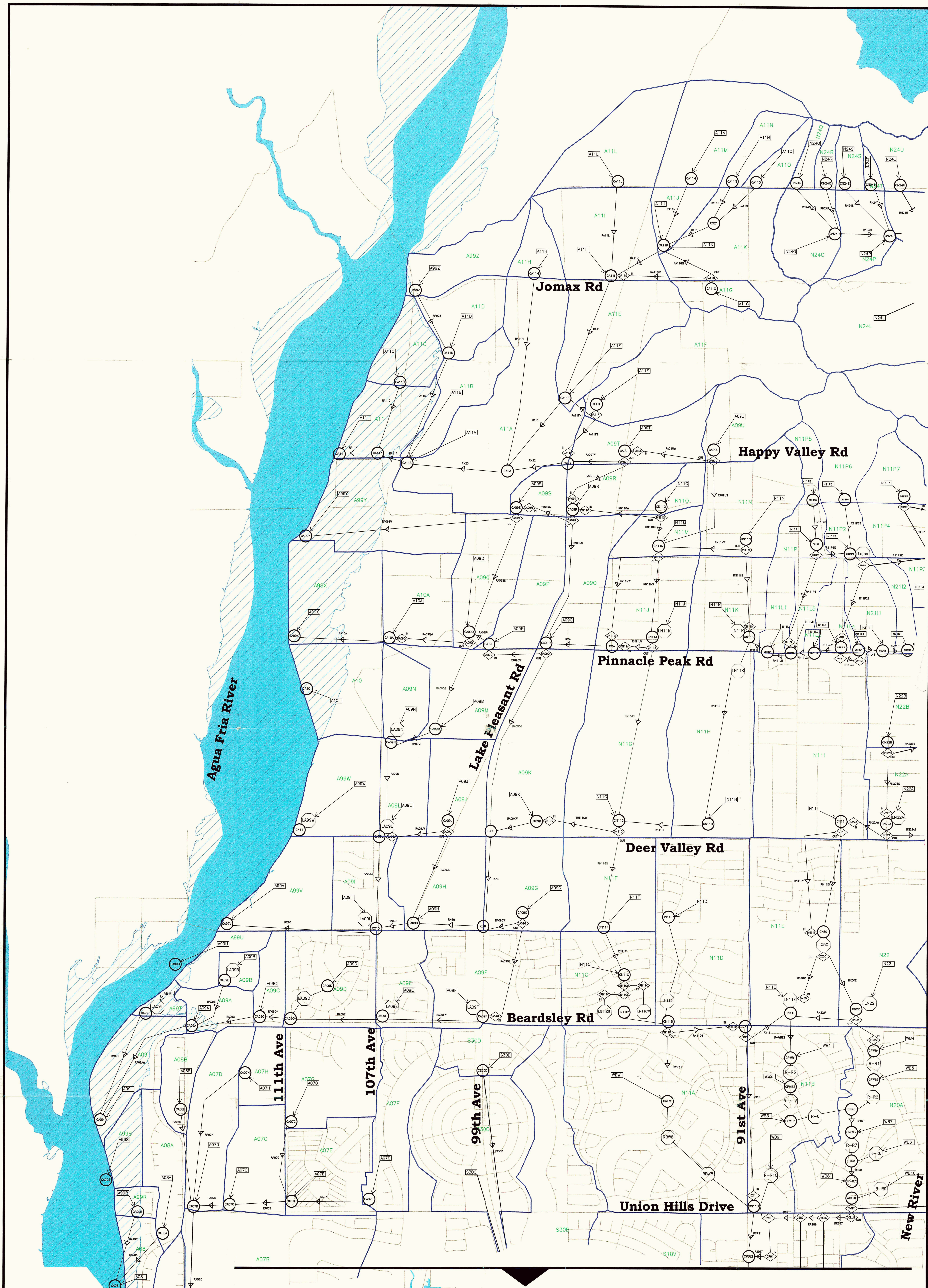


Glendale Peoria
Area Drainage Master Plan

GLENDALE · CITY OF PEORIA · Flood Control District of Maricopa County · Entellus · PENTACORE ARIZONA · LTM Engineering, Inc. · LOGAN SIMPSON DESIGN INC.

FIGURE RA-10
LEVEL III HEC-1 DESIGN FLOWS

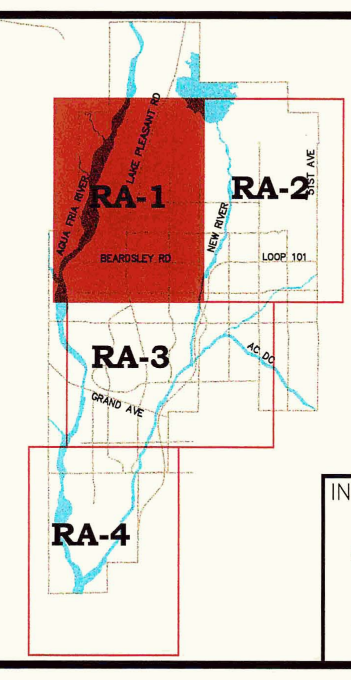
HEC-1 SCHEMATIC PLATES



LEGEND

- Basin Boundary
- N26A Basin
- CN26A Concentration Point
- Diversion Point
- Diversion Recovery Point
- Routing Reach
- LN22 Storage Routing
- Roadway Center Line
- Existing Floodplain
- Existing Floodway

600 0 600 1200



SHEET INDEX

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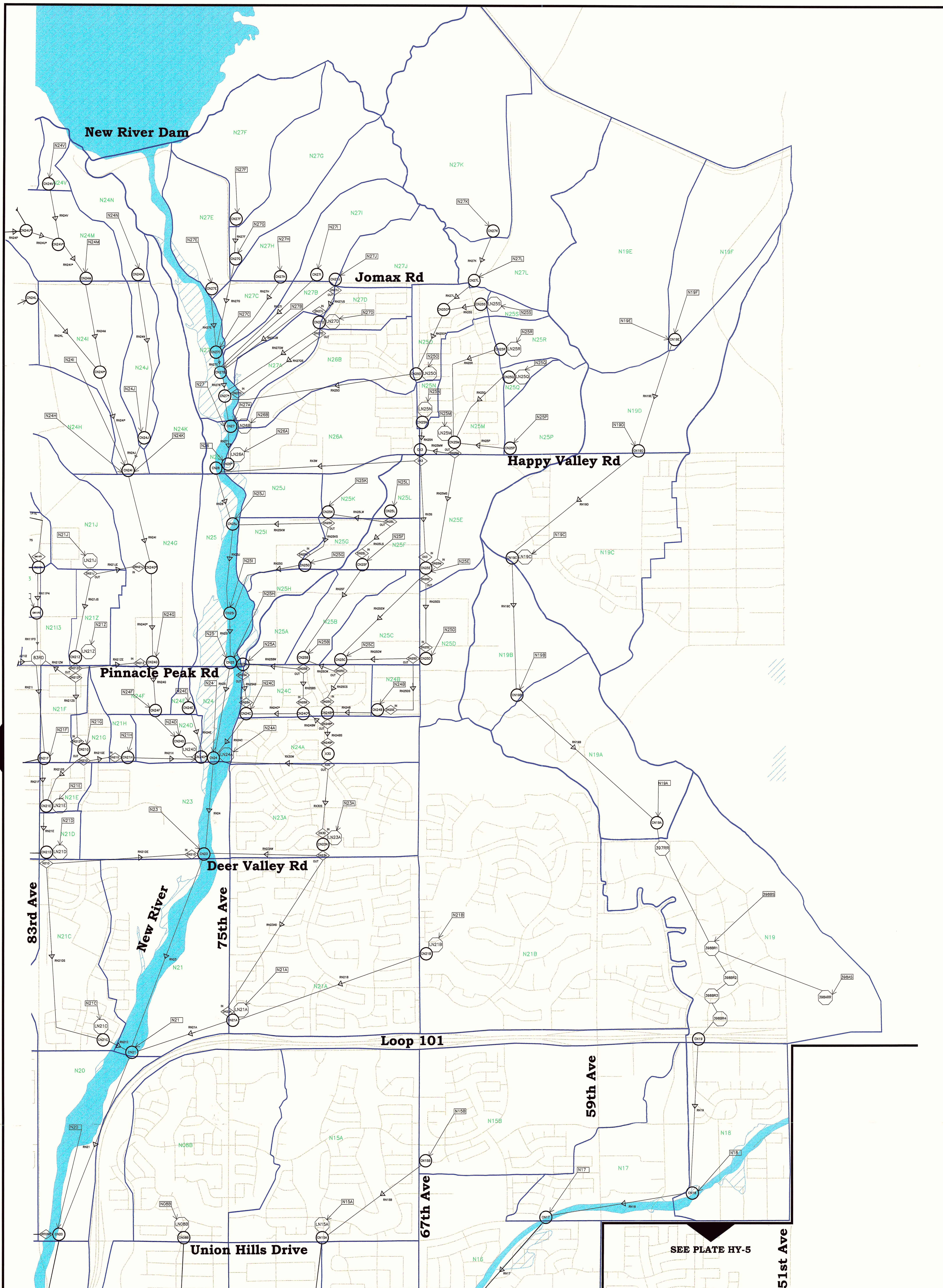
Project No. 310.017

GLENDALE/PEORIA ADMP UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FCD PROJECT NO. 99-44

PLATE RA-1

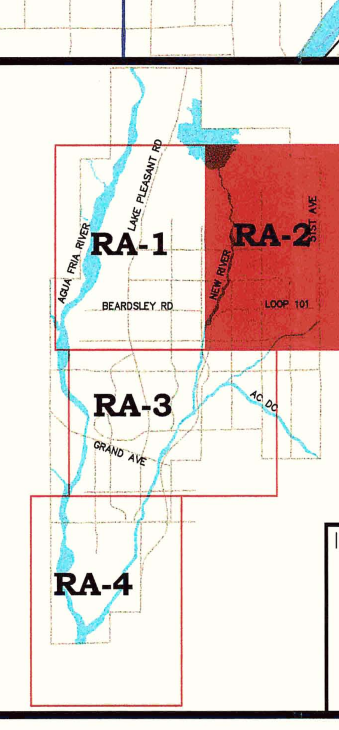
HEC-1 SCHEMATIC DRAWING



LEGEND

- Basin Boundary
- N26A Basin
- Concentration Point
- Diversion Point
- Diversion Recovery Point
- Routing Reach
- LN22 Storage Routing
- Roadway Center Line
- Existing Floodplain
- Existing Floodway

600 0 600 1200



SHEET INDEX

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GLENDALE/PEORIA ADMP UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FCD PROJECT NO. 99-44

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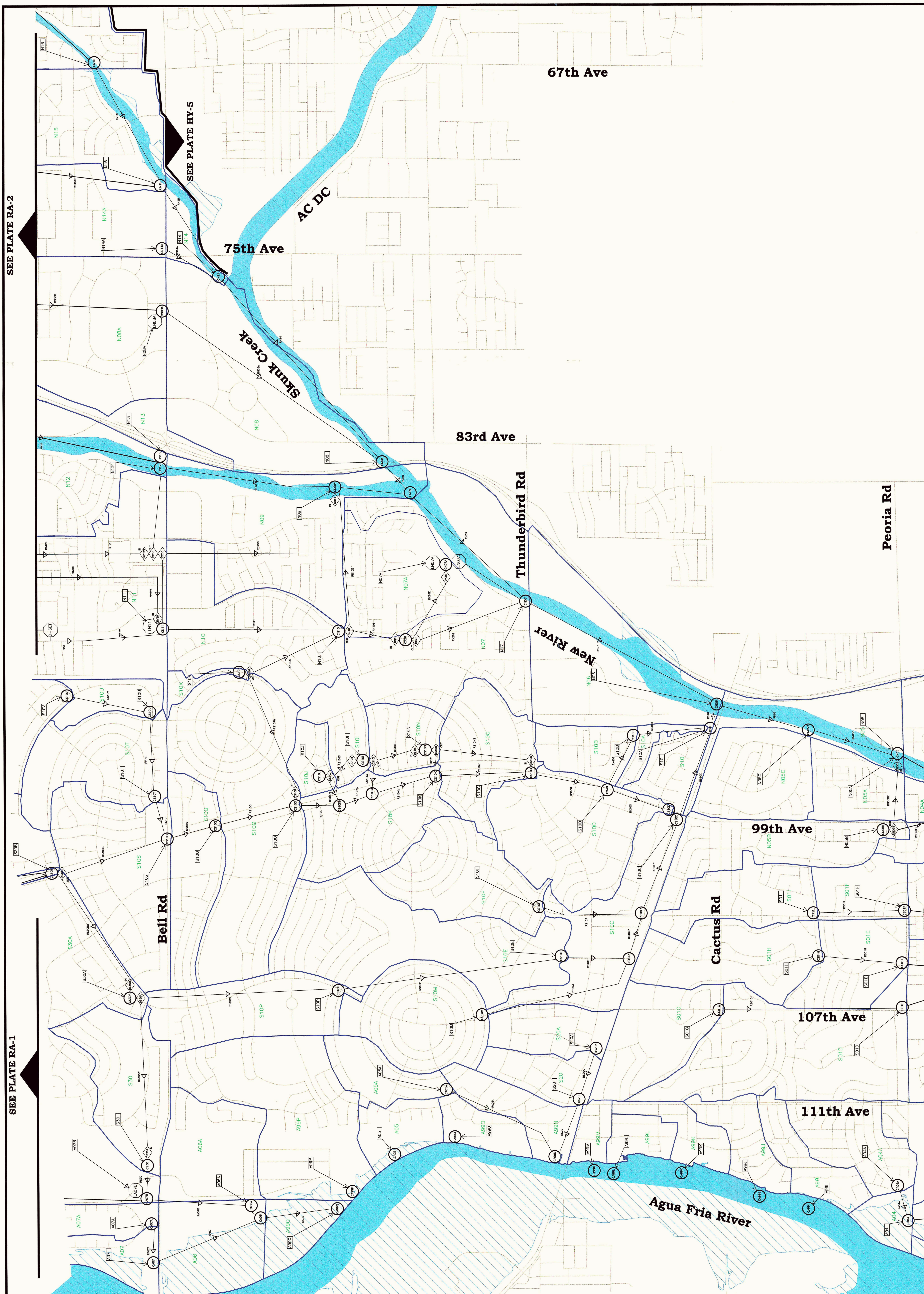
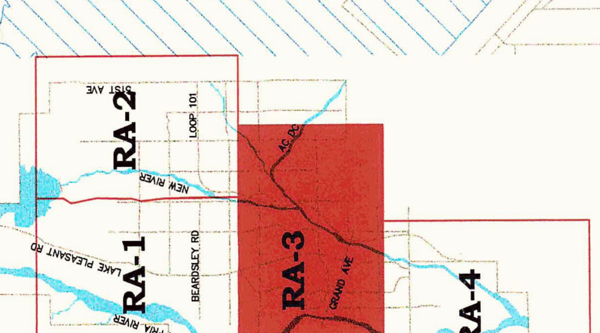
PLATE RA-2

HEC-1 SCHEMATIC DRAWING



LEGEND
- Basin Boundary
- Basin
- Concentration Point
- Diversion Point
- Diversion Recovery Point
- Routing Reach
- Storage Routing
- Roadway Center Line
- Existing Floodplain
- Existing Floodway

600 0 600 1200



SHEET INDEX

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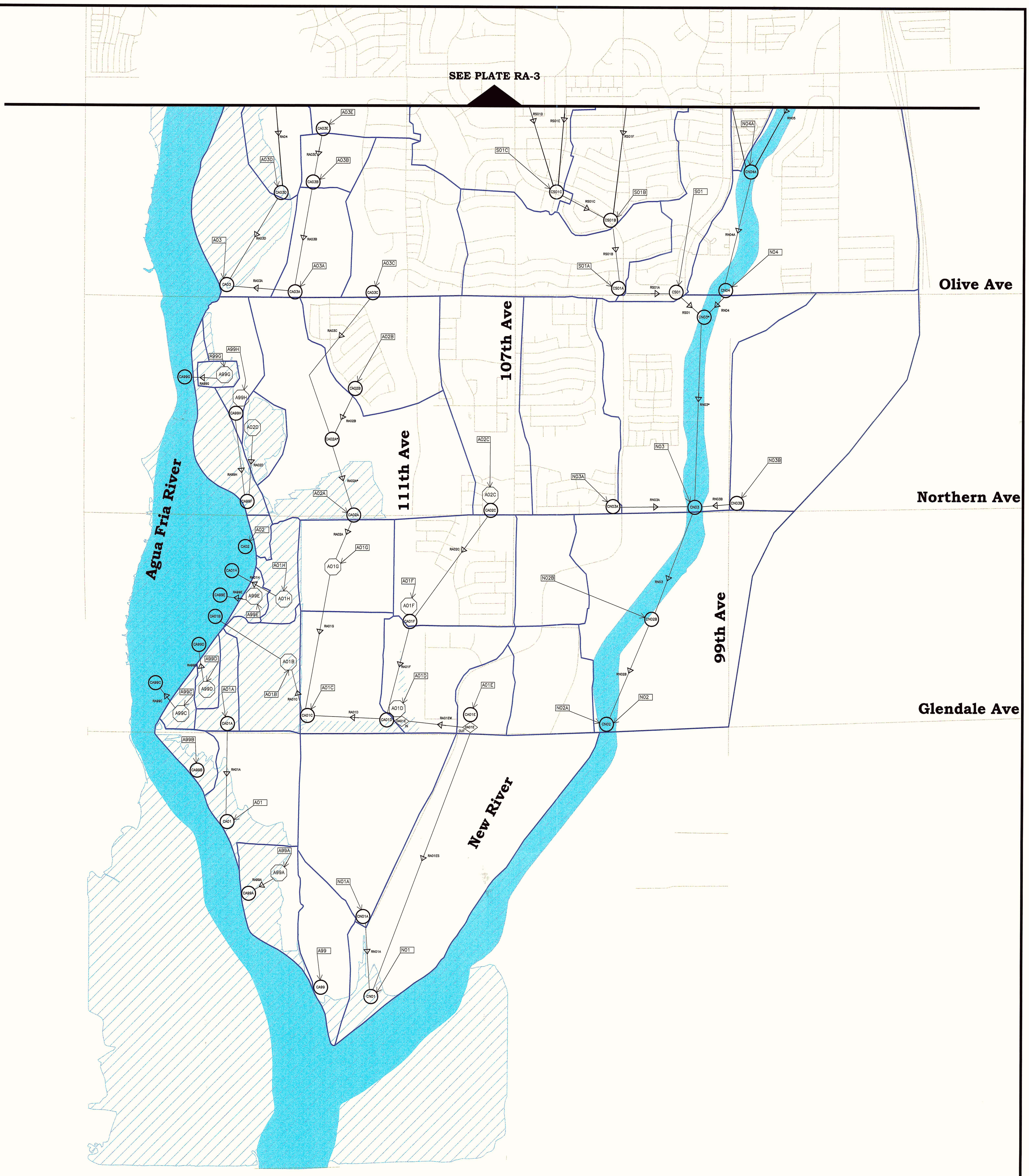
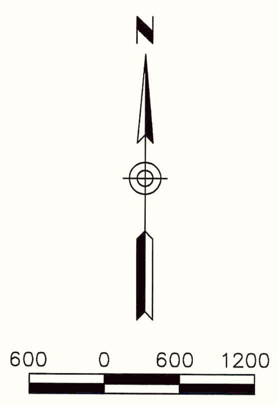
GLENDALE/PEORIA ADMP UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FCD PROJECT NO. 99-44

PLATE RA-3

HEC-1 SCHEMATIC DRAWING

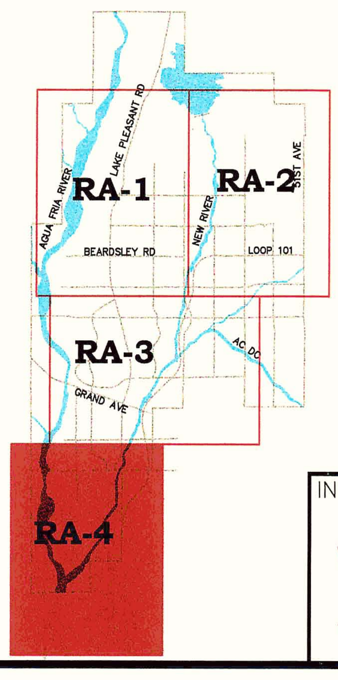




600 0 600 1200

LEGEND

- Basin Boundary
- Basin
- Concentration Point
- Diversion Point
- Diversion Recovery Point
- Routing Reach
- Storage Routing
- Roadway Center Line
- Existing Floodplain
- Existing Floodway



SHEET INDEX

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GLENDALE/PEORIA ADMP UPDATE
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
FCD PROJECT NO. 99-44

PLATE RA-4

HEC-1 SCHEMATIC DRAWING

ERRORS AND WARNING MESSAGES

Modeling Warning and Error Messages

There were no ERROR messages in the Level 3 HEC-1 model. Warning messages generated by the HEC-1 were examined to ensure that the model was not adversely affected.

The warning messages encountered for the 10-year, 6-hour HEC-1 model are as follows:

- WARNING --- MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR FLOWS BETWEEN (*Value*) TO (*Value*).
- WARNING --- EXCESS AT PONDING LESS THAN ZERO FOR PERIOD. EXCESS SET TO ZERO

The first warning specified a range of flows at which routing might be numerically unstable. This warning occurred in eighteen routing reaches. Ten of them became unstable at a range specified by the program that was higher than the flow being routed and the warning was ignored. The hydrographs of the other seven that were within the range of the specified flows were examined. These hydrographs showed no signs of instability and the warning was ignored.

The second warning message listed above referred to the rainfall loss calculations performed by HEC-1 using the Green and Ampt methodology. For any particular time period, it was possible to have the rainfall intensity value smaller than the estimated infiltration rate. If this case were encountered in modeling, the HEC-1 program would automatically set the rainfall loss as zero and print out a warning message. This message is not an indication of modeling problems and should be disregarded.

ROUTE INFORMATION

Level 3 Routes *(1)

Route ID	Length (ft)	Cross Section Type *(2)	Slope (ft/ft)
R11L3E	520	2-4' x 8' RCB	0.0016
R11L3W	1050	2-36" RCP	0.001
R11L4E	620	2-4' x 8' RCB	0.0016
R11P1E	830	20' Channel	0.002
R11P2E	2063	36" RCP	0.0026
R11P5S	1857	Road	0.0162
R11P6S	1620	Medium Wash	0.0222
R11P7E	2356	10' Channel	0.0144
R11P7W	2707	Shallow Flow	0.0111
RA09AW	5898	Large Natural Wash	0.0017
RA09C	1978	Beardsley Channel (Measured)	0.0056
RA09C*	841	Beardsley Channel (Measured)	0.0083
RA09E	2700	Beardsley Channel (Measured)	0.0041
RA09FW	3031	Beardsley Channel (Measured)	0.002
RA09H	841	2- 4' x 10' RCB	0.008
RA09KW	1473	20' Channel	0.0014
RN11GW	2318	20' Channel	0.0017
RN11H	2518	20' Channel	0.0016
RN11K	5178	20' Channel	0.0062
RN11L1	743	2-4' x 8' RCB	0.001
RN11L2	280	2-4' x 8' RCB	0.001
RN11L5	661	2-4' x 8' RCB	0.001
RN11P1	2675	Subdivision Road	0.0103
RN11PS	2681	Subdivision Road	0.0119
RN11P3	750	30' Channel	0.009
RN11P4	1330	30' Channel	0.009
RN21I	3117	48" RCP	0.004
RN21I1	770	2-4' x 8' RCB	0.0016
RN21I2	770	2-4' x 8' RCB	0.0016
RN25BW	2030	Road and Wall Left	0.0069
RN25CW	485	Road and Wall Left	0.0082
RN25DW	2674	Road and Wall Left	0.0056
RN25ES	2578	Road	0.005
RX10	4470	30' Channel	0.006
RX7S	2644	30' Channel	0.0061
RX3S	3183	Road	0.0091
RN25MS	3470	Channel (Measured)	0.0098
RN25ES	2578	Road	0.005
RN25EW	3500	Medium Wash	0.0072
RN25DW	2600	10' Channel	0.005
RN25CW	500	20' Channel	0.005
RN25BW	2030	20' Channel	0.005
RX8W	2280	20' Channel	0.00175

Notes: (1) These routes either are new or have a different dimension than in the existing 6-hour HEC-1.
(2) The general cross section dimensions are included on the following pages.

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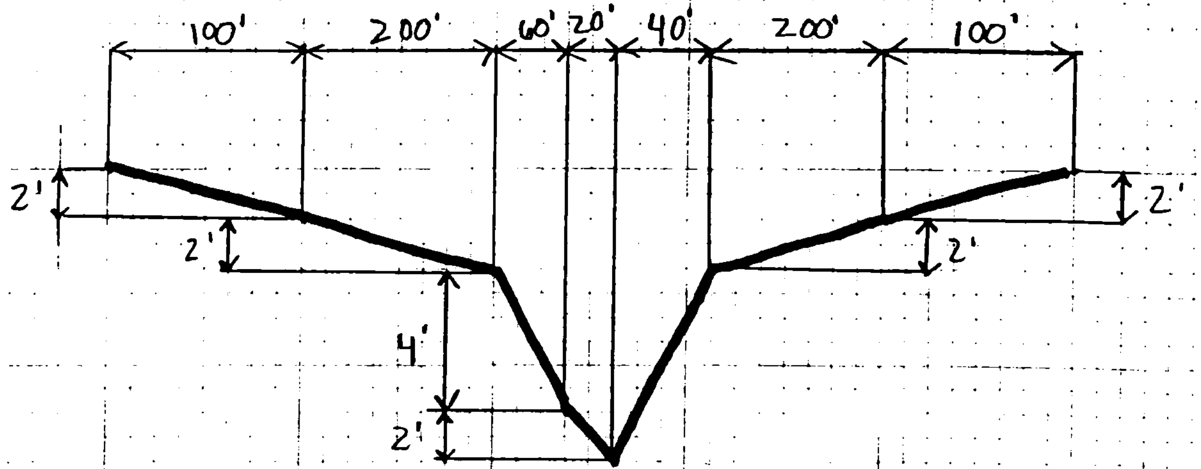
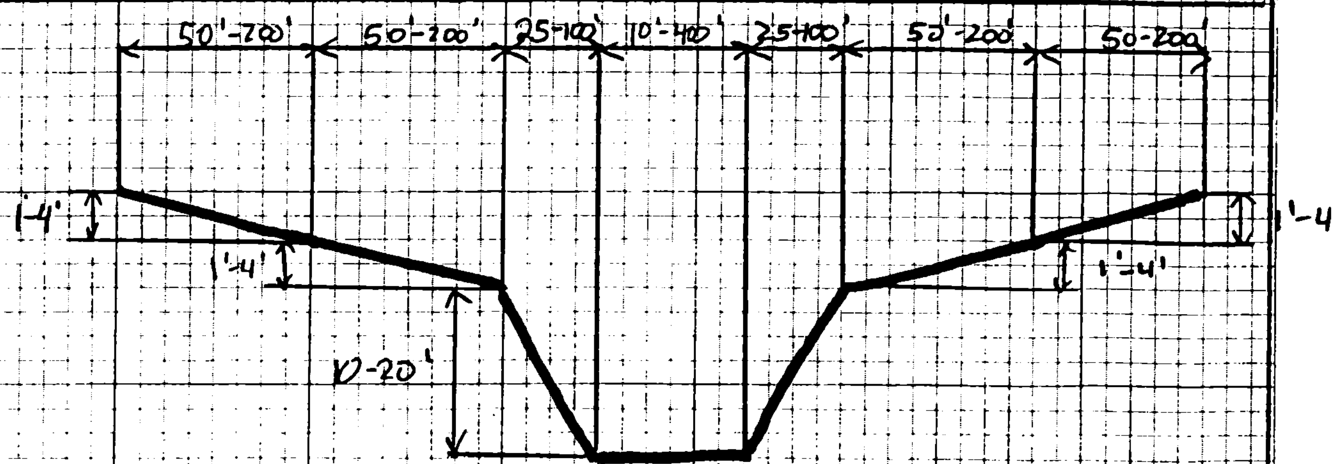
SHEET 1 OF 8
BY PAW DATE 7/11
CHECK ______ DATE ______

CLIENT G/P ADMP UPDATE
JOB NAME CROSS SECTION TYPE DRAWINGS
JOB NO. ______



MEDIUM WASH



LARGE WASH

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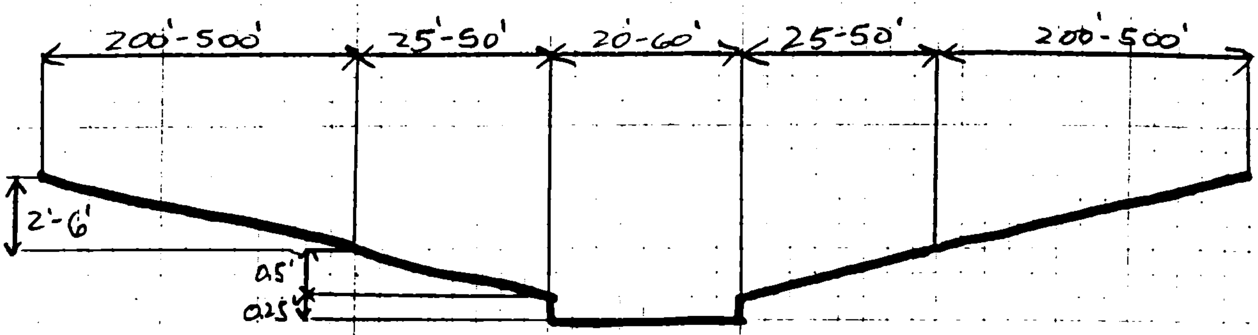
SHEET 2 OF 8

BY PAW DATE 7/11

CHECK ______ DATE ______

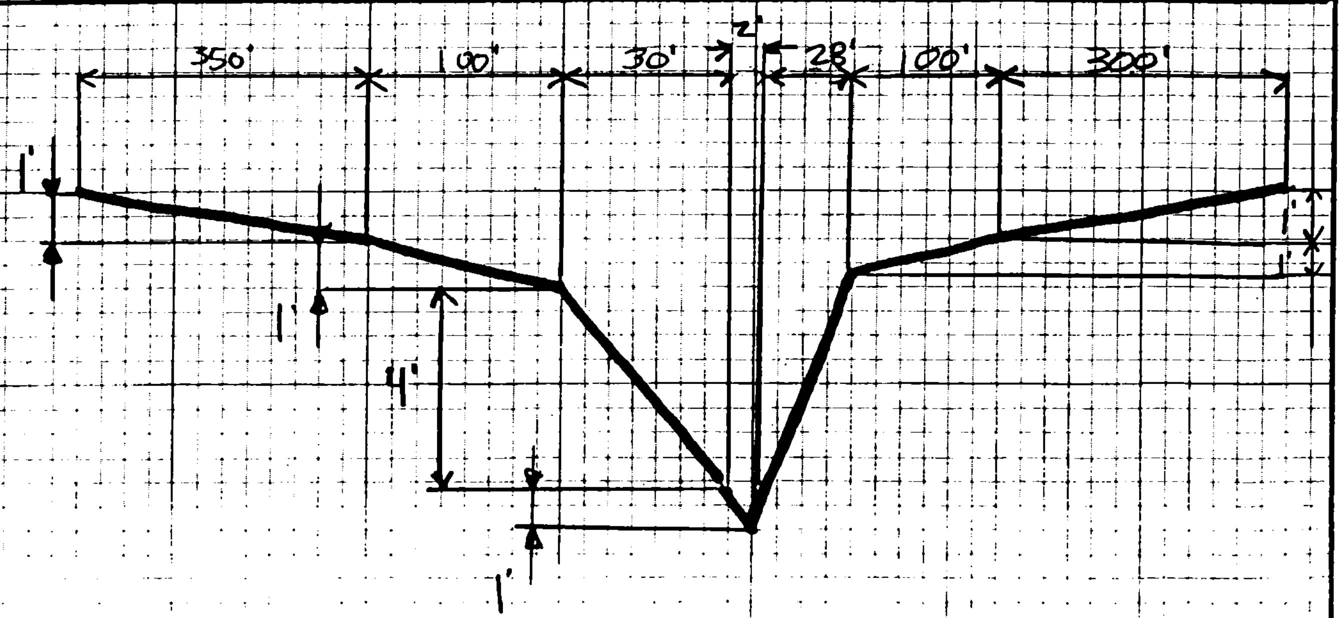
CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



OPEN TO OPEN

(Road with curb and gutter)



SMALL WASH

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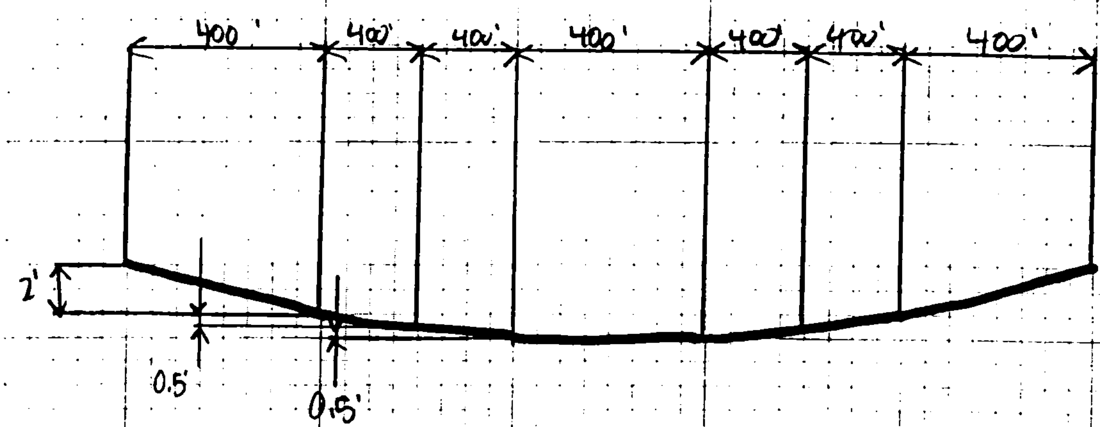
SHEET 3 OF 8

BY PAW DATE 7/11

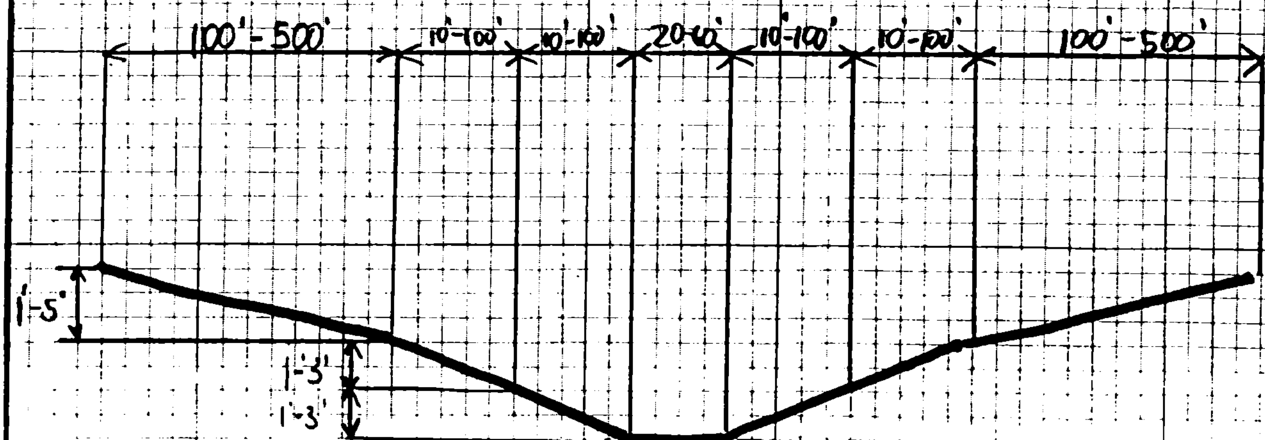
CHECK ______ DATE ______

CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



SHALLOW FLOW



RURAL ROAD

Entellus™

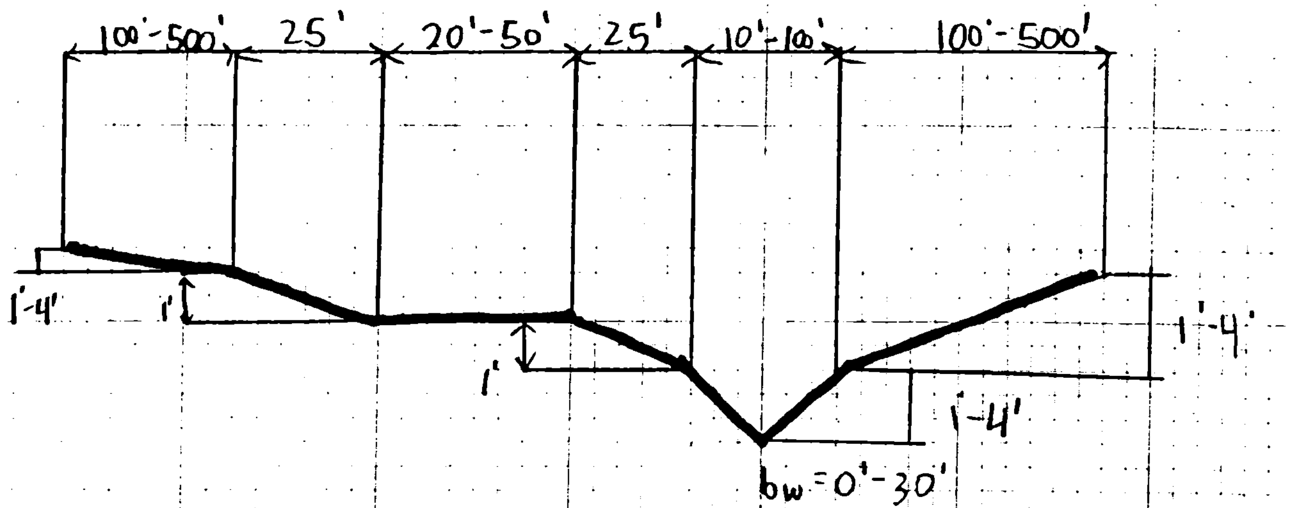
SHEET 4 OF 8

BY PAW DATE 7/11

CHECK ______ DATE ______

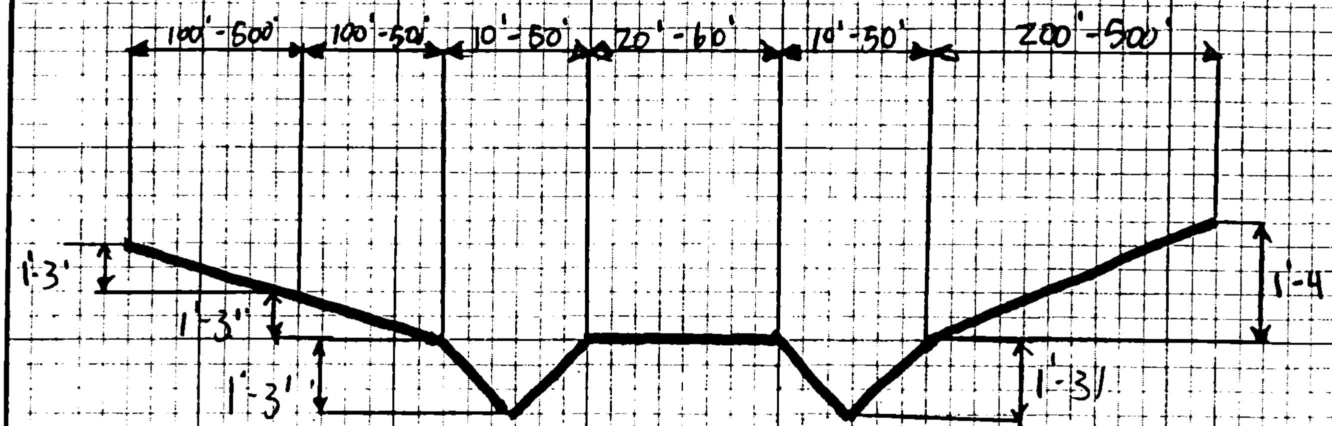
CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



DITCH RIGHT

(Ditch to the Right side of the Road)



HIGHWAY

(Typical Highway Cross Section)

Entellus™

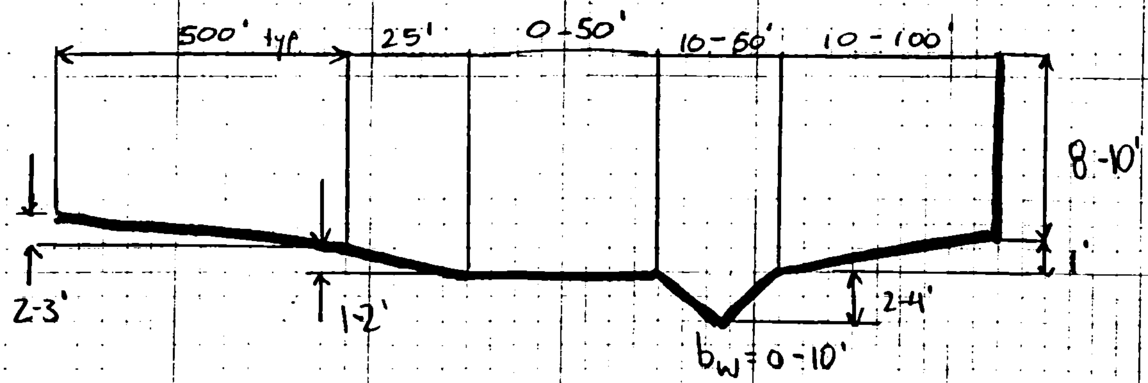
SHEET 5 OF 8

BY PAW DATE 7/11

CHECK ______ DATE ______

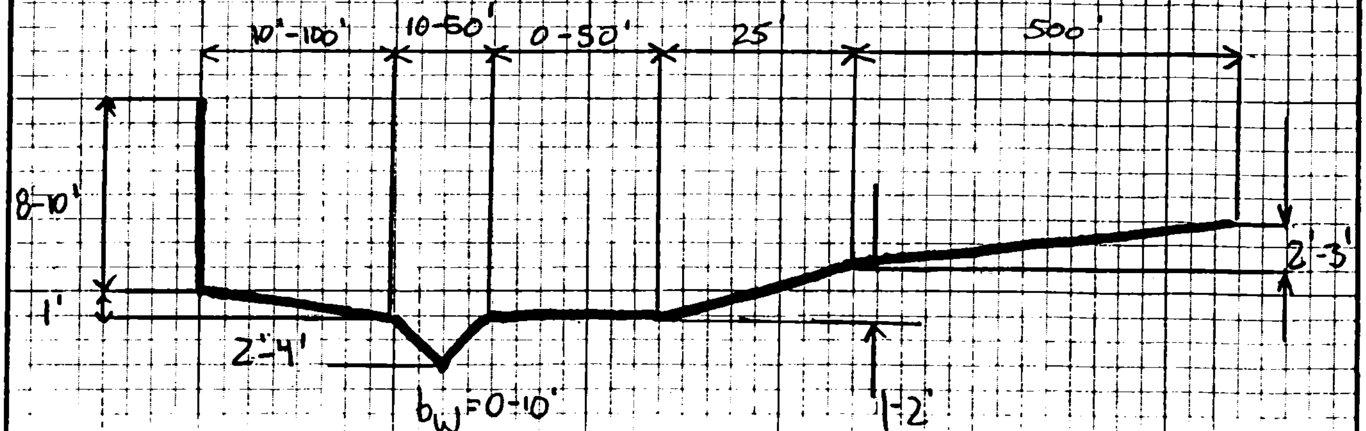
CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



DITCH AND WALL RIGHT

(Road with a small ditch and a wall/home to the right)
Note: Road may not be in place



DITCH AND WALL LEFT

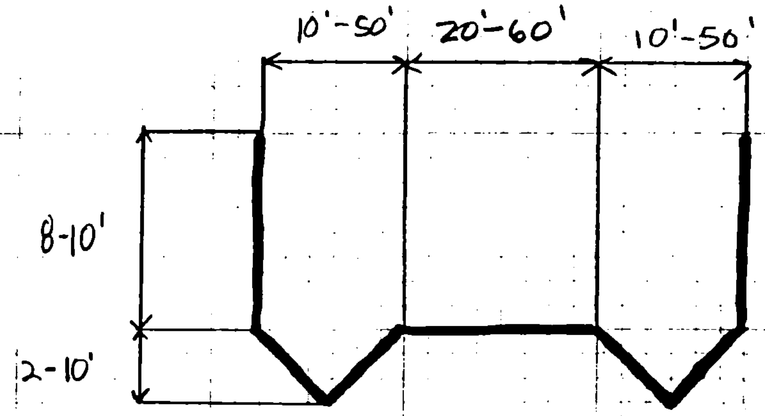
(Road with a small ditch and a wall/home to the left)
Note: Road may not be in place

Entellus™

SHEET 6 OF 8
BY PAW DATE 7/11
CHECK ______ DATE ______

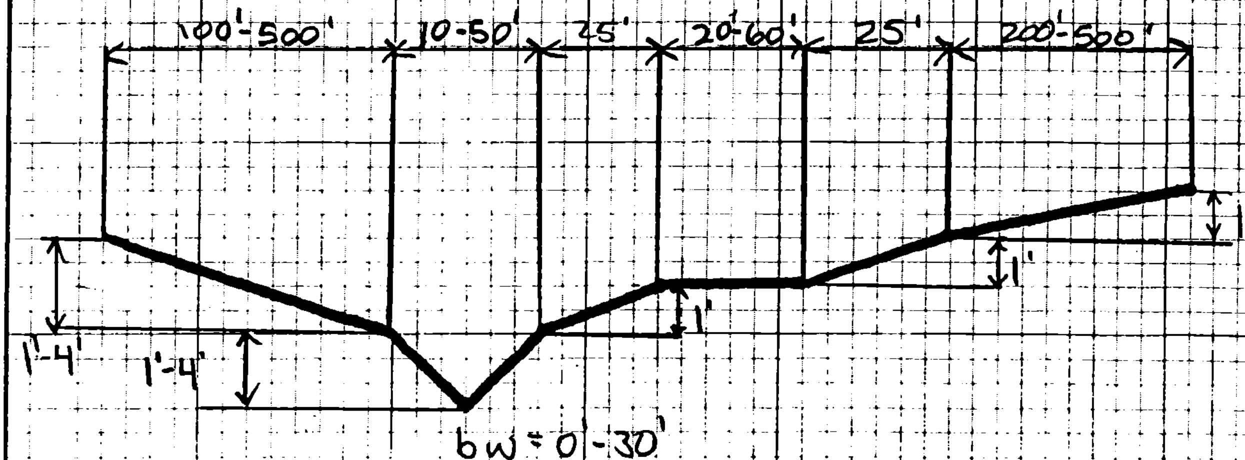
CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



DOUBLE DITCH AND WALL

(Ditches and walls/homes on both sides)



DITCH LEFT

(Ditch to the left side of the road)

Entellus™

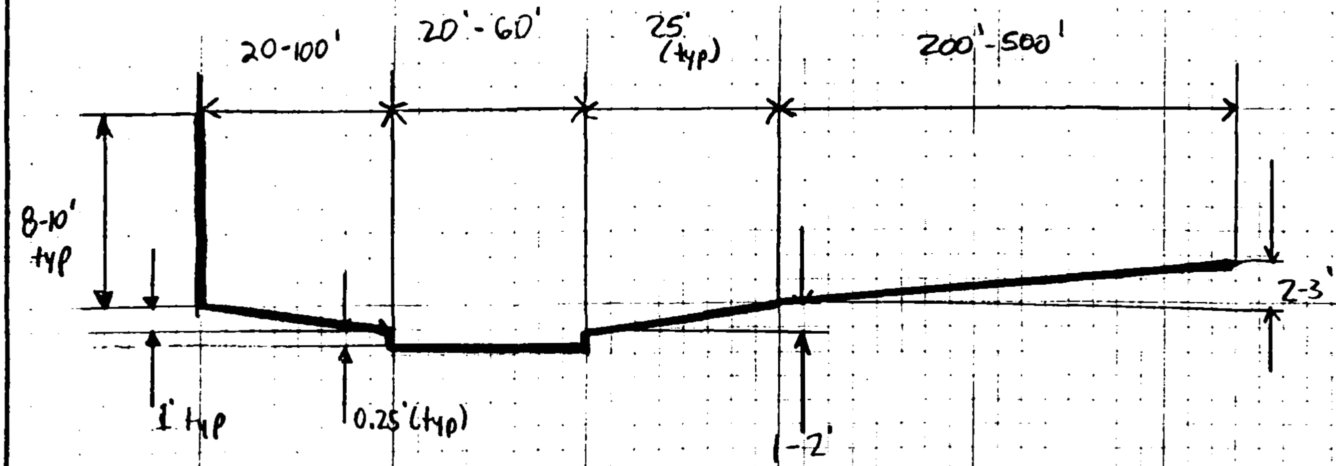
SHEET 7 OF 8

BY PAW DATE 7/11

CHECK ______ DATE ______

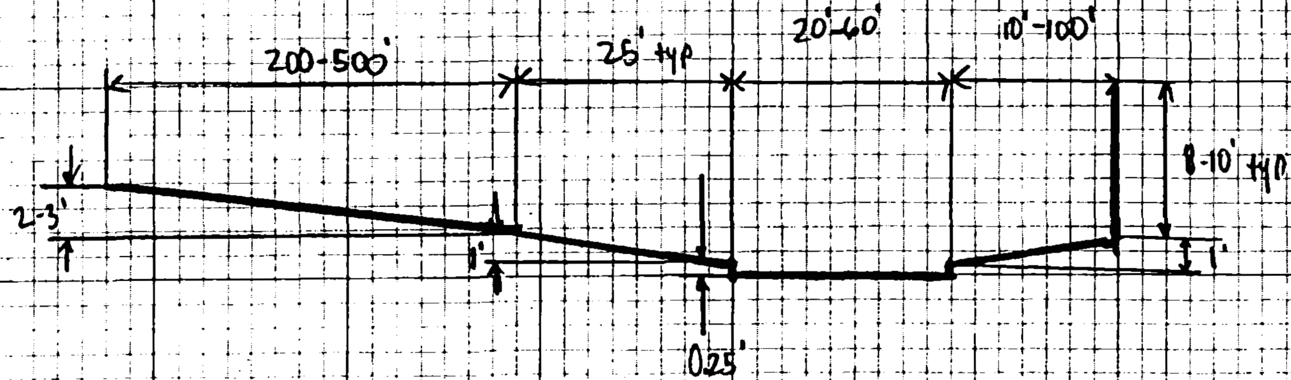
CLIENT G/P ADMP UPDATE

JOB NAME CROSS SECTION TYPE DRAWINGS JOB NO. ______



WALL LEFT

(Curb & Gutter Road w/ a wall or home on left Side)



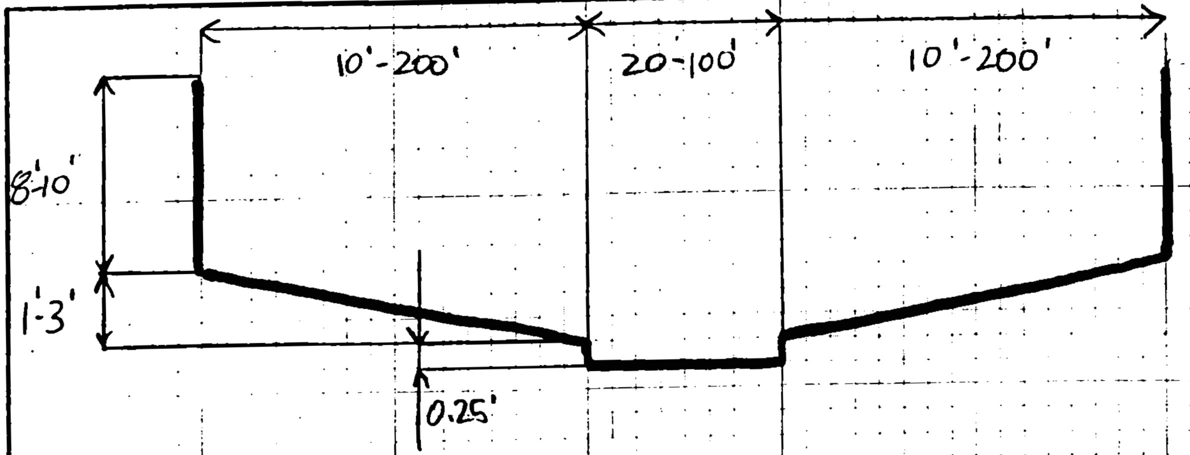
WALL RIGHT

(Curb & Gutter Road w/ a wall or home on Right Side

Entellus™

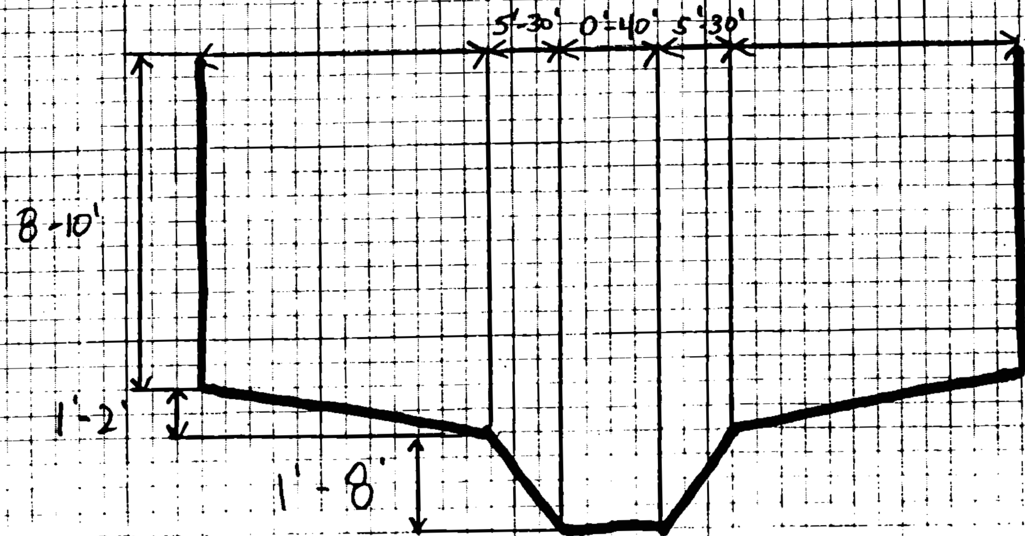
SHEET 8 OF 8
BY PAW DATE 7/11
CHECK ____ DATE ____

CLIENT G/P ADMP UPDATE
JOB NAME CROSS SECTION TYPE DRAWINGS
JOB NO. ____



TWO WALLS

(Walls or homes on both sides with no ditch)



MIDDLE DITCH

(Ditch is in center of roadway with walls/homes on both sides)

HEC-1 ROUTING TIME COMPARED TO MANNING'S NORMAL DEPTH ROUTING TIME

HEC-1 ROUTING TIME vs MANNING'S NORMAL DEPTH ROUTING TIME

HEC-1 Line Number	Route ID	Beginning Q (cfs)	Beginning Time (hr)	Ending Q (cfs)	Ending Time (hr)	Delta Q (cfs)	Delta Time Hec-1	ROUTE LENGTH (ft)	HEC-1 Velocity (fps)	Mannings Velocity (fps)	Delta Time Mannings	Time Diff. Minutes
5	R11P6S	367	4.1	350	4.17	17	0.07	1620	6.4	5.70	0.08	0.5
11	R11P5S	81	4.1	74	4.2	7	0.1	1857	5.2	3.10	0.17	4.0
23	R11P1E	93	4.1	90	4.2	3	0.1	830	2.3	2.10	0.11	0.6
83	RN11L5	106	4.27	105	4.3	1	0.03	661	6.1	3.90	0.05	1.0
119	RN21I1	166	4.17	164	4.2	2	0.03	770	7.1	5.30	0.04	0.6
128	RN21I2	227	4.2	225	4.2	2	0	770	0.0	5.90	0.04	2.2
146	R11P7W	187	4.07	136	4.27	51	0.2	2707	3.8	3.20	0.23	2.1
155	RN11P4	333	4.23	326	4.27	7	0.04	1330	9.2	4.20	0.09	2.9
164	RN11P3	371	4.27	370	4.3	1	0.03	750	6.9	5.20	0.04	0.6
176	RN21JS	390	4.07	348	4.23	42	0.16	2691	4.7	3.16	0.24	4.6
203	RN21ZW	384	4.07	328	4.37	56	0.3	871	0.8	1.56	0.16	8.7
215	RN21I	72	5.2	72	5.23	0	0.03	2703	25.0	13.70	0.05	1.5
236	RN21F	209	4.33	208	4.47	1	0.14	1522	3.0	3.83	0.11	1.8
245	RN21ZS	164	4.2	102	4.53	62	0.33	2677	2.3	1.60	0.46	8.1
257	RN21GS	88	4.17	88	4.53	0	0.36	2795	2.2	2.62	0.30	3.8
266	RN21E	361	4.43	355	4.63	6	0.2	1379	1.9	2.35	0.16	2.2
281	RN22BS	410	4.1	385	4.27	25	0.17	2633	4.3	2.67	0.27	6.2
296	RN22AE	619	4.23	568	4.5	51	0.27	1322	1.4	1.21	0.30	2.0
308	RN21DS	668	4.53	637	5	31	0.47	7844	4.6	4.50	0.48	0.9
323	RN21C	860	4.93	860	4.93	0	0	170	0.0	9.90	0.00	0.3
329	RN24Q	100	4.07	66	4.53	34	0.46	1688	1.0	0.91	0.52	3.3
335	RN24R	97	4.07	75	4.47	22	0.4	1587	1.1	1.00	0.44	2.5
344	RN24O	401	4.17	380	4.23	21	0.06	1635	7.6	3.54	0.13	4.1
350	RN24S	147	4.07	93	4.6	54	0.53	2530	1.3	1.03	0.68	9.1
365	RN24P	615	4.17	614	4.2	1	0.03	650	6.0	9.02	0.02	0.6
371	RN24U	333	4.07	293	4.23	40	0.16	1304	2.3	1.38	0.26	6.1
377	RN24U*	883	4.23	849	4.3	34	0.07	1056	4.2	3.34	0.09	1.1
383	RN24V	116	4.07	74	4.5	42	0.43	1649	1.1	0.87	0.53	5.8
389	RN24V*	848	4.3	811	4.4	37	0.1	1292	3.6	3.15	0.11	0.8
398	RN24M	996	4.37	976	4.43	20	0.06	1013	4.7	3.92	0.07	0.7
404	RN24L	1077	4.07	999	4.17	78	0.1	1704	4.7	5.41	0.09	0.8
410	RN24I*	1211	4.23	1166	4.6	45	0.37	4645	3.5	3.72	0.35	1.4
422	RN24N	214	4.2	146	4.67	68	0.47	4720	2.8	2.60	0.50	2.1
431	RN24J	227	4.63	225	4.67	2	0.04	688	4.8	2.11	0.09	3.0
440	RN24I	1517	4.63	1512	4.73	5	0.1	2747	7.6	4.75	0.16	3.6
446	RN21JE	174	4.07	141	4.43	33	0.36	1741	1.3	1.00	0.48	7.4
452	RN24G*	1508	4.73	1496	4.83	12	0.1	2913	8.1	4.50	0.18	4.8
476	RN24G	1643	4.8	1636	4.83	7	0.03	1400	13.0	6.43	0.06	1.8
521	RN27F	659	4.1	630	4.17	29	0.07	1409	5.6	4.50	0.09	1.0
530	RN27G	1098	4.17	1024	4.27	74	0.1	1925	5.3	4.90	0.11	0.5
536	RN27E	287	4.27	266	4.4	21	0.13	1575	3.4	2.97	0.15	1.0
542	RN27H	451	4.13	394	4.3	57	0.17	2852	4.7	3.81	0.21	2.3
551	RN27C	1412	4.27	1375	4.33	37	0.06	490	2.3	5.12	0.03	2.0
557	RN27I	411	4.1	344	4.33	67	0.23	3709	4.5	3.68	0.28	3.0
572	RN27JW	312	4.1	270	4.37	42	0.27	4085	4.2	3.43	0.33	3.6
578	RN27B	1738	4.33	1642	4.47	96	0.14	1515	3.0	4.35	0.10	2.6
593	RN27JS	189	4.1	175	4.17	14	0.07	1121	4.4	2.49	0.13	3.3
611	RN27DS	86	4.17	67	4.7	19	0.53	4205	2.2	1.75	0.67	8.2
617	RN27K	676	4.57	651	4.77	25	0.2	1922	2.7	2.57	0.21	0.5
626	RN27L	843	4.67	842	4.7	1	0.03	1009	9.3	7.95	0.04	0.3
632	RN25S	80	4.07	76	4.1	4	0.03	1477	13.7	3.60	0.11	5.0
638	RN25O*	847	4.7	843	4.73	4	0.03	2524	23.4	7.46	0.09	3.8
653	RN25O	854	4.73	848	4.87	6	0.14	5837	11.6	8.30	0.20	3.3
677	RN27	1966	4.5	1939	4.63	27	0.13	1501	3.2	2.26	0.18	3.3
698	RN25R	290	4.07	277	4.1	13	0.03	2400	22.2	6.93	0.10	4.0
704	RN25Q	88	4.07	83	4.13	5	0.06	1662	7.7	4.80	0.10	2.2
710	RN25P	498	4.07	470	4.13	28	0.06	1257	5.8	5.41	0.06	0.3
731	RN25MW	178	4.17	124	4.33	54	0.16	1114	1.9	1.16	0.27	6.4
761	RN26	2016	4.63	1943	4.73	73	0.1	1667	4.6	2.91	0.16	3.5
797	RN25J	1958	4.73	1882	4.97	76	0.24	2548	2.9	2.23	0.32	4.6
806	RN25KS	189	4.1	139	4.67	50	0.57	2074	1.0	1.00	0.58	0.4
812	RN25G	160	4.67	128	5.43	32	0.76	2633	1.0	0.80	0.91	9.3
821	RN25I	1913	4.97	1864	5.13	49	0.16	1522	2.6	2.20	0.19	1.9
830	RN25MS	1053	4.17	837	4.37	216	0.2	3470	4.8	3.70	0.26	3.6
848	RN25EW	496	4.37	459	4.6	37	0.23	1650	2.0	2.88	0.16	4.3
857	RN25ES	496	4.37	434	4.73	62	0.36	2578	2.0	2.10	0.34	1.1
869	RN25DW	335	4.03	304	4.13	31	0.1	2674	7.4	3.50	0.21	6.7
884	RN25CW	677	4.63	677	4.67	0	0.04	485	3.4	4.40	0.03	0.6
899	RN25F	195	4.13	160	4.43	35	0.3	3636	3.4	4.35	0.23	4.1
914	RN25BW	836	4.53	832	4.6	4	0.07	2030	8.1	4.70	0.12	3.0
938	RN25	2199	5.13	2095	5.4	104	0.27	2939	3.0	2.26	0.36	5.5
947	RN25DS	143	4.03	122	4.33	21	0.3	2839	2.6	2.16	0.37	3.9
953	RN24B	238	4.23	236	4.33	2	0.1	1291	3.6	3.70	0.10	0.2
971	RN24BW	223	4.33	219	4.4	4	0.07	1203	4.8	4.70	0.07	0.1
983	RN24C*	219	4.4	162	4.47	57	0.07	1188	4.7	7.48	0.04	1.6
998	RN24C	298	4.33	295	4.37	3	0.04	1954	13.6	8.97	0.06	1.2
1031	RN24	2021	5.43	1991	5.63	30	0.2	2795	3.9	2.76	0.28	4.9
1058	RN23AW	771	4.13	703	4.33	68	0.2	3230	4.5	4.00	0.22	1.5
1067	RN21DE	118	4.53	111	5.13	7	0.6	4696	2.2	2.33	0.56	2.4
1073	RN23	2009	5.63	1940	5.97	69	0.34	6182	5.1	4.05	0.42	5.0
1085	RN21B	1879	4.33	1300	4.73	579	0.4	7241	5.0	6.57	0.31	5.6
1091	RN23AS	242	4.13	179	4.77	63	0.64	6853	3.0	2.40	0.79	9.2
1106	RN21A	1327	4.77	1161	4.87	166	0.1	3153	8.8	8.90	0.10	0.1
1124	RA09US	364	4.1	309	4.33	55	0.23	3928	4.7	3.40	0.32	5.5
1148	RN11OS	107	4.13	85	4.5	22	0.37	1184	0.9	0.63	0.52	9.1
1163	RN11MS	307	4.27	294	4.53	13	0.26	2689	2.9	2.26	0.33	4.2
1184	RN11JS	257	4.13	228	4.67	29	0.54	5670	2.9	3.30	0.48	3.8

HEC-1 ROUTING TIME vs MANNING'S NORMAL DEPTH ROUTING TIME

HEC-1 Line Number	Route ID	Beginning Q (cfs)	Beginning Time (hr)	Ending Q (cfs)	Ending Time (hr)	Delta Q (cfs)	Delta Time Hec-1	ROUTE LENGTH (ft)	HEC-1 Velocity (fps)	Mannings Velocity (fps)	Delta Time Mannings	Time Diff. Minutes
1202	RN11NS	661	4.03	546	4.23	115	0.2	2645	3.7	3.69	0.20	0.1
1208	RN11L1	155	4.3	152	4.3	3	0	743	0.0	4.50	0.05	2.8
1220	RN11K	751	4.23	714	4.43	37	0.2	6450	9.0	5.20	0.34	8.7
1229	RN11H	1053	4.4	979	4.67	74	0.27	2506	2.6	3.10	0.22	2.7
1250	RN11F	452	4.23	394	4.5	58	0.27	3754	3.9	3.57	0.29	1.3
1331	RN22AW	109	4.23	100	4.5	9	0.27	1304	1.3	1.17	0.31	2.4
1343	RN11IS	519	4.2	506	4.3	13	0.1	3110	8.6	5.70	0.15	3.1
1349	RN11IW	519	4.2	505	4.4	14	0.2	4147	5.8	4.02	0.29	5.2
1364	RX50E	240	4.53	234	4.7	6	0.17	2549	4.2	2.88	0.25	4.6
1391	RX50W	627	4.53	619	4.67	8	0.14	2586	5.1	3.87	0.19	2.7
1592	RN11BS	249	6.13	249	6.43	0	0.3	4083	3.8	3.29	0.34	2.7
1634	RN11	1231	4.37	989	4.53	242	0.16	4972	8.6	6.60	0.21	3.0
1661	RN10E	750	4.27	750	4.53	0	0.26	3858	4.1	6.40	0.17	5.6
1679	RN21	2629	5.1	2548	5.37	81	0.27	5633	5.8	4.37	0.36	5.3
1691	RN20	2709	5.37	2654	5.6	55	0.23	5820	7.0	4.50	0.36	7.8
1709	RN12	2891	5.6	2825	5.83	66	0.23	5138	6.2	5.00	0.29	3.3
1715	RN09*	2974	5.83	2952	5.93	22	0.1	2117	5.9	3.50	0.17	4.1
1727	RN19E	937	4.63	853	4.8	84	0.17	3344	5.5	10.47	0.09	4.9
1736	RN19D	1029	4.7	1013	4.97	16	0.27	4986	5.1	3.50	0.40	7.5
1745	RN19C	1082	4.13	1070	4.3	12	0.17	4137	6.8	4.00	0.29	7.0
1754	RN19B	1321	4.23	1244	4.6	77	0.37	6101	4.6	4.36	0.39	1.1
1799	RN18	704	8.3	693	8.53	11	0.23	3730	4.5	3.33	0.31	4.9
1808	RN17	794	4.43	760	4.67	34	0.24	5234	6.1	4.60	0.32	4.6
1817	RN16	1415	4.63	1405	4.73	10	0.1	4011	11.1	5.92	0.19	5.3
1823	RN15B	792	4.37	753	4.9	39	0.53	5757	3.0	2.73	0.59	3.3
1838	RN15A	882	5.27	808	5.47	74	0.2	5536	7.7	6.92	0.22	1.3
1847	RN15	1990	4.8	1978	4.87	12	0.07	3500	13.9	7.15	0.14	4.0
1853	RN14A	458	4.4	454	4.5	4	0.1	2048	5.7	6.14	0.09	0.4
1862	RN14	2265	4.87	2112	5.17	153	0.3	7133	6.6	5.03	0.39	5.6
1874	RN08B	373	4.97	260	5.87	113	0.9	8001	2.5	2.96	0.75	8.9
1889	RN08A	420	5.07	334	6.07	86	1	7954	2.2	2.60	0.85	9.0
1898	RN08	2321	5.17	2317	5.2	4	0.03	1206	11.2	4.25	0.08	2.9
1904	RN09	3936	5.87	3902	6	34	0.13	4452	9.5	5.20	0.24	6.5
1910	RN10S	632	4.5	625	4.6	7	0.1	1746	4.9	3.75	0.13	1.8
1943	RN07	3925	6	3906	6.27	19	0.27	6272	6.5	4.50	0.39	7.0
1949	RA11L	662	4.2	607	4.37	55	0.17	2618	4.3	3.93	0.19	0.9
1955	RA11M	722	4.1	670	4.2	52	0.1	2070	5.7	4.47	0.13	1.7
1964	RA11N	210	4.1	200	4.13	10	0.03	1142	10.6	3.34	0.09	3.9
1970	RA11O	146	4.07	136	4.17	10	0.1	1549	4.3	3.13	0.14	2.2
1976	RX21	334	4.17	290	4.33	44	0.16	1814	3.1	2.85	0.18	1.0
1994	RA11GN	189	4.03	178	4.1	11	0.07	1364	5.4	4.47	0.08	0.9
2000	RA11K	1803	4.17	1735	4.27	68	0.1	1623	4.5	4.28	0.11	0.3
2015	RA11I	3887	6.27	3861	6.47	26	0.2	3989	5.5	4.62	0.24	2.4
2030	RA11FN	897	4.2	866	4.23	31	0.03	517	4.8	3.28	0.04	0.8
2036	RA11E	3842	6.47	3836	6.53	6	0.06	2499	11.6	5.78	0.12	3.6
2042	RA11H	188	4.07	149	4.37	39	0.3	5127	4.7	3.23	0.44	8.5
2048	RA09UW	91	4.1	67	4.33	24	0.23	2398	2.9	4.10	0.16	4.1
2063	RA09TW	210	4.03	210	4.37	0	0.34	1615	1.3	2.20	0.20	8.2
2075	RX22	210	4.37	210	4.43	0	0.06	1803	8.3	4.10	0.12	3.7
2081	RX23	3830	6.53	3827	6.7	3	0.17	4061	6.6	3.01	0.37	12.3
2087	RA99Z	333	4.17	302	4.43	31	0.26	1995	2.1	1.51	0.37	6.4
2096	RA11D	397	4.17	357	4.97	40	0.8	3225	1.1	1.03	0.87	4.2
2108	RA11A	3822	6.7	3819	6.73	3	0.03	661	6.1	5.66	0.03	0.1
2114	RA11C	152	4.33	140	4.6	12	0.27	2280	2.3	1.59	0.40	7.7
2120	RA11*	3816	6.73	3805	6.8	11	0.07	1266	5.0	2.74	0.13	3.5
2138	RA09TS	197	4.17	69	5.23	128	1.06	2824	0.7	0.73	1.07	0.9
2153	RA09RS	176	4.33	161	4.67	15	0.34	3928	3.2	2.38	0.46	7.1
2159	RN11MW	102	4.27	93	4.8	9	0.53	3871	2.0	1.69	0.64	6.4
2165	RN11JW	257	4.13	234	4.27	23	0.14	1080	2.1	1.60	0.19	2.9
2171	RX4	252	4.63	250	4.8	2	0.17	2164	3.5	2.00	0.30	7.8
2192	RN11GW	1386	4.63	1257	4.73	129	0.1	2318	6.4	4.30	0.15	3.0
2207	RA09KW	1401	4.7	1377	4.8	24	0.1	1473	4.1	1.60	0.26	9.3
2213	RX7S	1377	4.8	1348	4.9	29	0.1	860	2.4	3.97	0.06	2.4
2225	RA09GW	203	4.23	192	4.33	11	0.1	1045	2.9	1.86	0.16	3.4
2231	RX8W	1357	4.9	1332	5.03	25	0.13	2280	4.9	4.50	0.14	0.6
2243	RA09JS	121	4.3	111	4.53	10	0.23	2882	3.5	2.80	0.29	3.4
2252	RA09H	1360	5	1356	5.03	4	0.03	841	7.8	7.90	0.03	0.0
2273	RA09SS	142	4.17	119	4.53	23	0.36	4204	3.2	2.41	0.48	7.5
2285	RA09OW	474	4.67	466	4.73	8	0.06	1076	5.0	3.90	0.08	1.0
2291	RA09P	563	4.67	562	4.7	1	0.03	884	8.2	3.78	0.06	2.1
2318	RA09M	317	4.17	263	4.27	54	0.1	1102	3.1	5.35	0.06	2.6
2333	RA09N	451	4.2	284	4.53	167	0.33	2382	2.0	2.80	0.24	5.6
2339	RA09JW	121	4.3	112	4.37	9	0.07	1749	6.9	4.30	0.11	2.6
2354	RA09LS	373	4.63	343	4.8	30	0.17	2615	4.3	2.90	0.25	4.8
2369	RX10	1494	5.03	1469	5.17	25	0.14	4470	8.9	7.00	0.18	2.2
2381	RA09GS	203	4.23	167	4.67	36	0.44	3990	2.5	2.45	0.45	0.7
2396	RA09FW	492	4.3	432	4.67	60	0.37	3031	2.3	4.20	0.20	10.2
2411	RA09E	457	4.8	429	4.9	28	0.1	2700	7.5	5.60	0.13	2.0
2426	RA09C*	426	4.87	425	4.87	1	0	841	0.0	10.00	0.02	1.4
2435	RA09C	436	4.87	436	4.9	0	0.03	1978	18.3	5.20	0.11	4.5
2441	RA09B	130	4	106	4.43	24	0.43	2497	1.6	1.40	0.50	3.9
2456	RA09AW	370	4.37	320	5.63	50	1.26	5898	1.3	1.25	1.31	3.0
2483	RS30D	271	4.17	183	4.4	88	0.23	6176	7.5	4.60	0.37	8.6
2504	RS30BW	550	4.2	550	4.43	0	0.23	5060	6.1	3.75	0.37	8.7
2519	RS30AW	550	4.2	550	4.53	0	0.33	4919	4.1	8.30	0.16	9.9
2528	RS30	857	4.3	857	4.33	0	0.03	691	6.4	10.55	0.02	0.7
2540	RA07G	643	4.13	625	4.27	18	0.14	2439	4.8	3.11	0.22	4.7

HEC-1 ROUTING TIME vs MANNING'S NORMAL DEPTH ROUTING TIME

HEC-1 Line Number	Route ID	Beginning Q (cfs)	Beginning Time (hr)	Ending Q (cfs)	Ending Time (hr)	Delta Q (cfs)	Delta Time Hec-1	ROUTE LENGTH (ft)	HEC-1 Velocity (fps)	Mannings Velocity (fps)	Delta Time Mannings	Time Diff. Minutes
2546	RA07F	232	4.33	230	4.43	2	0.1	2619	7.3	6.20	0.12	1.0
2555	RA07E	1066	4.27	907	4.43	159	0.16	1771	3.1	6.50	0.08	5.1
2564	RA07C	1073	4.4	1071	4.43	2	0.03	1051	9.7	8.57	0.03	0.2
2570	RA07H	268	4.03	254	4.17	14	0.14	2386	4.7	2.30	0.29	8.9
2582	RA08B	245	4.37	209	4.63	36	0.26	2925	3.1	2.64	0.31	2.9
2591	RA07D	1151	4.47	1081	4.67	70	0.2	4828	6.7	4.95	0.27	4.3
2609	RA07B	2126	4.53	2029	4.63	97	0.1	2990	8.3	9.45	0.09	0.7
2621	RA07A	103	4.3	103	4.37	0	0.07	1095	4.3	4.02	0.08	0.3
2630	RA07	349	4.03	260	4.2	89	0.17	3464	5.7	5.10	0.19	1.1
2639	RA06	2201	4.6	2165	4.77	36	0.17	2650	4.3	3.40	0.22	2.8
2663	RS10V	303	4.2	289	4.4	14	0.2	3095	4.3	3.90	0.22	1.2
2672	RS10U	406	4.37	396	4.5	10	0.13	2399	5.1	5.00	0.13	0.2
2681	RS10T	762	4.43	754	4.5	8	0.07	1703	6.8	6.80	0.07	0.0
2687	RS30BS	485	4.37	466	4.6	19	0.23	3286	4.0	2.80	0.33	5.8
2699	RS10S	1429	4.57	1390	4.67	39	0.1	1434	4.0	7.40	0.05	2.8
2708	RS10Q	1590	4.63	1568	4.73	22	0.1	2335	6.5	10.32	0.06	2.2
2732	RS10JW	68	4.1	67	4.13	1	0.03	218	2.0	4.10	0.01	0.9
2738	RS10KN	2187	4.5	2181	4.53	6	0.03	1032	9.6	11.12	0.03	0.3
2744	RS10JS	96	4.1	93	4.17	3	0.07	1052	4.2	2.80	0.10	2.1
2759	RS10IW	126	4.17	124	4.2	2	0.03	440	4.1	3.38	0.04	0.4
2765	RS10KM	2232	4.53	2211	4.6	21	0.07	1941	7.7	11.77	0.05	1.5
2771	RS10IS	178	4.17	173	4.3	5	0.13	2001	4.3	3.67	0.15	1.3
2786	RS10NW	187	4.27	187	4.27	0	0	248	0.0	4.43	0.02	0.9
2795	RS10K	2583	4.53	2559	4.63	24	0.1	2792	7.8	12.54	0.06	2.3
2801	RS10NS	187	4.27	180	4.47	7	0.2	3090	4.3	3.47	0.25	2.8
2810	RS10G	2836	4.6	2819	4.67	17	0.07	2152	8.5	10.53	0.06	0.8
2819	RX40S	1903	4.67	1887	4.77	16	0.1	1867	5.2	8.47	0.06	2.3
2831	RS30AS	535	4.4	515	4.73	20	0.33	6201	5.2	4.31	0.40	4.2
2840	RS10P	739	4.7	689	5.03	50	0.33	8110	6.8	5.15	0.44	6.4
2849	RS10E	985	5.07	974	5.13	11	0.06	1822	8.4	4.70	0.11	2.9
2855	RS10M	722	4.17	673	4.4	49	0.23	5164	6.2	6.10	0.24	0.3
2861	RS10E*	1160	5.13	1156	5.17	4	0.04	1289	9.0	7.10	0.05	0.6
2867	RS10F	345	4.37	337	4.63	8	0.26	2906	3.1	3.20	0.25	0.5
2873	RS10F*	1335	5.13	1323	5.23	12	0.1	2976	8.3	6.99	0.12	1.1
2882	RS10C	3283	4.77	3270	4.83	13	0.06	2665	12.3	14.20	0.05	0.5
2894	RX40E	916	4.7	916	4.77	0	0.07	1961	7.8	6.21	0.09	1.1
2903	RS10B	1103	4.4	1097	4.47	6	0.07	2012	8.0	12.06	0.05	1.4
2912	RS10	4333	4.83	4331	4.83	2	0	562	0.0	16.00	0.01	0.6
2921	RN06	4611	5.03	4562	5.1	49	0.07	2721	10.8	12.40	0.06	0.5
2930	RN05C	4622	5.1	4579	5.17	43	0.07	2873	11.4	6.50	0.12	3.2
2954	RN05	4681	5.17	4672	5.23	9	0.06	2728	12.6	5.70	0.13	4.4
2960	RN05BS	199	4.53	198	4.7	1	0.17	2372	3.9	2.75	0.24	4.2
2969	RN04A	4777	5.23	4695	5.37	82	0.14	3178	6.3	5.00	0.18	2.2
2984	RN04	4854	5.33	4850	5.33	4	0	558	0.0	6.16	0.03	1.5
2990	RS01G	469	4.23	446	4.53	23	0.3	5223	4.8	3.52	0.41	6.7
2999	RS01D	941	4.53	925	4.7	16	0.17	3831	6.3	4.00	0.27	5.8
3005	RS01H	329	4.33	323	4.53	6	0.2	2756	3.8	3.60	0.21	0.8
3014	RS01E	575	4.4	566	4.53	9	0.13	3245	6.9	4.20	0.21	5.1
3023	RS01C	1599	4.67	1596	4.7	3	0.03	1239	11.5	4.90	0.07	2.4
3029	RS01I	333	4.23	323	4.37	10	0.14	2591	5.1	3.95	0.18	2.5
3038	RS01F	494	4.33	483	4.53	11	0.2	3731	5.2	3.97	0.26	3.7
3047	RS01B	2085	4.67	2077	4.73	8	0.06	1419	6.6	5.30	0.07	0.9
3056	RS01A	2254	4.73	2244	4.77	10	0.04	1563	10.9	12.75	0.03	0.4
3065	RS01	2374	4.77	2373	4.77	1	0	733	0.0	11.29	0.02	1.1
3071	RN03*	5826	5.27	5812	5.4	14	0.13	4858	10.4	6.06	0.22	5.6
3077	RN03A	351	4.4	347	4.5	4	0.1	1914	5.3	9.90	0.05	2.8
3083	RN03B	723	4.4	720	4.43	3	0.03	748	6.9	13.10	0.02	0.8
3092	RN03	6186	5.37	6183	5.43	3	0.06	3072	14.2	8.38	0.10	2.5
3107	RN02B	6196	5.43	6189	5.5	7	0.07	3169	12.6	6.90	0.13	3.5
3122	RS20A	247	4.23	245	4.3	2	0.07	1407	5.6	5.20	0.08	0.3
3131	RS20	466	4.27	464	4.3	2	0.03	1217	11.3	6.49	0.05	1.3
3137	RA05A	260	4.17	249	4.43	11	0.26	4306	4.6	3.10	0.39	7.6
3164	RA09QW	729	4.6	727	4.67	2	0.07	2468	9.8	6.30	0.11	2.3
3173	RA10A	772	4.57	772	4.63	0	0.06	2831	13.1	4.94	0.16	6.0
3203	RA08A	86	4.43	85	4.6	1	0.17	1747	2.9	2.60	0.19	1.0
3209	RA99R	88	4.07	73	4.3	15	0.23	2159	2.6	1.96	0.31	4.6
3251	RA04A	412	4.17	392	4.3	20	0.13	1051	2.2	2.43	0.12	0.6
3260	RA04	499	4.23	463	4.53	36	0.3	3194	3.0	3.07	0.29	0.7
3269	RA03D	557	4.53	520	4.8	37	0.27	2906	3.0	3.15	0.26	0.8
3275	RA03E	216	4.17	208	4.3	8	0.13	1517	3.2	3.16	0.13	0.2
3284	RA03B	304	4.17	267	4.7	37	0.53	3103	1.6	1.63	0.53	0.1
3293	RA03A	308	4.57	303	4.73	5	0.16	1390	2.4	2.65	0.15	0.9
3392	RA01A	97	4.13	82	4.4	15	0.27	2225	2.3	1.86	0.33	3.7
3431	RN01A	570	4.33	534	4.5	36	0.17	2337	3.8	2.32	0.28	6.6
3443	RA03C	529	4.17	501	4.33	28	0.16	4511	7.8	7.50	0.17	0.4
3449	RA02B	760	4.03	702	4.1	58	0.07	1060	4.2	4.00	0.07	0.2
3455	RA02A*	941	4.17	869	4.3	72	0.13	2274	4.9	3.60	0.18	2.7
3485	RA02C	418	4.37	284	4.97	134	0.6	5468	2.5	2.92	0.52	4.8
3500	RA01F	416	4.17	369	4.4	47	0.23	2986	3.6	4.49	0.18	2.7
3515	RA01EW	131	4.07	124	4.13	7	0.06	1434	6.6	3.81	0.10	2.7
3521	RA01D	521	4.37	442	4.63	79	0.26	2541	2.7	2.10	0.34	4.6

COMPUTER CD

APPENDIX H. C.I.P. PRIORITIZATION

FY 2002-2003 CIP

FLOOD CONTROL DISTRICT

PROJECT PROPOSAL

Project Description:

Name:	Rose Garden Lane Channel			
Requestor:	City of Peoria 8401 West Monroe Street Peoria, AZ 85345	Contact:		Burton Charron Ph. 623-773-7210 Fax. 623-773-7211
Location:	Rose Garden Lane from Lake Pleasant Road to the Agua Fria River			
Area:	Bounded:	South West East North	By:	Rose Garden Lane Agua Fria River Lake Pleasant Road West Wing Mountains

Agency Priority: This Project ranks first in Peoria's priority of projects for FY 2002-2003. This project has one phase: **Phase I – Rose Garden Lane Channel.**

Master Plan Element: The **Rose Garden Lane Channel Project** is part of the drainage improvements formulated in the Glendale/Peoria ADMP Update, Aug 2001. (ADMP) This project also addresses the flooding problems that occurred in the October 21, 2000 storm for the Ventana Lakes development.

The rapid upstream development in this area has caused the downstream drainage structures along Rose Garden Lane to become insufficient.

The general complaint in this region is that the on-going upstream developments are causing drainage problems south of Rose Garden Lane within the Ventana Lakes development. This project ranks high in the proposed alternatives formulated in the ADMP.

Hydrologic/Hydraulic Significance (Rose Garden Lane Channel): The watershed that contributes to the channel is generally between 91st Avenue and the Agua Fria River south of the West Wing Mountains. The current drainage between the old Lake Pleasant Road alignment and the current alignment flows north to south with flow crossing Rose Garden Lane and entering into the Ventana Lakes development. The Ventana Lakes development, which was developed under less stringent requirements, does not account for the ever-increasing upstream flow and flooding is likely during a large storm. The Rose Garden Lane Channel will route the flow west and away from the Ventana Lakes development.

The current Rose Garden Lane Channel routes flow on the north side of the Ventana Lakes development in a shotcrete channel. This channel makes a ninety-degree turn at the intersection of 111th Avenue and Rose Garden Lane. Maintenance problems with the channel exist and flow overtops the ninety-degree turn during larger storm events. The proposed Rose Garden Lane Channel reduces maintenance costs and removes the sharp transition at 111th Avenue and Rose Garden Lane. The proposed channel will be on the north side of Rose Garden Lane in a natural channel that flows west to the Agua Fria River.

Level of Protection: This Project provides 100-year protection to the Ventana Lakes development. The Project includes natural channels, a storm drain with an energy dissipater, and two culvert crossings. The channel removes the current overland flows into the Ventana Lakes development.

The storm drain, culvert crossings, and channel facilities are anticipated to maintain the drainage in accordance with the requirements set forth in *Maricopa County Drainage Design Manual.*

Area Protected: The proposed Rose Garden Lane Improvements would provide protection to existing, proposed and future developments on the south side of Rose Garden Lane from Lake Pleasant Road to the Agua Fria River. The watershed routed to this proposed project, Phase I, is approximately 1.4 square miles. The downstream area protected by this proposed project is nearly 1.3 square miles.

Environmental Quality: The proposed natural channels decrease the amount of maintenance required due to sediment from the high velocities in the existing shotcrete channel.

Area-wide benefits: The natural channels reduce the safety concerns associated with the steep side slopes in the existing shotcrete channel. The channel also has multi-use opportunities such as a trail.

Total Project Cost: The estimate of costs for the **Rose Garden Lane Channel** is $2,800,000. The City will continue to pursue participation from adjoining properties.

Level of Participation: The City anticipates participation from the Flood Control District for the Rose Garden Lane Channel Project. Upon favorable review by the Flood Control District for the improvements, the City will extend the budget amount in the next year CIP cycle to cover the City's proportionate share of improvements.

Operation & Maintenance Costs: The primary cost associated with the proposed improvements is the removal of sediment from the storm drains and energy dissipater. This maintenance would be performed as needed. The desert landscaping in the proposed facilities reduces the maintenance costs of lawn mowing and vegetative trimming.

Operation & Maintenance Responsibility: The City would maintain the storm drains and channels. Any major maintenance to the drainage facilities would be performed by Flood Control District.

Project Priority Worksheet
FY 02/03

Project Name: Rose Garden Lane Channel

Requested By: Peoria

Date: July 20, 2001

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

Project Description: This Request is for a one phase project that is part of the Glendale/Peoria ADMP Update. The project consists of a combination natural channel and storm drain on the north side of Rose Garden Lane. The channel begins to the west of Lake Pleasant Road and continues west until a storm drain which is located just east of the old alignment of Lake Pleasant Road. The storm drain carries the flow down a sharp incline until it outlets west of 107th Avenue. The storm drain will have an energy dissipater at the outlet to decrease the high velocities that result from the steep slope. The channel will continue west and outlet into the Agua Fria River. The total cost for the project is $2,800,000.

FY 2002-2003 CIP

FLOOD CONTROL DISTRICT

PROJECT PROPOSAL

Project Description:

Name:	83rd Avenue Drainage Improvements		
Requestor:	City of Peoria 8401 West Monroe Street Peoria, AZ 85345	Contact:	Burton Charron Ph. 623-773-7210 Fax. 623-773-7211
Location:	Pinnacle Peak Road from 95th Avenue to 83rd Avenue Calle Lejos from 89th Avenue to 83rd Avenue 83rd Avenue from Calle Lejos to Williams Drive 89th, 87th, and 85th Avenues from Camino Del Oro to Pinnacle Peak Road.		

Area:	Bounded:	South	By:	Williams Drive
		West		95th Avenue
		East		83rd Avenue
		North		West Wing Mountain

Agency Priority: This Project ranks second in Peoria's priority of projects for FY 2002-2003. There are two phases of the Project: **Phase I - 83rd Avenue Detention Basin and Outlet** and **Phase II - Calle Lejos Detention Basin and Pinnacle Peak Road Storm Drains**.

Master Plan Element: The **83rd Avenue Detention Basin and Outlet Project** is part of the drainage improvements formulated in the Glendale/Peoria ADMP Update, Aug 2001. (ADMP) This project also incorporates the 83rd Avenue Candidate Assessment Report (CAR) for 83rd Avenue in that the roadway will eventually be increased in size to accommodate the large development on the other side of the West Wing Mountain.

The rapid upstream development in this area has caused the downstream drainage structures along 83rd Avenue to become inadequate and flooding is expected in large storms. The proposed detention basin and outlet storm drain would reduce the peak flow in large storm events and as a result, the downstream drainage structures along 83rd Avenue become sufficient.

The **Calle Lejos Detention Basin and Pinnacle Peak Road Storm Drains Project** is also a part of the drainage improvements formulated in the ADMP. The proposed detention basin would reduce the downstream peak flows, which results in smaller storm drains required to carry the flow to the 83rd Avenue detention basin. This project would also incorporate the Pinnacle Peak Road CAR, which increases the size of the roadway to accommodate the increasing traffic flow.

The general complaint in this region is that the on-going upstream developmets are causing drainage problems south of Pinnacle Peak Road between 91st Avenue and 83rd Avenue.

Hydrologic/Hydraulic Significance: **83rd Avenue Detention Basin**: The watershed that contributes to the detention basin is generally between 91st Avenue and 83rd Avenue south of the West Wing Mountains. The current drainage structures along 83rd Avenue from Calle Lejos south to the New River are either under-sized or non-existent. Individual developers constructed inconsistent drainage structures and caused the system to be non-continuous. The proposed detention basin would reduce the peak flows causing the downstream drainage structures to become sufficient.

83rd Avenue would flood during the 100-year event under current conditions. This roadway is a major arterial in the City of Peoria and needs to be accessible during flooding events. The contributing area has steep slopes in the West Wing Mountain area and mild slopes in the remaining areas. The land use is generally low-density residential and natural desert. There are several developments planned in the upstream contributing areas.

Calle Lejos Detention Basin: The watershed that drains into this basin is mainly from the West Wing Mountains. The steep slopes and rocky soils result in a large and quick peak flow to the downstream areas. This proposed basin would reduce the peak flows to the downstream areas and provides protection to the existing developments between Calle Lejos and Pinnacle Peak Road.

The storm drains along Pinnacle Peak Road are also a part of this project. These proposed storm drains would carry the flow east from 87th Avenue into the 83rd detention basin and west of 87th Avenue to 95th Avenue an into the undeveloped state land area. These proposed storm drains would eliminate the flow that currently crosses Pinnacle Peak Road and causes flooding problems to the area between 91st Avenue and 83rd Avenue between Pinnacle Peak Road and Deer Valley Road.

Level of Protection: The Project provides 100-year protection along 83rd Avenue from Calle Lejos south to the New River and along Pinnacle Peak Road from 95th Avenue to 83rd Avenue. The Project includes two detention basins that reduce the downstream peak flows and a series of storm drains, which removes the current overland storm water flows.

The detention basin, storm drains, and channel facilities are anticipated to maintain the drainage in accordance with the requirements set forth in Maricopa County Drainage Design Manual.

Area Protected: The proposed 83rd Avenue Improvements would provide protection to existing, proposed and future developments along 83rd Avenue from Pinnacle Peak Road to the confluence with the New River. The watershed that is routed though Phase I is approximately 1.2 square miles. The downstream area protected by this proposed project is nearly 1 square mile.

The watershed for Phase II is a smaller portion of the same upstream area that drains to the 83rd Avenue detention basin. The watershed that is routed though Phase II is approximately 0.4 square miles, but the protected downstream area is 1.6 square miles. The protected downstream area is increased because the Pinnacle Peak Road storm drains would protect the area south between 91st and 83rd Avenues.

Environmental Quality: The two detention basins would improve water quality of storm water by reducing sediment and debris and the channels and storm drains would remove nuisance discharges and reduce erosion.

Area-wide benefits: The detention basins have many multi-use opportunities for the community, and there is a possibility of recharging some of the storm water into the groundwater.

Total Project Cost: The estimate of costs for the **83rd Avenue Detention Basin and Outlet** is $3,264,000 and for the **Calle Lejos Detention Basin with Outlet and Pinnacle Peak Road Storm Drains** is $8,970,000. The City will continue to pursue participation from the adjoining properties.

Level of Participation: The City anticipates participation from the Flood Control District for both the Phase I and Phase II improvements. The City has budgeted $3,200,000 within the 2002 CIP for the 83rd Avenue Detention Basin and Outlet. Upon favorable review by the Flood Control District for the Phase I improvements, the City will extend the budget amount in the next 5-year CIP cycle to cover the City's proportionate share of the Phase II improvements.

Operation & Maintenance Costs: The main cost associated with the Phase I, and Phase II improvements are the removal of sediment from the detention basins and within the storm drains. This maintenance would be performed as needed. The desert landscaping in the proposed facilities reduces the maintenance costs of things such as lawn mowing and vegetative trimming.

Operation & Maintenance Responsibility: The City would maintain the detention basins, storm drains, and channels. Any major maintenance to the drainage facilities would be performed by Flood Control District.

Project Priority Worksheet
FY 02/03

Project Name: 83rd Avenue Detention Basin

Requested By: Peoria

Date: July 11, 2001

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

Project Description: This Request is for a two phase project with both phases included in the Glendale/Peoria ADMP Update. Phase I is the 83rd Avenue Detention Basin and Outlet and Phase II is the Calle Lejos Detention Basin and Pinnacle Peak Road Storm Drains. The Calle Lejos Detention Basin and Pinnacle Peak Road storm drains flow into the 83rd Avenue Detention Basin. Rapid development in the upstream areas now threatens the downstream areas with flooding because the drainage structures downstream are under-sized. The City is seeking funding to construct the drainage improvements formulated in the Glendale/Peoria ADMP Update. Phase II of this request includes storm drains along Pinnacle Peak Road and Calle Lejos that drain into the 83rd Avenue detention basin. Total Cost for the Project is $12,234,000. The City would contribute $6,117,000 and the District would be responsible for $6,117,000.

FY 2002-2003 CIP

FLOOD CONTROL DISTRICT

PROJECT PROPOSAL

Project Description:

Name:	87th Avenue and Deer Valley Road Drainage Improvements			
Requestor:	Flood Control District 2801 W. Durango Phoenix, AZ 85009		Contact:	Marilyn DeRosa Ph. 602-506-4766 Fax. 602-506-4601
Location:	87th Avenue from Williams Drive to Deer Valley Road 88th Avenue from Williams Drive to Deer Valley Road 89th Avenue from Williams Drive to Deer Valley Road 90th Avenue from Williams Drive to Deer Valley Road Deer Valley Road from 83rd Avenue to 91st Avenue			
Area:	Bounded:	South West East North	By:	Deer Valley Road 91st Avenue 83rd Avenue Pinnacle Peak Road

Agency Priority: This Project ranks fourth in the District's priority of projects for FY 2002-2003. This project has one phase: **87th Avenue and Deer Valley Road Drainage Improvements**.

Master Plan Element: The **87th Avenue and Deer Valley Road Drainage Improvements Project** is part of the drainage improvements formulated in the Glendale/Peoria ADMP Update, Aug 2001. This project also addresses the flooding problems that occurred in this area from the October 21, 2000 storm.

The rapid upstream development and lack of drainage structures in the area has caused flooding problems. Flooding and ponding in this area are common in even minor events.

The general complaint in this region is the lack of drainage structures and the resultant flooding which is common in this area. A detailed study for this area was performed as part of the ADMP Update.

Hydrologic/Hydraulic Significance (87th Avenue and Deer Valley Road Drainage Improvements): The upstream watershed that contributes to the proposed facilities is between 91st Avenue and 83rd Avenue south of the West Wing Mountains. The current drainage in this area is generally overland with some flow carried by the streets. Most of the streets in this area are at the same elevation as the finished floor of many of the adjacent residences, which is a main reason for the common flooding. The area also lacks outlets that would carry the flow downstream across Deer Valley Road.

Level of Protection: This Project provides 10-year protection in this area. However, when the Pinnacle Peak Road and 83rd Avenue Improvements recommended in the ADMP Update are constructed, the 87th Avenue and Deer Valley Road Drainage Improvements will provide 100-year protection.

The road swales, culvert crossings, and channel facilities are anticipated to maintain the drainage in accordance with the requirements set forth in Maricopa County Drainage Design Manual.

Area Protected: The proposed 87th Avenue and Deer Valley Road Drainage Improvements would provide protection to existing, proposed and future developments in the area bounded by Pinnacle Peak Road and Deer Valley Road between 83rd Avenue and 91st Avenue.

The watershed that is routed to this proposed project is approximately 1.8 square miles and the area protected by this proposed project is almost 1/2 square mile.

Environmental Quality: The proposed drainage improvements reduce maintenance costs associated with flooding and ponding water.

Area-wide benefits: The proposed drainage improvements give this area a drainage infrastructure, which is currently non-existent for a large portion of this area.

Total Project Cost: The estimate of costs for the **87th Avenue and Deer Valley Road Drainage Improvements** is $1,785,000. The City will continue to pursue participation from adjoining developments.

Level of Participation: The Flood Control District will fund this project in participation with the Maricopa County Department of Transportation.

Operation & Maintenance Costs: The main cost associated with the proposed improvements is the removal of sediment from the culverts that cross under Deer Valley Road. This maintenance would be performed as needed.

Operation & Maintenance Responsibility: The City would maintain the culverts under Deer Valley Road. Any major maintenance to the drainage facilities would be performed by Flood Control District.