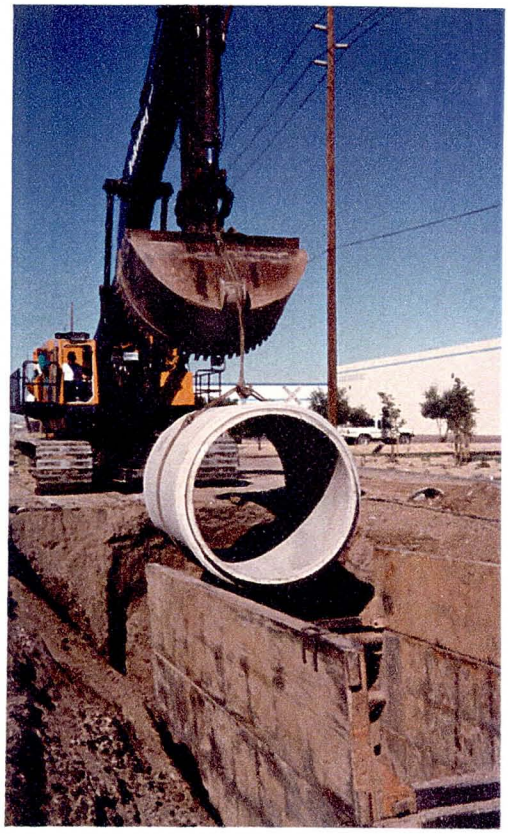
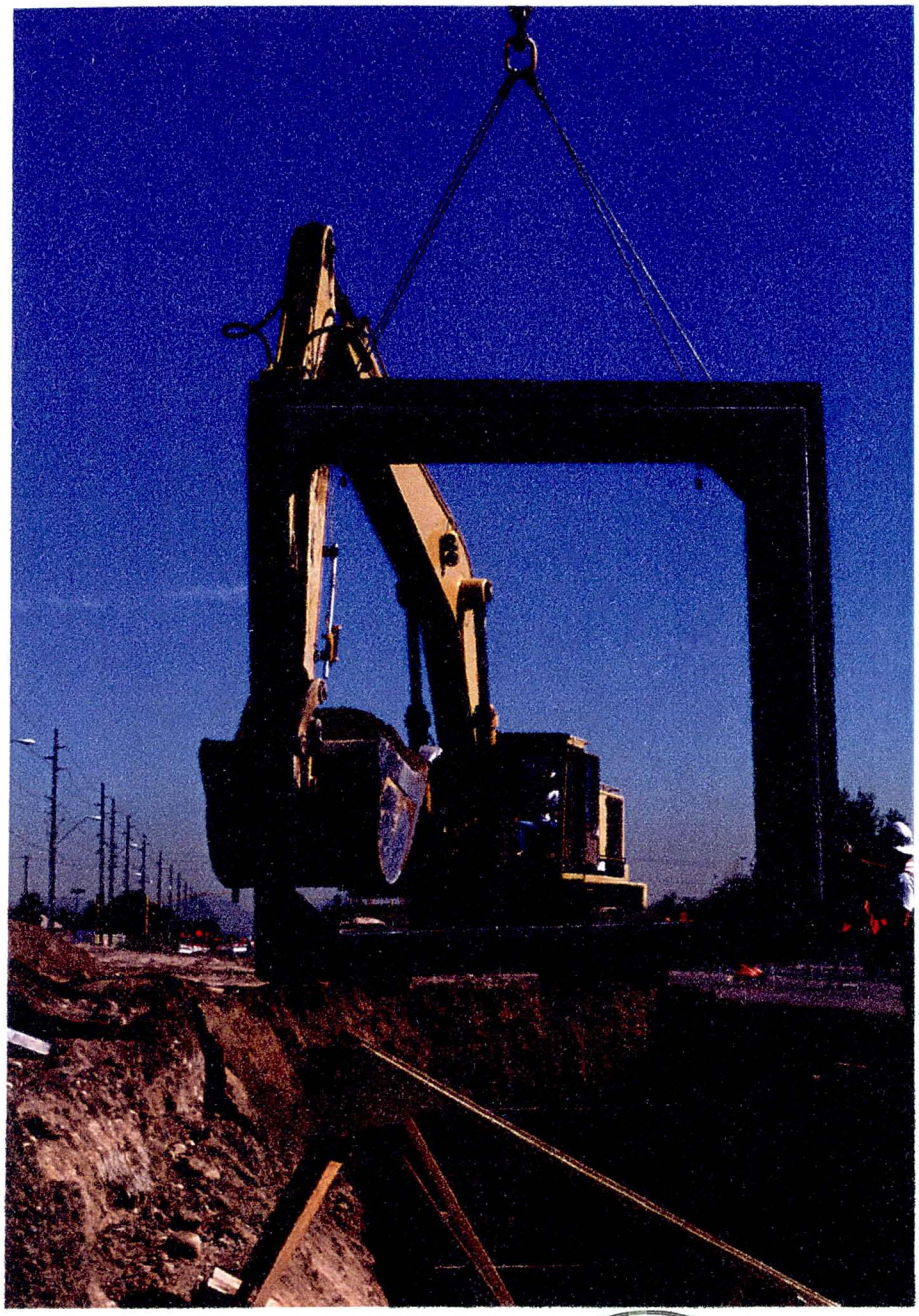
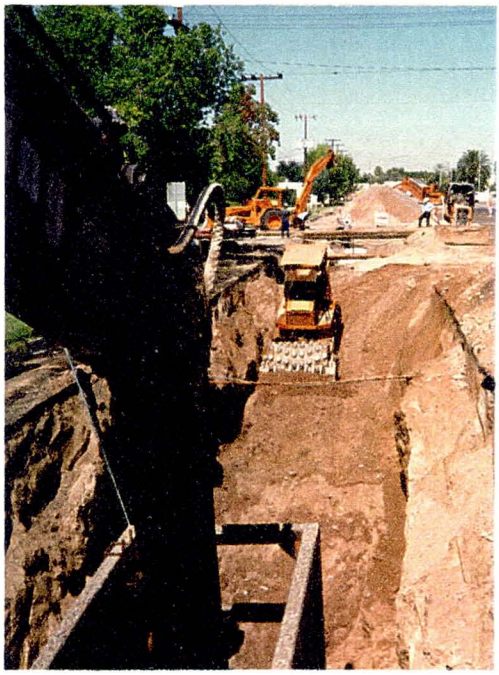
Northern/Orangewood Storm Drain Project

CONCEPT/ROUTING STUDY







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ASHOK C.
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Date Signed 3/14/96
ARIZONA, U.S.A.

Prepared for: Flood Control District of Maricopa County

Northern/Orangewood Storm Drain Project
CONCEPT/ROUTING STUDY

FCD Contract 94-12

March 14, 1996

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

Prepared by:
Wood, Patel & Associates, Inc.
1550 East Missouri
Suite 203
Phoenix, AZ 85014
WP # 94153

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	FINANCE		FILE
	C & M		
	ENGR		

REMARKS

March 14, 1996

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

Attn: Mr. R.W. Shobe, P.E.

Re: **Northern/Orangewood Storm Drain Project**
Concept/Routing Study
WP #94153

Dear Mr. Shobe:

We are pleased to submit ten (10) copies of the *Concept/Routing Study & Location Study* in conjunction with the *Northern/Orangewood Storm Drain Project*. A draft copy of the combined studies was submitted to the District on February 14, 1996. We have since incorporated your verbal review comments from that submittal into the enclosed individual studies. Per your direction, the small-scale alternative alignment-location study *(Location Study)* was separated from the draft report *(Concept/Routing Study)* and is being submitted as a separate document.

For your convenience, the *Concept/Routing Study* includes recommended storm drain alignments and the improvement costs. It is requested that the ADMP team (the District, City of Glendale, and City of Peoria) review the study and then approve the recommended storm drain alignments. In addition, please provide information on the availability of Capital Improvement Funds, fiscal years, and any suggestions as to each agency's priorities regarding the phasing of construction.

After receiving the ADMP team directions, Wood/Patel will prepare the Construction Phasing Plan, including 15% complete plans and profiles for the approved storm drain alignments.

Wood, Patel & Associates, Inc. • 1550 East Missouri, Suite 203 • Phoenix, Arizona 85014 • (602) 234-1344 • Fax (602) 234-1322
E-Mail: woodpatl@netzone.com

The entire *Concept/Routing Study* phase has been very exciting to us. As anticipated, the study has proved itself to be an excellent cost effective tool.

It is recommended that the District, and the Cities of Glendale and Peoria meet with Wood/Patel during the week of April 1, 1996 to discuss the studies and resolve any questions. We are looking forward to the next step - construction phasing plan and then the design of Phase I portion of the project.

Should you need any clarification, please feel free to contact us.

Sincerely,

WOOD, PATEL & ASSOCIATES, INC.

Ashok C. Patel, P.E., R.L.S.
Principal

ACP/djp

Enclosure

GENCOR\94153.M15

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Registered Professional Engineer (Civil) CERTIFICATE NO. 10512 ASHOK C. PATEL Date Signed 3/17/95 ARIZONA, U.S.A.

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Northern/Orangewood Storm Drain Project, Concept/Routing Study
Sheets 1 through 23 (full size) . . . . . Under Separate Cover

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APPENDIX III - STORM DRAIN PLAN/PROFILE SHEETS (at reduced size)

ACKNOWLEDGEMENTS

Wood, Patel & Associates, Inc. is pleased to have represented the Flood Control District of Maricopa County in preparation of this Concept/Routing Study for the Northern/Orangewood Storm Drain Project. This professional assignment presented many interesting and unique challenges requiring creative teamwork solutions.

Mr. R.W. Shobe, P.E. and Mr. Amir Motamedi of the Flood Control District of Maricopa County; Mr. Grant Anderson, P.E. and Mr. Daniel Sherwood, P.E. of the City of Glendale; and Mr. Dan Nissen P.E., and Mr. Bill Mattingly, P.E. of the City of Peoria provided critical technical support and decision-making guidance throughout the study phase.

Their individual and group contributions represent a key role in the successful and timely completion of this report.

We sincerely enjoyed these relationships and look forward to similar support through the construction phasing plan and subsequent design phases.

WOOD, PATEL & ASSOCIATES, INC.

Ashok C. Patel, P.E., R.L.S.
Principal

1.0 EXECUTIVE SUMMARY

On December 29, 1994, the Flood Control District of Maricopa County (District) entered into an agreement with Wood, Patel & Associates, Inc. (WPA) to perform a Concept/Routing Study for the Northern/Orangewood Storm Drain Project. This document is a result of that study. A phasing plan will be prepared upon acceptance of the study and detailed design plans will follow thereafter.

The storm drain project is located in Glendale and Peoria, Arizona. The Concept/Routing Study area is bounded by Butler Drive to the north, 63rd Avenue to the east, Glendale Avenue to the south, and the Agua Fria Freeway to the west. In Figure 1, Location Map, the dashed lines depict the Butler Drive, Northern Avenue, Orangewood Avenue, and Glendale Avenue storm drain alignments studied, including the contributing watershed shaded in cross hatch.

The original purpose of this study was to develop and evaluate storm drain routing schemes along the Orangewood Avenue and Northern Avenue alignments. Later in the study phase, Glendale Avenue and Butler Drive alignments were added to the concept evaluation.

The Concept/Routing Study is hereby presented to the District and the Cities of Glendale and Peoria with a number of storm drain alignment options and WPA's recommended option. These agencies, in turn, will review and select a recommended storm drain alignment scheme for further consideration. Once an alignment is selected, WPA will prepare preliminary plans (15% design) including phasing/cost analysis. The goal is that the selected alignments be built in phases that meet flood mitigation priorities while working within the District's Capital Improvement Program budget over a period of 5 to 6 years. Immediately following approval of the phasing/cost study, WPA will start design of construction Phase I of the selected alignment.

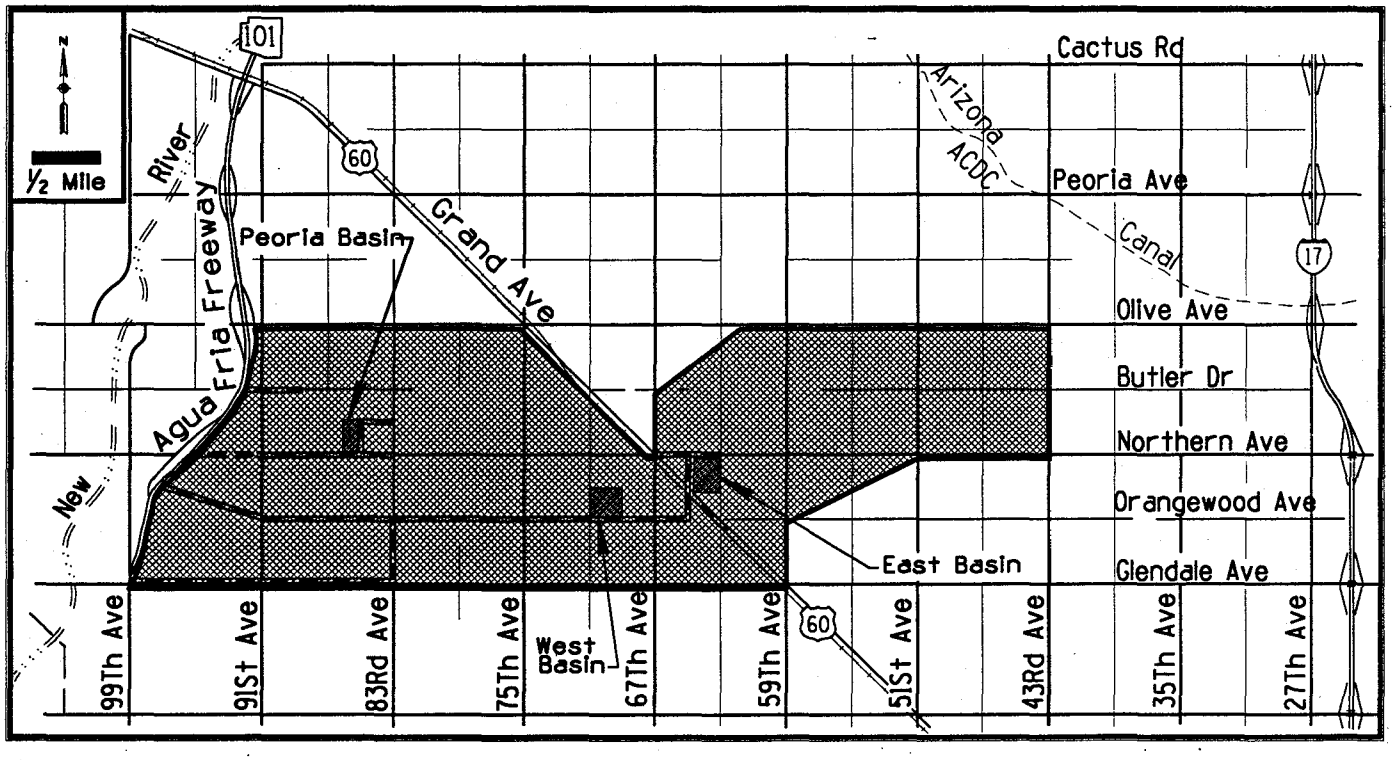

Figure 1, Location Map

Storm drain alignments evaluated in the Concept/Routing Study are depicted as dashed lines. The cross hatch shaded area represents the contributing watershed.

In the aforementioned Concept/Routing Study area, several alternative storm drain concept/routing plans were developed in the Glendale-Peoria area that would collect stormwater from both cities and convey it to the Agua Fria Freeway Outfall Channel which drains to the New River. These alternatives were then evaluated using a multi-criteria matrix procedure (Table 6-1) to determine an overall rating for each alternative. The following criteria were used for evaluation purposes:

- ease of construction;
- ease and cost of right-of-way acquisition;
- ease of utility crossings and traffic impacts;
- ease of construction phasing;
- compatibility of proposed detention basins to serve as parks;
- local community support, based on the ability of the option to serve the individual City's drainage needs;
- ADOT support (for Grand Avenue and Agua Fria Freeway Outfall Channel tie-ins); and
- capital cost.

The matrix evaluation showed that the most favorable alternative within the City of Glendale is the Orangewood Avenue storm drain alignment with a 39-acre detention/surge basin (referred in this report as East Basin) between 63rd Avenue and 65th Avenue south of Northern Avenue and an open channel outfall from 91st Avenue to the existing Agua Fria Freeway (AFF) Outfall Channel. In Peoria, a storm drain along Butler Drive from 87th Avenue to the AFF Outfall Channel and a storm drain along Northern Avenue from 83rd Avenue to 91st Avenue were obviously the most favorable alternatives. The existing 60-inch storm drain in Northern Avenue west of 91st Avenue will carry Peoria flows to the AFF Outfall Channel. In addition, the Peoria system will include an 18-acre detention/surge basin (Peoria Basin) west of 85th Avenue and north of Northern Avenue and several lateral storm drains adjacent to the recommended detention/surge basin.

The advantages of the above alternatives include:

- they are the lowest cost options;
- they follow routes that minimize traffic disruption and utility conflicts.

Table 1-1 on the following page summarizes the costs of the recommended options.

Since these costs are based on January, 1996 prices, the costs associated with phasing this project over a 5 to 6 year period should include an inflation factor.

Table 1-1, Cost/Benefit Summary for Recommended Options, includes the cost of basin land; right-of-way; engineering, construction, and contingencies (40%) related to construction administration. Some of these costs, e.g., basin costs, have been paid for out of a previously established $17 million budget for this project. Clarification as to the current status of monies expended on certain tasks and what yet needs to be completed on the project is addressed on Table 1-2. Table 1-2 also depicts a cost allocation of the recommended options.

TABLE 1-1

Concept/Routing Study
Cost/Benefit Summary for Recommended Options
(costs rounded to nearest $1000)

OPTION	*COST* *(a)*	*COST/BENEFIT DISTRIBUTION* *ADMP* *(b)*	*GLENDALE* *(c)*	*PEORIA* *(d)*	*ADOT* *(e)*
Peoria Watershed:					
Northern Ave./Butler Dr. alignment, Option B	$2,845,000	$2,038,000		$807,000	
Glendale Watershed:					
Orangewood alignment, Option 2B	$12,114,000	$11,235,000	$566,000		$313,000
TOTAL COST	$14,959,000	$13,273,000	$566,000	$807,000	$313,000

NOTES:
(a) Costs include Basin Land; Right-of way Acquisition; contingencies related to Engineering, Construction and Construction Administration (estimated 40%).
(b) ADMP costs to be shared by Agencies (FCDMC 50%, Glendale 25%,Peoria 25%)
(c) Extended Storm Drain Facility within Glendale service area also shared as per (b).
(d) Extended Storm Drain Facility within Peoria service area also shared as per (b).
(e) It is anticipated that ADOT will contribute this amount for improvements within Grand Avenue.

The Northern/Orangewood storm drain project includes a storm drain facility within ADOT's Grand avenue from 65th Avenue to 63rd Avenue (1,880 L.F.). The cost of this storm drain (estimated at $313,000) is anticipated to be funded by ADOT. Additionally, drainage from this storm drain is diverted into the proposed detention/surge basin at the southwest corner of Northern Avenue and 63rd Avenue (East Basin). This diversion is contributing approximately 22% of the total runoff intercepted by the basin. Cost share should be used (based on a percentage of the runoff contribution) as a guide for the improvement of this basin. ADOT would need to participate an estimated $923,000 toward the basin. This estimate (22% of the total cost) includes the land cost and basin improvements ($4,196,000 from Table II-7).

If the recommended Northern/Orangewood project is built and ADOT participates as described above, an estimated $3.6 million will be available from the original budget of $17 million for other projects. This report provides suggestions as to how the excess funds could be utilized to best serve the communities. Table 1-3 on page 8 summarizes some selected storm drain laterals which could be built from the excess funds. These laterals are listed below:

Glendale Watershed:

67th Avenue from Northern Avenue to Butler Drive (½ mile) 5-foot diameter storm drain for a cost of $489,000

Northern Avenue from 63rd to 59th Avenues (½ mile) 8-foot diameter storm drain for a cost of $1,018,000

Peoria Watershed:

Northern Avenue from 83rd to 79th Avenues (¼ mile) 5½-foot diameter storm drain and from 79th to 75th Avenues (¼ mile) 4½-foot diameter storm drain for a cost of $974,000.

TABLE 1-2

Concept/Routing Study
Budget & Cost Allocation of Recommended Options (a)
(costs rounded to nearest $1000)

The ADMP agencies have assigned a budgetary amount for the Northern/Orangewood Project. This tabulation summarizes the estimated project costs based on the recommended options using January 1996 Dollars.

Previously Assigned Amount:		**$17,000,000**
Expended Amount To Date:		
Land Costs		$2,191,000
1 36.92 acre basin @ Orangewood/71st Ave	$1,560,000	
2 18 acre basin @ Northern/85th Ave	$631,000	
Study Costs		$250,000
	Total Expended	**$2,441,000**
Amount Available for Improvements		***$14,559,000***

Here is how the funds will be used:

Glendale Watershed:		
Option 2B from Table II-7		
Storm Drain System		$7,425,000
ADMP	$6,859,000	
Glendale, Expanded Service Area	$566,000	
East Basin Land Cost Adjustments		$636,000
East Basin Improvement Costs		$1,950,000
Right-of-Way Costs for Storm Drains		$227,000
Grand Avenue Storm Drain (ADOT)		$313,000
Subtotal		**$10,551,000**
Peoria Watershed:		
Option B from Table II-2		
Storm Drain System		$1,070,000
ADMP	$718,000	
Peoria, Expanded Service Area	$352,000	
Peoria Basin Land Cost Adjustments		$0
Basin Improvement Costs		$675,000
Right-of-Way Costs for Storm Drains		$15,000
Subtotal		**$1,760,000**
	TOTAL COSTS	**$12,311,000**
ADOT Participation (Estimated)		($1,193,000)
Grand Ave Storm Drain	($313,000)	
East Basin, 22% Cost Share (Includes Land & Improvements)	($880,000)	
Amount Required for Improvements		***$11,118,000***
Amount Available for Expanded Area Improvements		***$3,441,000***

See Table 1-3

NOTES:
(a) Improvement Costs include contingencies related to Engineering, Construction & Construction Administration (estimated 40%).

TABLE 1-3

Concept/Routing Study
Use of Excess Fund For Expanded Area (a)
(costs rounded to nearest $1000)

The ADMP agencies have assigned a budgetary amount for the Northern/Orangewood Project. This tabulation summarizes the use of excess fund availablity and suggested use of these funds.

Excess Amount Available for Improvements Within Expanded Area ***$3,441,000***
From Table 1-2

Here is how the excess funds can be used:

Glendale Watershed:

Storm Drain System		$1,507,000
67th Ave From Northern to Butler	$489,000	
Northern From 63rd to 59th Ave.	$1,018,000	
Subtotal		**$1,507,000**

Peoria Watershed:

Storm Drain System ½ mile @ 66" & 54"		$974,000
Northern From 83rd to 75th Ave $696,000	$974,000	
Subtotal 40% contingency		**$974,000**
	TOTAL COSTS	**$2,481,000**

Amount Required for Improvements Within Expanded Area ***$2,481,000***

NOTES:
(a) Costs include contingencies related to Engineering, Construction & Construction Administration(estimated 40%).

2.0 INTRODUCTION

2.1 Background

The Flood Control District of Maricopa County (District) was established to control countywide drainage and flooding for the protection of life and property. In order to identify and correct drainage problems and flood prone areas, the District first initiates Area Drainage Master Studies (ADMS's) and Area Drainage Master Plans (ADMP's).

The District, in association with the Cities of Glendale and Peoria, sponsored a combined ADMP for the two cities. Camp Dresser & McKee, Inc. and James M. Montgomery, Consulting Engineers, Inc. were contracted to develop the *"Glendale-Peoria Area Drainage Master Plan"*. The *Glendale/Peoria ADMP* was completed in May of 1987.

The *Glendale-Peoria ADMP* recommended three (3) main storm drain facilities which were identified as:

1. Cactus Road
2. Olive Avenue
3. Northern Avenue/Orangewood Avenue.

Since the completion of the *Glendale-Peoria ADMP*, the Cactus Road drainage facilities have been designed and constructed. The Olive Avenue facilities have been designed and construction has started.

The District, together with Glendale and Peoria have allocated a $17 million budget for the Northern Avenue/Orangewood Avenue drainage facilities. Prior to commencing with the design of the recommended facilities, a more detailed study is required in order to establish storm drain sizes, optimum locations/alignments, detention basin volumes/locations, estimated costs, project impacts, etc.

The District entered into an agreement with Wood, Patel & Associates, Inc. (WPA) to perform the more detailed study called *"Northern/Orangewood Storm Drain Project Concept/Routing Study*.

2.2 Location

The study area is located in central Maricopa County, falling within the jurisdictions of the Cities of Glendale and Peoria as well as unincorporated areas of Maricopa County. The *Concept/Routing Study* area is bounded by Butler Drive to the north, 63rd Avenue to the east, Glendale Avenue to the south, and the Agua Fria Freeway to the west. See Figure 1, Location Map for an illustration of the study area limits.

2.3 Purpose

The original purpose of this study was to develop and evaluate storm drain routing schemes along the Orangewood Avenue and Northern Avenue alignments. Later in the study phase, Glendale Avenue and Butler Drive alignments, together with the East Basin, were added to the concept evaluation.

The Concept/Routing Study is prepared for the District and the Cities of Glendale and Peoria with a number of options. These agencies, in turn, will review and select a recommended storm drain alignment scheme for further consideration. Once an alignment is selected, WPA is to prepare preliminary plans (15% design) including phasing/cost analysis. To facilitate this task, the District will provide budgetary data over a period of 5 to 6 years to be used in the phasing/cost analysis. The goal is that the selected alignments be built in phases that meet flood mitigation priorities while working within the budgetary requirements over a period of 5 to 6 years. Immediately following the phasing study, WPA is to start design of Phase I of the selected alignment.

2.4 Scope of Work

The Scope of Work consists of providing professional engineering services necessary for the Concept/Routing Study and the Construction Phasing Plan of a 10-year storm drain for the City of Glendale along Orangewood Avenue with

laterals on 65th Avenue, including a 35-acre detention/surge basin (referred in this report as West Basin). Pipe size ranges from 3 feet to 12 feet in diameter. The Scope also includes a Peoria storm drain along Northern Avenue east of 91st Avenue, together with an 18-acre detention/surge basin (referred in this report as the Peoria Basin). The Peoria system is based on a 2-year frequency storm.

During the initial phase of this study, the Scope was modified and the Glendale Avenue and East Basin alignments were added within the City of Glendale. Likewise, the Butler Drive alignment was added in the City of Peoria.

The Scope of Work included several engineering phases. The Concept/Routing Study is performed as part of Contract Phase 1. This phase also includes a Construction Phasing Plan; which is to be performed immediately after the selection of storm drain alignments from the study. A separate fee proposal from WPA will be negotiated for the subsequent design phases following the Construction Phasing Plan.

Contract Phase 1:

In the first phase, the storm drain Concept/Routing Study is to be conducted. To complete this phase, several subtasks (location study; surveying; utility evaluation; as well as hydrologic, hydraulic, and cost analyses) are required.

The storm drain Concept/Routing Study is to be submitted for the agencies' review and approval. The District and the Cities of Glendale and Peoria will select the alignments of the storm drains including the detention/surge basin scheme to be used in the design phases.

Subsequent to the Concept/Routing Study, a detailed Construction Phasing Plan will be developed. The plan will be based upon the following considerations: capital improvement costs, hydrologic impacts, hydraulic effectiveness, future connections, and financial constraints. Input from the District and the Cities of Peoria and Glendale will also be used to develop the Construction Phasing Plan.

The Construction Phasing Plan will identify recommended construction phases (e.g., Phase I, II, III, and IV) for this project.

WPA is to submit a separate fee proposal for the Phase I design.

2.5 Previous Studies

Several major drainage/design studies prepared in the project area are relevant to this study. These studies have been utilized, as appropriate, in the preparation of this Concept/Routing Study.

Glendale-Peoria Area Drainage Master Plan, May, 1987
The District prepared an Area Drainage Master Plan through Camp Dresser & McKee, Inc. and James M. Montgomery Consulting Engineers, Inc. in May, 1987. The study evaluated and recommended a comprehensive system of storm drains and detention facilities. Per the study recommendation:

- Olive Avenue Storm Drain and Detention Basin outfall system is already built.

- Cactus Road Storm Drain Phase I is already built and Phase II is being initiated for construction.

- Northern/Orangewood Project (this study) is being refined by the Concept/Routing Study to finalize the most optimum storm drain alignment prior to going to the design phase.

Olive Avenue Storm Drain, 67th Avenue to the Outer Loop Freeway, Detention basin Alternatives, July, 1988
This study was performed by Boyle Engineering Corp. for the District. Several detention basin sites were investigated along Olive Avenue for their effectiveness and cost feasibility.

91st Avenue from Glendale Avenue to Northern Avenue, May, 1986
In 1986, Morrison-Knudson Engineers, Inc. performed a storm drain analysis for Northern Avenue in between 91st Avenue and the Agua Fria Freeway channel. The analysis was based upon the preliminary results of the *Glendale-Peoria ADMP*. Subsequently, a 60-inch pipe was designed and built along Northern Avenue.

Cactus Road Storm Drain, Hydrology Summary, September, 1992
SFC Engineering Company performed a hydrologic analysis in September of 1992 in conjunction with the Cactus Road Storm Drain between 67th Avenue and the Agua Fria Freeway channel. In December, 1995, Phase I of Cactus Road Storm Drain was built and Phase II was initiated for the construction phase.

75th Avenue (Glendale Avenue-Olive Avenue), Design Concept Report, November, 1994
Maricopa County Department of Transportation initiated a Design Concept Report for 75th Avenue roadway improvements. The report, prepared by Burgess & Niple, Inc. included a storm drain pipe along this alignment. The pipe size was based on a 10-year storm runoff generated by area within the right-of-way. Ultimately, the storm drain proposed in 75th Avenue will outfall into the Northern Avenue storm drain system.

2.6 Data Collection

The data collection phase was intended to identify sources of data, to collect the data, meet with relevant parties, and review and evaluate pertinent data. The information thus obtained served as a reference for later planning phases of the study. Data collection was an ongoing procedure throughout the project; development activity is dynamic and new information was continuously uncovered.

The following list describes the type of data which was collected for the *Concept/Routing Study*:

- Previous drainage reports
- Existing topographic data
- As-built or design plans for critical locations including paving, storm drain, sewer line, and water line plans.
- Field survey of sewer inverts at critical locations
- Field survey of critical roadway intersections
- Aerial photographs
- Soil and land use data

- ADOT Highway design plans
- Input from the AT&SF Railroad
- ADOT's input on Grand Avenue and the AFF channel.

3.0 HYDROLOGY

3.1 Introduction

This section documents the engineering procedures and methodologies used to generate the hydrologic models for this project. The hydrologic models were used in the preparation of conceptual design and routing plans for the Northern/Orangewood Storm Drain Project. This objective has been accomplished by developing HEC-1 models to estimate the 2-year (for Peoria) and the 10-year (for Glendale) peak discharge values for the 6-hour duration storm for concentration points along the proposed storm drains.

WPA has incorporated input from the District into this hydrologic analysis. This input resulted from several meetings and ongoing correspondence with the District during the course of the project.

3.2 Study Parameters

3.2.1 Rainfall Data

Two storm frequencies are used for analysis in this study. The 2-year 6-hour storm is used for the Peoria Watershed (north of Northern Avenue and west of Grand Avenue). The 10-year 6-hour storm is used for the remainder of the project watershed (referred to as the Glendale Watershed), which includes Glendale and some areas of unincorporated Maricopa County. The use of the above storm frequencies is in accordance with the respective cities' storm drain design requirements, and per the *Glendale-Peoria ADMP* guidelines.

Rainfall distributions based on watershed area for the 6-hour duration storm were furnished by the District and are listed in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology (Hydrology Manual).* There are a total of five precipitation patterns for the 6-hour storm. Each precipitation pattern is valid for a particular range of watershed area. The contributing watershed area and corresponding precipitation pattern were determined and input into the HEC-1 model using the PB and PC record option.

Point precipitation values used in this study were derived from the isopluvial maps in the *Hydrology Manual* which, in turn, were derived using the NOAA Atlas II, Volume VII. Average point precipitation values for the entire watershed were estimated for the storm events under consideration. Point precipitation values used for the various storm frequencies and durations are summarized in Table 3-1.

Note that, in the Peoria Watershed, the 10-year 6-hour storm was modeled in addition to the 2-year 6-hour storm model for reasons discussed in section 3.4.4.

3.2.2 Areal Precipitation Reduction

The precipitation reduction for the 6-hour duration storm is based on the depth-area curve presented in Figure 2.14 in the *Hydrology Manual*. This curve was developed for the historic storm of 1954 over the Queen Creek area by the U.S. Army Corps of Engineers in 1974. Depth-area reduction was simulated in HEC-1 by reducing the precipitation depth of the PC record.

Table 3-1 below summarizes the revised precipitation reduction factors used in the hydrologic analyses.

Table 3-1

Precipitation Depths and Areal Reduction Factors

Storm Frequency, yrs	Storm Duration, hrs	Precipitation Depth, in	Watershed Area, sq mi	Areal Reduction Factor
2 (Peoria)	6	1.2	2.6	.976
10 (Peoria)	6	2.0	2.6	.98
10 (Glendale)	6	2.0	7.5	.95

3.2.3 Soil Data

Soil textures for the study area were obtained from the *Soil Survey of Maricopa County, Arizona, Central Part,* (SCS Soil Survey), prepared by the United States Department of Agriculture, Soil Conservation Service, not dated (preliminary). Soil map unit areas were measured using a digital planimeter by superimposing the sub-basin boundaries on the SCS soil map.

3.2.4 Land Use Data

One of the variables affecting runoff is land use; the way land is developed. Land use categories could include commercial, industrial, residential, park areas, agricultural, or open desert.

Existing condition land use data for the study area were collected by inspection of aerial photographs and during field visits. Future condition land use data were obtained from the *Glendale General Plan - Development Guide*, the *Glendale Zoning Map*, and the *Peoria Comprehensive Master Plan*.

3.2.5 Retention

It was assumed that currently undeveloped areas (for example, agricultural land use) will be required to retain the 100-year, 2-hour storm as they develop (per City of Glendale, City of Peoria and Maricopa County requirements). The only flow that these areas would contribute in the future (developed) condition during a 2-year or 10-year storm would be runoff from pavement. In the *Glendale-Peoria ADMP* it was assumed that 15 percent of these sub-basin areas would contribute flow. The current detention guidelines for all jurisdictions within the watershed are more stringent than those used for the *ADMP*. Therefore, per input from the District, it is assumed for purposes of this study that **10 percent** of these sub-basin areas will contribute flow. Paved surfaces are assigned an impervious value of 95 percent.

3.2.6 Existing vs. Future Condition Analyses

In order to determine the worst case scenario, the watershed was analyzed for both the existing and future land use conditions. In the

future condition, it was assumed that the entire lateral storm drain system for individual cities outlined in the *Glendale-Peoria ADMP* would be in place. The storm drain sizes estimated in the *ADMP* were used for routing flows in this hydrologic analysis.

Upon analysis of the watershed north of Northern Avenue and west of Grand Avenue, it was determined that the future condition models produced the largest peak flows. It was assumed that the future condition would govern throughout the watershed. The sub-basin delineations on the HEC-1 schematic diagram (Exhibit A) are based on the future condition for the design flow.

3.3 Watershed Description and Flow Patterns

The total project watershed is approximately 10.2 square miles in area. Exhibit A shows the watershed boundary delineation. The study area is bounded on the north by Olive Avenue, on the east by 43rd Avenue, on the south by Orangewood Avenue, and on the west by the Agua Fria Freeway. The watershed is urbanized east of Grand Avenue, with several islands of agricultural land use. Agricultural land use is predominant west of Grand Avenue, with some industrial and residential land uses.

Slopes within the study area are fairly flat, on the order of 0.2 to 0.3 percent. The land slopes generally toward the southwest, but there are some agricultural fields where the land leveling has routed runoff to the west or to the south. The watershed area ranges in elevation from a low of 1066.7 MSL at the intersection of Glendale Avenue and 99th Avenue to a high of 1208 MSL at the intersection of 43rd Avenue and Olive Avenue.

Typical soil types are loams, sandy loams, and clay loams. Refer to Exhibit B for a Soil Map.

- **East of Grand Avenue**
  Most streets east of Grand Avenue have curb and gutter, meaning that all or a portion of the 10-year flow will be diverted along the street alignments rather than bypass the streets. Since the general direction of

flow is from northeast to southwest, flow splits and confluences will occur at major intersections.

This flow pattern is modeled by the use of numerous divert operations in HEC-1; runoff from each sub-basin upstream from a future storm drain is split into two components, a westward flow and a southward flow. See Exhibit A for an illustration of the flow pattern. This methodology is discussed in further detail in section 3.4.4.

Runoff originating in Glendale east of Grand Avenue is impeded by the AT&SF railroad parallel to Grand Avenue. Flow can cross the railroad at several points, including a trestle approximately 1,000 feet south of Northern Avenue and through a 42" pipe north of Northern Avenue.

These crossings were designed to accommodate storm runoff within and adjacent to Grand Avenue and have a relatively small capacity.

- **West of Grand Avenue**

  West of Grand Avenue, most streets in the existing project watershed are without curb and gutter, and thus have less capacity to carry flow. In these areas, the flow patterns tend to follow the general topography rather than the street grid. The exception to this is the Peoria residential areas west of 83rd Avenue, where curb and gutter exists and local adverse grading will direct flow towards the east for short distances.

  In the future condition, which is the condition used for the storm drain design, it is assumed that all arterial and collector streets will have curb and gutter.

  The watershed west of Grand Avenue also contains irrigation supply and tailwater ditches. One notable supply ditch runs north-south on the west side to 75th Avenue. This ditch currently has the capacity to divert flow approaching it from the east to the south. Discussions with the District indicated that the canal will likely be tiled prior to development. Therefore, divert routines were not included for this location in the future condition HEC-1 model.

3.4 Methodology

The study watershed area was modeled utilizing methodology set forth in the *Hydrology Manual*. As discussed earlier, the watershed was modeled for the 2-year 6-hour and the 10-year 6-hour storms.

The temporal rainfall distributions suggested in the *Hydrology Manual* were used for the 6-hour duration storm. The Phoenix Valley S-graph was used for unit hydrograph development. Rainfall losses were estimated using the Green-Ampt infiltration equation. Hydrographs were routed through both the Glendale and Peoria Watersheds using kinematic wave channel and pipeline routing. The watershed was modeled using the U.S. Army Corps of Engineers HEC-1 computer program, version 4.0.1E, dated May, 1991.

3.4.1 Interception and Infiltration Losses

Rainfall losses were estimated using the Green-Ampt infiltration equation. The procedures used are described in the following paragraphs.

The hydraulic conductivity at natural saturation (XKSAT), volumetric soil moisture deficit at the start of rainfall (DTHETA), and wetting from capillary suction (PSIF) parameters were estimated for each sub-basin by first calculating composite XKSAT values based on area. Composite values of XKSAT were calculated for each sub-basin using the District's spreadsheet SGRAPH.WK1 after the soil unit areas were measured.

The composite (unadjusted) XKSAT parameter was calculated by averaging the common logarithm of the XKSAT values using area weighting. This was accomplished by multiplying the total area of each soil map unit in the sub-basin by the common logarithm of the associated XKSAT value. The resultant products were then totalled and the sum was divided by the total area of the sub-basin. The result is the composite log-average XKSAT parameter. The log-average XKSAT parameter was then adjusted for the effects of vegetation cover using Figure 4.3 of the *Hydrology Manual.* This procedure was also automated by the District spreadsheet SGRAPH.WK1. The source of the vegetation cover density values is discussed in the Land Use Characteristics section.

The DTHETA parameters were read from lookup tables within the spreadsheet using the unadjusted XKSAT value calculated as described above. Two DTHETA conditions are possible, dry and normal. The "dry" condition was used for the "open" land-use category (undeveloped, unmaintained land). The "normal" condition was used for all other land-uses occurring within the project watershed. Both of the DTHETA values were read from the lookup tables corresponding to the unadjusted XKSAT value, and were averaged by land-use area-weighting within the spreadsheet. The value of PSIF was also read from lookup tables based on the unadjusted XKSAT value.

A summary of sub-basin soil map unit areas, land-use classifications, and Green-Ampt parameters used in the HEC-1 models is provided on the spreadsheet printouts in Appendix I.

3.4.2 Land-use Characteristics

Future land-use characteristics of the study area include agricultural, industrial, commercial, and residential. Surface characteristics affecting the hydrology include terrain (land-use classification), the proportion of impervious surfaces and vegetative cover density. These surface characteristics were used to calculate sub-basin composite values of initial abstraction (IA), percent impervious (RTIMP), and the vegetative cover adjustment to hydraulic conductivity (XKSAT).

A tabulation of land-use classifications by sub-basin is provided in Table 3-2. In that table, the "contributing area" column represents the sum of all land-use categories except future development, plus 10 percent of the future development area, as discussed in the Study Parameters section under "retention." The land-use areas in Table 3-2 were transferred to the SGRAPH.WK1 spreadsheet as percentages of the contributing area.

TABLE 3-2
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Glendale Watershed

Zoning Classification Areas in Square Miles
FUTURE CONDITION

Subarea ID	True Area, sq mi	Contributing Area, sq mi	10 % of Non-Contrib.	LAND USE CLASSIFICATION COM	MDR	MFR	VLDR	IND	PARK	AG	FUTURE DEVEL.
10	0.2154	0.2029	0.0014	0.0480	0.1535						0.0139
20	0.2500	0.2265	0.0026	0.0259	0.1297	0.0684					0.0261
30	0.3163	0.3163		0.0414	0.2278	0.0471					
40	0.2500	0.2500			0.1894					0.0606	
50	0.2500	0.1625	0.0097	0.0155	0.0871	0.0158			0.0080	0.0265	0.0972
60	0.5000	0.4574	0.0047	0.0170	0.2545	0.0663			0.0679	0.0470	0.0473
70	0.2216	0.1602	0.0068	0.0914	0.0620						0.0682
80	0.2236	0.1494	0.0082	0.0039		0.1372					0.0825
90	0.0525	0.0138	0.0043			0.0095					0.0430
100G	0.5000	0.4076	0.0103	0.0161	0.0834	0.1616		0.0554	0.0807		0.1027
110	0.4022	0.3758	0.0029	0.0839	0.1263	0.0846		0.0237	0.0545		0.0293
111	0.0329	0.0144	0.0021	0.0123							0.0206
115	0.0526	0.0526							0.0526		
120G	0.0752	0.0487	0.0030					0.0457			0.0295
125	0.0432	0.0268	0.0018					0.0250			0.0182
130	0.0623	0.0341	0.0031					0.0310			0.0313
140G	0.0606	0.0606						0.0606			
150	0.0622	0.0062	0.0062								0.0622
160	0.0682	0.0225	0.0051					0.0174			0.0508
170	0.2500	0.0556	0.0216					0.0340			0.2160
180G	0.2500	0.0813	0.0188		0.0625						0.1875
190	0.2063	0.0356	0.0190					0.0166			0.1897
200	0.1859	0.0186	0.0186								0.1859
210	0.2500	0.0250	0.0250								0.2500
220	0.2500	0.0250	0.0250								0.2500
230	0.1269	0.0127	0.0127								0.1269
240	0.1368	0.0931	0.0049	0.0285				0.0597			0.0486
250	0.2100	0.2100		0.0948		0.1152					
260	0.2400	0.1196	0.0134	0.0246	0.0743	0.0073					0.1338
270	0.2500	0.0678	0.0202		0.0240	0.0236					0.2024
280	0.2500	0.1075	0.0158	0.0051	0.0300	0.0566					0.1583
290	0.1988	0.0724	0.0141	0.0028		0.0555					0.1405
300	0.2356	0.0273	0.0231	0.0042							0.2314
310	0.2500	0.0513	0.0221					0.0292			0.2208
320	0.2500	0.0250	0.0250								0.2500
330	0.2100	0.0210	0.0210								0.2100

COM Commercial
IND Industrial
LDR Low-Density Residential
MDR Medium-Density Residential
MFR Multi-Family Residential
AG Agricultural

TABLE 3-2
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT

02/12/96

Peoria Waterhsed

Zoning Classification Areas in Square Miles
FUTURE CONDITION

Subarea ID	True Area, sq mi	Contributing Area, sq mi	10 % of Non-Contrib.	LAND USE CLASSIFICATION COM	IND	MDR	LDR	MFR	VLDR	AG	FUTURE DEVELOPMENT
10A	0.0294	0.0294			0.0294						
10B	0.0861	0.0086	0.0086								0.0861
10C	0.0133	0.0133							0.0133		
20A	0.0744	0.0744			0.0744						
20B	0.0853	0.0085	0.0085								0.0853
20C	0.0303	0.0030	0.0030								0.0303
30A	0.0315	0.0315			0.0315						
40A	0.1128	0.1128			0.1128						
40C	0.0289	0.0029	0.0029								0.0289
40D	0.0256	0.0026	0.0026								0.0256
40E	0.0317	0.0317			0.0317						
50A	0.1307	0.1307			0.1307						
50B	0.1189	0.0143	0.0116	0.0027							0.1162
60A	0.0261	0.0261			0.0261						
60B	0.0272	0.0027	0.0027								0.0272
60C	0.0040	0.0040		0.0040							
60D	0.1857	0.0186	0.0186								0.1857
70A	0.0625	0.0063	0.0063								0.0625
70B	0.0593	0.0059	0.0059								0.0593
80A	0.0208	0.0208			0.0208						
80B	0.1210	0.0121	0.0121								0.121
90A	0.0496	0.0496			0.0496						
90B	0.0604	0.0060	0.0060								0.0604
90C	0.0090	0.0090			0.009						
90D	0.0170	0.0017	0.0017								0.017
90E	0.0278	0.0278			0.0278						
90F	0.0124	0.0012	0.0012								0.0124
100P	0.1326	0.1326					0.0767		0.0559		
110A	0.0536	0.0536					0.0536				
110B	0.0417	0.0042	0.0042								0.0417
120P	0.0278	0.0278							0.0278		
140P	0.0402	0.0402								0.0402	
150A	0.1212	0.1212		0.0155			0.0815			0.0242	
160A	0.0610	0.0061	0.0061								0.061
160B	0.1448	0.0145	0.0145								0.1448
170P	0.1040	0.1040					0.104				
180P	0.0523	0.0523					0.0523				
190A	0.1069	0.0107	0.0107								0.1069
190B	0.0188	0.0019	0.0019								0.0188
200A	0.0446	0.0446					0.0373	0.0073			
200B	0.0277	0.0028	0.0028								0.0277
210A	0.0577	0.0058	0.0058								0.0577
210B	0.1174	0.0117	0.0117								0.1174
210C	0.0206	0.0021	0.0021								0.0206

LAND USE CLASSIFICATIONS:

Symbol	Description
COM	Commercial
IND	Industrial
VLDR	Very Low Density Residential
LDR	Low-Density Residential
MDR	Medium-Density Residential
MFR	Multi-Family Residential
AG	Agricultural

The initial abstraction (IA) parameter was estimated based on terrain classification characteristics, that is, "developed (residential and commercial)" or "agricultural". This methodology is based on the *Hydrology Manual*, in which values ranging from 0.05 inches to 0.20 inches are recommended for developed areas, and 0.50 inches is recommended for agricultural land-use. In this analysis, an IA value of 0.15 inch was used for commercial, industrial, residential, and city park areas. A value of 0.05 inch was used for pavement and 0.50 inch was used for agricultural areas. Percentages of area of each terrain type were estimated for all sub-basins by inspection of aerial photographs and zoning projection maps. The sub-basin average IA value was also calculated in the spreadsheet SGRAPH.WK1 using an area-weighting procedure.

Refer to the spreadsheet printouts in Appendix I for a tabulation of land-use classifications and weighted IA values by sub-basin.

The vegetation density values listed for each sub-basin in the spreadsheet printouts were based on inspection of aerial photos and on observations made during the field reconnaissance. For purposes of consistency throughout the model, the following vegetative cover values were used in all sub-basins:

Land-use	Vegetative Cover, %
Commercial	15
Industrial	10
Residential	20
Agricultural	5
Parks	85

Note that the agricultural land-use vegetation cover estimate is based on the assumption that the fields are in a fallow condition. This represents the worst-case scenario in terms of runoff potential.

The values of RTIMP corresponding to the above land-use classifications recommended by the District in the SGRAPH.WK1 spreadsheet were used for this project. A value of 100-percent effective was used for the impervious area in all sub-basins. This is because in the urban setting, most impervious areas are composed of rooftops and pavement, which are often adjacent to each other. Flow leaving rooftops often falls on pavement or flows over only a short distance of soil before reaching pavement, thus creating a fairly continuous impervious path for runoff.

3.4.3 Unit Hydrographs

S-Graphs

The *Hydrology Manual* lists two types of s-graphs approved for use in Maricopa County. These are the Phoenix Mountain S-Graph and the Phoenix Valley S-Graph. The Clark unit hydrograph was tested on several sub-basins, but was eliminated from further consideration because the calculated times of concentration far exceeded the time of the most intense rainfall excess. Following discussion with the District, the Phoenix Valley S-Graph was used for all sub-basins in the study. A separate S-Graph-based unit hydrograph was generated for each sub-basin by the use of the computer program MCUHP2. This program was written by the District and is furnished with the *Hydrology Manual*. This program creates a set of unit hydrograph (UI) records for direct input into HEC-1. Table 3-3 summarizes the S-Graph parameters used for each sub-basin.

Lag Times

A lag time for each sub-basin was evaluated using the following equation:

$$\text{lag} = C \frac{(LL_{ca})^m}{S^p}$$

where lag = basin lag time in hours, and

L = length of the longest watercourse in miles

L_{ca} = length along the watercourse to a point opposite the centroid in miles

TABLE 3-3
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Glendale Watershed

Phoenix Valley S-Graph Unit Hydrograph 02/12/96
Parameter Summary
FUTURE CONDITION

Subarea ID	*Length, miles*	*Lca, miles*	*Kn*	*Slope ft/mi*	*Basin Lag (min)*
10	0.9470	0.4640	0.0551	15.95	34.30
20	0.9091	0.4545	0.0550	15.18	33.79
30	1.2595	0.5871	0.0552	12.39	43.94
40	1.0000	0.5000	0.1756	16.70	113.83
50	1.0000	0.5000	0.1599	15.20	105.50
60	1.5000	0.5606	0.1798	17.07	141.41
70	1.3636	0.4545	0.0546	17.16	38.21
80	1.0000	0.5000	0.0544	18.80	34.50
90	0.7936	0.5316	0.0509	19.78	29.95
100G	1.5000	0.7500	0.1533	14.47	138.93
110	1.0227	0.4167	0.1272	7.82	89.59
111	0.3409	0.1894	0.0532	7.92	18.26
115	0.1231	0.1184	0.5520	81.23	69.12
120G	0.4830	0.2178	0.0544	15.94	19.66
125	0.4451	0.3030	0.0543	20.00	20.66
130	0.5000	0.2500	0.0539	18.60	20.22
140G	0.5000	0.2500	0.0552	10.00	23.29
150	0.5000	0.2500	0.0414	12.00	16.87
160	0.5000	0.2500	0.0521	15.00	20.34
170	1.0000	0.5000	0.0498	13.90	33.45
180G	1.0000	0.5000	0.0520	14.10	34.81
190	1.0000	0.5000	0.0478	7.20	36.38
200	1.0000	0.5000	0.0414	12.50	28.35
210	1.0000	0.5000	0.0414	13.50	27.94
220	1.0000	0.5000	0.0414	20.17	25.89
230	0.9167	0.4167	0.0414	7.42	28.26
240	0.7102	0.2936	0.0545	22.53	23.92
250	0.9659	0.7481	0.0552	18.64	40.30
260	1.0000	0.5000	0.0537	14.30	35.82
270	1.0000	0.5000	0.0511	13.89	34.29
280	1.0000	0.5000	0.0532	15.30	35.04
290	1.0000	0.5000	0.0525	18.40	33.42
300	1.0000	0.5000	0.0435	15.90	28.47
310	1.0000	0.5000	0.0493	11.80	34.10
320	1.0000	0.5000	0.0414	18.00	26.45
330	0.9091	0.4545	0.0414	15.18	25.41

TABLE 3-3
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Peoria Watershed

Phoenix Valley S-Graph Unit Hydrograph 02/12/96
Parameter Summary
FUTURE CONDITION

Subarea ID	*Length, miles*	*Lca, miles*	*Kn*	*Slope ft/mi*	*Basin Lag (min)*
10A	0.2348	0.1061	0.0552	17.03	11.40
10B	0.5114	0.3220	0.0621	23.47	24.74
10C	0.3788	0.0852	0.0552	5.28	15.72
20A	0.5000	0.2102	0.0552	16.00	19.94
20B	0.6193	0.3371	0.0621	19.38	28.08
20C	0.4735	0.2557	0.0621	19.01	22.91
30A	1.4773	0.2784	0.0552	6.84	39.36
40A	0.2841	0.0852	0.0552	28.16	10.25
40C	0.3788	0.1553	0.0621	23.76	16.69
40D	0.3314	0.0947	0.0621	15.09	14.33
40E	0.2557	0.1184	0.0552	31.29	10.94
50A	0.6193	0.2869	0.0552	21.80	22.96
50B	0.7197	0.3598	0.0608	20.84	29.42
60A	0.2670	0.1288	0.0552	14.98	13.21
60B	0.3504	0.1752	0.0621	12.84	19.07
60C	0.1420	0.0710	0.0552	14.08	8.39
60D	0.7386	0.1193	0.0621	11.51	22.34
70A	0.4735	0.2367	0.0621	9.72	25.27
70B	0.4924	0.2462	0.0621	7.11	27.63
80A	0.1932	0.0852	0.0552	15.53	9.91
80B	0.7367	0.3598	0.0621	18.60	30.99
90A	0.3314	0.1326	0.0552	18.10	13.98
90B	0.4735	0.2367	0.0621	9.50	25.38
90C	0.1610	0.0805	0.0552	12.42	9.44
90D	0.2652	0.1420	0.0621	7.54	17.52
90E	0.3542	0.1761	0.0552	31.06	14.42
90F	0.2273	0.1136	0.0621	11.00	14.13
100P	0.9754	0.5019	0.0552	20.50	34.13
110A	0.5492	0.1894	0.0552	16.39	19.77
110B	0.3409	0.1705	0.0621	11.73	19.00
120P	0.4356	0.1799	0.0552	25.25	16.36
140P	0.2462	0.1174	0.5520	36.55	104.36
150A	0.7292	0.2689	0.1544	16.46	70.31
160A	0.4735	0.2367	0.0621	8.45	25.95
160B	0.9659	0.4356	0.0621	14.49	38.72
170P	0.6761	0.2330	0.0552	18.34	22.66
180P	0.3883	0.1705	0.0552	22.41	15.69
190A	0.7197	0.3598	0.0621	13.89	32.46
190B	0.2841	0.1326	0.0621	17.60	14.92
200A	0.4167	0.2367	0.0552	14.40	19.86
200B	0.2462	0.1231	0.0621	4.06	18.15
210A	0.4735	0.2367	0.0621	12.67	24.03
210B	0.9943	0.4735	0.0621	14.78	40.26
210C	0.4735	0.1894	0.0621	14.78	21.44

S	=	watercourse slope in feet per mile
C	=	$24K_n$ (from U.S. Army Corps of Engineers (COE))
m	=	0.38 (from COE)
p	=	0.5
K_n	=	estimated mean Manning's value for all channels in the sub-basin.

The parameters listed above, which are necessary to estimate lag time, were derived from the detailed topographic mapping. The K_n values used in this study were estimated based on guidelines in the *Hydrology Manual* for the 100-year storm. Since the design storm frequencies are much less than 100 years and the average flow depths much lower, the actual K_n values are much higher. An estimate of more appropriate values was made by comparing street flow velocities calculated using normal depth to the velocities calculated based on the sub-basin flow path length and the basin time of concentration. The basin time of concentration was estimated from the above lag equation by using the approximation 0.6 x Tc = lag.

The new K_n values were estimated by adjusting the K_n values in the above equation until the lag equation-based street velocities matched the normal depth street velocities. Sub-basin 30 in the Glendale Watershed was used as a representative sub-basin for calculation of the new K_n value because there was only one land-use category within that basin. The ratio of the new K_n to the old K_n was then applied to the K_n value for each land-use category.

Note that in the Peoria Watershed, sub-basins containing future development areas do not contain any other land-use category. Runoff originates only from pavement in these sub-basins. In the Glendale Watershed, however, sub-basins may be composed of several land-use categories, including future development. Runoff may originate from an existing developed area within a sub-basin and flow along streets through an adjacent future development area within the same sub-basin. As a result, average flow depths over paved surfaces within the future

development sub-basins of the Peoria Watershed will experience lower flow depths than the paved surfaces in the mixed sub-basins of the Glendale Watershed for a given excess rainfall depth. For this reason, slightly higher K_n values were used for future development areas in the Peoria Watershed compared to the Glendale Watershed.

Calculations showing the calibration of K_n values are provided in Appendix I.

The resulting K_n values used in the HEC-1 models in this study are summarized below:

Land-use	Kn
Commercial	0.055
Industrial	0.055
Residential	0.055
Agricultural	0.552
Parks	0.552
Future Development (Glendale)	0.041
Future Development (Peoria)	0.062

3.4.4 Routing Parameters

Routing of sub-basin hydrographs in the study area was done utilizing the kinematic wave option of HEC-1. The routing reach paths within the watershed are shown on Exhibit A. Table 3-4 summarizes the kinematic wave routing parameters for each routing operation in the HEC-1 models.

In the mostly developed Glendale east watershed (east of Grand Avenue), where a 10-year storm is modeled, it was assumed that routed flows would not be confined to a single street. Instead, the flow would likely follow several parallel streets.

TABLE 3-4
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Peoria Watershed

Kinematic Wave Routing Parameters 02/12/96
FUTURE CONDITION

Routing Operation	*Length ft*	*Slope ft/ft*	*Manning's n*	*Shape*	*Bottom Width, ft*	*Side slope z*
10AR	1220	0.002	0.015	TRAP	125	0.01
10BR	650	0.001	0.015	TRAP	125	0.01
10CR1	1000	0.002	0.03	TRAP	50	0.01
10CR2	1650	0.0073	0.03	TRAP	50	0.01
20AR	1250	0.001	0.015	TRAP	125	0.01
20BR	720	0.001	0.015	TRAP	125	0.01
30CR	2700	0.003	0.014	CIRC	4	----------
40AR	700	0.0044	0.014	CIRC	5	----------
20CR	690	0.002	0.015	TRAP	105	0.01
40CR	590	0.002	0.015	TRAP	105	0.01
40DR	1380	0.0044	0.014	CIRC	5	----------
40ER	690	0.0044	0.014	CIRC	5	----------
50AR	1310	0.0031	0.014	CIRC	5	----------
50BR	1260	0.004	0.015	TRAP	105	0.01
60AR	1300	0.0059	0.015	TRAP	50	0.01
60BR	610	0.0057	0.015	TRAP	50	0.01
60DR	750	0.003	0.014	CIRC	5	----------
61R	1400	0.0031	0.014	CIRC	5	----------
70AR	1320	0.003	0.015	TRAP	50	0.01
70BR	750	0.002	0.015	TRAP	105	0.01
80AR1	550	0.003	0.014	CIRC	5	----------
80AR2	1300	0.001	0.014	CIRC	5.5	----------
80BR	500	0.0037	0.014	TRAP	125	0.01
90AR	500	0.002	0.015	TRAP	105	0.01
90BR	490	0.0048	0.014	CIRC	6	----------
90CR	900	0.0048	0.014	CIRC	6	----------
90DR	1290	0.0009	0.014	CIRC	6	----------
90ER	500	0.0037	0.014	TRAP	125	0.01
90FR	1290	0.0048	0.014	CIRC	6	----------
91R	1320	0.0009	0.014	CIRC	3.5	----------
110R	1450	0.0026	0.015	TRAP	105	0.01
110BR	1500	0.0044	0.015	TRAP	125	0.01
111R	4300	0.0036	0.025	TRAP	50	0.01
112R	1000	0.0059	0.014	CIRC	2	----------
150AR	1150	0.0026	0.014	CIRC	3.5	----------
160AR	1320	0.0009	0.014	CIRC	3.5	----------
160AR2	1320	0.0026	0.014	CIRC	2	----------
160BR	1320	0.0033	0.014	CIRC	4	----------
170R	1300	0.0026	0.014	CIRC	3.5	----------
180R	890	0.0032	0.014	CIRC	4	----------
190BR	1830	0.0034	0.015	TRAP	125	0.01
200AR	460	0.0032	0.014	CIRC	4	----------
200BR	1200	0.0023	0.014	CIRC	5	----------
210AR	1540	0.0023	0.014	CIRC	5	----------
210CR	700	0.0026	0.014	CIRC	3.5	----------

TABLE 3-4
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Glendale Watershed (Page 1 of 3)

Kinematic Wave Routing Parameters 02/12/96
FUTURE CONDITION

Routing Operation	*Length ft*	*Slope ft/ft*	*Manning's n*	*Shape*	*Bottom Width, ft*	*Side Slope z*
Orangewood Avenue Alignment, east basin:						
10AR1	1320	0.0038	0.013	CIRC	5.0	----------
10AR2	1320	0.0038	0.013	CIRC	5.0	----------
10B1R	2640	0.0026	0.020	TRAP	125.0	0.01
10B2R1	1320	0.0019	0.013	CIRC	7.0	----------
10B2R2	1320	0.0019	0.013	CIRC	7.0	----------
20AR	2640	0.0040	0.020	TRAP	110.0	0.01
20BR1	1320	0.0011	0.013	CIRC	7.0	----------
20BR2	1320	0.0011	0.013	CIRC	7.0	----------
30R	2640	0.0045	0.013	CIRC	8.0	----------
40AR1	1320	0.0034	0.013	CIRC	5.0	----------
40AR2	1320	0.0034	0.013	CIRC	5.0	----------
40BR	2640	0.0020	0.020	TRAP	110.0	0.01
45R	2640	0.0038	0.013	CIRC	8.0	----------
50AR	2640	0.0038	0.020	TRAP	110.0	0.01
50BR1	1320	0.0027	0.013	CIRC	7.0	----------
50BR2	1320	0.0027	0.013	CIRC	7.0	----------
60AR	2640	0.0038	0.013	CIRC	9.0	----------
70AR	2450	0.0036	0.020	TRAP	100.0	0.01
70BR1	1880	0.0021	0.013	CIRC	4.5	----------
80AR	2640	0.0028	0.013	CIRC	5.0	----------
80BR	2640	0.0023	0.020	TRAP	100.0	0.01
85R	1320	0.0008	0.013	CIRC	3.0	----------
90R1	1320	0.0011	0.013	CIRC	10.0	----------
90R2	1320	0.0011	0.013	CIRC	10.0	----------
90R3	1320	0.0011	0.013	CIRC	5.0	----------
96R	1320	0.0038	0.013	CIRC	4.0	----------
110R	2640	0.0030	0.013	CIRC	4.5	----------
120R	1320	0.0038	0.013	CIRC	6.5	----------
130AR	1320	0.0034	0.020	TRAP	90.0	0.01
130BR	1320	0.0019	0.020	TRAP	90.0	0.01
140R	1320	0.0038	0.013	CIRC	6.5	----------
155R	1320	0.0019	0.013	CIRC	7.0	----------
160R	1320	0.0019	0.020	TRAP	105.0	0.01
170AR	1320	0.0026	0.020	TRAP	125.0	0.01
170BR	1320	0.0019	0.013	CIRC	7.0	----------
170R	1320	0.0021	0.013	CIRC	7.5	----------
180AR	1320	0.0017	0.020	TRAP	105.0	0.01
180BR	1320	0.0021	0.013	CIRC	7.5	----------
180R	1320	0.0019	0.013	CIRC	7.5	----------
190AR	1320	0.0015	0.020	TRAP	125.0	0.01
190BR	1320	0.0019	0.013	CIRC	7.5	----------
190R	1320	0.0063	0.013	CIRC	7.5	----------

TABLE 3-4
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Glendale Watershed (Page 2 of 3)

Kinematic Wave Routing Parameters 02/12/96
FUTURE CONDITION

Routing Operation	*Length ft*	*Slope ft/ft*	*Manning's n*	*Shape*	*Bottom Width, ft*	*Side Slope z*
200AR	1320	0.0008	0.020	TRAP	105.0	0.01
200BR	1320	0.0063	0.013	CIRC	7.5	----------
200R	1320	0.0009	0.013	CIRC	9.0	----------
210AR	1320	0.0009	0.013	TRAP	125.0	0.01
210BR	1320	0.0009	0.013	CIRC	9.0	----------
210R	1320	0.0007	0.013	TRAP	10.0	0.01
220AR	1320	0.0030	0.020	TRAP	105.0	0.01
220BR	1320	0.0007	0.013	TRAP	10.0	0.01
220R	1055	0.0007	0.020	TRAP	10.0	0.01
230BR	1055	0.0007	0.020	TRAP	10.0	0.01

Orangewood Avenue Alignment, west basin

70BR1	1880	0.0048	0.013	CIRC	5.0	----------
85R	1320	0.0045	0.013	CIRC	8.5	----------
90R3	1320	0.0083	0.013	CIRC	5.0	----------
96R	1320	0.0030	0.013	CIRC	11.0	----------
110R	2640	0.0030	0.013	CIRC	10.5	----------
120R	1320	0.0020	0.013	CIRC	9.0	----------
130AR	1320	0.0034	0.020	TRAP	90.0	0.01
130BR	1320	0.0019	0.020	TRAP	90.0	0.01
140R	1320	0.0030	0.013	CIRC	4.0	----------
155R	1320	0.0019	0.013	CIRC	5.0	----------
160R	1320	0.0019	0.020	TRAP	105.0	0.01
170AR	1320	0.0026	0.020	TRAP	125.0	0.01
170BR	1320	0.0019	0.013	CIRC	5.0	----------
170R	1320	0.0021	0.013	CIRC	5.5	----------
180AR	1320	0.0017	0.020	TRAP	105.0	0.01
180BR	1320	0.0021	0.013	CIRC	5.5	----------
180R	1320	0.0019	0.013	CIRC	5.5	----------
190AR	1320	0.0015	0.020	TRAP	125.0	0.01
190BR	1320	0.0019	0.013	CIRC	5.5	----------
190R	1320	0.0063	0.013	CIRC	5.5	----------
200AR	1320	0.0008	0.020	TRAP	105.0	0.01
200BR	1320	0.0063	0.013	CIRC	5.5	----------
200R	1320	0.0009	0.013	CIRC	7.5	----------
210AR	1320	0.0009	0.013	TRAP	125.0	0.01
210BR	1320	0.0009	0.013	CIRC	7.5	----------
210R	1320	0.0007	0.013	TRAP	10.0	0.01
220AR	1320	0.0030	0.020	TRAP	105.0	0.01
220BR	1320	0.0007	0.020	TRAP	10.0	0.01
220R	1055	0.0007	0.020	TRAP	10.0	0.01
230BR	1055	0.0007	0.020	TRAP	10.0	0.01

TABLE 3-4
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
Glendale Watershed (Page 3 of 3)

Kinematic Wave Routing Parameters 02/12/96
FUTURE CONDITION

Routing Operation	*Length ft*	*Slope ft/ft*	*Manning's n*	*Shape*	*Bottom Width, ft*	*Side Slope z*
Glendale Avenue Alignment, west basin:						
190AR	1320	0.0015	0.020	TRAP	125.0	0.01
190R	1320	0.0064	0.020	TRAP	105.0	0.01
200AR	1320	0.0008	0.020	TRAP	105.0	0.01
200BR	1320	0.0064	0.020	TRAP	105.0	0.01
200R	1320	0.0019	0.020	TRAP	105.0	0.01
210AR	1320	0.0030	0.020	TRAP	125.0	0.01
210BR	1320	0.0019	0.020	TRAP	105.0	0.01
210R	1320	0.0019	0.020	TRAP	105.0	0.01
220AR	1320	0.0030	0.020	TRAP	105.0	0.01
220BR	1320	0.0019	0.020	TRAP	105.0	0.01
220R	1055	0.0027	0.020	TRAP	105.0	0.01
230BR	1055	0.0027	0.020	TRAP	105.0	0.01
240R	1320	0.0015	0.020	TRAP	125.0	0.01
250R	1320	0.0037	0.020	TRAP	125.0	0.01
260AR	1320	0.0023	0.020	TRAP	105.0	0.01
260BR	1320	0.0037	0.020	TRAP	125.0	0.01
260R	1320	0.0029	0.020	TRAP	125.0	0.01
270AR	1320	0.0033	0.020	TRAP	125.0	0.01
270BR	1320	0.0025	0.020	TRAP	125.0	0.01
270R	1320	0.0025	0.020	TRAP	125.0	0.01
280AR	1320	0.0029	0.020	TRAP	105.0	0.01
280BR	1320	0.0025	0.020	TRAP	125.0	0.01
280R	1320	0.0041	0.020	TRAP	125.0	0.01
190CDR	1320	0.0036	0.013	CIRC	5.5	----------
290AR	1320	0.0036	0.013	CIRC	5.5	----------
290BR	1320	0.0041	0.020	TRAP	125.0	0.01
290R	1320	0.0034	0.013	CIRC	7.5	----------
300AR	1320	0.0001	0.020	TRAP	105.0	0.01
300BR	1320	0.0034	0.013	CIRC	7.5	----------
300R	1320	0.0034	0.013	CIRC	7.5	----------
210CDR	1320	0.0590	0.020	TRAP	125.0	0.01
310AR	1320	0.0059	0.020	TRAP	125.0	0.01
310BR	1320	0.0034	0.013	CIRC	7.5	----------
310R	1320	0.0034	0.013	CIRC	7.5	----------
220CDR	1320	0.0047	0.020	TRAP	105.0	0.01
320AR	1320	0.0047	0.020	TRAP	105.0	0.01
320BR	1320	0.0034	0.013	CIRC	7.5	----------
320R	1050	0.0019	0.013	CIRC	8.5	----------
230CDR	1320	0.0036	0.020	TRAP	100.0	0.01
330AR	1320	0.0036	0.020	TRAP	100.0	0.01
330BR	1050	0.0019	0.013	CIRC	8.5	----------

In the mostly undeveloped Glendale west watershed (west of Grand Avenue), the future condition routing geometry was based on single street routing. This was done because future land-use in this area is mostly industrial, in which grid street layouts and parallel flow paths are not as common as in areas of residential development.

In the Peoria Watershed, it was assumed that the routed 2-year flows would be contained within a single street right-of-way.

3.4.5 Flow Splits

Flow Splits Within Sub-Basins

Within the Glendale Watershed, the majority of sub-basins consist of quarter-section areas bounded by arterial streets, creating a square, grid-shaped pattern. The actual flow direction is towards the southwest. In order to compute storm drain flows at quarter-mile concentration points along the arterial streets, it was necessary to use divert operations to split a certain percentage of flow to the west and a certain percentage to the south. The split percentage was estimated based on elevations at the corners of each quarter-section square, as described in the following paragraphs.

Specifically, the average elevation change in the each direction (east-west vs. north-south) was computed using the detailed topographic mapping by Kenney Aerial Mapping, Inc. Let z_{NE} be the elevation at the northeast corner of the quarter-section square, let z_{NW} be the elevation at the northwest corner, y_{SE} the elevation at the southeast corner, and z_{SW} the elevation at the southwest corner. Then the average elevation change in the east-west direction (z_{EW}) is

$$z_{EW} = ((z_{NE} - z_{NW}) + (z_{SE} - z_{SW})) / 2.$$

Similarly, the average elevation change in the north-south direction (z_{NS}) is

$$z_{NS} = ((z_{NE} - z_{SE}) + (z_{NW} - z_{SW})) / 2.$$

Assuming uniform (and steady) flow, the quantity of flow in the east-west direction according to Manning's equation is

$$Q_{EW} = 1.49\ R_{EW}^{(2/3)}\ S_{EW}^{(1/2)}\ A_{EW} / n.$$

Similarly, the quantity of flow in the north-south direction is

$$Q_{NS} = 1.49\ R_{NS}^{(2/3)}\ S_{NS}^{(1/2)}\ A_{NS} / n.$$

The total runoff from the sub-basin is $Q = Q_{EW} + Q_{NS}$. The (decimal percentage of flow in the east-west direction is $\%Q_{EW} = Q_{EW} / Q$ and in the north-south direction it is $\%Q_{NS} = Q_{NS} / Q$. If we assume that the cross-section (geometric) variables R and A are relatively constant in each direction compared to the slope, in other words, $R_{EW} \approx R_{NS}$ and $A_{EW} \approx A_{NS}$, then the flow in each direction is proportional to the square root of the slope:

$$Q_{EW} = k\ S_{EW}^{(1/2)} \text{ and } Q_{NS} = k\ S_{NS}^{(1/2)}.$$

where k is a proportionality constant.

Combining these two expressions with the percentage expressions above,

$$\%Q_{EW} \approx S_{EW}^{(1/2)} / (S_{EW}^{(1/2)} + S_{NS}^{(1/2)}) \text{ and}$$

$$\%Q_{NS} \approx S_{NS}^{(1/2)} / (S_{EW}^{(1/2)} + S_{NS}^{(1/2)}).$$

Flow Splits Along Northern Avenue

Since the Peoria storm drain system is evaluated for the 2-year storm and the Glendale system is evaluated for the 10-year storm, the possibility exists that flows between the 2-year and 10-year magnitude would bypass the proposed Northern Avenue storm drain in Peoria and enter the Glendale Watershed to the south.

In order to estimate the quantity of breakout flow that would cross Northern Avenue, 10-year 6-hour storm was modeled in the Peoria Watershed. Divert operations were placed at concentration points along Northern Avenue where the north-south arterial had sufficient slope towards the south to carry flow. This occurred only at three locations: 87th, 91st, and 95th Avenues.

At those locations, flow was diverted to the south only after the storm drain capacity, the crown-full capacity of the north half of the street, and the curb-full capacity of the south half of the street were reached. These capacities were estimated using normal depth of flow.

The HEC-1 results show that no flow breakouts to the south occur during storm events between the 2-year and 10-year magnitudes.

Along Orangewood and Glendale Avenues

Within the Glendale Watershed, flow breakouts could occur along Orangewood and Glendale Avenues at locations where no storm drain is proposed. In order to estimate the quantity of breakout flow, the same procedure was used as along Northern Avenue. Flow was diverted to the south only after the crown-full capacity of the north half of the roadway plus the curb-full capacity of the south half of the roadway was reached.

3.4.6 Field Reconnaissance

Field reconnaissance for hydrology task was done in February, March, and October 1995. Table 3-4 contains the basin physical descriptions for each routing reach. The source of the cross-section data used for each reach is a combination of field observation, inspection of aerial photos and topographic mapping, and assumptions on future development. Specifically, it was assumed that collector streets at half- and quarter-mile city blocks would be developed with curb and gutter in the future condition.

3.4.7 Computation Time Interval

The computation time interval (NMIN) used in the HEC-1 models is based on guidelines in the District's *Hydrology Manual,* which recommends an NMIN value of 0.15 x Tc. Using the minimum basin lag time from the study area, 8.39 minutes in basin 60C of the Peoria Watershed, a time of concentration of approximately 8.39/0.6 = 14.0 minutes was estimated. Then, using the above recommendation, NMIN = 0.15 x 14.0 = 2.10 minutes. Therefore a 2-minute hydrograph time interval is used for the entire study area.

3.5 Hydrologic Analysis and Results

The results of the HEC-1 analyses are provided in Appendix I and are summarized below along with flows from the *Glendale-Peoria ADMP* in Table 3-5 for key concentration points.

TABLE 3-5
HEC-1 Results
Future Condition Flows
in cfs

HEC-1 OPERATION	DESCRIPTION	2-YR 6-HR	10-YR 6-HR	PER ADMP
85C2	63rd Avenue & Northern	--	660	780
91C	Northern Avenue West of 83rd Avenue	281	--	520
310BR	Glendale Avenue East of 91st Avenue	--	472	--

Table 3-6 summarizes HEC-1 results along the proposed pipe alignments in the Peoria Watershed and Table 3-7 summarizes flows along proposed pipe alignments in the Glendale Watershed.

The Glendale Watershed HEC-1 printout included in Appendix I is for the Orangewood Avenue alignment, West Basin option, even though the option recommended in this report is the East Basin option. All HEC-1 options are included on diskette in Appendix I.

TABLE 3-6

SUMMARY OF PEAK FLOWS

Peoria Watershed

Northern Avenue Storm Drain Alignment:

Pipe Number (a)	Pipe Along	Location	HEC-1 ID (b)	2-year flows in cfs (c) Option A	Option B
	Northern Ave.	AFF Pipe @ 93rd Ave.	210AC	90	40
	Northern Ave.	93rd Ave. to 91st Ave.	200BC2	90	30
10	Northern Ave.	91st Ave. to 89th Ave.	160BC	80	20
11	Northern Ave.	89th Ave. to 85th Ave.	91D	70	10
12	Northern Ave.	85th Ave. to 83rd Ave.	90DC2	210	210
13	85th Ave.	Northern Ave. to Trans. Line Corridor	111D	20	20
14	Trans. Line Corridor	85th Ave. to 83rd Ave.	80BDIV	130	130

Butler Drive Storm Drain Alignment:

Pipe Number (a)	Pipe Along	Location	HEC-1 ID (b)	2-year flows in cfs (c) Option A	Option B
1	Butler Dr.	AFF Channel to 91st Ave.	210CC	80	80
2	Butler Dr.	91st Ave. to 89th Ave.	170AC	70	70
3	Butler Dr.	89th Ave. to 87th Ave.	150AC	30	30

(a) See Plates in Appendix II for pipe number locations
(b) See Exhibit A in Appendix I for HEC-1 operation ID
(c) Peak Flow HEC-1 filenames: PEO0215A (OPTION A) AND PEO0214A (OPTION B)

TABLE 3-7

SUMMARY OF PEAK FLOWS

Glendale Watershed

Orangewood Avenue Storm Drain Alignment:

Pipe Number (a)	Pipe Along	Location	HEC-1 ID (b)	10-year flows in cfs (c) Options 1A, 1B	Options 2A, 2B
1	Orangewood Ave.	AFF Channel to 91st Ave.	230BC	350	580
2	Orangewood Ave.	91st Ave. to 87th Ave.	210BC	320	560
3	Orangewood Ave.	87th Ave. to 83rd Ave.	200BC	350	490
4	Orangewood Ave.	83rd Ave. to 79th Ave.	190BC	180	440
5	Orangewood Ave.	79th Ave. to 75th Ave.	180BC	130	410
6	Orangewood Ave.	75th Ave. to 71st Ave.	170BC	90	370
7	Orangewood Ave.	71st Ave. to 69th Ave.	140R	70	240
8	Orangewood Ave.	69th Ave. to 66th Ave.	120C2	1030	180
9	66th Ave.	Orangewood Ave. to Frier Dr.	110R	1010	110
10	Frier Dr.	66th Ave. to Grand Ave.	110R	1010	110
11	65th Ave.	Grand Ave. to Northern Ave.	96R	760	70
12	Northern Ave.	65th Ave. to 67th Ave.	111C	110	110
13	Northern Ave.	65th Ave. to 63rd Ave.	85R	660	40
14	Grand Ave.	65th Ave. to 63rd Ave.	70BR1	120	120

Glendale Avenue Storm Drain Alignment:

Pipe Number (a)	Pipe Along	Location	HEC-1 ID (b)	10-year Flow, cfs (c)
41	Glendale Ave.	AFF Channel to 95th Ave.	330BC	480
42,43	Glendale Ave.	95th Ave. to 83rd Ave.	320BC	450
44	Orangewood Ave.	83rd Ave. to 79th Ave.	190CDV	210
5	Orangewood Ave.	79th Ave. to 75th Ave.	180BC	130
6	Orangewood Ave.	75th Ave. to 71st Ave.	170BC	90
7	Orangewood Ave.	71st Ave. to 69th Ave.	155C	70
8	Orangewood Ave.	69th Ave. to 66th Ave.	120C2	1030
9	66th Ave.	Orangewood Ave. to Frier Dr.	115C	1010
10	Frier Dr.	66th Ave. to Grand Ave.	115C	1010
11	65th Ave.	Grand Ave. to Northern Ave.	95C	760
12	Northern Ave.	65th Ave. to 67th Ave.	111C	110
13	Northern Ave.	65th Ave. to 63rd Ave.	85C2	660
14	Grand Ave.	65th Ave. to 63rd Ave.	70BR1	120

(a) See Plates in Appendix II for pipe number locations
(b) See Exhibit A in Appendix I for HEC-1 operation ID
(c) Peak Flow HEC-1 filenames: OR122295 (Options 1A, 1B), OR021396 (Options 2A, 2B) and GL122295.OUT (Glendale Ave. alignment)

4.0 STORM DRAIN CONCEPT/ROUTING STUDY

4.1 Introduction

The *Glendale-Peoria ADMP* outlines major trunk line and lateral storm drain systems within the *Concept/Routing Study* area. In that *ADMP*, several storm drain alignments were recommended including trunk lines along major arterial streets such as Cactus Road, Olive Avenue, Northern Avenue and Orangewood Avenue.

The *ADMP* recommendations were used as a basis for the development of conceptual alignments in this study. While maintaining the general storm drain alignment concept presented in the *ADMP*, small-scale alternative alignments and pipe sizes were identified for several locations through the *Northern/Orangewood Storm Drain Project, Location Study* (separate document).

The most desirable small-scale alignments from the *Location Study* were selected for their incorporation into the two major storm drain outfall alignments. These alignments are:

- Northern Avenue and Butler Drive storm drain alignments for the City of Peoria
- Orangewood Avenue or Glendale Avenue for the City of Glendale.

An in-depth cost evaluation was then carried out for the alignments. Several key components were included to further refine the alignments presented in Section 4.2.

The detention basins proposed in this Concept/Routing Study will serve as surge basins to meet the intent of the *Glendale/Peoria ADMP*. According to the *ADMP* concept, by significantly reducing the downstream pipe size at strategic locations, the stormwater hydraulic grade line is pushed higher within the upstream storm drain system. By providing a large opening area immediately upstream of the smaller diameter pipe, the larger peak flows will be diverted into the surge basin through the opening.

The surge basin facility thus operates as an off-line detention basin. It offers the following advantages:

- Allows initial runoff to continue in the small diameter pipe, thereby bypassing the detention basin. This, in turn, will keep the basin free from all nuisance flows. This small pipe concept will convey the majority of frequent storms on an annual basis. As a result, problems associated with siltation, ponding, nuisance vegetation growth, and maintenance can be significantly reduced. Additionally, multiple use of the basin facility for recreation and play fields can mitigate the basin's undesirability.

- Allows much lower invert elevations for the storm drain system. As a result, keeping the storm drain pipe below the majority of existing utilities, e.g., sanitary sewer line, irrigation lines, electric/telephone/gas lines. This option reduces relocation costs associated with both dry and wet utilities.

For the purpose of hydraulic/hydrologic modeling, an off-line type of hydrograph divert subroutine was used. This modeling was concurred with by the District.

Earthwork cost estimates for the detention/surge basin are based on the peak storage volume for diverted hydrographs during the final design of the detention/surge basin. Several factors will cause adjustments to the earthwork estimates presented in this report which include:

- configuration of recreational fields, parking areas, etc.;
- terracing requirements within basins (i.e., certain areas above 1-year and 2-year peak water surface elevations);
- handling of low-flow swales within the basin and type of lining material used; and
- minimum acceptable cross slope in basin bottom.

Section 4.2 describes the *ADMP* alignments as they apply to this project as well as several alternative alignments. The alternatives resulted from discussions

among the Flood Control District of Maricopa County, the Cities of Peoria and Glendale, and WPA.

In the following sections, numerous plates and tables are referenced in order to explain the various alternatives. The plates and tables are included in Appendix II.

4.2 Concept/Routing Study

The general storm drain alignments proposed in the *Glendale-Peoria ADMP* along with the recommended alignments from the small-scale *Location Study* were used as a basis for study of additional, large-scale storm drain system concepts. This *Concept/Routing Study* discusses those large-scale concept alternatives.

Future condition flows were used for the hydrologic analyses in this study. During the initial phase of this project, both existing and future condition hydrologic conditions were modeled in the Peoria Watershed (areas west of Grand Avenue, north of Northern Avenue, and south of Olive Avenue) as a test to determine which condition would produce the highest (design) peak flows. It was found that the future condition model produced the higher peak flows in the test watershed. Therefore only the future condition flows were used for subsequent hydrologic models. The District concurred with this procedure.

In the Peoria Watershed, the 2-year storm was used for hydrologic modeling. This is in accordance with local (City of Peoria) storm drain design requirements. Similarly, in the Glendale Watershed which composes the remainder of the study area, the 10-year storm was used for hydrologic modeling in accordance with City of Glendale storm drain design requirements. This procedure is consistent with the *Glendale-Peoria ADMP*.

The following discussion is divided into two sections, the Peoria Watershed and the Glendale Watershed.

4.2.1 Peoria Watershed

Butler Drive Alignment:

The Butler Drive alignment (shown on Plate II-3) consists of a 36-inch storm drain from 87th Avenue to 89th Avenue, a 42-inch storm drain from 89th Avenue to 91st Avenue, and a 48-inch storm drain from 91st Avenue to the existing Agua Fria Freeway Outfall Channel.

This storm drain diverts runoff from north of Butler Drive toward the west into the existing Agua Fria Freeway Outfall Channel by ADOT, cutting off flow that would otherwise follow 91st Avenue to the south. The reduction in 91st Avenue flow allows a greater flow to be routed in the Northern Avenue storm drain from the east.

Detailed costs as well as pipe sizes and hydraulic analysis data for the Butler Drive storm drain alignment are shown on Tables II-1 and II-2. The three (3) pipe segments are depicted by pipe numbers on Plate II-3.

Northern Avenue Alignment:

A major consideration in the development of the Northern Avenue alignment was an existing 60-inch storm drain in Northern Avenue from 91st Avenue west to the Agua Fria Freeway (AFF) Outfall Channel. The storm drain represents funds already spent by the Maricopa County Department of Transportation. Initially, WPA attempted to utilize the full (optimum) capacity of the existing storm drain. Option A (Plate II-3) accomplishes this with a 54-inch Northern Avenue storm drain between the Peoria detention/surge basin and 91st Avenue. However, further investigation revealed that other solutions exist that favor less than full utilization of the 60-inch pipe.

Specifically, if additional flow is detained in the Peoria detention/surge basin, less flow is routed westward in the Northern Avenue storm drain. This allows a smaller pipe size to be constructed between the Peoria basin and 91st Avenue. Option B (Plate II-3) evaluates this by utilizing a 27-inch pipe between the Peoria basin and 91st Avenue. Comparing Options A and B, the additional cost of constructing a slightly larger

basin is more than offset by the cost savings of constructing a smaller pipe between the basin and 91st Avenue.

Since this scenario involves under-utilizing the existing 60-inch storm drain, it is desirable to identify ways to fully utilize the pipe. One way is to construct larger catch basins on 91st Avenue north of Northern Avenue to intercept pavement runoff with a magnitude greater than the 2-year flow, a design requirement of the City of Peoria. With larger catch basins, a greater level of protection is provided by the system along 91st Avenue.

Another way the City of Peoria could utilize the remaining capacity in the existing 60-inch pipe is to negotiate a partial waiver of City retention requirements with property owners north of Northern Avenue and west of 91st Avenue. Since this would result in a cost savings to the future development in this area, landowner contributions to capital improvement funds could be negotiated for other city storm drain projects.

If either of the above 60-inch pipe utilization options is pursued by the City of Peoria, it is important for the City to restrict peak inflows from 91st Avenue and/or developments such that is does not conflict with the design capacity necessary to accommodate peak flows from east of 91st Avenue. Although it is likely that the hydrograph peaks from 91st Avenue and/or developments to the west of 91st Avenue would arrive at the 60-inch storm drain much sooner than the peak from the Northern Avenue storm drain east of 91st Avenue, additional hydrologic analyses would be required to ensure the proper performance of the Northern Avenue storm drain, both east and west of 91st Avenue.

One significant proposed change in the Northern Avenue alignment from the *Glendale-Peoria ADMP* is that the 91st Avenue storm drain between Northern Avenue and Orangewood Avenue is eliminated. In addition, the size of the storm drain in Northern Avenue between 85th Avenue and 91st Avenue is substantially reduced from 5-foot in diameter to 2.25-foot in diameter. This results in a considerable cost savings. This savings could possibly be used to extend the Northern Avenue storm drain to the

east. Based on flows and unit costs documented in this report, it is estimated that the storm drain could be extended in Northern Avenue between 83rd Avenue and 75th Avenue for a cost of $974,000.

4.2.2 Glendale Watershed

In this section, major storm drain alignments, more specifically along Orangewood and Glendale Avenues, are evaluated. Several suboptions, such as basin locations, outfalls and drains, and type of hydraulic section or material, are also discussed.

Orangewood Avenue Alignment:

Based upon the preliminary concept evaluation during the *Location Study*, several site-specific cost-effective alternative alignments have been identified. WPA further evaluated the conceptual alternatives, specifically Grand Avenue near 67th Avenue (West and East Basins) and ultimate outfall alternatives at 91st Avenue near the Agua Fria Freeway Outfall Channel.

Following are descriptions of the West and East Basins:

West Basin: This basin is located on the northeast corner of 71st Avenue and Orangewood Avenue (Plate II-2). The District owns the right-of-way for this basin.

East Basin: This basin is located on the southwest corner of 63rd Avenue and Northern Avenue (Plate II-1). It is currently a vacant agricultural land and will need to be acquired if the alternative for using this site is selected for further implementation.

A cost analysis was performed for each basin. The analysis included proposed improvements for the entire Orangewood Avenue alignment from Grand Avenue near 63rd Avenue to 91st Avenue and from 91st Avenue to the outfall at the AFF channel. Costs for the basins with alternative outlet (91st to AFF) are based upon January, 1996 unit prices and are summarized in Table II-3. Since the land for the West Basin was

previously purchased, the actual purchase unit price was used. The unit price for the East Basin is based on January, 1996 land costs provided by the District.

The elements of each alternative have been grouped together based on the agency receiving the benefit. These divisions include the *ADMP* (District, City of Peoria, and City of Glendale), Arizona Department of Transportation (ADOT), and the City of Glendale.

Option 1A:
West Basin and a Box Culvert Outlet from 91st Avenue to the AFF channel

Option 1A (Table II-3) reflects costs based on the West Basin location, the upstream and downstream storm drain system required with this basin, and a box culvert outlet from 91st Avenue to the Agua Fria Freeway Outfall Channel.

As shown on Plate II-2, the proposed storm drain within Northern Avenue includes a 10-foot diameter pipe between 65th and 63rd Avenues (Pipe 13) and a 5½-foot diameter pipe between 67th and 65th Avenues (Pipe 12). Likewise, a 9-foot diameter pipe is proposed along Grand Avenue between 65th and 63rd Avenues (Pipe 14). A 12-foot diameter pipe is proposed along 65th Avenue alignment from Northern Avenue to Frier Drive (Pipe 11), from 65th Avenue to 66th Avenue along Frier Drive (Pipe 10), from Frier Drive to Orangewood Avenue in 66th Avenue (Pipe 9), and from 66th Avenue to 69th Avenue (Pipe 8) in the Orangewood Avenue alignment. At this point, the West Basin will intercept all of the surged flow from the trunk line. The storm drain immediately downstream of the surge point is reduced to a 6-foot diameter pipe (Pipe 7). The storm drain system will continue within the Orangewood Avenue alignment from 69th Avenue to 91st Avenue (Pipes 2 through 6) collecting and conveying flows from the drainage areas contributing to this reach. From 91st Avenue and Orangewood Avenue, flows will be conveyed within a box culvert to the outfall at the Agua Fria Freeway Outfall Channel at approximately Frier Drive.

The benefits of this option are that the alignment is within the existing right-of-way of Orangewood Avenue, Northern Avenue, and Grand Avenue and there will be no need to acquire additional right-of-way for these segments. However, the segments along 65th Avenue (Northern to Grand), Frier Drive (65th Avenue to 66th Avenue), 66th Avenue (Frier Drive to Orangewood Avenue) and 91st Avenue to the AFF Outfall Channel will require acquisition of additional right-of-way. For the proposed West Basin in this option, the land has already been acquired.

The proposed Frier Drive and 66th Avenue alignments will avoid significant utility conflicts and should simplify construction and minimize costs for these segments. In addition, for any portion of the alignment which falls within major roadways, the proposed storm drain will intercept the pavement drainage generated from localized watersheds.

This option requires an 8-foot storm drain within Northern Avenue from 63rd Avenue to 65th Avenue (Pipe 13). In the East Basin option this segment requires a 3-foot storm drain (Pipe 13) which can be located within the basin. Therefore, this option increases project costs significantly along this segment.

Construction along Orangewood Avenue does not appear to present many difficulties, except at intersections. Primarily because Orangewood Avenue does not have extensive traffic volumes and the possibility for a detour is very good. Additionally, utility conflicts appear manageable. However, this alignment, between 69th Avenue and 65th Avenue, will still require extensive effort in order to design and construct a 12-foot diameter pipe as proposed.

The cost estimate for this option is $12.7 million as shown in Table II-4.

Option 1B:
West Basin and Open Channel from 91st Avenue to the AFF Outfall Channel

Option 2A is identical to Option 1A except the outlet from 91st Avenue to the existing Agua Fria Freeway Outfall Channel has been changed from a box culvert to an open channel and the pipe diameter of the segment between 87th Avenue and 91st Avenue has been reduced from 7½ feet to 7 feet. The construction cost savings ($1.2 million) of an open channel over a box culvert make this option the least expensive of the four options analyzed. The open channel option creates constraints on the proposed commercial/industrial land-use between 91st Avenue and the AFF. With some modifications to the land-use, it is feasible to later consider a channel/box combination option.

Costs of $11.5 million for this option are presented in Table II-5.

Option 2A:
East Basin and a Box Culvert from 91st Avenue to the AFF Outfall Channel

This option is similar to Option 1A except the surge basin (East Basin) is located northeast of Grand Avenue as shown on Plate II-1.

The flow will be routed via a 5-foot diameter pipe (Pipe 12) from the Northern Avenue and 67th Avenue intersection easterly along Northern Avenue to 65th Avenue. An 8-foot pipe (not shown on plate) will be installed in Northern Avenue for a few hundred feet east of 63rd Avenue. This 8-foot pipe will discharge at a surge point into the East Basin and into a 3-foot diameter pipe (Pipe 13) located along Northern Avenue between 63rd and 65th Avenues within the East Basin right-of-way. Since the 3-foot diameter pipe will be located within the basin boundaries, construction will be simplified. There will be less traffic disturbance and less utility conflicts with this segment due to the reduced limits of construction within Northern Avenue. Cast-in-place pipe option may be available for this pipe which can translate into cost

savings. From the junction at Northern Avenue and 65th Avenue, a 4½-foot diameter pipe (Pipe 11) will follow the westerly boundary of the East Basin to Grand Avenue near Frier Drive. The combined flow from the 5- and 3-foot diameter pipes will try to enter this 4½-foot diameter pipe thereby causing flow to surge into the East Basin at Northern Avenue and 65th Avenue.

Within Grand Avenue, a 9-foot diameter pipe (Pipe 14) is proposed between 63rd Avenue to 65th Avenue. Flow from this 9-foot diameter pipe will be discharged to the 4½-foot diameter the outflow storm drain. However, excess flow will surge into the East Basin at Grand Avenue and 65th Avenue. This option creates better hydraulics for the Grand Avenue pipe crossing. For intense localized storm events it is likely that the 9-foot diameter pipe will provide capacity in excess of the 10-year design.

The 4½-foot diameter pipe (Pipe 10) will cross Grand Avenue and then continue along Frier from 65th Avenue to 66th Avenue. The 4½-foot diameter pipe (Pipe 9) will turn south in 66th Avenue to Orangewood Avenue then westerly along Orangewood Avenue (Pipe 8). The portions of pipe within the 65th Avenue, Frier Drive and 66th Avenue alignments will require new right-of-way. Additionally, the entire East Basin area will have to be purchased.

The benefits of this option are that construction activity in Northern Avenue between 63rd and 65th Avenues will be reduced causing less traffic disruption. Additionally, by moving construction away from this major traffic thoroughfare the construction period will be reduced due to fewer conflicts with traffic and utilities. A high cost reduction is possible with this option in this segment.

Additionally, the East Basin will be located next to an existing park, thereby enhancing joint use opportunities for the park facility. This option will also receive more support from ADOT because it will significantly improve Grand Avenue drainage immediately after the East Basin is operational.

By constructing the East Basin rather than the West Basin, it is possible for this portion of construction to be complete in an early phase and relieve local drainage problems northeast of Grand Avenue without the need to construct pipe segments 8, 9, 10, and 11.

It is recognized that a positive drain is not available to discharge the stored water in the basin, so some special provision will be required to drain the basin. This is also true for the West Basin.

A disadvantage of the East Basin option is that it has a larger contributing watershed area between the basin and the AFF outfall; therefore, larger flows must be conveyed by the pipes than in the West Basin option. Although Option 2A provides cost savings immediately adjacent to the basin, the overall cost is highest among the options, as shown in Table II-3. The cost estimate for this option ($14.5 million) is shown in Table 11-6.

Option 2B:
East Basin and an Open Channel from 91st Avenue to the AFF Outfall Channel

Option 2B is identical to Option 1B except for the outlet from 91st Avenue to the Agua Fria Freeway Outfall Channel has been changed from a box culvert to an open channel, and the pipe between 89th Avenue and 91st Avenue has been decreased from 9-foot diameter to 8½-foot diameter. This option is $2.3 million less expensive than Option 2A. However, due to the larger downstream pipes and an increase in basin land costs, this option is $0.6 million more costly than Option 1B but $0.6 million less costly than Option 1A, as shown in Table II-3. A cost breakdown ($12.1 million) for Option 2B is shown in Table 11-7.

Glendale Avenue Alignment Option:
In addition to the Orangewood Avenue storm drain alignment, an alignment along 83rd Avenue and Glendale Avenue was investigated.

When the preliminary storm drain alignments were being looked at, the City of Glendale expressed concern for what property the Orangewood alignment would impact; and which additional right-of-way would have to be purchased. Due to these concerns, the City of Glendale recommended selecting storm drain routes along existing right-of-way. To address Glendale's concern, a storm drain alignment along 83rd Avenue and Glendale Avenue was chosen for consideration in addition to the *Glendale-Peoria ADMP* recommended alignments.

The 83rd Avenue/Glendale Avenue storm drain outfall option has several significant disadvantages. Because Glendale Avenue is a federal highway linking Luke Air Force Base and I-17, the road could not be completely closed at any time during storm drain construction. The proposed pipe in the Glendale Avenue alignment option varies up to 10½ feet in diameter. Avoiding complete closure of the road during construction would require detours and high traffic control costs.

The Agua Fria Freeway south of Northern Avenue is not projected for completion until the year 2003. Therefore, any freeway storm channel that could accept flow from the Glendale Avenue storm drain would not be available until that time. In order to reach another outfall point, additional miles of storm drain would be required.

Another disadvantage of the Glendale Avenue alignment option is that a storm drain system would not be provided along Orangewood Avenue between 83rd Avenue and the Agua Fria Freeway. Conversely, with the Orangewood storm drain alignment, flood protection is not provided along Glendale Avenue.

Plate II-3 shows the Glendale Avenue alignment option and Table II-8 shows the associated cost of $13 million.

4.3 Traffic Impacts

Bolduc, Smiley & Associates, Inc. (BSA) has reviewed the Northern, Orangewood, and Glendale Avenue storm drain alignments and has identified traffic related issues. In this section, discussions are included for some critical

street locations along the recommended alignments that will be impacted by the storm drains.

4.3.1 Glendale Watershed with the Recommended Option

The more heavily travelled sections of major streets that will be impacted by construction of the recommended storm drain alignments in the Glendale Watershed will include the following:

- *Northern Avenue between 67th Avenue and 63rd Avenue*
  This section of street is carrying over 16,000 vehicles per day on a roadway cross-section that includes two traffic lanes in each direction and a painted, two-way left turn lane type median.

  Option 2B, the recommended alignment, which provides sections of 5-foot diameter and 3-foot diameter storm drain in Northern Avenue east of 67th Avenue, minimizes major construction in the 67th Avenue/Northern Avenue/Grand Avenue intersection. This, in turn reduces disruption to drivers on these major streets and will result in less delay and a safer driving environment. However, the installation of a 5-foot diameter pipe in Northern Avenue between 67th Avenue and 65th Avenue will require significant traffic control and a reduced number of traffic lanes available to drivers during construction.

- *65th Avenue between Northern Avenue and Orangewood Avenue*
  65th Avenue does not exist as a functioning street in this area. Construction of a storm drain should have little impact on traffic except as it crosses under Grand Avenue.

- *Grand Avenue between 65th Avenue and 63rd Avenue*
  All options require the installation of a 9-foot diameter storm drain pipe in Grand Avenue between 65th Avenue and 63rd Avenue. This construction will require the closure of one or more traffic lanes in Grand Avenue. Because Grand Avenue is carrying over 20,000 vehicles per day, the location of this section of storm drain needs to consider that two lanes, in each direction of travel,

will be required during peak traffic periods. The installation of the 4½-foot diameter pipe that will cross Grand Avenue and the railroad along the 65th Avenue alignment will also require special consideration. It is likely that this section of pipe may require boring beneath the railroad and under a portion of Grand Avenue.

- *Orangewood Avenue between 65th and 91st Avenues*

  This 3¼ mile long section of the Orangewood Avenue alignment traverses an area with primarily agricultural, residential, and industrial land-uses. There are no traffic volumes available for this section of street. The construction of the storm drain along Orangewood as it crosses under 67th Avenue is a major emphasis area for construction zone traffic control. This section of 67th Avenue is carrying over 18,000 vehicles per day on a street cross-section that has two traffic lanes in each direction with left turn lanes for traffic turning onto Orangewood. The Orangewood/67th Avenue intersection is signalized. Installation of the 5-foot diameter pipe through the intersection will require reducing the number of through lanes that are available to traffic and possibly eliminating northbound and southbound left turns during critical construction periods.

  The Orangewood/75th Avenue intersection will be a less critical traffic control area than 67th Avenue during storm drain construction. This section of 75th Avenue is carrying 10,000 vehicles per day on a rural character roadway that has a single lane in each direction. The Maricopa County Department of Transportation is beginning a design project which will widen 75th Avenue between Glendale and Olive to an urban type cross-section with two lanes in each direction and a painted median. The installation of a section of the ultimate storm drain across 75th Avenue in conjunction with this project is recommended for consideration.

  The Orangewood/83rd Avenue intersection will have traffic control complexities similar to the 75th Avenue intersection. 83rd

Avenue is a 2-lane rural roadway carrying approximately 8,000 vehicles per day. This volume is still significant and it will probably not be desirable to close this section of 83rd Avenue during construction. As a result, a single lane of traffic, in each direction through the Orangewood intersection, will need to remain open to traffic during construction. To facilitate construction, the contractor may need to prohibit left turns from 83rd Avenue onto Orangewood during certain periods and it may be necessary to reduce north/south traffic to a single shared lane during hours that the contractor is working by flagging traffic through the work area. However, during non-working hours the operation of 83rd Avenue needs to be returned to 2-lane, 2-way operation.

The storm drain crossing of 91st Avenue along the Orangewood alignment will be less complicated. 91st Avenue carries approximately 5,000 vehicles per day. Because there are no residential developments which access 91st Avenue between Glendale and Northern, it may be possible to implement a total closure of 91st Avenue at Orangewood, eliminating the need for the contractor to maintain construction zone traffic control. Local access will need to be maintained to fields and the dairy operation on the southeast corner of 91st Avenue and Orangewood.

4.3.2 Peoria Watershed with the Recommended Option

The recommended storm drain alignments in the Peoria Watershed involve construction in Butler Drive, Northern Avenue and 85th Avenue.

- *Northern Avenue between 83rd Avenue and 91st Avenue*

  This section of Northern Avenue is carrying approximately 7,000 vehicles per day. Section 4.3.3 of this report lists MAG Transportation Improvement Program (TIP) projects scheduled in the 1996 through 2000 period. Two City of Peoria projects are listed which will widen this section of Northern Avenue from its current 2-lanes to 4-lanes. The first project is scheduled in 1996 and will widen Northern Avenue from 89th Avenue to 87th

Avenue. The second project will widen Northern Avenue from 85th Avenue to 87th Avenue in the Year 2000. Ideally the storm drain installation work should be scheduled concurrent with the roadway improvement projects. At a minimum, the storm drain installation should precede the roadway improvements. Because Northern Avenue interchanges with the Agua Fria Freeway (SR 101L) it is unlikely that this section of roadway can be closed for storm drain installation. The construction will need to maintain a single lane of travel in each direction; however, it may not be possible to maintain access off of Northern Avenue from both directions of travel to side streets and driveways.

Many of the traffic control treatments discussed earlier for the 83rd Avenue at Orangewood intersection will need to be employed at the 83rd Avenue and Northern Avenue intersection. While construction is impacting this intersection it will be necessary to maintain, at a minimum, a single through lane in each direction at all times. Left turns may need to be prohibited. While construction activities are underway, it will be necessary to have a uniformed, off-duty police officer on-site to control the traffic signal during the peak traffic periods or to manually direct traffic if the traffic signal has to be taken out of service for short periods of time.

- *Butler Drive from 86th Avenue to the Agua Fria Freeway Channel Outfall*

  Butler Drive is a residential collector street in the City of Peoria. Traffic volume data is not available. Because Butler Drive is functioning as a residential collector and the residential areas which front on this section do not directly access Butler Drive, it may be possible and desirable to close Butler during storm drain construction, or at a minimum restrict its usage to "Local Traffic Only". The Butler Drive crossing of 91st Avenue will require that 91st Avenue remain open during construction.

4.3.3 Other Roadway Improvement Projects

The cities of Glendale and Peoria and the Maricopa County Department of Transportation have each programmed roadway/street improvement projects in this area and several of these impact the streets where the Northern/Orangewood Storm Drain is being proposed. These projects are listed in the *1996-2000 MAG Transportation Improvement Program (Draft), December 1995*. These projects are listed below:

CITY OF GLENDALE		
1997	83rd Avenue: Camelback Road to Northern Avenue	Widen from two lanes to four lanes with curb, gutter, and sidewalk
1997	91st Avenue: Glendale Avenue to Northern Avenue	Widen from two lanes to four lanes with curb, gutter, and sidewalk
2000	67th Avenue: Camelback Road to Grand Avenue	Widen from two lanes to four lanes, reconstruct and overlay
CITY OF PEORIA		
1996	Northern Avenue: 87th Avenue to 89th Avenue	Widen from two lanes to four lanes with curb, gutter, and sidewalk
1999	Butler Drive: 89th Avenue to 91st Avenue	Widen from two lanes to four lanes with paving, curb, and gutter
2000	Northern Avenue: 85th Avenue to 87th Avenue	Widen from two lanes to four lanes with paving, curb, and gutter

To minimize disruption to traffic on the major streets such as 67th Avenue, Northern, 83rd Avenue, and Butler Drive it is desirable to program the storm drain construction and street improvements in the same construction project.

4.4 Unit Price Analysis

WPA has prepared data on the unit costs and contingencies for the Northern/Orangewood Storm Drain Project. Rubber gasket reinforced concrete pipe (RGRCP) material costs were quoted by Hydro Conduit.

To get a better handle on the installed cost of RGRCP, WPA contacted Roger Eshies, Pulice Construction of Phoenix. Pulice is a major local contractor and has performed several similar storm drain projects in Maricopa County. Additionally, Pulice has worked very closely with Hydro Conduit.

A detailed installation estimate (shown in Table II-9) was prepared based on review and input from Pulice. The estimate included all major tasks/materials including: pipe material, bedding requirements per MAG, excess dirt export, pavement replacement, trenching (up to 20-foot depth), minor traffic, and utility conflicts. More specific items such as construction through major intersections, major traffic corridors, and major utilities are excluded from the estimate.

A separate item "Rural Section" is also included with this estimate. The rural section will be less expensive than the urban section, primarily due to reduction in the pavement replacement related costs, traffic control, and ease of construction.

To estimate contingencies for all non-storm drain related items, WPA took the actual Bid Tabulations from the District's recent "Cactus Road Storm Drain Project". As shown on Table II-10, all bids were itemized under two major items: pipes and total project cost. By dividing total project cost with the pipe cost, gross contingencies were estimated.

The gross construction contingencies, therefore, include all items such as catch basins, connector pipes, pavement replacement, utility conflicts, irrigation conflicts, traffic, bedding, dirt export, mobilization, trenching, etc.

Unit prices from the *Glendale-Peoria ADMP* are included for price comparison. Table 19 "Capital Costs for South Peoria/Glendale Pipes" is taken *as-is* from the *Glendale-Peoria ADMP*.

The above data was previously submitted to the District and subsequently approved for use in this report.

5.0 COST EVALUATION

5.1 *Glendale-Peoria ADMP*

The *Glendale-Peoria ADMP* contains a cost analysis of facilities recommended in that report. To provide a baseline for comparison of the options discussed in the *Concept/Routing Study* presented in this report, those cost analyses are reproduced.

Table 5-1 summarizes the overall cost of *ADMP* facilities for the Cities of Glendale and Peoria and Table II-11 gives a more detailed cost breakdown for each facility as presented in the *ADMP*.

TABLE 5-1

Glendale-Peoria ADMP Cost Summary (a)

DESCRIPTION	*COST*	*PERCENT OF TOTAL COST*
City of Glendale		
STORM DRAIN PIPE, INSTALLATION, R/W AND CONTINGENCIES	$12,870,000	58%
35-ACRE DETENTION BASIN R/W, EARTHWORK, STRUCTURES, AND CONTINGENCIES	$6,586,000	30%
	$19,456,000	***87%***
City of Peoria		
STORM DRAIN PIPE, INSTALLATION, R/W AND CONTINGENCIES	$1,589,000	7%
18-ACRE DETENTION BASIN R/W, EARTHWORK, STRUCTURES, AND CONTINGENCIES	$1,210,000	5%
	$2,799,000	***13%***
TOTAL COSTS	***$22,255,000***	***100%***

(a) These costs are taken as-is from the Glendale-Peoria ADMP for cost-comparison purposes. For details see Table II-11.

5.2 Concept/Routing Study

Table 5-2 summarizes the bottom-line costs for each option presented in the Concept/Routing Study of Section 4.2. These costs were developed based on January, 1996 unit prices previously discussed in Section 4.4. The District furnished unit prices for the right-of-way acquisition cost for various locations. The Glendale Watershed option costs include right-of-way, but to further aid in comparison of outfall options, right-of-way acquisition areas are also provided.

The contingency factor estimated in Table II-10 represents storm drain construction in an urbanized street section. As a result, contingency of 24 percent was used as a basis for our detailed estimate. Adjustments were made to this value as appropriate for a specific urban or rural section, e.g., for urban section, this value was upgraded from 24 percent to 28 percent to account for uncertainty in bidding prices, traffic/utility difficulties. Whereas for the rural section, the value was downgraded from 24 percent to 18 percent to reflect ease of construction and lack of utility conflict. Additional contingency factors, e.g. engineering and construction administration were then added to derive the gross contingency value as stated below:

Contingency estimates:

	Urban	Rural
Construction cost, utility conflicts, traffic control, inlets, manholes, mobilization, etc.	28%	18%
Engineering (Concept/Routing Study Design Plans/Specifications) and Construction Administration	15%	13%
Totals (gross contingency)	**43%**	**31%**

Using a preliminary estimate of 75 percent urban and 25 percent rural, an overall weighted average contingency percentage of 40 percent was estimated. Therefore, 40 percent gross contingencies were used for all cost evaluations.

During the initial stage of cost analysis, alternative pipe/box culvert materials were evaluated. The evaluation considered rubber gasket reinforced concrete pipe (RGRCP), cast-in-place pipe (CIPP), cast-in-place box culverts, and precast box culverts. Due to the complexity involved with the various routing alignments (agricultural, rural, and urban) and four jurisdictional boundaries (Glendale, Peoria, MCDOT, and ADOT), it was decided to use either RGRCP for pipes and cast-in-place box culverts for the *Concept/Routing* phase of this study.

After selection is made of the recommended alignment by the *ADMP* team, pipe material alternatives for each segment of each alignment will be explored. For example, in urban segments RGRCP will be the first choice; for rural/agricultural/basin areas, if approved by the local jurisdiction, CIPP will be considered. The CIPP option would offer substantial cost savings and thereby reduce the overall capital improvement costs. Perhaps the cost savings thus achieved can stay with that jurisdiction and can be used for expanding their portion of the storm drain system.

TABLE 5-2

Concept/Routing Study
Option Cost Summary
(costs rounded to nearest $1000)

OPTION	COST (a)	STORM DRAIN RIGHT-OF-WAY (ac)	BASIN RIGHT-OF-WAY (ac)	COST DISTRIBUTION ADMP (b)	GLENDALE (c)	PEORIA (d)	ADOT (e)
Peoria Watershed:							
Northern Ave./Butler Dr. alignment, Option A	$3,046,000	0.95	23	$2,224,000		$822,000	
Northern Ave./Butler Dr. alignment, Option B	$2,845,000	0.95	23	$2,023,000		$822,000	
Glendale Watershed:							
Orangewood alignment, Option 1A	$12,722,000	6.36	36.92	$10,853,000	$1,521,000		$348,000
Orangewood alignment, Option 1B	$11,475,000	12.42	36.92	$9,354,000	$1,773,000		$348,000
Orangewood alignment, Option 2A	$14,479,000	6.74	39	$13,600,000	$566,000		$313,000
Orangewood alignment, Option 2B	$12,114,000	12.8	39	$11,235,000	$566,000		$313,000
Glendale Ave. alignment (f)	$12,962,000	1.52	36.92	$11,094,000	$1,520,000		$348,000

NOTES:
(a) Costs include Basin Land; Right-of way Acquisition; contingencies related to Engineering, Construction & Construction Administration (estimated 40%).
(b) ADMP costs to be shared by Agencies (FCDMC 50%, Glendale 25%,Peoria 25%)
(c) Extended Storm Drain Facility within Glendale service area also shared as per (b).
(d) Extended Storm Drain Facility within Peoria service area also shared as per (b).
(e) It is anticipated that ADOT will contribute this amount for improvements within Grand Avenue.
(f) The costs from this alignment should be compared with the costs from Orangewood alignment Option 1b ($11,475,000). This is because both of these options have identical drainage systems upstream of the 83rd Avenue and Orangewood Avenue intersection.

5.3 Recommended Options for Further Considerations

Table 5-3 below is a cost summary of the recommended, or recommended, options discussed in the *Concept/Routing Study* (Section 4.2).

TABLE 5-3

Concept/Routing Study

Cost/Benefit Summary for Recommended Options

(costs rounded to nearest $1000)

OPTION	*COST* (a)	*COST/BENEFIT DISTRIBUTION* *ADMP* (b)	*GLENDALE* (c)	*PEORIA* (d)	*ADOT* (e)
Peoria Watershed:					
Northern Ave./Butler Dr. alignment, Option B	$2,845,000	$2,038,000		$807,000	
Glendale Watershed:					
Orangewood alignment, Option 2B	$12,114,000	$11,235,000	$566,000		$313,000
TOTAL COST	$14,959,000	$13,273,000	$566,000	$807,000	$313,000

NOTES:

(a) Costs include Basin Land; Right-of way Acquisition; contingencies related to Engineering, Construction and Construction Administration (estimated 40%).

(b) ADMP costs to be shared by Agencies (FCDMC 50%, Glendale 25%,Peoria 25%)

(c) Extended Storm Drain Facility within Glendale service area also shared as per (b).

(d) Extended Storm Drain Facility within Peoria service area also shared as per (b).

(e) It is anticipated that ADOT will contribute this amount for improvements within Grand Avenue.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The *Glendale-Peoria ADMP* outlines major trunk line and lateral storm drain systems within the study area. In that report, several storm drain alignments were laid out including trunk lines along major arterial streets such as Cactus Road, Olive Avenue, Northern Avenue and Orangewood Avenue.

The general *ADMP* layout was used as a basis for the development of conceptual alignments in this study. The two major storm drain outfall alignments analyzed in this study are:

- Northern Avenue and Butler Drive storm drain alignments for the City of Peoria
- Orangewood Avenue or Glendale Avenue for the City of Glendale.

An in-depth cost evaluation was then carried out for these alignments. Several key components were included to further refine the alignments presented in Section 4.2.

This *Concept/Routing Study* primarily focussed on the storm drain alignments (from their outfall points into the Agua Fria Freeway Outfall Channel) along Northern, Orangewood, Butler, and Glendale Avenues. A detailed hydrologic evaluation, together with site-specific hydraulic analyses and utility conflict evaluation, were performed to seek the most cost-effective, workable optimum alignment along these roadway corridors.

Since these alignments follow major roadway corridors, issues such as traffic impacts, roadway closures, and business access, immediate flood control relief, ease of construction, phasing of construction, utility conflict, and costs play a significant role in the decision-making process.

For the Peoria Watershed, selection of the recommended alignment became very obvious. Due to the cost-effectiveness and ease of construction reasons, it is recommended that the *ADMP* team adopt:

- Butler Drive storm drain alignment
- Northern Avenue storm drain alignment, Option B.

For the Glendale Watershed, selection of the recommended alignment was somewhat difficult. This was because there were two basin options and about five outfall options, each having their own merits and shortcomings.

To help in the alignment selection process and to help quantify the advantages and disadvantages of each alternative considered, a rating matrix approach was utilized as shown in Tables 6-1 and 6-2 on the following pages.

While it is recognized that the ratings are somewhat subjective, it does define quantifiable results which are easy to compare. Based on this procedure, Option 2B, Basin East of Grand Avenue and with an open channel between 91st Avenue and the AFF Outfall Channel is recommended for adoption by the *ADMP* team.

The *ADMP* team chose the right approach of pursuing the best cost-effective storm drain alignment through a *Concept/Routing Study*. This approach deviated from the conventional practice of following the storm drain alignment recommendations from the *Glendale-Peoria ADMP*. To quantify this conclusion, the following estimates have been prepared:

	ADMP			Concept/Routing Study		
Jurisdiction	**Glendale**	**Peoria**	**TOTAL**	**Glendale**	**Peoria**	**TOTAL**
Northern/ Orangewood alignments per ADMP (per Table II-11)	19456000	2,799,000	**22,255,000**			
Northern/ Orangewood alignments for the **expanded** area (per Table II-12)	23,140,000	4,177,000	**27,317,000**	11,948,000	2,794,000	**14,739,000**

As can be seen from the cost summary above, the *Concept/Routing Study* not only cut costs, but expanded service beyond the *ADMP* coverage. Therefore, a *Concept/Routing Study* has proved itself to be an excellent value engineering tool in storm drainage system analysis.

Since the costs of improving the *ADMP* portion of storm drain have been reduced without compromising the design guidelines, it is further recommended that the City's service area be expanded with the extra funds.

Following are some recommendations:

1. As discussed in Section 4.2.1, the storm drain could be extended along Northern Avenue from 83rd Avenue to 75th Avenue for a probable cost of $974,000 in the City of Peoria. This extension will help in providing an outlet to MCDOT's proposed storm drain in 75th Avenue.

2. A storm drain can be extended for an estimated cost of $489,000 along 67th Avenue north of Northern Avenue in the City of Glendale. This extension will significantly enhance the flood mitigation along 67th Avenue.

3. Another project would be to extend the storm drain along Northern Avenue from 63rd Avenue to 59th Avenue. It is estimated that this extension would cost $1,018,000.

Plan and profile drawings (reduced size) of the recommended Phase 1 *Concept/Routing Study* storm drains are included in Appendix III.

TABLE 6-1

ORANGEWOOD ALIGNMENT
(East of 83rd Avenue)

RATING MATRIX FOR ALIGNMENT ALTERNATIVES

		CONSTRUCTION RELATED					PARK RELATED	AGENCY RELATED					COST RELATED	
OPTION	DESCRIPTION	EASE OF CONSTN	ROW ACQUISITION	EASE OF UTILITY CROSSING	TRAFFIC IMPACT	EASE OF PHASING	BENEFIT	GLENDALE SUPPORT	PEORIA SUPPORT	FCDMC SUPPORT	ADOT SUPPORT	RAILROAD IMPACT	COST	TOTAL
1A, 1B	West Basin	2	4	3	2	2	3	4	4	3	4	3	4	38
2A, 2B	East Basin	4	1	5	4	4	4	5	5	4	5	4	3	48*

RATING EXPLANATION

1 Worst
2 Poor
3 Average
4 Better
5 Best

* Recommended Option

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TABLE 6-2

ORANGEWOOD VS. GLENDALE AVENUE OUTFALL OPTIONS
(West of 83rd Avenue)

RATING MATRIX FOR ALIGNMENT ALTERNATIVES

		CONSTRUCTION RELATED					AGENCY RELATED				COST RELATED	
	DESCRIPTION	EASE OF CONSTN	ROW ACQUISITION	EASE OF UTILITY CROSSING	TRAFFIC IMPACT	EASE OF PHASING	GLENDALE SUPPORT	PEORIA SUPPORT	FCDMC SUPPORT	ADOT SUPPORT	COST	TOTAL
1A, 2A	Orangewood Ave. Box Culvert Outfall	4	1	5	5	5	3	2	1	5	4	35
1B, 2B	Orangewood Ave. Open Channel Outfall	5	1	5	5	5	2	3	4	5	5	40*
2A	83rd Ave. - Glendale Ave. Outfall*	1	5	1	1	1	5	2	2	3	3	24

* This alignment is not technically feasible until ADOT's AFF channel is built south of Glendale Avenue; therefore, its phasing cannot be planned for implementation until the Year 2003.

RATING EXPLANATION

1 Worst
2 Poor
3 Average
4 Better
5 Best

* Recommended Option

WP #94153

7.0 REFERENCES

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APPENDICES

Appendix I - Hydrologic Appendix
Appendix II - Concept/Routing Alternatives
Appendix III - Plan/Profiles *Concept/Routing Study* (reduced size)

APPENDIX I - HYDROLOGY

OUTPUT FROM SPREADSHEET SGRAPH.WK1
PEORIA WATERSHED, FUTURE CONDITION

LOSS PARAMETERS FOR SUBBASIN: 10A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	41.400	41.40	0.05	-0.539	0.00	0.00
TW	28.500	28.50	0.05	-0.371	0.00	0.00
LE	22.200	22.20	0.04	-0.310	0.00	0.00
MS	7.900	7.90	0.01	-0.158	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.04	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.25	=	9.7
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150
100.000	=TOTAL AREA OK		AVERAGE =	10.00	TOTAL =	75.00	AVG. =	0.150
					% =	75.00		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.040

IMPERVIOUS AREA:

URBAN @	100	% effective =	75.00
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
10A	100.000	0.150	0.150	9.70	0.040	75.00	11.40

LOSS PARAMETERS FOR SUBBASIN: 10B

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	41.400	41.40	0.05	-0.539	0.00	0.00
TW	28.500	28.50	0.05	-0.371	0.00	0.00
LE	22.200	22.20	0.04	-0.310	0.00	0.00
MS	7.900	7.90	0.01	-0.158	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.04 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.25	=	9.7
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050
100.000	=TOTAL AREA OK		AVERAGE =	0.00	TOTAL = % =	100.00 100.00	AVG. =	0.050

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.040

IMPERVIOUS AREA: URBAN @ 100 % effective = ******
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = ******

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
10B	100.000	0.050	0.150	9.70	0.040	100.00	24.74

LOSS PARAMETERS FOR SUBBASIN: 10C

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	75.000	75.00	0.05	-0.976	0.00	0.00
LE	25.000	25.00	0.04	-0.349	0.00	0.00
	0.000	0.00	---	0.000	---	---
		0.00	---	0.000	---	---

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	OPEN	100.00	DRY	15.00	0.00	0.00	0.15	0.150
	PAVEMENT	0.00	NORMAL		100.00	0.00		0.000

100.000 =TOTAL AREA OK AVERAGE = 15.00 TOTAL = 0.00 AVG. = 0.150
% = 0.00

PERCENT OF SUBBASIN DRY = 100.00 %
NORMAL = 0.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.270

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.053

IMPERVIOUS AREA: URBAN @ 100 % effective = 0.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 0.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
10C	100.000	0.150	0.270	8.80	0.053	0.00	15.72

LOSS PARAMETERS FOR SUBBASIN: 20A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	52.700	52.70	0.05	-0.686	0.00	0.00
TT	19.600	19.60	0.04	-0.274	0.00	0.00
TW	9.900	9.90	0.05	-0.129	0.00	0.00
LE	8.000	8.00	0.04	-0.112	0.00	0.00
LCA	7.700	7.70	0.25	-0.046	0.00	0.00
LB	2.100	2.10	0.4	-0.008	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150

100.000 =TOTAL AREA OK AVERAGE = 10.00 TOTAL = 75.00 AVG. = 0.150
% = 75.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 100 % effective = 75.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
20A	100.000	0.150	0.150	8.40	0.060	75.00	19.94

LOSS PARAMETERS FOR SUBBASIN: 20B

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	52.700	52.70	0.05	-0.686	0.00	0.00
TT	19.600	19.60	0.04	-0.274	0.00	0.00
TW	9.900	9.90	0.05	-0.129	0.00	0.00
LE	8.000	8.00	0.04	-0.112	0.00	0.00
LCA	7.700	7.70	0.25	-0.046	0.00	0.00
LB	2.100	2.10	0.4	-0.008	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.29	=	8.4
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
20B	100.000	0.050	0.150	8.40	0.060	95.00	28.08

LOSS PARAMETERS FOR SUBBASIN: 20C

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	52.700	52.70	0.05	-0.686	0.00	0.00
TT	19.600	19.60	0.04	-0.274	0.00	0.00
TW	9.900	9.90	0.05	-0.129	0.00	0.00
LE	8.000	8.00	0.04	-0.112	0.00	0.00
LCA	7.700	7.70	0.25	-0.046	0.00	0.00
LB	2.100	2.10	0.4	-0.008	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.06	%ROCK=	0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
20C	100.000	0.050	0.150	8.40	0.060	95.00	22.91

LOSS PARAMETERS FOR SUBBASIN: 30A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TW	52.600	52.60	0.05	-0.684	0.00	0.00
MR	47.400	47.40	0.05	-0.617	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150
100.000	=TOTAL AREA OK		AVERAGE =	10.00	TOTAL =	75.00	AVG. =	0.150
					% =	75.00		

PERCENT OF SUBBASIN

DRY =	0.00 %
NORMAL =	100.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:

URBAN @	100 %	effective =	75.00
ROCK OUTCROP @	--- %	effective =	0.00
	% EFFECTIVE IMP. =		75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
30A	100.000	0.150	0.150	8.80	0.050	75.00	39.36

LOSS PARAMETERS FOR SUBBASIN: 40A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	53.400	53.45	0.05	-0.695	0.00	0.00
LCA	32.500	32.53	0.25	-0.196	0.00	0.00
GXA	7.100	7.11	0.23	-0.045	0.00	0.00
LE	3.000	3.00	0.04	-0.042	0.00	0.00
TT	2.100	2.10	0.04	-0.029	0.00	0.00
TW	1.800	1.80	0.05	-0.023	0.00	0.00
TOTAL =	99.900 PERCENT		XKSAT =	0.09	%ROCK=	0.00

DTHETA

Dry = 0.33
Normal = 0.15
Wet = 0

PSIF

= 7.3

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150
100.000 =TOTAL AREA OK			AVERAGE =	10.00	TOTAL = % =	75.00 75.00	AVG. =	0.150

PERCENT OF SUBBASIN

DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA:

URBAN @ 100 % effective = 75.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
40A	99.900	0.150	0.150	7.30	0.090	75.00	10.25

LOSS PARAMETERS FOR SUBBASIN: 40C

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	53.400	53.45	0.05	-0.695	0.00	0.00
LCA	32.500	32.53	0.25	-0.196	0.00	0.00
GXA	7.100	7.11	0.23	-0.045	0.00	0.00
LE	3.000	3.00	0.04	-0.042	0.00	0.00
TT	2.100	2.10	0.04	-0.029	0.00	0.00
TW	1.800	1.80	0.05	-0.023	0.00	0.00
TOTAL =	99.900 PERCENT	XKSAT =		0.09	%ROCK=	0.00

DTHETA

Dry = 0.33
Normal = 0.15
Wet = 0

PSIF

= 7.3

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050
100.000 =TOTAL AREA OK			AVERAGE =	0.00	TOTAL = % =	100.00 100.00	AVG. =	0.050

PERCENT OF SUBBASIN

DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA:

URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
40C	99.900	0.050	0.150	7.30	0.090	95.00	16.69

LOSS PARAMETERS FOR SUBBASIN: 40D

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	53.400	53.45	0.05	-0.695	0.00	0.00
LCA	32.500	32.53	0.25	-0.196	0.00	0.00
GXA	7.100	7.11	0.23	-0.045	0.00	0.00
LE	3.000	3.00	0.04	-0.042	0.00	0.00
TT	2.100	2.10	0.04	-0.029	0.00	0.00
TW	1.800	1.80	0.05	-0.023	0.00	0.00
TOTAL =	99.900 PERCENT	XKSAT =		0.09	%ROCK=	0.00

DTHETA

Dry = 0.33
Normal = 0.15
Wet = 0

PSIF

= 7.3

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050
100.000	=TOTAL AREA OK		AVERAGE =	0.00	TOTAL = % =	100.00 100.00	AVG. =	0.050

PERCENT OF SUBBASIN

DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA:

URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
40D	99.900	0.050	0.150	7.30	0.090	95.00	14.33

LOSS PARAMETERS FOR SUBBASIN: 40E

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	53.400	53.45	0.05	-0.695	0.00	0.00
LCA	32.500	32.53	0.25	-0.196	0.00	0.00
GXA	7.100	7.11	0.23	-0.045	0.00	0.00
LE	3.000	3.00	0.04	-0.042	0.00	0.00
TT	2.100	2.10	0.04	-0.029	0.00	0.00
TW	1.800	1.80	0.05	-0.023	0.00	0.00

TOTAL = 99.900 PERCENT XKSAT = 0.09 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.33	=	7.3
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150

100.000 =TOTAL AREA OK AVERAGE = 10.00 TOTAL = 75.00 AVG. = 0.150
% = 75.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA: URBAN @ 100 % effective = 75.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
40E	99.900	0.150	0.150	7.30	0.090	75.00	10.94

LOSS PARAMETERS FOR SUBBASIN: 50A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TW	36.400	36.36	0.05	-0.473	0.00	0.00
GT	20.700	20.68	0.04	-0.289	0.00	0.00
LE	18.100	18.08	0.04	-0.253	0.00	0.00
MS	15.300	15.28	0.01	-0.306	0.00	0.00
MR	9.600	9.59	0.05	-0.125	0.00	0.00

TOTAL = 100.100 PERCENT XKSAT = 0.04 %ROCK= 0.00

DTHETA		PSIF
Dry =	0.25	= 9.7
Normal =	0.15	
Wet =	0	

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150

100.000 =TOTAL AREA OK AVERAGE = 10.00 TOTAL = 75.00 AVG. = 0.150
% = 75.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.040

IMPERVIOUS AREA: URBAN @ 100 % effective = 75.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
50A	100.100	0.150	0.150	9.70	0.040	75.00	22.96

LOSS PARAMETERS FOR SUBBASIN: 50B

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TW	36.400	36.36	0.05	-0.473	0.00	0.00
GT	20.700	20.68	0.04	-0.289	0.00	0.00
LE	18.100	18.08	0.04	-0.253	0.00	0.00
MS	15.300	15.28	0.01	-0.306	0.00	0.00
MR	9.600	9.59	0.05	-0.125	0.00	0.00
		0.00	---	0.000	---	---

TOTAL = 100.100 PERCENT XKSAT = 0.04 %ROCK= 0.00

DTHETA

Dry = 0.25
Normal = 0.15
Wet = 0

PSIF

= 9.7

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.040

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
50B	100.100	0.050	0.150	9.70	0.040	95.00	29.42

LOSS PARAMETERS FOR SUBBASIN: 60A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	45.200	45.15	0.05	-0.587	0.00	0.00
TW	23.400	23.38	0.05	-0.304	0.00	0.00
LE	21.100	21.08	0.04	-0.295	0.00	0.00
RBA	8.100	8.09	0.26	-0.047	0.00	0.00
GT	2.300	2.30	0.04	-0.032	0.00	0.00

TOTAL = 100.100 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150

100.000 =TOTAL AREA OK AVERAGE = 10.00 TOTAL = 75.00 AVG. = 0.150
% = 75.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 100 % effective = 75.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
60A	100.100	0.150	0.150	8.80	0.050	75.00	13.21

LOSS PARAMETERS FOR SUBBASIN: 60B

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	45.200	45.15	0.05	-0.587	0.00	0.00
TW	23.400	23.38	0.05	-0.304	0.00	0.00
LE	21.100	21.08	0.04	-0.295	0.00	0.00
RBA	8.100	8.09	0.26	-0.047	0.00	0.00
GT	2.300	2.30	0.04	-0.032	0.00	0.00
		0.00	---	0.000	---	---

TOTAL = 100.100 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
60B	100.100	0.050	0.150	8.80	0.050	95.00	19.07

LOSS PARAMETERS FOR SUBBASIN: 60C

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	45.200	45.15	0.05	-0.587	0.00	0.00
TW	23.400	23.38	0.05	-0.304	0.00	0.00
LE	21.100	21.08	0.04	-0.295	0.00	0.00
RBA	8.100	8.09	0.26	-0.047	0.00	0.00
GT	2.300	2.30	0.04	-0.032	0.00	0.00
TOTAL =	100.100 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150
100.000 =TOTAL AREA OK			AVERAGE =	10.00	TOTAL =	75.00	AVG. =	0.150
					% =	75.00		

PERCENT OF SUBBASIN

DRY =	0.00 %
NORMAL =	100.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:

URBAN @	100 % effective =	75.00
ROCK OUTCROP @	--- % effective =	0.00
	% EFFECTIVE IMP. =	75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
60C	100.100	0.150	0.150	8.80	0.050	75.00	8.39

LOSS PARAMETERS FOR SUBBASIN: 60D

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	45.200	45.15	0.05	-0.587	0.00	0.00
TW	23.400	23.38	0.05	-0.304	0.00	0.00
LE	21.100	21.08	0.04	-0.295	0.00	0.00
RBA	8.100	8.09	0.26	-0.047	0.00	0.00
GT	2.300	2.30	0.04	-0.032	0.00	0.00
		0.00	---	0.000	---	---

TOTAL = 100.100 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
60D	100.100	0.050	0.150	8.80	0.050	95.00	22.34

LOSS PARAMETERS FOR SUBBASIN: 70A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LE	30.100	30.07	0.04	-0.420	0.00	0.00
MR	28.700	28.67	0.05	-0.373	0.00	0.00
TW	21.900	21.88	0.05	-0.285	0.00	0.00
LB	11.700	11.69	0.4	-0.047	0.00	0.00
GT	6.300	6.29	0.04	-0.088	0.00	0.00
MS	1.400	1.40	0.01	-0.028	0.00	0.00

TOTAL = 100.100 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
70A	100.100	0.050	0.150	8.40	0.060	95.00	25.27

LOSS PARAMETERS FOR SUBBASIN: 70B

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LE	30.100	30.07	0.04	-0.420	0.00	0.00
MR	28.700	28.67	0.05	-0.373	0.00	0.00
TW	21.900	21.88	0.05	-0.285	0.00	0.00
LB	11.700	11.69	0.4	-0.047	0.00	0.00
GT	6.300	6.29	0.04	-0.088	0.00	0.00
MS	1.400	1.40	0.01	-0.028	0.00	0.00

TOTAL = 100.100 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
70B	100.100	0.050	0.150	8.40	0.060	95.00	27.63

LOSS PARAMETERS FOR SUBBASIN: 90F

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GT	51.100	51.10	0.04	-0.714	0.00	0.00
LE	27.400	27.40	0.04	-0.383	0.00	0.00
MR	9.500	9.50	0.05	-0.124	0.00	0.00
GXA	4.400	4.40	0.23	-0.028	0.00	0.00
RBA	4.400	4.40	0.26	-0.026	0.00	0.00
LCA	3.200	3.20	0.25	-0.019	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	PAVEMENT	100.00	NORMAL	0.00	100.00	100.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 100.00 AVG. = 0.050
% = 100.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 95 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
90F	100.000	0.050	0.150	8.80	0.050	95.00	14.13

LOSS PARAMETERS FOR SUBBASIN: 100P

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	47.600	47.60	0.05	-0.619	0.00	0.00
LCA	30.100	30.10	0.25	-0.181	0.00	0.00
GT	15.900	15.90	0.04	-0.222	0.00	0.00
LE	6.400	6.40	0.04	-0.089	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.08 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.32	=	7.6
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
42.200	V.L.D.R	42.20	NORMAL	20.00	15.00	6.33	0.15	0.063
57.800	L.D.R.	57.80	NORMAL	20.00	25.00	14.45	0.15	0.087

100.000 =TOTAL AREA OK AVERAGE = 20.00 TOTAL = 20.78 AVG. = 0.150
% = 20.78

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.089

IMPERVIOUS AREA: URBAN @ 100 % effective = 20.78
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 20.78

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
100P	100.000	0.150	0.150	7.60	0.089	20.78	34.13

LOSS PARAMETERS FOR SUBBASIN: 120P

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GT	88.100	88.10	0.04	-1.232	0.00	0.00
RBA	11.900	11.90	0.26	-0.070	0.00	0.00
TOTAL =	100.000 PERCENT	XKSAT =		0.05	%ROCK=	0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	V.L.D.R	100.00	NORMAL	20.00	15.00	15.00	0.15	0.150
100.000	=TOTAL AREA OK		AVERAGE =	20.00	TOTAL = % =	15.00 15.00	AVG. =	0.150

PERCENT OF SUBBASIN

DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.056

IMPERVIOUS AREA:

URBAN @ 100 % effective = 15.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 15.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
120P	100.000	0.150	0.150	8.80	0.056	15.00	16.36

LOSS PARAMETERS FOR SUBBASIN: 140P

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	91.100	91.19	0.05	-1.186	0.00	0.00
LCA	8.600	8.61	0.25	-0.052	0.00	0.00
TFA	0.200	0.20	0.37	-0.001	0.00	0.00

TOTAL = 99.900 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.29	=	8.4
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	ROW CROP	100.00	NORMAL	5.00	0.00	0.00	0.50	0.500
100.000	=TOTAL AREA OK		AVERAGE =	5.00	TOTAL =	0.00	AVG. =	0.500
					% =	0.00		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.060

IMPERVIOUS AREA: URBAN @ 100 % effective = 0.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 0.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
140P	99.900	0.500	0.150	8.40	0.060	0.00	104.36

LOSS PARAMETERS FOR SUBBASIN: 150A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	60.200	60.14	0.05	-0.782	0.00	0.00
LCA	24.200	24.18	0.25	-0.146	0.00	0.00
MS	7.100	7.09	0.01	-0.142	0.00	0.00
BT	4.300	4.30	0.25	-0.026	0.00	0.00
VF	4.300	4.30	0.01	-0.086	0.00	0.00

TOTAL = 100.100 PERCENT XKSAT = 0.07 %ROCK= 0.00

DTHETA

Dry = 0.3
Normal = 0.15
Wet = 0

PSIF

= 8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
67.200	L.D.R.	67.20	NORMAL	20.00	25.00	16.80	0.15	0.101
12.800	COMM	12.80	NORMAL	15.00	90.00	11.52	0.15	0.019
20.000	ROW CROP	20.00	NORMAL	5.00	0.00	0.00	0.50	0.100

100.000 =TOTAL AREA OK AVERAGE = 16.36 TOTAL = 28.32 AVG. = 0.220
% = 28.32

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.075

IMPERVIOUS AREA: URBAN @ 100 % effective = 28.32
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 28.32

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
150A	100.100	0.220	0.150	8.00	0.075	28.32	70.31

LOSS PARAMETERS FOR SUBBASIN: 190A

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	77.000	77.00	0.05	-1.002	0.00	0.00
TW	21.600	21.60	0.05	-0.281	0.00	0.00
LB	0.900	0.90	0.4	-0.004	0.00	0.00
LCA	0.500	0.50	0.25	-0.003	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 95.00 AVG. = 0.050
% = 95.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
190A	100.000	0.050	0.150	8.80	0.050	95.00	32.46

OUTPUT FROM SPREADSHEET SGRAPH.WK1
GLENDALE WATERSHED, FUTURE CONDITION

LOSS PARAMETERS FOR SUBBASIN: 10S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AA	43.610	43.61	0.26	-0.255	0.00	0.00
AO	28.570	28.57	0.04	-0.399	0.00	0.00
VK	15.040	15.04	0.26	-0.088	0.00	0.00
VH	11.280	11.28	0.27	-0.064	0.00	0.00
GGA	1.500	1.50	0.25	-0.009	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.15 %ROCK= 0.00

DTHETA

Dry = 0.4
Normal = 0.25
Wet = 0

PSIF

= 6

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
75.650	M.D.R.	75.66	NORMAL	20.00	45.00	34.04	0.15	0.113
23.660	COMM	23.66	NORMAL	15.00	90.00	21.29	0.15	0.035
0.680	FUTURE DEVEL	0.68	NORMAL	0.00	95.00	0.65	0.05	0.000

99.990 =TOTAL AREA OK AVERAGE = 18.68 TOTAL = 55.98 AVG. = 0.149
% = 55.99

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.164

IMPERVIOUS AREA: URBAN @ 100 % effective = 55.99
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 55.99

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
10S	100.000	0.149	0.250	6.00	0.164	55.99	34.30

LOSS PARAMETERS FOR SUBBASIN: 20

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AO	50.290	50.29	0.04	-0.703	0.00	0.00
GGA	19.210	19.21	0.25	-0.116	0.00	0.00
AA	14.120	14.12	0.26	-0.083	0.00	0.00
TT	6.780	6.78	0.04	-0.095	0.00	0.00
GE	4.520	4.52	0.26	-0.026	0.00	0.00
ES	3.950	3.95	0.25	-0.024	0.00	0.00
VH	1.130	1.13	0.27	-0.006	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.09 %ROCK= 0.00

DTHETA

Dry = 0.33
Normal = 0.15
Wet = 0

PSIF

= 7.3

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
57.240	M.D.R.	57.24	NORMAL	20.00	45.00	25.76	0.15	0.086
30.200	M.F.R.	30.20	NORMAL	20.00	65.00	19.63	0.15	0.045
11.410	COMM	11.41	NORMAL	15.00	90.00	10.27	0.15	0.017
1.150	FUTURE DEVEL	1.15	NORMAL	0.00	95.00	1.09	0.05	0.001

100.000 =TOTAL AREA OK AVERAGE = 19.20 TOTAL = 56.75 AVG. = 0.149
% = 56.75

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.099

IMPERVIOUS AREA: URBAN @ 100 % effective = 56.75
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 56.75

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
20	100.000	0.149	0.150	7.30	0.099	56.75	33.79

LOSS PARAMETERS FOR SUBBASIN: 30S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	49.300	49.29	0.25	-0.297	0.00	0.00
AA	19.250	19.25	0.26	-0.113	0.00	0.00
BS	12.680	12.68	0.39	-0.052	0.00	0.00
GE	9.860	9.86	0.26	-0.058	0.00	0.00
AO	3.760	3.76	0.04	-0.053	0.00	0.00
BT	3.290	3.29	0.25	-0.020	0.00	0.00
ES	1.880	1.88	0.25	-0.011	0.00	0.00

TOTAL = 100.020 PERCENT XKSAT = 0.25 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.35	=	4.8
Normal =	0.25		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
72.030	M.D.R.	72.03	NORMAL	20.00	45.00	32.41	0.15	0.108
14.880	M.F.R.	14.88	NORMAL	20.00	65.00	9.67	0.15	0.022
13.090	COMM	13.09	NORMAL	15.00	90.00	11.78	0.15	0.020

100.000 =TOTAL AREA OK AVERAGE = 19.35 TOTAL = 53.87 AVG. = 0.150

% = 53.87

PERCENT OF SUBBASIN DRY = 0.00 %

NORMAL = 100.00 %

WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.276

IMPERVIOUS AREA: URBAN @ 100 % effective = 53.87

ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 53.87

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
30S	100.020	0.150	0.250	4.80	0.276	53.87	43.94

LOSS PARAMETERS FOR SUBBASIN: 40S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
AO	38.790	38.79	0.04	-0.542	0.00	0.00
TT	23.030	23.03	0.04	-0.322	0.00	0.00
GT	10.300	10.30	0.04	-0.144	0.00	0.00
GGA	9.700	9.70	0.25	-0.058	0.00	0.00
LCA	4.850	4.85	0.25	-0.029	0.00	0.00
LE	4.850	4.85	0.04	-0.068	0.00	0.00
MR	4.240	4.24	0.05	-0.055	0.00	0.00
ES	4.240	4.24	0.25	-0.026	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
75.760	M.D.R.	75.76	NORMAL	20.00	45.00	34.09	0.15	0.114
24.240	ROW CROP	24.24	NORMAL	5.00	0.00	0.00	0.50	0.121

100.000 =TOTAL AREA OK AVERAGE = 16.36 TOTAL = 34.09 AVG. = 0.235
% = 34.09

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.064

IMPERVIOUS AREA: URBAN @ 100 % effective = 34.09
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 34.09

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
40S	100.000	0.235	0.150	8.40	0.064	34.09	113.83

LOSS PARAMETERS FOR SUBBASIN: 50S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	38.250	38.25	0.05	-0.498	0.00	0.00
TT	30.600	30.60	0.04	-0.428	0.00	0.00
ES	15.850	15.85	0.25	-0.095	0.00	0.00
AO	8.740	8.74	0.04	-0.122	0.00	0.00
LE	5.460	5.46	0.04	-0.076	0.00	0.00
TW	1.090	1.09	0.05	-0.014	0.00	0.00

TOTAL = 99.990 PERCENT XKSAT = 0.06 %ROCK= 0.00

DTHETA

Dry = 0.29
Normal = 0.15
Wet = 0

PSIF

= 8.4

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
53.570	M.D.R.	53.57	NORMAL	20.00	45.00	24.11	0.15	0.080
9.700	M.F.R.	9.70	NORMAL	20.00	65.00	6.31	0.15	0.015
9.510	COMM	9.51	NORMAL	15.00	90.00	8.56	0.15	0.014
5.980	FUTURE DEVEL	5.98	NORMAL	0.00	95.00	5.68	0.05	0.003
4.950	PARK	4.95	NORMAL	85.00	0.00	0.00	0.15	0.007
16.290	ROW CROP	16.29	NORMAL	5.00	0.00	0.00	0.50	0.081

100.000 =TOTAL AREA OK AVERAGE = 19.10 TOTAL = 44.65 AVG. = 0.201
% = 44.65

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.066

IMPERVIOUS AREA: URBAN @ 100 % effective = 44.65
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 44.65

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
50S	99.990	0.201	0.150	8.40	0.066	44.65	105.50

LOSS PARAMETERS FOR SUBBASIN: 60S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	34.830	34.83	0.25	-0.210	0.00	0.00
TT	33.790	33.79	0.04	-0.472	0.00	0.00
GE	9.660	9.66	0.26	-0.057	0.00	0.00
AA	8.280	8.28	0.26	-0.048	0.00	0.00
BS	3.790	3.79	0.39	-0.015	0.00	0.00
AO	3.450	3.45	0.04	-0.048	0.00	0.00
LCA	3.100	3.10	0.25	-0.019	0.00	0.00
TW	1.720	1.72	0.05	-0.022	0.00	0.00
MR	0.690	0.69	0.05	-0.009	0.00	0.00
VH	0.690	0.69	0.27	-0.004	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.12 %ROCK= 0.00

DTHETA

Dry = 0.37
Normal = 0.19
Wet = 0

PSIF

= 6.6

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
55.640	M.D.R.	55.65	NORMAL	20.00	45.00	25.04	0.15	0.083
14.480	M.F.R.	14.48	NORMAL	20.00	65.00	9.41	0.15	0.022
3.730	COMM	3.73	NORMAL	15.00	90.00	3.36	0.15	0.006
1.030	FUTURE DEVEL	1.03	NORMAL	0.00	95.00	0.98	0.05	0.001
14.840	PARK	14.84	NORMAL	85.00	0.00	0.00	0.15	0.022
10.270	ROW CROP	10.27	NORMAL	5.00	0.00	0.00	0.50	0.051
99.990	=TOTAL AREA OK		AVERAGE =	27.71	TOTAL =	38.79	AVG. =	0.185
					% =	38.79		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.190

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.143

IMPERVIOUS AREA: URBAN @ 100 % effective = 38.79
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 38.79

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
60S	100.000	0.185	0.190	6.60	0.143	38.79	141.41

LOSS PARAMETERS FOR SUBBASIN: 70S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	49.370	49.37	0.25	-0.297	0.00	0.00
AO	22.500	22.50	0.04	-0.315	0.00	0.00
ES	10.630	10.63	0.25	-0.064	0.00	0.00
AA	8.750	8.75	0.26	-0.051	0.00	0.00
TT	6.250	6.25	0.04	-0.087	0.00	0.00
GT	2.500	2.50	0.04	-0.035	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.14 %ROCK= 0.00

DTHETA

Dry = 0.39
Normal = 0.23
Wet = 0

PSIF

= 6.2

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
38.690	M.D.R.	38.69	NORMAL	20.00	45.00	17.41	0.15	0.058
57.050	COMM	57.05	NORMAL	15.00	90.00	51.35	0.15	0.086
4.260	FUTURE DEVEL	4.26	NORMAL	0.00	95.00	4.05	0.05	0.002

100.000 =TOTAL AREA OK AVERAGE = 16.30 TOTAL = 72.80 AVG. = 0.146
% = 72.80

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.230

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.150

IMPERVIOUS AREA: URBAN @ 100 % effective = 72.80
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 72.80

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
70S	100.000	0.146	0.230	6.20	0.150	72.80	38.21

LOSS PARAMETERS FOR SUBBASIN: 80S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LE	43.140	43.14	0.04	-0.603	0.00	0.00
TW	32.680	32.68	0.05	-0.425	0.00	0.00
MR	18.300	18.30	0.05	-0.238	0.00	0.00
LCA	5.880	5.88	0.25	-0.035	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
91.850	M.F.R.	91.85	NORMAL	20.00	65.00	59.70	0.15	0.138
2.630	COMM	2.63	NORMAL	15.00	90.00	2.37	0.15	0.004
5.520	FUTURE DEVEL	5.52	NORMAL	0.00	95.00	5.24	0.05	0.003

100.000 =TOTAL AREA OK AVERAGE = 18.76 TOTAL = 67.31 AVG. = 0.144
% = 67.31

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.055

IMPERVIOUS AREA: URBAN @ 100 % effective = 67.31
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 67.31

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
80S	100.000	0.144	0.150	8.80	0.055	67.31	34.50

LOSS PARAMETERS FOR SUBBASIN: 90S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	51.530	51.53	0.05	-0.670	0.00	0.00
TW	48.470	48.47	0.05	-0.631	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
68.890	M.F.R.	68.89	NORMAL	20.00	65.00	44.78	0.15	0.103
31.110	FUTURE DEVEL	31.11	NORMAL	0.00	95.00	29.55	0.05	0.016
100.000	=TOTAL AREA OK		AVERAGE =	13.78	TOTAL =	74.33	AVG. =	0.119
					% =	74.33		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.052

IMPERVIOUS AREA:			
URBAN @	100	% effective =	74.33
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	74.33

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
90S	100.000	0.119	0.150	8.80	0.052	74.33	29.95

LOSS PARAMETERS FOR SUBBASIN: 100G

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TT	36.930	36.93	0.04	-0.516	0.00	0.00
MR	34.310	34.31	0.05	-0.446	0.00	0.00
TW	16.010	16.01	0.05	-0.208	0.00	0.00
LE	8.170	8.17	0.04	-0.114	0.00	0.00
LCA	4.580	4.58	0.25	-0.028	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
20.470	M.D.R.	20.47	NORMAL	20.00	45.00	9.21	0.15	0.031
39.650	M.F.R.	39.65	NORMAL	20.00	65.00	25.77	0.15	0.059
13.600	IND	13.60	NORMAL	10.00	75.00	10.20	0.15	0.020
3.960	COMM	3.96	NORMAL	15.00	90.00	3.56	0.15	0.006
2.520	FUTURE DEVEL	2.52	NORMAL	0.00	95.00	2.39	0.05	0.001
19.810	PARK	19.81	NORMAL	85.00	0.00	0.00	0.15	0.030
100.010	=TOTAL AREA OK		AVERAGE =	30.81	TOTAL =	51.14	AVG. =	0.147
					% =	51.14		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.061

IMPERVIOUS AREA: URBAN @ 100 % effective = 51.14
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 51.14

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
100G	100.000	0.147	0.150	8.80	0.061	51.14	138.93

LOSS PARAMETERS FOR SUBBASIN: 110S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	45.230	45.23	0.25	-0.272	0.00	0.00
TT	27.220	27.22	0.04	-0.381	0.00	0.00
MR	18.520	18.52	0.05	-0.241	0.00	0.00
GT	4.310	4.31	0.04	-0.060	0.00	0.00
ES	2.580	2.58	0.25	-0.016	0.00	0.00
LE	1.280	1.28	0.04	-0.018	0.00	0.00
AO	0.860	0.86	0.04	-0.012	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.10 %ROCK= 0.00

DTHETA

Dry = 0.35
Normal = 0.15
Wet = 0

PSIF

= 7

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
33.590	M.D.R.	33.59	NORMAL	20.00	45.00	15.12	0.15	0.050
22.500	M.F.R.	22.50	NORMAL	20.00	65.00	14.63	0.15	0.034
6.290	IND	6.29	NORMAL	10.00	75.00	4.72	0.15	0.009
22.330	COMM	22.33	NORMAL	15.00	90.00	20.10	0.15	0.033
0.780	FUTURE DEVEL	0.78	NORMAL	0.00	95.00	0.74	0.05	0.000
14.510	PARK	14.51	NORMAL	85.00	0.00	0.00	0.15	0.022

100.000 =TOTAL AREA OK AVERAGE = 27.53 TOTAL = 55.30 AVG. = 0.149
% = 55.30

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.119

IMPERVIOUS AREA: URBAN @ 100 % effective = 55.30
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 55.30

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
110S	100.000	0.149	0.150	7.00	0.119	55.30	89.59

LOSS PARAMETERS FOR SUBBASIN: 111S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TT	55.970	55.96	0.04	-0.782	0.00	0.00
MR	35.230	35.23	0.05	-0.458	0.00	0.00
LE	8.810	8.81	0.04	-0.123	0.00	0.00

TOTAL = 100.010 PERCENT XKSAT = 0.04 %ROCK= 0.00

DTHETA

Dry = 0.25
Normal = 0.15
Wet = 0

PSIF

= 9.7

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
85.650	COMM	85.65	NORMAL	15.00	90.00	77.09	0.15	0.128
14.350	FUTURE DEVEL	14.35	NORMAL	0.00	95.00	13.63	0.05	0.007

100.000 =TOTAL AREA OK AVERAGE = 12.85 TOTAL = 90.72 AVG. = 0.136
% = 90.72

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.041

IMPERVIOUS AREA: URBAN @ 100 % effective = 90.72
ROCK OUTCROP @ % effective = 0.00
% EFFECTIVE IMP. = 90.72

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
111S	100.010	0.136	0.150	9.70	0.041	90.72	18.26

LOSS PARAMETERS FOR SUBBASIN: 120G

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TT	57.970	57.97	0.04	-0.810	0.00	0.00
MR	31.880	31.88	0.05	-0.415	0.00	0.00
LE	5.800	5.80	0.04	-0.081	0.00	0.00
ES	4.350	4.35	0.25	-0.026	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
93.940	IND	93.94	NORMAL	10.00	75.00	70.46	0.15	0.141
6.060	FUTURE DEVEL	6.06	NORMAL	0.00	95.00	5.76	0.05	0.003
100.000	=TOTAL AREA OK		AVERAGE =	9.39	TOTAL =	76.21	AVG. =	0.144
					% =	76.21		

PERCENT OF SUBBASIN

DRY =	0.00 %
NORMAL =	100.00 %
WET =	0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:

URBAN @	100 %	effective =	76.21
ROCK OUTCROP @	--- %	effective =	0.00
% EFFECTIVE IMP. =			76.21

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
120G	100.000	0.144	0.150	8.80	0.050	76.21	19.66

LOSS PARAMETERS FOR SUBBASIN: 125S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	41.780	41.78	0.25	-0.252	0.00	0.00
ES	37.470	37.47	0.25	-0.226	0.00	0.00
TT	20.750	20.75	0.04	-0.290	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.17	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.39	=	5.7
Normal =	0.25		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
93.210	IND	93.21	NORMAL	10.00	75.00	69.91	0.15	0.140
6.790	FUTURE DEVEL	6.79	NORMAL	0.00	95.00	6.45	0.05	0.003
100.000	=TOTAL AREA OK		AVERAGE =	9.32	TOTAL =	76.36	AVG. =	0.143
					% =	76.36		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.170

IMPERVIOUS AREA:

URBAN @	100	% effective =	76.36
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	76.36

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
125S	100.000	0.143	0.250	5.70	0.170	76.36	20.66

LOSS PARAMETERS FOR SUBBASIN: 130S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	80.360	80.35	0.05	-1.045	0.00	0.00
LE	14.290	14.29	0.04	-0.200	0.00	0.00
TW	3.570	3.57	0.05	-0.046	0.00	0.00
TT	1.790	1.79	0.04	-0.025	0.00	0.00
TOTAL =	100.010 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
90.830	IND	90.83	NORMAL	10.00	75.00	68.12	0.15	0.136
9.170	FUTURE DEVEL	9.17	NORMAL	0.00	95.00	8.71	0.05	0.005
100.000	=TOTAL AREA OK		AVERAGE =	9.08	TOTAL =	76.83	AVG. =	0.141
					% =	76.83		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:			
URBAN @	100	% effective =	76.83
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	76.83

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
130S	100.010	0.141	0.150	8.80	0.050	76.83	20.22

LOSS PARAMETERS FOR SUBBASIN: 140G

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TT	98.180	98.18	0.04	-1.372	0.00	0.00
MR	1.820	1.82	0.05	-0.024	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.04	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.25	=	9.7
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	IND	100.00	NORMAL	10.00	75.00	75.00	0.15	0.150
100.000	=TOTAL AREA OK		AVERAGE =	10.00	TOTAL = % =	75.00 75.00	AVG. =	0.150

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.040

IMPERVIOUS AREA:

URBAN @	100	% effective =	75.00
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	75.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
140G	100.000	0.150	0.150	9.70	0.040	75.00	23.29

LOSS PARAMETERS FOR SUBBASIN: 150S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	75.930	75.93	0.05	-0.988	0.00	0.00
TT	22.220	22.22	0.04	-0.311	0.00	0.00
LE	1.850	1.85	0.04	-0.026	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.27	=	8.8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050
	PARK	0.00	NORMAL		0.00	0.00		0.000
100.000 =TOTAL AREA OK			AVERAGE =	0.00	TOTAL =	95.00	AVG. =	0.050
					% =	95.00		

PERCENT OF SUBBASIN

DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:

URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00

% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
150S	100.000	0.050	0.150	8.80	0.050	95.00	16.87

LOSS PARAMETERS FOR SUBBASIN: 160S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	100.000	100.00	0.05	-1.301	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.05	%ROCK=	0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
77.400	IND	77.40	NORMAL	10.00	75.00	58.05	0.15	0.116
22.600	FUTURE DEVEL	22.60	NORMAL	0.00	95.00	21.47	0.05	0.011
100.000	=TOTAL AREA OK		AVERAGE =	7.74	TOTAL =	79.52	AVG. =	0.127
					% =	79.52		

PERCENT OF SUBBASIN
DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA:
URBAN @ 100 % effective = 79.52
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 79.52

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
160S	100.000	0.127	0.150	8.80	0.050	79.52	20.34

LOSS PARAMETERS FOR SUBBASIN: 170S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LE	40.740	40.74	0.04	-0.570	0.00	0.00
MR	33.800	33.80	0.05	-0.440	0.00	0.00
TW	21.760	21.76	0.05	-0.283	0.00	0.00
TU	2.310	2.31	0.25	-0.014	0.00	0.00
LCA	1.390	1.39	0.25	-0.008	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	M.D.R.	0.00	NORMAL		45.00	0.00		0.000
61.150	IND	61.15	NORMAL	10.00	75.00	45.86	0.15	0.092
38.850	FUTURE DEVEL	38.85	NORMAL	0.00	95.00	36.91	0.05	0.019

100.000 =TOTAL AREA OK AVERAGE = 6.12 TOTAL = 82.77 AVG. = 0.111
% = 82.77

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.050

IMPERVIOUS AREA: URBAN @ 100 % effective = 82.77
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 82.77

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
170S	100.000	0.111	0.150	8.80	0.050	82.77	33.45

LOSS PARAMETERS FOR SUBBASIN: 180G

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	84.440	84.45	0.05	-1.099	0.00	0.00
LE	10.670	10.67	0.04	-0.149	0.00	0.00
TW	3.110	3.11	0.05	-0.040	0.00	0.00
LCA	1.330	1.33	0.25	-0.008	0.00	0.00
GT	0.440	0.44	0.04	-0.006	0.00	0.00

TOTAL = 99.990 PERCENT XKSAT = 0.05 %ROCK= 0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
76.920	M.D.R.	76.92	NORMAL	20.00	45.00	34.61	0.15	0.115
	IND	0.00	NORMAL		75.00	0.00		0.000
23.080	FUTURE DEVEL	23.08	NORMAL	0.00	95.00	21.93	0.05	0.012

100.000 =TOTAL AREA OK AVERAGE = 15.38 TOTAL = 56.54 AVG. = 0.127
% = 56.54

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.053

IMPERVIOUS AREA: URBAN @ 100 % effective = 56.54
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 56.54

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
180G	99.990	0.127	0.150	8.80	0.053	56.54	34.81

LOSS PARAMETERS FOR SUBBASIN: 190S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	51.560	51.56	0.05	-0.671	0.00	0.00
LCA	27.560	27.56	0.25	-0.166	0.00	0.00
LE	20.440	20.44	0.04	-0.286	0.00	0.00
GT	0.440	0.44	0.04	-0.006	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.07 %ROCK= 0.00

DTHETA		PSIF
Dry =	0.3	= 8
Normal =	0.15	
Wet =	0	

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	V.L.D.R	0.00	NORMAL	20.00	15.00	0.00	0.15	0.000
	M.D.R.	0.00	NORMAL		45.00	0.00		0.000
46.670	IND	46.67	NORMAL	10.00	75.00	35.00	0.15	0.070
53.330	FUTURE DEVEL	53.33	NORMAL	0.00	95.00	50.66	0.05	0.027

100.000 =TOTAL AREA OK AVERAGE = 4.67 TOTAL = 85.67 AVG. = 0.097
% = 85.67

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.070

IMPERVIOUS AREA: URBAN @ 100 % effective = 85.67
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 85.67

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
190S	100.000	0.097	0.150	8.00	0.070	85.67	36.38

LOSS PARAMETERS FOR SUBBASIN: 200S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LCA	23.610	23.61	0.25	-0.142	0.00	0.00
LE	21.030	21.03	0.04	-0.294	0.00	0.00
GT	19.310	19.31	0.04	-0.270	0.00	0.00
GGA	11.590	11.59	0.25	-0.070	0.00	0.00
LB	6.010	6.01	0.4	-0.024	0.00	0.00
MR	4.290	4.29	0.05	-0.056	0.00	0.00
BS	4.290	4.29	0.39	-0.018	0.00	0.00
TW	3.860	3.86	0.05	-0.050	0.00	0.00
GE	3.860	3.86	0.26	-0.023	0.00	0.00
RBA	1.720	1.72	0.26	-0.010	0.00	0.00
TG	0.430	0.43	0.04	-0.006	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.11 %ROCK= 0.00

DTHETA

Dry = 0.36
Normal = 0.17
Wet = 0

PSIF

= 6.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	V.L.D.R	0.00	NORMAL		15.00	0.00		0.000
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050
	ROW CROP	0.00	NORMAL		0.00	0.00		0.000

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 95.00 AVG. = 0.050
% = 95.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.170

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.110

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
200S	100.000	0.050	0.170	6.80	0.110	95.00	28.35

LOSS PARAMETERS FOR SUBBASIN: 210S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LCA	36.410	36.42	0.25	-0.219	0.00	0.00
LE	19.350	19.35	0.04	-0.271	0.00	0.00
BS	15.210	15.21	0.39	-0.062	0.00	0.00
GT	8.290	8.29	0.04	-0.116	0.00	0.00
LB	6.910	6.91	0.4	-0.028	0.00	0.00
CB	4.610	4.61	0.4	-0.018	0.00	0.00
GXA	2.760	2.76	0.23	-0.018	0.00	0.00
RBA	2.760	2.76	0.26	-0.016	0.00	0.00
BT	2.300	2.30	0.25	-0.014	0.00	0.00
MR	1.380	1.38	0.05	-0.018	0.00	0.00

TOTAL = 99.980 PERCENT XKSAT = 0.17 %ROCK= 0.00

DTHETA		PSIF
Dry =	0.39	= 5.7
Normal =	0.25	
Wet =	0	

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	V.L.D.R	0.00	NORMAL		15.00	0.00		0.000
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 95.00 AVG. = 0.050
% = 95.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.170

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
210S	99.980	0.050	0.250	5.70	0.170	95.00	27.94

LOSS PARAMETERS FOR SUBBASIN: 220S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LCA	75.000	75.00	0.25	-0.452	0.00	0.00
MR	12.500	12.50	0.05	-0.163	0.00	0.00
TW	12.500	12.50	0.05	-0.163	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.17	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.39	=	5.7
Normal =	0.25		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	V.L.D.R	0.00	NORMAL		15.00	0.00		0.000
	IND	0.00	NORMAL		75.00	0.00		0.000
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050
100.000	=TOTAL AREA OK		AVERAGE =	0.00	TOTAL =	95.00	AVG. =	0.050
					% =	95.00		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.170

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ --- % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
220S	100.000	0.050	0.250	5.70	0.170	95.00	25.89

LOSS PARAMETERS FOR SUBBASIN: 230S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	50.000	50.00	0.05	-0.651	0.00	0.00
TW	27.970	27.97	0.05	-0.364	0.00	0.00
LCA	22.030	22.03	0.25	-0.133	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.07	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.3	=	8
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
	V.L.D.R	0.00	NORMAL		15.00	0.00		0.000
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050
100.000	=TOTAL AREA OK		AVERAGE =	0.00	TOTAL =	95.00	AVG. =	0.050
					% =	95.00		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.070

IMPERVIOUS AREA:

URBAN @	100	% effective =	95.00
ROCK OUTCROP @	---	% effective =	0.00
		% EFFECTIVE IMP. =	95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
230S	100.000	0.050	0.150	8.00	0.070	95.00	28.26

LOSS PARAMETERS FOR SUBBASIN: 240S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	64.180	64.18	0.25	-0.386	0.00	0.00
ES	22.730	22.73	0.25	-0.137	0.00	0.00
MR	12.720	12.72	0.05	-0.165	0.00	0.00
TT	0.370	0.37	0.04	-0.005	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.20	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.37	=	5.3
Normal =	0.25		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
64.150	IND	64.15	NORMAL	10.00	75.00	48.11	0.15	0.096
30.630	COMM	30.63	NORMAL	15.00	90.00	27.57	0.15	0.046
5.220	FUTURE DEVEL	5.22	NORMAL	0.00	95.00	4.96	0.05	0.003
100.000	=TOTAL AREA OK		AVERAGE =	11.01	TOTAL =	80.64	AVG. =	0.145
					% =	80.64		

PERCENT OF SUBBASIN

DRY =	0.00	%
NORMAL =	100.00	%
WET =	0.00	%

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.202

IMPERVIOUS AREA:

URBAN @	100	% effective =	80.64
ROCK OUTCROP @	0	% effective =	0.00
		% EFFECTIVE IMP. =	80.64

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
240S	100.000	0.145	0.250	5.30	0.202	80.64	23.92

LOSS PARAMETERS FOR SUBBASIN: 250S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
GGA	56.520	56.52	0.25	-0.340	0.00	0.00
ES	25.360	25.36	0.25	-0.153	0.00	0.00
TT	11.580	11.58	0.04	-0.162	0.00	0.00
MR	6.540	6.54	0.05	-0.085	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.18 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.38	=	5.6
Normal =	0.25		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
54.860	M.F.R.	54.86	NORMAL	20.00	65.00	35.66	0.15	0.082
45.140	COMM	45.14	NORMAL	15.00	90.00	40.63	0.15	0.068

100.000 =TOTAL AREA OK AVERAGE = 17.74 TOTAL = 76.29 AVG. = 0.150
% = 76.29

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.250

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.195

IMPERVIOUS AREA: URBAN @ 100 % effective = 76.29
ROCK OUTCROP @ 0 % effective = 0.00

% EFFECTIVE IMP. = 76.29

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
250S	100.000	0.150	0.250	5.60	0.195	76.29	40.30

LOSS PARAMETERS FOR SUBBASIN: 260S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TT	84.550	84.55	0.04	-1.182	0.00	0.00
MR	15.450	15.45	0.05	-0.201	0.00	0.00
TOTAL =	100.000 PERCENT		XKSAT =	0.04	%ROCK=	0.00

DTHETA		PSIF	
Dry =	0.25	=	9.7
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
62.130	M.D.R.	62.14	NORMAL	20.00	45.00	27.96	0.15	0.093
6.100	M.F.R.	6.10	NORMAL	20.00	65.00	3.97	0.15	0.009
20.570	COMM	20.57	NORMAL	15.00	90.00	18.51	0.15	0.031
11.190	FUTURE DEVEL	11.19	NORMAL	0.00	95.00	10.63	0.05	0.006
99.990	=TOTAL AREA OK		AVERAGE =	16.73	TOTAL =	61.07	AVG. =	0.139
					% =	61.07		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.043

IMPERVIOUS AREA: URBAN @ 100 % effective = 61.07
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 61.07

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
260S	100.000	0.139	0.150	9.70	0.043	61.07	35.82

LOSS PARAMETERS FOR SUBBASIN: 270S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	47.180	47.18	0.05	-0.614	0.00	0.00
TT	30.440	30.44	0.04	-0.426	0.00	0.00
LE	18.620	18.62	0.04	-0.260	0.00	0.00
TU	3.120	3.12	0.25	-0.019	0.00	0.00
GGA	0.640	0.64	0.25	-0.004	0.00	0.00
TOTAL =	100.000 PERCENT	XKSAT =		0.05	%ROCK=	0.00

DTHETA

Dry = 0.27
Normal = 0.15
Wet = 0

PSIF

= 8.8

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
35.380	M.D.R.	35.38	NORMAL	20.00	45.00	15.92	0.15	0.053
34.790	M.F.R.	34.79	NORMAL	20.00	65.00	22.61	0.15	0.052
29.830	FUTURE DEVEL	29.83	NORMAL	0.00	95.00	28.34	0.05	0.015
100.000	=TOTAL AREA OK		AVERAGE =	14.03	TOTAL =	66.87	AVG. =	0.120
					% =	66.87		

PERCENT OF SUBBASIN
DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.052

IMPERVIOUS AREA:
URBAN @ 100 % effective = 66.87
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 66.87

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
270S	100.000	0.120	0.150	8.80	0.052	66.87	34.29

LOSS PARAMETERS FOR SUBBASIN: 280S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LCA	52.640	52.65	0.25	-0.317	0.00	0.00
MR	34.700	34.70	0.05	-0.452	0.00	0.00
TW	8.220	8.22	0.05	-0.107	0.00	0.00
RBA	4.430	4.43	0.26	-0.026	0.00	0.00

TOTAL = 99.990 PERCENT XKSAT = 0.13 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.38	=	6.4
Normal =	0.21		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
27.900	M.D.R.	27.90	NORMAL	20.00	45.00	12.56	0.15	0.042
52.640	M.F.R.	52.64	NORMAL	20.00	65.00	34.22	0.15	0.079
4.740	COMM	4.74	NORMAL	15.00	90.00	4.27	0.15	0.007
14.720	FUTURE DEVEL	14.72	NORMAL	0.00	95.00	13.98	0.05	0.007

100.000 =TOTAL AREA OK AVERAGE = 16.82 TOTAL = 65.02 AVG. = 0.135
% = 65.02

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.210

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.140

IMPERVIOUS AREA: URBAN @ 100 % effective = 65.02
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 65.02

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
280S	99.990	0.135	0.210	6.40	0.140	65.02	35.04

LOSS PARAMETERS FOR SUBBASIN: 290S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	62.310	62.31	0.05	-0.811	0.00	0.00
LCA	31.200	31.20	0.25	-0.188	0.00	0.00
TW	3.890	3.89	0.05	-0.051	0.00	0.00
LE	2.600	2.60	0.04	-0.036	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.08 %ROCK= 0.00

DTHETA		PSIF
Dry =	0.32	= 7.6
Normal =	0.15	
Wet =	0	

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
76.710	M.F.R.	76.71	NORMAL	20.00	65.00	49.86	0.15	0.115
3.870	COMM	3.87	NORMAL	15.00	90.00	3.48	0.15	0.006
19.420	FUTURE DEVEL	19.42	NORMAL	0.00	95.00	18.45	0.05	0.010

100.000 =TOTAL AREA OK AVERAGE = 15.92 TOTAL = 71.79 AVG. = 0.131
% = 71.79

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.085

IMPERVIOUS AREA: URBAN @ 100 % effective = 71.79
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 71.79

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
290S	100.000	0.131	0.150	7.60	0.085	71.79	33.42

LOSS PARAMETERS FOR SUBBASIN: 300S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
MR	40.570	40.57	0.05	-0.528	0.00	0.00
LCA	35.410	35.41	0.25	-0.213	0.00	0.00
TG	5.710	5.71	0.04	-0.080	0.00	0.00
TW	5.710	5.71	0.05	-0.074	0.00	0.00
TH	4.570	4.57	0.04	-0.064	0.00	0.00
LE	4.020	4.02	0.04	-0.056	0.00	0.00
GXA	4.020	4.02	0.23	-0.026	0.00	0.00

TOTAL = 100.010 PERCENT XKSAT = 0.09 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.33	=	7.3
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
15.360	COMM	15.36	NORMAL	15.00	90.00	13.82	0.15	0.023
84.640	FUTURE DEVEL	84.64	NORMAL	0.00	95.00	80.41	0.05	0.042
100.000	=TOTAL AREA OK		AVERAGE =	2.30	TOTAL =	94.23	AVG. =	0.065
					% =	94.23		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA: URBAN @ 100 % effective = 94.23
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 94.23

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
300S	100.010	0.065	0.150	7.30	0.090	94.23	28.47

LOSS PARAMETERS FOR SUBBASIN: 310S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LE	25.150	25.15	0.04	-0.352	0.00	0.00
MR	20.750	20.75	0.05	-0.270	0.00	0.00
LCA	18.600	18.60	0.25	-0.112	0.00	0.00
AA	17.470	17.47	0.26	-0.102	0.00	0.00
GT	13.100	13.10	0.04	-0.183	0.00	0.00
TG	2.750	2.75	0.04	-0.038	0.00	0.00
TFA	2.180	2.18	0.37	-0.009	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.09 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.33	=	7.3
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
56.940	IND	56.94	NORMAL	10.00	75.00	42.71	0.15	0.085
43.060	FUTURE DEVEL	43.06	NORMAL	0.00	95.00	40.91	0.05	0.022

100.000 =TOTAL AREA OK AVERAGE = 5.69 TOTAL = 83.61 AVG. = 0.107
% = 83.61

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA: URBAN @ 100 % effective = 83.61
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 83.61

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
310S	100.000	0.107	0.150	7.30	0.090	83.61	34.10

LOSS PARAMETERS FOR SUBBASIN: 320S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
LCA	40.610	40.53	0.25	-0.244	0.00	0.00
GT	17.440	17.41	0.04	-0.243	0.00	0.00
MR	15.710	15.68	0.05	-0.204	0.00	0.00
AA	5.850	5.84	0.26	-0.034	0.00	0.00
CB	5.250	5.24	0.4	-0.021	0.00	0.00
RBA	4.850	4.84	0.26	-0.028	0.00	0.00
TW	3.490	3.48	0.05	-0.045	0.00	0.00
LE	2.920	2.91	0.04	-0.041	0.00	0.00
CP	2.320	2.32	0.4	-0.009	0.00	0.00
GGA	1.760	1.76	0.25	-0.011	0.00	0.00

TOTAL = 100.200 PERCENT XKSAT = 0.13 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.38	=	6.4
Normal =	0.21		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050
100.000	=TOTAL AREA	ERR	AVERAGE =	0.00	TOTAL =	95.00	AVG. =	0.050
					% =	95.00		

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.210

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.130

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
320S	100.200	0.050	0.210	6.40	0.130	95.00	26.45

LOSS PARAMETERS FOR SUBBASIN: 330S

Soil Survey Used CENTRAL

XKSAT

Map Unit	AREA PERCENT	% Area	XKSAT	log(XKSAT) *(% Area)	% ROCK OUTCROP	% Area * %R.O.
TW	40.420	40.42	0.05	-0.526	0.00	0.00
GGA	25.110	25.11	0.25	-0.151	0.00	0.00
MR	16.510	16.51	0.05	-0.215	0.00	0.00
LCA	13.470	13.47	0.25	-0.081	0.00	0.00
GT	4.490	4.49	0.04	-0.063	0.00	0.00

TOTAL = 100.000 PERCENT XKSAT = 0.09 %ROCK= 0.00

DTHETA		PSIF	
Dry =	0.33	=	7.3
Normal =	0.15		
Wet =	0		

LAND USE

AREA PERCENT	LAND USE type	% Area	DTHETA condition	% veg. cover	% Imp. Inc.ROW	ImpArea PERCENT	IA in.	Wgtd.IA in.
100.000	FUTURE DEVEL	100.00	NORMAL	0.00	95.00	95.00	0.05	0.050

100.000 =TOTAL AREA OK AVERAGE = 0.00 TOTAL = 95.00 AVG. = 0.050
% = 95.00

PERCENT OF SUBBASIN DRY = 0.00 %
NORMAL = 100.00 %
WET = 0.00 %

SUBBASIN DTHETA WEIGHTED BY LAND USE = 0.150

SUBBASIN XKSAT ADJUSTED FOR VEG. = 0.090

IMPERVIOUS AREA: URBAN @ 100 % effective = 95.00
ROCK OUTCROP @ 0 % effective = 0.00
% EFFECTIVE IMP. = 95.00

INPUT VALUES FOR MCUHP2 PROGRAM

SUBBASIN	AREA percent	IA inches	DTHETA	PSIF	XKSAT adj.	RTIMP %	LAG min.
330S	100.000	0.050	0.150	7.30	0.090	95.00	25.41

HEC-1 OUTPUT:
PEORIA WATERSHED, 2-YEAR 6-HOUR STORM
FUTURE CONDITION

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*            VERSION 4.0.1E            *
*      Lahey F77L-EM/32 version 5.01   *
*       Dodson & Associates, Inc.      *
*  RUN DATE  02/16/96  TIME  08:53:09  *
****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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

              *DIAGRAM
  1           ID   NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
  2           ID   GRAND AVENUE TO AGUA FRIA FREEWAY, NORTHERN AVENUE TO OLIVE AVENUE
  3           ID   PHOENIX VALLEY S-GRAPH UNIT HYDROGRAPH
  4           ID   KINEMATIC WAVE CHANNEL ROUTING
  5           ID   2-YEAR, 6-HOUR STORM
  6           ID   FUTURE CONDITION
  7           ID   OPTION B
  8           ID   FILE PE00214A.DAT
  9           ID   PREPARED FOR FCDMC BY WOOD, PATEL & ASSOCIATES, INC., OCTOBER 1995
 10           ID
 11           ID   AREAS OF FUTURE DEVELOPMENT ARE MODELED AS THOUGH ONLY 10 PERCENT OF
 12           ID   THE ACTUAL DRAINAGE AREA IS CONTRIBUTING; THIS 10 PERCENT IS MODELED
 13           ID   AS 95 PERCENT IMPERVIOUS (PAVEMENT)
 14           ID
 15           ID   ALL BUT 12 CFS DIVERTED INTO SURGE BASIN AT 85TH AVENUE
 16           ID
 17           ID   ** ADJUSTED Kn VALUES **
 18           IT      2                    900
 19           IO      5

 20           KK    10AS
 21           KM   BASIN 10A
 22           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 23           KM    L=    .2348  Lca=    .1061   S=  17.03  Kn=.0552  LAG= 11.40
 24           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 25           BA   .0294
 26           IN     15
 27           KM   RAINFALL DEPTH OF 1.20 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 28           KM   AN AREAL REDUCTION COEFFICIENT OF .976 WAS USED
 29           PB    1.17
 30           KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 1.96
 31           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .076
 32           PC    .087    .100    .120    .162    .251    .448    .699    .840    .901    .938
 33           PC    .950    .963    .975    .988   1.000
 34           LG     .15     .15    9.70     .04   75.00
 35           UI       9      24      43      56      77     105      78      60      45      28
 36           UI      15      11       7       3       3       3       3       0       0       0

 37           KK    10AR
 38           KM   ROUTE 10A SOUTH ON 75TH AVENUE TO BUTLER DRIVE
 39           RK    1220    .002    .015            TRAP     125     .01

 40           KK    10BS
 41           KM   BASIN 10B
 42           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 43           KM    L=    .5114  Lca=    .3220   S=  23.47  Kn=.0621  LAG= 24.74
 44           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 45           BA   .0086
 46           LG     .05     .15    9.70     .04   95.00
 47           UI       1       1       2       4       5       6       7       7       8      10
 48           UI      12      15      14      11      10       9       8       7       6       5
 49           UI       4       3       2       2       2       1       1       1       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  50          KK   10CS
  51          KM  BASIN 10C
  52          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  53          KM   L=    .3788  Lca=    .0852   S=  6.864  Kn=.0552  LAG= 15.72
  54          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  55          BA  .0133
  56          LG    .15     .27     8.8    .053      10
  57          UI      3       4      11      14      17      21      28      35      28      23
  58          UI     19      15      12       7       5       4       3       2       1       1
  59          UI      1       1       1       0       0       0       0       0       0       0

  60          KK  10CR1
  61          KM  ROUTE 10CS THROUGH SUBBASIN 10B TO CP 10BC
  62          RK   1000    .002    .030            TRAP      50     .01

  63          KK  10CR2
  64          KM  ROUTE 10CR1 THROUGH SUBBASIN 10B TO CP 10BC
  65          RK   1650   .0073    .030            TRAP      50     .01

  66          KK   10BC
  67          KM  COMBINE 10AR, 10BS AND 10CR2 AT BUTLER DRIVE
  68          HC      3

  69          KK   10BR
  70          KM  ROUTE 10BC SOUTH ON 75TH AVENUE
  71          RK    650    .001    .015            TRAP     125     .01

  72          KK   20BS
  73          KM  BASIN 20B
  74          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  75          KM   L=    .6193  Lca=    .3371   S=  19.38  Kn=.0621  LAG= 28.08
  76          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  77          BA  .0085
  78          LG    .05     .15    8.40     .06   95.00
  79          UI      1       1       1       3       4       5       5       6       6       7
  80          UI      8      10      12      13      11      10       9       8       7       6
  81          UI      6       5       4       3       2       2       2       2       1       1
  82          UI      1       1       0       0       0       0       0       0       0       0

  83          KK   20BC
  84          KM  COMBINE 10BR AND 20BS
  85          HC      2

  86          KK   20BR
  87          RK    720    .001    .015            TRAP     125     .01

  88          KK   20AS
  89          KM  BASIN 20A
  90          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  91          KM   L=    .5000  Lca=     .2102  S=  16.00  Kn=.0552  LAG= 19.94
  92          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  93          BA  .0744
  94          LG    .15     .15    8.40     .06   75.00
  95          UI     13      13      33      52      64      74      85     100     132     160
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 96           UI     132     111      96      81      69      58      42      27      22      21
 97           UI      13      13       6       4       4       4       4       4       4       0

 98           KK    20AC
 99           KM   COMBINE 20BR AND 20AS
100           HC       2

101           KK    20AR
102           KM   ROUTE 20AC SOUTH ON 75TH AVENUE TO NORTHERN AVENUE
103           RK    1250    .001    .015            TRAP     125     .01

104           KK    20CS
105           KM   BASIN 20C
106           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
107           KM    L=    .4735  Lca=     .2557  S=  19.01  Kn=.0621  LAG= 22.91
108           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
109           BA   .0030
110           LG     .05     .15    8.40     .06   95.00
111           UI       0       0       1       2       2       2       3       3       3       4
112           UI       6       5       4       4       3       3       2       2       2       1
113           UI       1       1       1       0       0       0       0       0       0       0

114           KK    20CR
115           KM   ROUTE 20C SOUTH ON 71ST AVENUE
116           RK     690    .002    .015            TRAP     105     .01

117           KK    40CS
118           KM   BASIN 40C
119           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
120           KM    L=    .3788  Lca=    .1553   S=  23.76  Kn=.0621  LAG= 16.69
121           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
122           BA   .0029
123           LG     .05     .15    7.30     .09   95.00
124           UI       1       1       2       3       3       4       5       7       7       5
125           UI       4       4       3       2       1       1       1       1       0       0

126           KK    40CC
127           KM   COMBINE 20CR AND 40CS
128           HC       2

129           KK    40CR
130           KM   ROUTE 40CC SOUTH ON 71ST AVENUE
131           RK     590    .002    .015            TRAP     105     .01

132           KK    30AS
133           KM   BASIN 30A
134           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
135           KM    L=   1.4773  Lca=    .2784   S=   6.84  Kn=.0552  LAG= 39.36
136           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
137           BA   .0315
138           LG     .15     .15    8.80     .05   75.00
139           UI       3       3       3       3       6       9      10      12      13      15
140           UI      15      16      18      19      21      23      27      31      36      33
141           UI      29      26      24      22      21      19      18      16      15      14
142           UI      13      11       9       8       5       5       5       4       4       4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 143          UI       3       3       3       3       1       1       1       1       1       1
 144          UI       1       1       1       1       1       1       1       1       0       0

 145          KK    30CC
 146          KM   COMBINE 40CR AND 30AS
 147          HC       2

 148          KK    30CR
 149          KM   ROUTE 30CC IN FUTURE NORTHERN AVENUE STORM DRAIN
 150          RK    2700    .003    .014            CIRC       4

 151          KK    40AS
 152          KM   BASIN 40A
 153          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 154          KM    L=   .2841   Lca=    .0852   S=  28.16  Kn=.0552  LAG= 10.25
 155          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 156          BA   .1128
 157          LG     .15     .15    7.30     .09   75.00
 158          UI      37     120     198     265     415     378     276     201     125      64
 159          UI      44      23      11      11      11       0       0       0       0       0

 160          KK    40AC
 161          KM   COMBINE 20AR, 30CR, AND 40AS AT 75TH AVENUE & NORTHERN
 162          HC       3

 163          KK    40AR
 164          KM   ROUTE 40AC WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 165          RK     700   .0044    .014            CIRC       5

 166          KK    40ES
 167          KM   BASIN 40E
 168          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 169          KM    L=    .2557  Lca=    .1184   S=  31.29  Kn=.0552  LAG= 10.94
 170          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 171          BA   .0317
 172          LG     .15     .15    7.30     .09   75.00
 173          UI      10      28      50      65      94     114      82      62      45      23
 174          UI      16      10       5       3       3       3       0       0       0       0

 175          KK    40EC
 176          KM   COMBINE 40AR AND 40ES AT NORTHERN AVENUE
 177          HC       2

 178          KK    40ER
 179          KM   ROUTE 40EC WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 180          RK     690   .0044    .014            CIRC       5

 181          KK    70AS
 182          KM   BASIN 70A
 183          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 184          KM    L=    .4735  Lca=    .2367   S=   9.72  Kn=.0621  LAG= 25.27
 185          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 186          BA   .0063
 187          LG     .05     .15    8.40     .06   95.00
 188          UI       1       1       1       3       4       4       5       5       6       7
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 189          UI       8      10      10       9       7       7       6       5       5       4
 190          UI       3       2       1       1       1       1       1       1       0       0

 191          KK    70AR
 192          KM   ROUTE 70AS SOUTH ALONG LOCAL STREET
 193          RK    1320   .0030    .015            TRAP      50     .01

 194          KK    40DS
 195          KM   BASIN 40D
 196          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 197          KM    L=    .3314  Lca=    .0947   S=  15.09  Kn=.0621  LAG= 14.33
 198          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 199          BA   .0026
 200          LG     .05     .15    7.30     .09   95.00
 201          UI       1       1       2       3       4       5       7       7       5       4
 202          UI       3       2       1       1       1       1       0       0       0       0

 203          KK    40DC
 204          KM   COMBINE 40DS AND 40ER AT NORTHERN AVENUE
 205          HC       3

 206          KK    40DR
 207          KM   ROUTE 40DC WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 208          RK    1380   .0044    .014            CIRC       5

 209          KK    70BS
 210          KM   BASIN 70B
 211          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 212          KM    L=    .4924  Lca=    .2462   S=   7.11  Kn=.0621  LAG= 27.63
 213          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 214          BA   .0059
 215          LG     .05     .15    8.40     .06   95.00
 216          UI       1       1       1       2       3       3       4       4       5       5
 217          UI       6       7       9       9       8       7       6       5       5       4
 218          UI       4       3       3       2       1       1       1       1       1       1
 219          UI       1       0       0       0       0       0       0       0       0       0

 220          KK    70BR
 221          KM   ROUTE 70BS SOUTH ALONG (FUTURE) 79TH AVENUE
 222          RK     750    .002    .015            TRAP     105     .01

 223          KK    90AS
 224          KM   BASIN 90A
 225          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 226          KM    L=    .3314  Lca=    .1326   S=  18.10  Kn=.0552  LAG= 13.98
 227          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 228          BA   .0496
 229          LG     .15     .15    8.80     .05   75.00
 230          UI      12      23      50      65      80     104     148     121      97      77
 231          UI      61      42      23      20      12       9       4       4       4       4
 232          UI       0       0       0       0       0       0       0       0       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 233          KK    90AC
 234          KM   COMBINE 40BR AND 90AS
 235          HC       2

 236          KK    90AR
 237          KM   ROUTE 90AC SOUTH ALONG (FUTURE) 79TH AVENUE
 238          RK     500    .002    .015            TRAP     105     .01

 239          KK    90FS
 240          KM   BASIN 90F
 241          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 242          KM    L=    .2273  Lca=    .1136   S=  11.00  Kn=.0621  LAG= 14.13
 243          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 244          BA   .0012
 245          LG     .05     .15    8.80     .05   95.00
 246          UI       0       1       1       2       2       2       4       3       2       2
 247          UI       1       1       1       0       0       0       0       0       0       0

 248          KK   90FC1
 249          KM   COMBINE 90FS AND 90AR
 250          HC       2

 251          KK   90FC2
 252          KM   COMBINE 40DR AND 90FC1
 253          HC       2

 254          KK    90FR
 255          KM   ROUTE 90FC2 WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 256          RK    1290   .0048    .014            CIRC       6

 257          KK    90BS
 258          KM   BASIN 90B
 259          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 260          KM    L=    .4735  Lca=    .2367   S=   9.50  Kn=.0621  LAG= 25.38
 261          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 262          BA   .0060
 263          LG     .05     .15    8.80     .05   95.00
 264          UI       1       1       1       3       3       4       4       5       6       6
 265          UI       8      10      10       8       7       6       6       5       4       4
 266          UI       3       2       1       1       1       1       1       1       0       0

 267          KK    90BC
 268          KM   COMBINE 90FR AND 90BS AT NORTHERN AVENUE
 269          HC       2

 270          KK    90BR
 271          KM   ROUTE 90BC WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 272          RK     490   .0048    .014            CIRC       6
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 273          KK    90CS
 274          KM   BASIN 90C
 275          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 276          KM    L=     .1610  Lca=     .0805   S=  12.42  Kn=.0552  LAG=  9.44
 277          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 278          BA   .0090
 279          LG     .15     .15    8.80     .05   75.00
 280          UI       3      12      18      26      38      28      20      13       6       4
 281          UI       2       1       1       1       0       0       0       0       0       0

 282          KK    90CC
 283          KM   COMBINE 90BR AND 90CS
 284          HC       2

 285          KK    90CR
 286          KM   ROUTE 90CC WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 287          RK     900   .0048    .014            CIRC       6

 288          KK    90DS
 289          KM   BASIN 90D
 290          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 291          KM    L=     .2652  Lca=     .1420   S=   7.54  Kn=.0621  LAG= 17.52
 292          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 293          BA   .0017
 294          LG     .05     .15    8.80     .05   95.00
 295          UI       0       0       1       2       2       2       3       3       4       3
 296          UI       3       2       2       2       1       1       1       0       0       0

 297          KK   90DC1
 298          KM   COMBINE 90CR AND 90DS AT 83RD AVENUE & NORTHERN
 299          HC       2

 300          KK    50BS
 301          KM   BASIN 50B
 302          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 303          KM    L=     .7197  Lca=     .3598   S=  20.84  Kn=.0608  LAG= 29.42
 304          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 305          BA   .0143
 306          LG     .05     .15    9.70     .04   95.00
 307          UI       2       2       2       4       6       7       8       9      10      11
 308          UI      12      14      17      20      20      17      15      14      12      11
 309          UI      10       9       8       7       5       4       3       3       3       2
 310          UI       2       2       2       1       1       1       1       1       1       1
 311          UI       1       1       1       0       0       0       0       0       0       0

 312          KK    50BR
 313          KM   ROUTE 50BS WEST ALONG BUTLER DRIVE
 314          RK    1260    .004    .015            TRAP     105     .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 315          KK    50AS
 316          KM   BASIN 50A
 317          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 318          KM    L=     .6193  Lca=     .2869   S=  21.80  Kn=.0552  LAG= 22.96
 319          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 320          BA   .1307
 321          LG     .15     .15    9.70     .04   75.00
 322          UI      19      19      35      69      88     102     114     130     149     183
 323          UI     241     227     187     163     145     124     109      94      78      54
 324          UI      34      33      31      20      19      15       6       6       6       6
 325          UI       6       6       6       6       0       0       0       0       0       0

 326          KK    50AC
 327          KM   COMBINE 50BR AND 50AS
 328          HC       2

 329          KK    50AR
 330          KM   ROUTE 50AC WEST ALONG BUTLER DRIVE
 331          RK    1310   .0031    .014            CIRC       5

 332          KK    60CS
 333          KM   BASIN 60C
 334          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 335          KM    L=     .1420  Lca=     .0710   S=  14.08  Kn=.0552  LAG=  8.39
 336          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 337          BA   .0040
 338          LG     .15     .15    8.80     .05   75.00
 339          UI       2       7      10      16      17      11       7       3       2       1
 340          UI       0       0       0       0       0       0       0       0       0       0

 341          KK    60BS
 342          KM   BASIN 60B
 343          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 344          KM    L=     .3504  Lca=     .1752   S=  12.84  Kn=.0621  LAG= 19.07
 345          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 346          BA   .0040
 347          LG     .05     .15    8.80     .05   95.00
 348          UI       0       0       1       2       3       3       3       4       6       6
 349          UI       5       4       3       3       2       2       1       1       1       1
 350          UI       0       0       0       0       0       0       0       0       0       0

 351          KK    60BC
 352          KM   COMBINE 60BS AND 60CS
 353          HC       2

 354          KK    60BR
 355          KM   ROUTE 60BC SOUTH ALONG LOCAL STREET
 356          RK     610   .0057    .015            TRAP      50     .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 357          KK    60AS
 358          KM   BASIN 60A
 359          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 360          KM    L=    .2670  Lca=    .1288   S=  14.98  Kn=.0552  LAG= 13.21
 361          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 362          BA   .0261
 363          LG     .15     .15    8.80     .05   75.00
 364          UI       7      14      29      38      47      66      81      60      48      38
 365          UI      28      15      11       8       6       2       2       2       2       0

 366          KK    60AC
 367          KM   COMBINE 60BR AND 60AS
 368          HC       2

 369          KK    60AR
 370          KM   ROUTE 60AC SOUTH ON LOCAL STREET
 371          RK    1300   .0059    .015            TRAP      50     .01

 372          KK     61C
 373          KM   COMBINE 60AR AND 50AR AT BUTLER DRIVE
 374          HC       2

 375          KK     61R
 376          KM   ROUTE 61C WEST IN FUTURE BUTLER DRIVE STORM DRAIN
 377          RK    1400   .0031    .014            CIRC       5

 378          KK    60DS
 379          KM   BASIN 60D
 380          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 381          KM    L=    .7386  Lca=    .1193   S=  11.51  Kn=.0621  LAG= 22.34
 382          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 383          BA   .0186
 384          LG     .05     .15    8.80     .05   95.00
 385          UI       3       3       6      10      13      15      17      20      23      30
 386          UI      36      31      26      23      20      17      15      13       9       6
 387          UI       5       5       4       3       3       1       1       1       1       1
 388          UI       1       1       1       0       0       0       0       0       0       0

 389          KK   60DC1
 390          KM   COMBINE 60DS AND 61R
 391          HC       2

 392          KK   110BS
 393          KM   BASIN 110B
 394          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 395          KM    L=    .3409  Lca=    .1705   S=  11.73  Kn=.0621  LAG= 19.00
 396          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 397          BA   .0042
 398          LG     .05     .15    8.40     .06   95.00
 399          UI       1       1       2       3       4       5       5       6       9       9
 400          UI       7       6       5       4       4       3       2       1       1       1
 401          UI       1       0       0       0       0       0       0       0       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

402           KK   110BR
403           KM   ROUTE 110BS SOUTH ALONG 83RD AVENUE
404           RK    1500   .0044    .015            TRAP     125     .01

405           KK   60DC2
406           KM   COMBINE 110BR AND 60DC1 AT 83RD AVENUE
407           HC      2

408           KK    60DR
409           KM   ROUTE 60DC2 SOUTH IN FUTURE 83RD AVENUE STORM DRAIN
410           RK     750   .003    .014            CIRC       5

411           KK    80AS
412           KM   BASIN 80A
413           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
414           KM    L=    .1932  Lca=    .0852   S=  15.53  Kn=.0552  LAG=  9.91
415           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
416           BA   .0208
417           LG    .15     .15    8.40     .06   75.00
418           UI      7      24      39      53      82      67      49      35      19      12
419           UI      7       3       2       2       0       0       0       0       0       0

420           KK    80AC
421           KM   COMBINE 60DR AND 80AS
422           HC      2

423           KK   80AR1
424           KM   ROUTE 80AC SOUTH IN PROPOSED 83RD AVENUE STORM DRAIN
425           RK     550   .003    .014            CIRC       5

426           KK    80BS
427           KM   BASIN 80B
428           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
429           KM    L=    .7367  Lca=    .3598   S=  18.60  Kn=.0621  LAG= 30.99
430           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
431           BA   .0121
432           LG    .05     .15    8.40     .06   95.00
433           UI      1       1       1       3       5       5       6       7       8       8
434           UI      9      10      12      15      17      16      13      12      11      10
435           UI      9       8       7       7       6       5       4       2       2       2
436           UI      2       1       1       1       1       0       0       0       0       0

437           KK    80BC
438           KM   COMBINE 80BS AND 80AR1
439           HC      2

440           KK    80BD
441           KM   DIVERT 132 CFS WEST INTO PROPOSED 66" STORM DRAIN
442           DT  80BDIV
443           DI      0     132   10000
444           DQ      0     132     132
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

445           KK    80BR
446           KM   ROUTE 80BD SOUTH ON 83RD AVENUE
447           RK     500   .0037    .014            TRAP     125     .01

448           KK    90ES
449           KM   BASIN 90E
450           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
451           KM    L=    .3542  Lca=    .1761   S=  31.06  Kn=.0552  LAG= 14.42
452           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
453           BA   .0278
454           LG    .15     .19    6.60     .12   75.00
455           UI      6      12      26      35      42      53      78      70      55      45
456           UI     36      27      15      11       8       6       3       2       2       2
457           UI      2       0       0       0       0       0       0       0       0       0

458           KK    90EC
459           KM   COMBINE 90ES AND 80BR
460           HC      2

461           KK    90ER
462           KM   ROUTE 90EC SOUTH ON 83RD AVE TO NORTHERN AVE
463           RK     500   .0037    .014            TRAP     125     .01

464           KK   90DC2
465           KM   COMBINE 90DC1 AND 90ER AT NORTHERN AVENUE
466           HC      2

467           KK    90DR
468           KM   ROUTE 90DC2 WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
469           RK    1290   .0009    .014            CIRC       6

470           KK   110AS
471           KM   BASIN 110A
472           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
473           KM    L=    .5492  Lca=    .1894   S=  16.39  Kn=.0552  LAG= 19.77
474           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
475           BA   .0536
476           LG    .15     .15    8.40     .07   25.00
477           UI      9       9      24      38      47      54      63      74      97     116
478           UI     94      79      69      58      49      41      29      18      16      14
479           UI      9       9       3       3       3       3       3       3       3       0

480           KK    110D
481           KM   DIVERT 50 % OF FLOW TO WEST ALONG BUTLER DRIVE
482           DT  110DIV
483           DI      0     500
484           DQ      0     250

485           KK    111R
486           KM   ROUTE 110AS THROUGH RESIDENTIAL AREA TO NORTHERN AVENUE
487           RK    4300   .0036    .025            TRAP      50     .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 488          KK  80BDIV
 489          KM   RETRIEVE DIVERTED FLOW
 490          DR  80BDIV

 491          KK   80AR2
 492          KM   ROUTE 80BDIV WEST IN PROPOSED 66" STORM DRAIN
 493          RK   1300     .001    .014            CIRC     5.5

 494          KK    111C
 495          KM   COMBINE 111R AND 80AR2
 496          HC       2

 497          KK    111D
 498          KM   DIVERT ALL BUT CAPACITY OF 85TH AVE STORM DRAIN (24") INTO SURGE BASIN
 499          DT  111DIV
 500          DI       0      20   10000
 501          DQ       0       0   99980

 502          KK    112R
 503          KM   ROUTE REMAINING FLOW SOUTH ON 85TH AVENUE
 504          RK    1000   .0059    .014            CIRC       2

 505          KK    100P
 506          KM   BASIN 100
 507          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 508          KM    L=    .9754  Lca=    .5019   S=  20.50  Kn=.0552  LAG= 34.13
 509          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 510          BA   .1326
 511          LG     .15     .15    7.60     .09   20.78
 512          UI      13      13      13      15      43      49      59      65      72      77
 513          UI      84      92     101     112     136     160     169     145     129     117
 514          UI     108     100      90      81      75      67      62      53      41      32
 515          UI      23      23      21      21      15      13      13      13       5       4
 516          UI       4       4       4       4       4       4       4       4       4       4
 517          UI       0       0       0       0       0       0       0       0       0       0

 518          KK    100C
 519          KM   COMBINE 111R AND 100S
 520          HC       2

 521          KK    120P
 522          KM   BASIN 120
 523          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 524          KM    L=    .4356  Lca=    .1799   S=  25.25  Kn=.0552  LAG= 16.36
 525          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 526          BA   .0278
 527          LG     .15     .15    8.80     .06   15.00
 528          UI       6       7      21      28      33      40      50      71      62      50
 529          UI      42      34      28      20      11      10       7       6       3       2
 530          UI       2       2       2       2       0       0       0       0       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  531         KK    120C
  532         KM   COMBINE 110C AND 120S
  533         HC       2

  534         KK     91C
  535         KM   COMBINE 90DR AND 120C AT NORTHERN AVENUE
  536         HC       2

  537         KK     91D
  538         KM   DIVERT ALL BUT 12 CFS INTO SURGE BASIN
  539         DT   91DIV
  540         DI       0      12     500
  541         DQ       0       0     488

  542         KK     91R
  543         KM   ROUTE 91C IN PROPOSED NORTHERN AVENUE STORM DRAIN
  544         RK    1320   .0009    .014            CIRC     3.5

  545         KK   140CD
  546         KM   DIVERT FLOW IN EXCESS OF 2-YR STORM DRAIN CAPACITY AND NORTHERN AVE STREET
  547         KM   CAPACITY TO SOUTH ON 87TH AVENUE
  548         DT  140CDV
  549         DI       0      68    1000
  550         DQ       0       0     932

  551         KK   160AR
  552         KM   ROUTE 140CD IN PROPOSED NORTHERN AVENUE STORM DRAIN
  553         RK    1320   .0009    .014            CIRC     3.5

  554         KK  110DIV
  555         KM   RETRIEVE DIVERTED FLOW FROM BASIN 110A
  556         DR  110DIV

  557         KK    110R
  558         KM   ROUTE 110D WEST ON BUTLER DRIVE
  559         RK    1450   .0026    .015            TRAP     105     .01

  560         KK   150AS
  561         KM   BASIN 150A
  562         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  563         KM    L=     .7292  Lca=     .2689   S=  16.46  Kn=.1544  LAG= 70.31
  564         KM   0.0151 S MI OF THIS 0.1212 SQ MI BASIN DRAIN TO A BERMED BALL FIELD AT THE
  565         KM   SOUTHWEST CORNER OF THE BASIN; THEREFORE THE CONTRIBUTING DRAINAGE AREA
  566         KM   EQUALS 0.1212 - 0.0151, OR 0.1061 SQ MI.
  567         KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  568         BA   .1061
  569         LG     .22     .15    8.00     .08   28.32
  570         UI       6       6       6       6       6       6       6       6      18      19
  571         UI      21      22      24      27      28      28      31      32      33      34
  572         UI      35      37      38      40      43      44      46      49      53      58
  573         UI      65      67      75      78      72      67      62      59      56      53
  574         UI      51      49      47      46      44      42      39      37      36      35
  575         UI      33      31      30      28      27      27      23      22      18      17
  576         UI      17      10      10      10      10      10      10      10      10      10
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 577          UI       8       6       6       6       6       6       6       6       4       2
 578          UI       2       2       2       2       2       2       2       2       2       2
 579          UI       2       2       2       2       2       2       2       2       2       2
 580          UI       2       2       2       2       0       0       0       0       0       0

 581          KK   150AC
 582          KM   COMBINE 110R AND 150AS
 583          HC       2

 584          KK   150AR
 585          KM   ROUTE 150AC WEST ON BUTLER DRIVE
 586          RK    1150   .0026    .014            CIRC     3.5

 587          KK    170P
 588          KM   BASIN 170
 589          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 590          KM    L=    .6761  Lca=    .2330   S=  18.34  Kn=.0552  LAG= 22.66
 591          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 592          BA   .1040
 593          LG     .15     .15    8.40     .07   25.00
 594          UI      15      15      29      56      72      83      93     107     122     156
 595          UI     195     177     147     129     114      98      85      73      57      39
 596          UI      27      26      23      15      15       8       5       5       5       5
 597          UI       5       5       5       0       0       0       0       0       0       0

 598          KK   170AC
 599          KM   COMBINE 150AR AND 170S
 600          HC       2

 601          KK    170R
 602          KM   ROUTE 170AC WEST IN BUTLER AVE STORM DRAIN TO 91ST AVENUE
 603          RK    1300   .0026    .014            CIRC     3.5

 604          KK    170D
 605          KM   DIVERT 100 % OF 170R FOR LATER RETRIEVAL
 606          DT  170DIV
 607          DI       0   10000
 608          DQ       0   10000

 609          KK   160AS
 610          KM   BASIN 160A
 611          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 612          KM    L=    .4735  Lca=    .2367   S=   8.45  Kn=.0621  LAG= 25.95
 613          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 614          BA   .0061
 615          LG     .05     .15    8.00     .07   95.00
 616          UI      1.      1.      1.      3.      3.      4.      4.      5.      5.      6.
 617          UI      7.      9.     10.      9.      7.      7.      6.      5.      5.      4.
 618          UI      3.      3.      2.      1.      1.      1.      1.      1.      1.      0.
 619          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 620          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
```

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

 621          KK   160RC
 622          KM   FAKE COMBINE OF 170D (0 CFS) WITH 160AS
 623          HC       2

 624          KK  160AR2
 625          KM   ROUTE 160RC SOUTH ALONG 89TH AVENUE
 626          RK    1320   .0026    .014            TRAP      25     .01

 627          KK   160BS
 628          KM   BASIN 160B
 629          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 630          KM    L=    .9659  Lca=    .4356   S=  14.49  Kn=.0621  LAG= 38.72
 631          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 632          BA   .0145
 633          LG     .05     .15    8.00     .07   95.00
 634          UI      1.      1.      1.      1.      3.      4.      5.      6.      6.      7.
 635          UI      7.      8.      8.      9.     10.     11.     13.     15.     17.     15.
 636          UI     13.     12.     11.     10.     10.      9.      8.      7.      7.      6.
 637          UI      6.      5.      4.      3.      2.      2.      2.      2.      2.      1.
 638          UI      1.      1.      1.      1.      0.      0.      0.      0.      0.      0.
 639          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
 640          UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 641          KK   160BC
 642          KM   COMBINE 160AR2, 160BS, AND 160AR
 643          HC       3

 644          KK   160BR
 645          KM   ROUTE 160BC WEST IN PROPOSED NORTHERN AVENUE STORM DRAIN
 646          RK    1320   .0033    .014            CIRC       4

 647          KK   190BS
 648          KM   BASIN 190B
 649          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 650          KM    L=    .2841  Lca=    .1326   S=  17.60  Kn=.0621  LAG= 14.92
 651          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 652          BA   .0019
 653          LG     .05     .15    8.80     .05   95.00
 654          UI       0       1       2       2       3       3       5       5       4       3
 655          UI       3       2       1       1       1       0       0       0       0       0

 656          KK   190BR
 657          KM   ROUTE 190BS SOUTH ON 91ST AVENUE
 658          RK    1830   .0034    .015            TRAP     125     .01

 659          KK   190AS
 660          KM   BASIN 190A
 661          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 662          KM    L=    .7197  Lca=    .3598   S=  13.89  Kn=.0621  LAG=32.46
 663          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 664          KM    ACTUAL BASIN AREA IS 0.1069 SQ MI
 665          BA   .0107
 666          LG    .063     .15    8.80     .05   84.92
 667          UI       1       1       1       2       4       4       5       6       6       7
```

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

  668         UI       7       8       9      11      13      15      13      11      10       9
  669         UI       8       8       7       6       6       5       4       3       2       2
  670         UI       2       2       2       1       1       1       1       0       0       0

  671         KK  190BC1
  672         KM   COMBINE 190BR AND 190A
  673         HC       2

  674         KK  170DIV
  675         KM   RETRIEVE BUTLER AVE STORM DRAIN FLOW
  676         DR  170DIV

  677         KK  190BC2
  678         KM   COMBINE 190BC1 AND 170DIV
  679         HC       2

  680         KK   210CS
  681         KM   BASIN 210C
  682         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  683         KM    L=    .4735  Lca=    .1894   S=  14.78  Kn=.0621  LAG= 21.44
  684         KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  685         BA   .0021
  686         LG     .05     .15    7.60     .08   95.00
  687         UI       0       0       1       1       2       2       2       2       3       4
  688         UI       4       3       3       3       2       2       2       1       1       1
  689         UI       1       0       0       0       0       0       0       0       0       0

  690         KK   210CC
  691         KM   COMBINE 190BC2 AND 210CS
  692         HC       2

  693         KK   210CR
  694         KM   ROUTE 210CC WEST IN BUTLER AVE STORM DRAIN
  695         RK     700   .0026    .014            CIRC     3.5

  696         KK    210D
  697         KM   DIVERT 210CR OUT OF MODEL
  698         DT  210DIV
  699         DI       0   10000
  700         DQ       0   10000

  701         KK    180P
  702         KM   BASIN 180
  703         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  704         KM    L=    .3883  Lca=    .1705   S=  22.41  Kn=.0552  LAG= 15.69
  705         KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  706         BA   .0523
  707         LG     .15     .19    6.60     .13   25.00
  708         UI      11      16      42      57      68      82     111     139     111      92
  709         UI      74      61      48      28      19      17      11       8       3       3
  710         UI       3       3       3       0       0       0       0       0       0       0
```

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

 711          KK  181RET
 712          KM   STORAGE-ROUTE 180S THROUGH RETENTION BASIN AT 91ST AVE
 713          RS       1    STOR      -1
 714          SA    3.20    3.28    4.48    4.80
 715          SE    96.6      98    98.9    99.5
 716          SQ       0       0       0     185

 717          KK    180C
 718          KM   FAKE COMBINE 210D (0 CFS) AND 181RET
 719          HC       2
              * KK  180R
              * KM ROUTE 180C SOUTH IN FUTURE 91ST AVENUE STORM DRAIN
              * RK   890   .0032    .014            CIRC       4

 720          KK   200AS
 721          KM   BASIN 200A
 722          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 723          KM    L=    .4167  Lca=    .2367   S=  14.40  Kn=.0552  LAG= 19.86
 724          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 725          BA   .0446
 726          LG     .15     .25    4.90     .27   31.56
 727          UI       8       8      20      31      39      44      52      60      80      96
 728          UI      79      66      58      48      41      35      25      15      13      12
 729          UI       8       8       3       2       2       2       2       2       2       0

 730          KK   200AC
 731          KM   COMBINE 180R AND 200AS
 732          HC       2

 733          KK   200AR
 734          KM   ROUTE 200AC SOUTH IN FUTURE 91ST AVENUE STORM DRAIN
 735          RK     460   .0032    .014            CIRC       4

 736          KK   200BS
 737          KM   BASIN 200B
 738          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 739          KM    L=    .2462  Lca=    .1231   S=   4.06  Kn=.0621  LAG= 18.15
 740          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 741          BA   .0028
 742          LG     .05     .25    4.90     .24   95.00
 743          UI       1       1       2       2       3       3       4       5       7       6
 744          UI       5       4       3       3       2       1       1       1       1       1
 745          UI       0       0       0       0       0       0       0       0       0       0

 746          KK  200BC1
 747          KM   COMBINE 200AR AND 200BS
 748          HC       2

 749          KK  200BC2
 750          KM   COMBINE 200BC1 AND 160BR
 751          HC       2
```

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

752           KK   200BD
753           KM   DIVERT FLOW IN EXCESS OF EXISTING NORTHERN AVE STORM DRAIN AND STREET
754           KM   CAPACITY TO SOUTH ON 91ST AVENUE
755           DT  200BDV
756           DI       0     184   10000
757           DQ       0       0    9816

758           KK   200BR
759           KM   ROUTE 200BC2 WEST IN EXISTING NORTHERN AVENUE STORM DRAIN
760           RK    1200   .0023    .014            CIRC       5

761           KK   210AS
762           KM   BASIN 210A
763           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
764           KM    L=    .4735  Lca=    .2367   S=  12.67  Kn=.0621  LAG= 24.03
765           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
766           BA   .0058
767           LG     .05     .15    7.60     .08   95.00
768           UI       1       1       1       3       4       4       5       5       6       7
769           UI       9      11       9       7       7       6       5       4       4       3
770           UI       2       1       1       1       1       1       1       0       0       0

771           KK   210AC
772           KM   COMBINE 200BR AND 210AS
773           HC       2

774           KK   210AR
775           KM   ROUTE 210AC WEST IN EXISTING NORTHERN AVENUE STORM DRAIN
776           RK    1540   .0023    .014            CIRC       5

777           KK   210BS
778           KM   BASIN 210B
779           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
780           KM    L=    .9943  Lca=    .4735   S=  14.78  Kn=.0621  LAG= 40.26
781           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
782           BA   .0117
783           LG     .05     .15    7.60     .08   95.00
784           UI       1       1       1       1       2       3       4       4       5       5
785           UI       6       6       6       7       7       8       9      11      12      13
786           UI      11      10       9       8       8       7       7       6       6       5
787           UI       5       5       4       3       3       2       2       2       2       2
788           UI       1       1       1       1       1       0       0       0       0       0

789           KK   210BC
790           KM   COMBINE 210AR AND 210BS
791           HC       2

792           KK   210BD
793           KM   DIVERT FLOW IN EXCESS OF EXISTING NORTHERN AVE STORM DRAIN AND STREET
794           KM   CAPACITY TO SOUTH ON 95TH AVE
795           DT  210BDV
796           DI       0     232    1000
797           DQ       0       0     768
```

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

 798          KK   91DIV
 799          KM   RETRIEVE FLOW DIVERTED INTO SURGE BASIN
 800          DR   91DIV

 801          KK  111DIV
 802          KM   RETRIEVE FLOW DIVERTED INTO SURGE BASIN
 803          DR  111DIV

 804          KK    140P
 805          KM   BASIN 140
 806          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 807          KM    L=    .2462  Lca=    .1174   S=  36.55  Kn=.5520  LAG=104.36
 808          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 809          BA   .0402
 810          LG     .50     .15    8.40     .06     .00
 811          UI       1       1       1       1       1       1       1       1       1       1
 812          UI       1       1       4       4       4       5       5       5       5       6
 813          UI       6       6       6       6       7       7       7       7       8       8
 814          UI       8       8       8       9       9       9      10      10      10      10
 815          UI      11      11      12      13      13      15      15      15      17      18
 816          UI      17      16      15      14      14      13      13      12      12      12
 817          UI      11      11      11      10      10      10      10       9       9       9
 818          UI       8       8       8       8       7       7       7       7       6       6
 819          UI       6       6       6       5       5       5       4       4       4       4
 820          UI       3       2       2       2       2       2       2       2       2       2
 821          UI       2       2       2       2       2       1       1       1       1       1
 822          UI       1       1       1       1       1       1       1       0       0       0

 823          KK    140C
 824          KM   COMBINE 91DIV, 111DIV, AND 140S IN SURGE BASIN
 825          KO       1
 826          HC       3
 827          ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

           (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  20        10AS
               V
               V
  37        10AR
               .
               .
  40           .        10BS
               .           .
               .           .
  50           .           .        10CS
               .           .           V
               .           .           V
  60           .           .       10CR1
               .           .           V
               .           .           V
  63           .           .       10CR2
               .           .           .
               .           .           .
  66        10BC.......................
               V
               V
  69        10BR
               .
               .
  72           .        20BS
               .           .
               .           .
  83        20BC............
               V
               V
  86        20BR
               .
               .
  88           .        20AS
               .           .
               .           .
  98        20AC............
               V
               V
 101        20AR
               .
               .
 104           .        20CS
               .           V
               .           V
 114           .        20CR
               .           .
               .           .
               .           .        40CS
               .           .           .
               .           .           .
 126           .        40CC............
               .           V
```

```
          .          V
129       .       40CR
          .          .
          .          .
          .          .        30AS
          .          .          .
          .          .          .
145       .       30CC............
          .          V
          .          V
148       .       30CR
          .          .
          .          .
151       .          .        40AS
          .          .          .
          .          .          .
160    40AC......................
          V
          V
163    40AR
          .
          .
166       .       40ES
          .          .
          .          .
175    40EC............
          V
          V
178    40ER
          .
          .
181       .       70AS
          .          V
          .          V
191       .       70AR
          .          .
          .          .
194       .          .        40DS
          .          .          .
          .          .          .
203    40DC......................
          V
          V
206    40DR
          .
          .
209       .       70BS
          .          V
          .          V
220       .       70BR
          .          .
          .          .
223       .          .        90AS
          .          .          .
          .          .          .
          .       90AC............
          .          V
          .          V
236       .       90AR
          .          .
```

```
          .           .
239       .           .        90FS
          .           .           .
          .           .           .
          .       90FC1............
          .           .
          .           .
251     90FC2............
          V
          V
254      90FR
          .
          .
257       .        90BS
          .           .
          .           .
267      90BC............
          V
          V
270      90BR
          .
          .
273       .        90CS
          .           .
          .           .
282      90CC............
          V
          V
285      90CR
          .
          .
288       .        90DS
          .           .
          .           .
297     90DC1............
          .
          .
300       .        50BS
          .           V
          .           V
312       .        50BR
          .           .
          .           .
315       .           .        50AS
          .           .           .
          .           .           .
326       .        50AC............
          .           V
          .           V
329       .        50AR
          .           .
          .           .
332       .           .        60CS
          .           .           .
          .           .           .
          .           .           .        60BS
          .           .           .           .
          .           .           .           .
351       .           .        60BC............
          .           .           V
```

```
                 .          .          V
354              .          .       60BR
                 .          .          .
                 .          .          .
                 .          .          .        60AS
                 .          .          .          .
                 .          .          .          .
366              .          .       60AC............
                 .          .          V
                 .          .          V
369              .          .       60AR
                 .          .          .
                 .          .          .
372              .        61C............
                 .          V
                 .          V
375              .        61R
                 .          .
                 .          .
378              .          .       60DS
                 .          .          .
                 .          .          .
389              .     60DC1............
                 .          .
                 .          .
392              .          .      110BS
                 .          .          V
                 .          .          V
402              .          .      110BR
                 .          .          .
                 .          .          .
405              .     60DC2............
                 .          V
                 .          V
408              .       60DR
                 .          .
                 .          .
411              .          .       80AS
                 .          .          .
                 .          .          .
420              .       80AC............
                 .          V
                 .          V
423              .     80AR1
                 .          .
                 .          .
426              .          .       80BS
                 .          .          .
                 .          .          .
437              .       80BC............
                 .          .
                 .          .
442              .          .-------> 80BDIV
440              .       80BD
                 .          V
                 .          V
 5               .       80BR
                 .          .
                 .          .
448              .          .       90ES
```

```
            .          .          .
            .          .          .
458         .       90EC............
            .          V
            .          V
            .       90ER
            .          .
            .          .
464      90DC2............
            V
            V
467      90DR
            .
            .
470         .      110AS
            .          .
            .          .
482         .          .-------> 110DIV
480         .       110D
            .          V
            .          V
485         .       111R
            .          .
            .          .
490         .          .          .<-------  80BDIV
488         .          .     80BDIV
            .          .          V
            .          .          V
491         .          .      80AR2
            .          .          .
            .          .          .
494         .       111C............
            .          .
            .          .
499         .          .-------> 111DIV
497         .       111D
            .          V
            .          V
502         .       112R
            .          .
            .          .
505         .          .       100P
            .          .          .
            .          .          .
518         .       100C............
            .          .
            .          .
521         .          .       120P
            .          .          .
            .          .          .
531         .       120C............
            .          .
            .          .
534      91C............
            .
            .
            .-------> 91DIV
537      91D
            V
            V
```

```
542         91R
              .
              .
548           .-------> 140CDV
          140CD
              V
              V
551       160AR
              .
              .
556           .           .<-------  110DIV
554           .      110DIV
              .           V
              .           V
557           .        110R
              .           .
              .           .
560           .           .       150AS
              .           .           .
              .           .           .
581           .       150AC............
              .           V
              .           V
584           .       150AR
              .           .
              .           .
587           .           .        170P
              .           .           .
              .           .           .
598           .       170AC............
              .           V
              .           V
601           .        170R
              .           .
              .           .
606           .           .-------> 170DIV
604           .        170D
              .           .
              .           .
609           .           .       160AS
              .           .           .
              .           .           .
621           .       160RC............
              .           V
              .           V
624           .      160AR2
              .           .
              .           .
627           .           .       160BS
              .           .           .
              .           .           .
641       160BC........................
              V
              V
644       160BR
              .
              .
647           .       190BS
              .           V
              .           V
```

```
656          .       190BR
             .           .
             .           .
659          .           .       190AS
             .           .           .
             .           .           .
671          .      190BC1............
             .           .
             .           .
676          .           .           .<-------  170DIV
674          .           .      170DIV
             .           .           .
             .           .           .
677          .      190BC2............
             .           .
             .           .
680          .           .       210CS
             .           .           .
             .           .           .
690          .       210CC............
             .           V
             .           V
693          .       210CR
             .           .
             .           .
698          .           .------->  210DIV
696          .        210D
             .           .
             .           .
701          .           .        180P
             .           .           V
             .           .           V
711          .           .      181RET
             .           .           .
             .           .           .
717          .        180C............
             .           .
             .           .
720          .           .       200AS
             .           .           .
             .           .           .
730          .       200AC............
             .           V
             .           V
733          .       200AR
             .           .
             .           .
736          .           .       200BS
             .           .           .
             .           .           .
746          .      200BC1............
             .           .
             .           .
749     200BC2............
             .
             .
 5           .------->  200BDV
752      200BD
             V
             V
```

```
758       200BR
              .
              .
761           .       210AS
              .           .
              .           .
771       210AC............
              V
              V
774       210AR
              .
              .
777           .       210BS
              .           .
              .           .
789       210BC............
              .
              .
795           .-------> 210BDV
792       210BD
              .
              .
800           .           .<-------   91DIV
798           .       91DIV
              .           .
              .           .
803           .           .           .<-------  111DIV
801           .           .      111DIV
              .           .           .
              .           .           .
              .           .           .        140P
              .           .           .           .
              .           .           .           .
823           .        140C........................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*           VERSION 4.0.1E             *
*      Lahey F77L-EM/32 version 5.01   *
*       Dodson & Associates, Inc.      *
*  RUN DATE  02/16/96  TIME  08:53:09  *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
```

```
                    NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
                    GRAND AVENUE TO AGUA FRIA FREEWAY, NORTHERN AVENUE TO OLIVE AVENUE
                    PHOENIX VALLEY S-GRAPH UNIT HYDROGRAPH
                    KINEMATIC WAVE CHANNEL ROUTING
                    2-YEAR, 6-HOUR STORM
                    FUTURE CONDITION
                    OPTION B
                    FILE PE00214A.DAT
                    PREPARED FOR FCDMC BY WOOD, PATEL & ASSOCIATES, INC., OCTOBER 1995

                    AREAS OF FUTURE DEVELOPMENT ARE MODELED AS THOUGH ONLY 10 PERCENT OF
                    THE ACTUAL DRAINAGE AREA IS CONTRIBUTING; THIS 10 PERCENT IS MODELED
                    AS 95 PERCENT IMPERVIOUS (PAVEMENT)

                    ALL BUT 12 CFS DIVERTED INTO SURGE BASIN AT 85TH AVENUE

                    ** ADJUSTED Kn VALUES **

 19 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN           2  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1    0  STARTING DATE
                      ITIME        0000  STARTING TIME
                         NQ         900  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2    0  ENDING DATE
                     NDTIME        0558  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL    0.03 HOURS
                      TOTAL TIME BASE   29.97 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT


        *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1
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*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1

WARNING FDKRUT FAILURE TO PRESERVE UPSTREAM HYDROGRAPH VOLUME - CHECK ROUTED HYDROGRAPH SUMQU=    0.0000 SUMQT=    0.0000
WARNING FDKRUT FAILURE TO PRESERVE UPSTREAM HYDROGRAPH VOLUME - CHECK ROUTED HYDROGRAPH SUMQU=    0.0000 SUMQT=    0.0000

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WARNING FDKRUT FAILURE TO PRESERVE UPSTREAM HYDROGRAPH VOLUME - CHECK ROUTED HYDROGRAPH SUMQU=    0.0000 SUMQT=    0.0000

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              **************
              *            *
823 KK        *     140C   *
              *            *
              **************

825 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          1  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

826 HC          HYDROGRAPH COMBINATION
                      ICOMP          3  NUMBER OF HYDROGRAPHS TO COMBINE

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HYDROGRAPH AT STATION 140C

SUM OF 3 HYDROGRAPHS

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DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0730	226	0.	1		1500	451	0.	1		2230	676	0.
1		0002	2	0.	1		0732	227	0.	1		1502	452	0.	1		2232	677	0.
1		0004	3	0.	1		0734	228	0.	1		1504	453	0.	1		2234	678	0.
1		0006	4	0.	1		0736	229	0.	1		1506	454	0.	1		2236	679	0.
		0008	5	0.	1		0738	230	0.	1		1508	455	0.	1		2238	680	0.
1		0010	6	0.	1		0740	231	0.	1		1510	456	0.	1		2240	681	0.
1		0012	7	0.	1		0742	232	0.	1		1512	457	0.	1		2242	682	0.
1		0014	8	0.	1		0744	233	0.	1		1514	458	0.	1		2244	683	0.
1		0016	9	0.	1		0746	234	0.	1		1516	459	0.	1		2246	684	0.
1		0018	10	0.	1		0748	235	0.	1		1518	460	0.	1		2248	685	0.
1		0020	11	0.	1		0750	236	0.	1		1520	461	0.	1		2250	686	0.
1		0022	12	0.	1		0752	237	0.	1		1522	462	0.	1		2252	687	0.
1		0024	13	0.	1		0754	238	0.	1		1524	463	0.	1		2254	688	0.
1		0026	14	0.	1		0756	239	0.	1		1526	464	0.	1		2256	689	0.
1		0028	15	0.	1		0758	240	0.	1		1528	465	0.	1		2258	690	0.
1		0030	16	0.	1		0800	241	0.	1		1530	466	0.	1		2300	691	0.
1		0032	17	0.	1		0802	242	0.	1		1532	467	0.	1		2302	692	0.
1		0034	18	0.	1		0804	243	0.	1		1534	468	0.	1		2304	693	0.
1		0036	19	0.	1		0806	244	0.	1		1536	469	0.	1		2306	694	0.
1		0038	20	0.	1		0808	245	0.	1		1538	470	0.	1		2308	695	0.
1		0040	21	0.	1		0810	246	0.	1		1540	471	0.	1		2310	696	0.
1		0042	22	0.	1		0812	247	0.	1		1542	472	0.	1		2312	697	0.
1		0044	23	0.	1		0814	248	0.	1		1544	473	0.	1		2314	698	0.
1		0046	24	0.	1		0816	249	0.	1		1546	474	0.	1		2316	699	0.
1		0048	25	0.	1		0818	250	0.	1		1548	475	0.	1		2318	700	0.
1		0050	26	0.	1		0820	251	0.	1		1550	476	0.	1		2320	701	0.
1		0052	27	0.	1		0822	252	0.	1		1552	477	0.	1		2322	702	0.
1		0054	28	0.	1		0824	253	0.	1		1554	478	0.	1		2324	703	0.
1		0056	29	0.	1		0826	254	0.	1		1556	479	0.	1		2326	704	0.
		0058	30	0.	1		0828	255	0.	1		1558	480	0.	1		2328	705	0.
1		0100	31	0.	1		0830	256	0.	1		1600	481	0.	1		2330	706	0.
1		0102	32	0.	1		0832	257	0.	1		1602	482	0.	1		2332	707	0.
1		0104	33	0.	1		0834	258	0.	1		1604	483	0.	1		2334	708	0.
1		0106	34	0.	1		0836	259	0.	1		1606	484	0.	1		2336	709	0.

1	0108	35	0.	*	1	0838	260	0.	*	1	1608	485	0.	*	1	2338	710	0.
1	0110	36	0.	*	1	0840	261	0.	*	1	1610	486	0.	*	1	2340	711	0.
1	0112	37	0.	*	1	0842	262	0.	*	1	1612	487	0.	*	1	2342	712	0.
1	0114	38	0.	*	1	0844	263	0.	*	1	1614	488	0.	*	1	2344	713	0.
	0116	39	0.	*	1	0846	264	0.	*	1	1616	489	0.	*	1	2346	714	0.
	0118	40	0.	*	1	0848	265	0.	*	1	1618	490	0.	*	1	2348	715	0.
1	0120	41	0.	*	1	0850	266	0.	*	1	1620	491	0.	*	1	2350	716	0.
1	0122	42	0.	*	1	0852	267	0.	*	1	1622	492	0.	*	1	2352	717	0.
1	0124	43	0.	*	1	0854	268	0.	*	1	1624	493	0.	*	1	2354	718	0.
1	0126	44	0.	*	1	0856	269	0.	*	1	1626	494	0.	*	1	2356	719	0.
1	0128	45	0.	*	1	0858	270	0.	*	1	1628	495	0.	*	1	2358	720	0.
1	0130	46	0.	*	1	0900	271	0.	*	1	1630	496	0.	*	2	0000	721	0.
1	0132	47	0.	*	1	0902	272	0.	*	1	1632	497	0.	*	2	0002	722	0.
1	0134	48	0.	*	1	0904	273	0.	*	1	1634	498	0.	*	2	0004	723	0.
1	0136	49	0.	*	1	0906	274	0.	*	1	1636	499	0.	*	2	0006	724	0.
1	0138	50	0.	*	1	0908	275	0.	*	1	1638	500	0.	*	2	0008	725	0.
1	0140	51	0.	*	1	0910	276	0.	*	1	1640	501	0.	*	2	0010	726	0.
1	0142	52	0.	*	1	0912	277	0.	*	1	1642	502	0.	*	2	0012	727	0.
1	0144	53	0.	*	1	0914	278	0.	*	1	1644	503	0.	*	2	0014	728	0.
1	0146	54	0.	*	1	0916	279	0.	*	1	1646	504	0.	*	2	0016	729	0.
1	0148	55	0.	*	1	0918	280	0.	*	1	1648	505	0.	*	2	0018	730	0.
1	0150	56	0.	*	1	0920	281	0.	*	1	1650	506	0.	*	2	0020	731	0.
1	0152	57	0.	*	1	0922	282	0.	*	1	1652	507	0.	*	2	0022	732	0.
1	0154	58	0.	*	1	0924	283	0.	*	1	1654	508	0.	*	2	0024	733	0.
1	0156	59	0.	*	1	0926	284	0.	*	1	1656	509	0.	*	2	0026	734	0.
1	0158	60	0.	*	1	0928	285	0.	*	1	1658	510	0.	*	2	0028	735	0.
1	0200	61	0.	*	1	0930	286	0.	*	1	1700	511	0.	*	2	0030	736	0.
1	0202	62	0.	*	1	0932	287	0.	*	1	1702	512	0.	*	2	0032	737	0.
1	0204	63	0.	*	1	0934	288	0.	*	1	1704	513	0.	*	2	0034	738	0.
1	0206	64	0.	*	1	0936	289	0.	*	1	1706	514	0.	*	2	0036	739	0.
	0208	65	0.	*	1	0938	290	0.	*	1	1708	515	0.	*	2	0038	740	0.
1	0210	66	0.	*	1	0940	291	0.	*	1	1710	516	0.	*	2	0040	741	0.
1	0212	67	0.	*	1	0942	292	0.	*	1	1712	517	0.	*	2	0042	742	0.
1	0214	68	0.	*	1	0944	293	0.	*	1	1714	518	0.	*	2	0044	743	0.
1	0216	69	0.	*	1	0946	294	0.	*	1	1716	519	0.	*	2	0046	744	0.
1	0218	70	1.	*	1	0948	295	0.	*	1	1718	520	0.	*	2	0048	745	0.
1	0220	71	1.	*	1	0950	296	0.	*	1	1720	521	0.	*	2	0050	746	0.
1	0222	72	1.	*	1	0952	297	0.	*	1	1722	522	0.	*	2	0052	747	0.
1	0224	73	1.	*	1	0954	298	0.	*	1	1724	523	0.	*	2	0054	748	0.
1	0226	74	1.	*	1	0956	299	0.	*	1	1726	524	0.	*	2	0056	749	0.
1	0228	75	1.	*	1	0958	300	0.	*	1	1728	525	0.	*	2	0058	750	0.
1	0230	76	2.	*	1	1000	301	0.	*	1	1730	526	0.	*	2	0100	751	0.
1	0232	77	2.	*	1	1002	302	0.	*	1	1732	527	0.	*	2	0102	752	0.
1	0234	78	2.	*	1	1004	303	0.	*	1	1734	528	0.	*	2	0104	753	0.
1	0236	79	2.	*	1	1006	304	0.	*	1	1736	529	0.	*	2	0106	754	0.
1	0238	80	2.	*	1	1008	305	0.	*	1	1738	530	0.	*	2	0108	755	0.
1	0240	81	2.	*	1	1010	306	0.	*	1	1740	531	0.	*	2	0110	756	0.
1	0242	82	3.	*	1	1012	307	0.	*	1	1742	532	0.	*	2	0112	757	0.
1	0244	83	3.	*	1	1014	308	0.	*	1	1744	533	0.	*	2	0114	758	0.
1	0246	84	3.	*	1	1016	309	0.	*	1	1746	534	0.	*	2	0116	759	0.
1	0248	85	3.	*	1	1018	310	0.	*	1	1748	535	0.	*	2	0118	760	0.
1	0250	86	3.	*	1	1020	311	0.	*	1	1750	536	0.	*	2	0120	761	0.
1	0252	87	4.	*	1	1022	312	0.	*	1	1752	537	0.	*	2	0122	762	0.
1	0254	88	4.	*	1	1024	313	0.	*	1	1754	538	0.	*	2	0124	763	0.
1	0256	89	4.	*	1	1026	314	0.	*	1	1756	539	0.	*	2	0126	764	0.
	0258	90	4.	*	1	1028	315	0.	*	1	1758	540	0.	*	2	0128	765	0.
1	0300	91	5.	*	1	1030	316	0.	*	1	1800	541	0.	*	2	0130	766	0.
1	0302	92	5.	*	1	1032	317	0.	*	1	1802	542	0.	*	2	0132	767	0.
1	0304	93	5.	*	1	1034	318	0.	*	1	1804	543	0.	*	2	0134	768	0.
1	0306	94	6.	*	1	1036	319	0.	*	1	1806	544	0.	*	2	0136	769	0.

1	0308	95	7.	*	1	1038	320	0.	*	1	1808	545	0.	*	2	0138	770	0.
1	0310	96	7.	*	1	1040	321	0.	*	1	1810	546	0.	*	2	0140	771	0.
1	0312	97	8.	*	1	1042	322	0.	*	1	1812	547	0.	*	2	0142	772	0.
1	0314	98	9.	*	1	1044	323	0.	*	1	1814	548	0.	*	2	0144	773	0.
	0316	99	11.	*	1	1046	324	0.	*	1	1816	549	0.	*	2	0146	774	0.
	0318	100	12.	*	1	1048	325	0.	*	1	1818	550	0.	*	2	0148	775	0.
1	0320	101	14.	*	1	1050	326	0.	*	1	1820	551	0.	*	2	0150	776	0.
1	0322	102	16.	*	1	1052	327	0.	*	1	1822	552	0.	*	2	0152	777	0.
1	0324	103	19.	*	1	1054	328	0.	*	1	1824	553	0.	*	2	0154	778	0.
1	0326	104	21.	*	1	1056	329	0.	*	1	1826	554	0.	*	2	0156	779	0.
1	0328	105	24.	*	1	1058	330	0.	*	1	1828	555	0.	*	2	0158	780	0.
1	0330	106	27.	*	1	1100	331	0.	*	1	1830	556	0.	*	2	0200	781	0.
1	0332	107	31.	*	1	1102	332	0.	*	1	1832	557	0.	*	2	0202	782	0.
1	0334	108	36.	*	1	1104	333	0.	*	1	1834	558	0.	*	2	0204	783	0.
1	0336	109	41.	*	1	1106	334	0.	*	1	1836	559	0.	*	2	0206	784	0.
1	0338	110	47.	*	1	1108	335	0.	*	1	1838	560	0.	*	2	0208	785	0.
1	0340	111	54.	*	1	1110	336	0.	*	1	1840	561	0.	*	2	0210	786	0.
1	0342	112	62.	*	1	1112	337	0.	*	1	1842	562	0.	*	2	0212	787	0.
1	0344	113	72.	*	1	1114	338	0.	*	1	1844	563	0.	*	2	0214	788	0.
1	0346	114	84.	*	1	1116	339	0.	*	1	1846	564	0.	*	2	0216	789	0.
1	0348	115	99.	*	1	1118	340	0.	*	1	1848	565	0.	*	2	0218	790	0.
1	0350	116	115.	*	1	1120	341	0.	*	1	1850	566	0.	*	2	0220	791	0.
1	0352	117	131.	*	1	1122	342	0.	*	1	1852	567	0.	*	2	0222	792	0.
1	0354	118	145.	*	1	1124	343	0.	*	1	1854	568	0.	*	2	0224	793	0.
1	0356	119	160.	*	1	1126	344	0.	*	1	1856	569	0.	*	2	0226	794	0.
1	0358	120	174.	*	1	1128	345	0.	*	1	1858	570	0.	*	2	0228	795	0.
1	0400	121	190.	*	1	1130	346	0.	*	1	1900	571	0.	*	2	0230	796	0.
1	0402	122	206.	*	1	1132	347	0.	*	1	1902	572	0.	*	2	0232	797	0.
1	0404	123	223.	*	1	1134	348	0.	*	1	1904	573	0.	*	2	0234	798	0.
1	0406	124	238.	*	1	1136	349	0.	*	1	1906	574	0.	*	2	0236	799	0.
	0408	125	252.	*	1	1138	350	0.	*	1	1908	575	0.	*	2	0238	800	0.
1	0410	126	262.	*	1	1140	351	0.	*	1	1910	576	0.	*	2	0240	801	0.
1	0412	127	269.	*	1	1142	352	0.	*	1	1912	577	0.	*	2	0242	802	0.
1	0414	128	289.	*	1	1144	353	0.	*	1	1914	578	0.	*	2	0244	803	0.
1	0416	129	283.	*	1	1146	354	0.	*	1	1916	579	0.	*	2	0246	804	0.
1	0418	130	284.	*	1	1148	355	0.	*	1	1918	580	0.	*	2	0248	805	0.
1	0420	131	288.	*	1	1150	356	0.	*	1	1920	581	0.	*	2	0250	806	0.
1	0422	132	292.	*	1	1152	357	0.	*	1	1922	582	0.	*	2	0252	807	0.
1	0424	133	297.	*	1	1154	358	0.	*	1	1924	583	0.	*	2	0254	808	0.
1	0426	134	302.	*	1	1156	359	0.	*	1	1926	584	0.	*	2	0256	809	0.
1	0428	135	306.	*	1	1158	360	0.	*	1	1928	585	0.	*	2	0258	810	0.
1	0430	136	308.	*	1	1200	361	0.	*	1	1930	586	0.	*	2	0300	811	0.
1	0432	137	306.	*	1	1202	362	0.	*	1	1932	587	0.	*	2	0302	812	0.
1	0434	138	303.	*	1	1204	363	0.	*	1	1934	588	0.	*	2	0304	813	0.
1	0436	139	298.	*	1	1206	364	0.	*	1	1936	589	0.	*	2	0306	814	0.
1	0438	140	297.	*	1	1208	365	0.	*	1	1938	590	0.	*	2	0308	815	0.
1	0440	141	297.	*	1	1210	366	0.	*	1	1940	591	0.	*	2	0310	816	0.
1	0442	142	290.	*	1	1212	367	0.	*	1	1942	592	0.	*	2	0312	817	0.
1	0444	143	282.	*	1	1214	368	0.	*	1	1944	593	0.	*	2	0314	818	0.
1	0446	144	272.	*	1	1216	369	0.	*	1	1946	594	0.	*	2	0316	819	0.
1	0448	145	262.	*	1	1218	370	0.	*	1	1948	595	0.	*	2	0318	820	0.
1	0450	146	251.	*	1	1220	371	0.	*	1	1950	596	0.	*	2	0320	821	0.
1	0452	147	240.	*	1	1222	372	0.	*	1	1952	597	0.	*	2	0322	822	0.
1	0454	148	229.	*	1	1224	373	0.	*	1	1954	598	0.	*	2	0324	823	0.
1	0456	149	217.	*	1	1226	374	0.	*	1	1956	599	0.	*	2	0326	824	0.
	0458	150	205.	*	1	1228	375	0.	*	1	1958	600	0.	*	2	0328	825	0.
1	0500	151	194.	*	1	1230	376	0.	*	1	2000	601	0.	*	2	0330	826	0.
1	0502	152	182.	*	1	1232	377	0.	*	1	2002	602	0.	*	2	0332	827	0.
1	0504	153	171.	*	1	1234	378	0.	*	1	2004	603	0.	*	2	0334	828	0.
1	0506	154	160.	*	1	1236	379	0.	*	1	2006	604	0.	*	2	0336	829	0.

1	0508	155	149.	*	1	1238	380	0.	*	1	2008	605	0.	*	2	0338	830	0.
1	0510	156	139.	*	1	1240	381	0.	*	1	2010	606	0.	*	2	0340	831	0.
1	0512	157	130.	*	1	1242	382	0.	*	1	2012	607	0.	*	2	0342	832	0.
1	0514	158	121.	*	1	1244	383	0.	*	1	2014	608	0.	*	2	0344	833	0.
	0516	159	113.	*	1	1246	384	0.	*	1	2016	609	0.	*	2	0346	834	0.
	0518	160	105.	*	1	1248	385	0.	*	1	2018	610	0.	*	2	0348	835	0.
1	0520	161	98.	*	1	1250	386	0.	*	1	2020	611	0.	*	2	0350	836	0.
1	0522	162	92.	*	1	1252	387	0.	*	1	2022	612	0.	*	2	0352	837	0.
1	0524	163	86.	*	1	1254	388	0.	*	1	2024	613	0.	*	2	0354	838	0.
1	0526	164	81.	*	1	1256	389	0.	*	1	2026	614	0.	*	2	0356	839	0.
1	0528	165	76.	*	1	1258	390	0.	*	1	2028	615	0.	*	2	0358	840	0.
1	0530	166	71.	*	1	1300	391	0.	*	1	2030	616	0.	*	2	0400	841	0.
1	0532	167	67.	*	1	1302	392	0.	*	1	2032	617	0.	*	2	0402	842	0.
1	0534	168	62.	*	1	1304	393	0.	*	1	2034	618	0.	*	2	0404	843	0.
1	0536	169	58.	*	1	1306	394	0.	*	1	2036	619	0.	*	2	0406	844	0.
1	0538	170	55.	*	1	1308	395	0.	*	1	2038	620	0.	*	2	0408	845	0.
1	0540	171	51.	*	1	1310	396	0.	*	1	2040	621	0.	*	2	0410	846	0.
1	0542	172	48.	*	1	1312	397	0.	*	1	2042	622	0.	*	2	0412	847	0.
1	0544	173	45.	*	1	1314	398	0.	*	1	2044	623	0.	*	2	0414	848	0.
1	0546	174	42.	*	1	1316	399	0.	*	1	2046	624	0.	*	2	0416	849	0.
1	0548	175	40.	*	1	1318	400	0.	*	1	2048	625	0.	*	2	0418	850	0.
1	0550	176	37.	*	1	1320	401	0.	*	1	2050	626	0.	*	2	0420	851	0.
1	0552	177	35.	*	1	1322	402	0.	*	1	2052	627	0.	*	2	0422	852	0.
1	0554	178	33.	*	1	1324	403	0.	*	1	2054	628	0.	*	2	0424	853	0.
1	0556	179	29.	*	1	1326	404	0.	*	1	2056	629	0.	*	2	0426	854	0.
1	0558	180	19.	*	1	1328	405	0.	*	1	2058	630	0.	*	2	0428	855	0.
1	0600	181	24.	*	1	1330	406	0.	*	1	2100	631	0.	*	2	0430	856	0.
1	0602	182	27.	*	1	1332	407	0.	*	1	2102	632	0.	*	2	0432	857	0.
1	0604	183	25.	*	1	1334	408	0.	*	1	2104	633	0.	*	2	0434	858	0.
1	0606	184	24.	*	1	1336	409	0.	*	1	2106	634	0.	*	2	0436	859	0.
	0608	185	22.	*	1	1338	410	0.	*	1	2108	635	0.	*	2	0438	860	0.
1	0610	186	21.	*	1	1340	411	0.	*	1	2110	636	0.	*	2	0440	861	0.
1	0612	187	20.	*	1	1342	412	0.	*	1	2112	637	0.	*	2	0442	862	0.
1	0614	188	19.	*	1	1344	413	0.	*	1	2114	638	0.	*	2	0444	863	0.
1	0616	189	17.	*	1	1346	414	0.	*	1	2116	639	0.	*	2	0446	864	0.
1	0618	190	16.	*	1	1348	415	0.	*	1	2118	640	0.	*	2	0448	865	0.
1	0620	191	14.	*	1	1350	416	0.	*	1	2120	641	0.	*	2	0450	866	0.
1	0622	192	13.	*	1	1352	417	0.	*	1	2122	642	0.	*	2	0452	867	0.
1	0624	193	12.	*	1	1354	418	0.	*	1	2124	643	0.	*	2	0454	868	0.
1	0626	194	10.	*	1	1356	419	0.	*	1	2126	644	0.	*	2	0456	869	0.
1	0628	195	9.	*	1	1358	420	0.	*	1	2128	645	0.	*	2	0458	870	0.
1	0630	196	8.	*	1	1400	421	0.	*	1	2130	646	0.	*	2	0500	871	0.
1	0632	197	7.	*	1	1402	422	0.	*	1	2132	647	0.	*	2	0502	872	0.
1	0634	198	7.	*	1	1404	423	0.	*	1	2134	648	0.	*	2	0504	873	0.
1	0636	199	6.	*	1	1406	424	0.	*	1	2136	649	0.	*	2	0506	874	0.
1	0638	200	5.	*	1	1408	425	0.	*	1	2138	650	0.	*	2	0508	875	0.
1	0640	201	5.	*	1	1410	426	0.	*	1	2140	651	0.	*	2	0510	876	0.
1	0642	202	4.	*	1	1412	427	0.	*	1	2142	652	0.	*	2	0512	877	0.
1	0644	203	4.	*	1	1414	428	0.	*	1	2144	653	0.	*	2	0514	878	0.
1	0646	204	3.	*	1	1416	429	0.	*	1	2146	654	0.	*	2	0516	879	0.
1	0648	205	3.	*	1	1418	430	0.	*	1	2148	655	0.	*	2	0518	880	0.
1	0650	206	2.	*	1	1420	431	0.	*	1	2150	656	0.	*	2	0520	881	0.
1	0652	207	2.	*	1	1422	432	0.	*	1	2152	657	0.	*	2	0522	882	0.
1	0654	208	2.	*	1	1424	433	0.	*	1	2154	658	0.	*	2	0524	883	0.
1	0656	209	1.	*	1	1426	434	0.	*	1	2156	659	0.	*	2	0526	884	0.
	0658	210	1.	*	1	1428	435	0.	*	1	2158	660	0.	*	2	0528	885	0.
1	0700	211	1.	*	1	1430	436	0.	*	1	2200	661	0.	*	2	0530	886	0.
1	0702	212	1.	*	1	1432	437	0.	*	1	2202	662	0.	*	2	0532	887	0.
1	0704	213	1.	*	1	1434	438	0.	*	1	2204	663	0.	*	2	0534	888	0.
1	0706	214	0.	*	1	1436	439	0.	*	1	2206	664	0.	*	2	0536	889	0.

1	0708	215	0.	*	1	1438	440	0.	*	1	2208	665	0.	*	2	0538	890	0.
1	0710	216	0.	*	1	1440	441	0.	*	1	2210	666	0.	*	2	0540	891	0.
1	0712	217	0.	*	1	1442	442	0.	*	1	2212	667	0.	*	2	0542	892	0.
1	0714	218	0.	*	1	1444	443	0.	*	1	2214	668	0.	*	2	0544	893	0.
	0716	219	0.	*	1	1446	444	0.	*	1	2216	669	0.	*	2	0546	894	0.
	0718	220	0.	*	1	1448	445	0.	*	1	2218	670	0.	*	2	0548	895	0.
1	0720	221	0.	*	1	1450	446	0.	*	1	2220	671	0.	*	2	0550	896	0.
1	0722	222	0.	*	1	1452	447	0.	*	1	2222	672	0.	*	2	0552	897	0.
1	0724	223	0.	*	1	1454	448	0.	*	1	2224	673	0.	*	2	0554	898	0.
1	0726	224	0.	*	1	1456	449	0.	*	1	2226	674	0.	*	2	0556	899	0.
1	0728	225	0.	*	1	1458	450	0.	*	1	2228	675	0.	*	2	0558	900	0.
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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
(CFS)	(HR)		6-HR	24-HR	72-HR	29.97-HR
308.	4.50	(CFS)	69.	17.	14.	14.
		(INCHES)	16.018	16.018	16.018	16.018
		(AC-FT)	34.	34.	34.	34.

CUMULATIVE AREA = 0.04 SQ MI

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	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10AS	20.	4.03	3.	1.	1.	0.03		
ROUTED TO	10AR	20.	4.20	3.	1.	1.	0.03		
HYDROGRAPH AT	10BS	5.	4.23	1.	0.	0.	0.01		
HYDROGRAPH AT	10CS	6.	4.13	1.	0.	0.	0.01		
ROUTED TO	10CR1	6.	4.33	1.	0.	0.	0.01		
ROUTED TO	10CR2	6.	4.60	1.	0.	0.	0.01		
3 COMBINED AT	10BC	25.	4.20	5.	1.	1.	0.05		
ROUTED TO	10BR	25.	4.27	5.	1.	1.	0.05		
HYDROGRAPH AT	20BS	5.	4.30	1.	0.	0.	0.01		
2 COMBINED AT	20BC	30.	4.27	6.	1.	1.	0.06		
ROUTED TO	20BR	30.	4.33	6.	1.	1.	0.06		
HYDROGRAPH AT	20AS	45.	4.17	8.	2.	2.	0.07		
2 COMBINED AT	20AC	72.	4.27	14.	3.	3.	0.13		
ROUTED TO	20AR	72.	4.37	14.	3.	3.	0.13		
HYDROGRAPH AT	20CS	2.	4.20	0.	0.	0.	0.00		
ROUTED TO	20CR	2.	4.40	0.	0.	0.	0.00		
HYDROGRAPH AT	40CS	2.	4.10	0.	0.	0.	0.00		
2 COMBINED AT	40CC	3.	4.23	1.	0.	0.	0.01		
ROUTED TO	40CR	3.	4.37	1.	0.	0.	0.01		
HYDROGRAPH AT	30AS	15.	4.50	3.	1.	1.	0.03		
2 COMBINED AT	30CC	18.	4.47	4.	1.	1.	0.04		
ROUTED TO	30CR	18.	4.53	4.	1.	1.	0.04		
HYDROGRAPH AT	40AS	76.	4.03	12.	3.	2.	0.11		
3 COMBINED AT	40AC	132.	4.13	29.	7.	6.	0.28		
ROUTED TO	40AR	132.	4.17	29.	7.	6.	0.28		
HYDROGRAPH AT	40ES	21.	4.03	3.	1.	1.	0.03		

2 COMBINED AT	40EC	151.	4.13	32.	8.	7.	0.32
ROUTED TO	40ER	151.	4.13	32.	8.	7.	0.32
HYDROGRAPH AT	70AS	4.	4.23	1.	0.	0.	0.01
ROUTED TO	70AR	4.	4.43	1.	0.	0.	0.01
HYDROGRAPH AT	40DS	2.	4.07	0.	0.	0.	0.00
3 COMBINED AT	40DC	155.	4.17	33.	9.	7.	0.32
ROUTED TO	40DR	155.	4.17	33.	9.	7.	0.32
HYDROGRAPH AT	70BS	4.	4.27	1.	0.	0.	0.01
ROUTED TO	70BR	4.	4.43	1.	0.	0.	0.01
HYDROGRAPH AT	90AS	32.	4.07	5.	1.	1.	0.05
2 COMBINED AT	90AC	34.	4.10	6.	2.	1.	0.06
ROUTED TO	90AR	34.	4.13	6.	2.	1.	0.06
HYDROGRAPH AT	90FS	1.	4.03	0.	0.	0.	0.00
2 COMBINED AT	90FC1	35.	4.13	6.	2.	1.	0.06
2 COMBINED AT	90FC2	190.	4.17	39.	10.	8.	0.38
ROUTED TO	90FR	189.	4.17	39.	10.	8.	0.38
HYDROGRAPH AT	90BS	4.	4.23	1.	0.	0.	0.01
2 COMBINED AT	90BC	193.	4.17	40.	10.	8.	0.39
ROUTED TO	90BR	193.	4.20	40.	10.	8.	0.39
HYDROGRAPH AT	90CS	6.	4.03	1.	0.	0.	0.01
2 COMBINED AT	90CC	197.	4.17	41.	10.	8.	0.40
ROUTED TO	90CR	197.	4.20	41.	10.	8.	0.40
HYDROGRAPH AT	90DS	1.	4.10	0.	0.	0.	0.00
2 COMBINED AT	90DC1	198.	4.20	41.	11.	8.	0.40
HYDROGRAPH AT	50BS	8.	4.33	2.	0.	0.	0.01
ROUTED TO	50BR	8.	4.47	2.	0.	0.	0.01
HYDROGRAPH AT	50AS	77.	4.23	14.	4.	3.	0.13
2 COMBINED AT	50AC	84.	4.23	16.	4.	3.	0.15
ROUTED TO	50AR	84.	4.27	16.	4.	3.	0.15
HYDROGRAPH AT	60CS	3.	4.00	0.	0.	0.	0.00

HYDROGRAPH AT	60BS	2.	4.13	0.	0.	0.	0.00
2 COMBINED AT	60BC	4.	4.03	1.	0.	0.	0.01
ROUTED TO	60BR	4.	4.10	1.	0.	0.	0.01
HYDROGRAPH AT	60AS	17.	4.07	3.	1.	1.	0.03
2 COMBINED AT	60AC	22.	4.07	4.	1.	1.	0.03
ROUTED TO	60AR	21.	4.13	4.	1.	1.	0.03
2 COMBINED AT	61C	103.	4.23	19.	5.	4.	0.18
ROUTED TO	61R	103.	4.23	19.	5.	4.	0.18
HYDROGRAPH AT	60DS	12.	4.20	2.	1.	0.	0.02
2 COMBINED AT	60DC1	115.	4.23	22.	5.	4.	0.20
HYDROGRAPH AT	110BS	3.	4.13	1.	0.	0.	0.00
ROUTED TO	110BR	3.	4.47	0.	0.	0.	0.00
2 COMBINED AT	60DC2	117.	4.23	22.	6.	4.	0.20
ROUTED TO	60DR	117.	4.27	22.	6.	4.	0.20
HYDROGRAPH AT	80AS	14.	4.03	2.	1.	0.	0.02
2 COMBINED AT	80AC	126.	4.23	24.	6.	5.	0.22
ROUTED TO	80AR1	126.	4.23	24.	6.	5.	0.22
HYDROGRAPH AT	80BS	7.	4.37	1.	0.	0.	0.01
2 COMBINED AT	80BC	132.	4.23	26.	6.	5.	0.23
DIVERSION TO	80BDIV	132.	4.23	26.	6.	5.	0.23
HYDROGRAPH AT	80BD	0.	4.23	0.	0.	0.	0.23
ROUTED TO	80BR	0.	4.63	0.	0.	0.	0.23
HYDROGRAPH AT	90ES	17.	4.10	3.	1.	1.	0.03
2 COMBINED AT	90EC	17.	4.10	3.	1.	1.	0.26
ROUTED TO	90ER	17.	4.13	3.	1.	1.	0.26
2 COMBINED AT	90DC2	214.	4.20	44.	11.	9.	0.66
ROUTED TO	90DR	214.	4.23	44.	11.	9.	0.66
HYDROGRAPH AT	110AS	26.	4.20	3.	1.	1.	0.05
DIVERSION TO	110DIV	13.	4.20	2.	0.	0.	0.05
HYDROGRAPH AT	110D	13.	4.20	2.	0.	0.	0.05

ROUTED TO	111R	13.	4.73	2.	0.	0.	0.05
HYDROGRAPH AT	80BDIV	132.	4.23	26.	6.	5.	0.00
ROUTED TO	80AR2	132.	4.77	26.	6.	5.	0.00
2 COMBINED AT	111C	144.	4.73	27.	7.	6.	0.05
DIVERSION TO	111DIV	144.	6.00	22.	6.	4.	0.05
HYDROGRAPH AT	111D	19.	6.00	5.	1.	1.	0.05
ROUTED TO	112R	19.	6.03	5.	1.	1.	0.05
HYDROGRAPH AT	100P	47.	4.43	8.	2.	2.	0.13
2 COMBINED AT	100C	54.	4.23	12.	3.	3.	0.19
HYDROGRAPH AT	120P	14.	4.13	2.	0.	0.	0.03
2 COMBINED AT	120C	67.	4.20	14.	4.	3.	0.21
2 COMBINED AT	91C	281.	4.23	58.	15.	12.	0.88
DIVERSION TO	91DIV	269.	2.10	46.	12.	9.	0.88
HYDROGRAPH AT	91D	12.	2.10	12.	3.	3.	0.88
ROUTED TO	91R	12.	2.17	12.	3.	3.	0.88
DIVERSION TO	140CDV	0.	2.17	0.	0.	0.	0.88
HYDROGRAPH AT	140CD	12.	2.17	12.	3.	3.	0.88
ROUTED TO	160AR	12.	2.27	12.	3.	3.	0.88
HYDROGRAPH AT	110DIV	13.	4.20	2.	0.	0.	0.00
ROUTED TO	110R	13.	4.37	2.	0.	0.	0.00
HYDROGRAPH AT	150AS	28.	5.00	7.	2.	2.	0.11
2 COMBINED AT	150AC	32.	4.93	9.	2.	2.	0.11
ROUTED TO	150AR	32.	4.97	9.	2.	2.	0.11
HYDROGRAPH AT	170P	47.	4.23	7.	2.	1.	0.10
2 COMBINED AT	170AC	71.	4.30	16.	4.	3.	0.21
ROUTED TO	170R	71.	4.33	16.	4.	3.	0.21
DIVERSION TO	170DIV	71.	0.03	16.	4.	3.	0.21
HYDROGRAPH AT	170D	0.	0.03	0.	0.	0.	0.21
HYDROGRAPH AT	160AS	4.	4.27	1.	0.	0.	0.01
2 COMBINED AT	160RC	4.	4.27	1.	0.	0.	0.22

ROUTED TO	160AR2	4.	4.40	1.	0.	0.	0.22		
HYDROGRAPH AT	160BS	8.	4.47	2.	0.	0.	0.01		
3 COMBINED AT	160BC	23.	4.43	14.	4.	3.	1.11		
ROUTED TO	160BR	23.	4.47	14.	4.	3.	1.11		
HYDROGRAPH AT	190BS	1.	4.07	0.	0.	0.	0.00		
ROUTED TO	190BR	1.	4.70	0.	0.	0.	0.00		
HYDROGRAPH AT	190AS	6.	4.37	1.	0.	0.	0.01		
2 COMBINED AT	190BC1	6.	4.57	1.	0.	0.	0.01		
HYDROGRAPH AT	170DIV	71.	4.33	16.	4.	3.	0.00		
2 COMBINED AT	190BC2	77.	4.33	17.	4.	3.	0.01		
HYDROGRAPH AT	210CS	1.	4.20	0.	0.	0.	0.00		
2 COMBINED AT	210CC	78.	4.33	17.	4.	4.	0.01		
ROUTED TO	210CR	77.	4.37	17.	4.	4.	0.01		
DIVERSION TO	210DIV	77.	0.03	17.	4.	4.	0.01		
HYDROGRAPH AT	210D	0.	0.03	0.	0.	0.	0.01		
HYDROGRAPH AT	180P	22.	4.13	3.	1.	1.	0.05		
ROUTED TO	181RET	0.	0.03	0.	0.	0.	0.05	98.34	6.67
2 COMBINED AT	180C	0.	0.03	0.	0.	0.	0.07		
HYDROGRAPH AT	200AS	12.	4.20	2.	0.	0.	0.04		
2 COMBINED AT	200AC	12.	4.20	2.	0.	0.	0.11		
ROUTED TO	200AR	12.	4.23	2.	0.	0.	0.11		
HYDROGRAPH AT	200BS	2.	4.13	0.	0.	0.	0.00		
2 COMBINED AT	200BC1	14.	4.23	2.	1.	0.	0.11		
2 COMBINED AT	200BC2	35.	4.27	16.	5.	4.	1.22		
DIVERSION TO	200BDV	0.	4.27	0.	0.	0.	1.22		
HYDROGRAPH AT	200BD	35.	4.27	16.	5.	4.	1.22		
ROUTED TO	200BR	35.	4.30	16.	5.	4.	1.22		
HYDROGRAPH AT	210AS	4.	4.20	1.	0.	0.	0.01		
2 COMBINED AT	210AC	39.	4.30	17.	5.	4.	1.23		
ROUTED TO	210AR	39.	4.33	17.	5.	4.	1.23		

HYDROGRAPH AT	210BS	6.	4.50	1.	0.	0.	0.01
2 COMBINED AT	210BC	44.	4.33	18.	5.	4.	1.24
DIVERSION TO	210BDV	0.	4.33	0.	0.	0.	1.24
HYDROGRAPH AT	210BD	44.	4.33	18.	5.	4.	1.24
HYDROGRAPH AT	91DIV	269.	4.23	46.	12.	9.	0.00
HYDROGRAPH AT	111DIV	144.	4.73	22.	6.	4.	0.00
HYDROGRAPH AT	140P	3.	5.60	1.	0.	0.	0.04
3 COMBINED AT	140C	308.	4.50	69.	17.	14.	0.04

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
10AR	MANE	2.00	20.01	251.27	1.01	2.00	19.91	252.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1576E+01 EXCESS=0.0000E+00 OUTFLOW=0.1585E+01 BASIN STORAGE=0.1447E-03 PERCENT ERROR= -0.6

10CR1	MANE	2.00	5.73	261.35	0.43	2.00	5.71	260.00	0.43

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3021E+00 EXCESS=0.0000E+00 OUTFLOW=0.3043E+00 BASIN STORAGE=0.6331E-04 PERCENT ERROR= -0.7

10CR2	MANE	2.00	5.70	275.18	0.47	2.00	5.68	276.00	0.47

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3040E+00 EXCESS=0.0000E+00 OUTFLOW=0.3343E+00 BASIN STORAGE=0.2676E-03 PERCENT ERROR= -10.0

10BR	MANE	2.00	25.09	256.61	0.89	2.00	25.09	256.00	0.89

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2434E+01 EXCESS=0.0000E+00 OUTFLOW=0.2436E+01 BASIN STORAGE=0.3348E-03 PERCENT ERROR= -0.1

20BR	MANE	2.00	30.08	260.30	0.92	2.00	30.05	260.00	0.92

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2946E+01 EXCESS=0.0000E+00 OUTFLOW=0.2946E+01 BASIN STORAGE=0.4909E-03 PERCENT ERROR= 0.0

20AR	MANE	2.00	71.93	261.49	0.96	2.00	71.74	262.00	0.96

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6871E+01 EXCESS=0.0000E+00 OUTFLOW=0.6877E+01 BASIN STORAGE=0.1411E-02 PERCENT ERROR= -0.1

20CR	MANE	2.00	1.82	265.09	1.08	2.00	1.81	264.00	1.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1722E+00 EXCESS=0.0000E+00 OUTFLOW=0.1727E+00 BASIN STORAGE=0.2586E-04 PERCENT ERROR= -0.3

40CR	MANE	2.03	3.34	261.23	1.10	2.00	3.33	262.00	1.10

ITY SUMMARY (AC-FT) - INFLOW=0.3443E+00 EXCESS=0.0000E+00 OUTFLOW=0.3448E+00 BASIN STORAGE=0.5784E-04 PERCENT ERROR= -0.2

30CR	MANE	2.00	18.44	272.99	1.02	2.00	18.42	272.00	1.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2030E+01 EXCESS=0.0000E+00 OUTFLOW=0.2032E+01 BASIN STORAGE=0.5849E-05 PERCENT ERROR= -0.1

40AR	MANE	0.49	132.31	249.17	0.97	2.00	132.24	250.00	0.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1474E+02 EXCESS=0.0000E+00 OUTFLOW=0.1473E+02 BASIN STORAGE=0.2079E-04 PERCENT ERROR= 0.0

40ER	MANE	0.41	150.89	248.68	0.97	2.00	150.57	248.00	0.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1638E+02 EXCESS=0.0000E+00 OUTFLOW=0.1637E+02 BASIN STORAGE=0.2063E-04 PERCENT ERROR= 0.0

70AR	MANE	2.00	3.82	266.01	1.11	2.00	3.82	266.00	1.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3725E+00 EXCESS=0.0000E+00 OUTFLOW=0.3733E+00 BASIN STORAGE=0.3172E-04 PERCENT ERROR= -0.2

40DR	MANE	0.77	154.82	249.61	0.98	2.00	154.81	250.00	0.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1690E+02 EXCESS=0.0000E+00 OUTFLOW=0.1690E+02 BASIN STORAGE=0.4224E-04 PERCENT ERROR= 0.0

70BR	MANE	2.00	3.55	267.13	1.14	2.00	3.55	266.00	1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3569E+00 EXCESS=0.0000E+00 OUTFLOW=0.3575E+00 BASIN STORAGE=0.2997E-04 PERCENT ERROR= -0.2

90AR	MANE	1.16	34.42	248.21	1.01	2.00	34.42	248.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2993E+01 EXCESS=0.0000E+00 OUTFLOW=0.2997E+01 BASIN STORAGE=0.4201E-04 PERCENT ERROR= -0.2

90FR	MANE	0.54	189.57	250.82	0.98	2.00	189.18	250.00	0.98

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1997E+02 EXCESS=0.0000E+00 OUTFLOW=0.1997E+02 BASIN STORAGE=0.3855E-04 PERCENT ERROR= 0.0

90BR	MANE	0.34	192.72	250.82	0.98	2.00	192.67	252.00	0.98

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2032E+02 EXCESS=0.0000E+00 OUTFLOW=0.2032E+02 BASIN STORAGE=0.1483E-04 PERCENT ERROR= 0.0

90CR	MANE	0.37	196.99	250.86	0.98	2.00	196.95	252.00	0.98

ITY SUMMARY (AC-FT) - INFLOW=0.2080E+02 EXCESS=0.0000E+00 OUTFLOW=0.2080E+02 BASIN STORAGE=0.2745E-04 PERCENT ERROR= 0.0

50BR	MANE	1.98	8.40	268.07	1.17	2.00	8.39	268.00	1.17

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8885E+00 EXCESS=0.0000E+00 OUTFLOW=0.8898E+00 BASIN STORAGE=0.6994E-04 PERCENT ERROR= -0.2

50AR	MANE	0.82	83.74	255.96	1.02	2.00	83.74	256.00	1.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7884E+01 EXCESS=0.0000E+00 OUTFLOW=0.7886E+01 BASIN STORAGE=0.2388E-05 PERCENT ERROR= 0.0

60BR	MANE	1.63	4.38	245.20	0.87	2.00	4.36	246.00	0.87

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3685E+00 EXCESS=0.0000E+00 OUTFLOW=0.3698E+00 BASIN STORAGE=0.3031E-05 PERCENT ERROR= -0.3

60AR	MANE	1.91	21.49	248.83	0.97	2.00	21.47	248.00	0.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1753E+01 EXCESS=0.0000E+00 OUTFLOW=0.1758E+01 BASIN STORAGE=0.2494E-04 PERCENT ERROR= -0.2

61R	MANE	0.96	103.25	254.55	1.01	2.00	103.16	254.00	1.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9644E+01 EXCESS=0.0000E+00 OUTFLOW=0.9645E+01 BASIN STORAGE=0.3558E-05 PERCENT ERROR= 0.0

110BR	MANE	2.07	2.72	269.45	1.12	2.00	2.72	268.00	1.12

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2504E+00 EXCESS=0.0000E+00 OUTFLOW=0.2517E+00 BASIN STORAGE=0.1069E-03 PERCENT ERROR= -0.5

60DR	MANE	0.12	116.72	254.32	1.03	2.00	116.72	256.00	1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1104E+02 EXCESS=0.0000E+00 OUTFLOW=0.1104E+02 BASIN STORAGE=0.3331E-06 PERCENT ERROR= 0.0

80AR1	MANE	0.32	125.89	254.73	1.02	2.00	125.76	254.00	1.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1213E+02 EXCESS=0.0000E+00 OUTFLOW=0.1213E+02 BASIN STORAGE=0.2456E-05 PERCENT ERROR= 0.0

80BR	MANE	0.50	0.22	276.42	0.00	2.00	0.19	278.00	0.00

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1811E-02 EXCESS=0.0000E+00 OUTFLOW=0.4052E-02 BASIN STORAGE=0.5232E-05 PERCENT ERROR=-124.1

90ER	MANE	1.36	16.97	247.63	0.10	2.00	16.95	248.00	0.10

ITY SUMMARY (AC-FT) - INFLOW=0.1400E+01 EXCESS=0.0000E+00 OUTFLOW=0.1403E+01 BASIN STORAGE=0.1632E-04 PERCENT ERROR= -0.2

90DR	MANE	1.02	214.33	253.53	0.63	2.00	214.12	254.00	0.63

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2230E+02 EXCESS=0.0000E+00 OUTFLOW=0.2231E+02 BASIN STORAGE=0.7910E-04 PERCENT ERROR= 0.0

111R	MANE	2.00	12.68	283.49	0.31	2.00	12.68	284.00	0.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8557E+00 EXCESS=0.0000E+00 OUTFLOW=0.8995E+00 BASIN STORAGE=0.1180E-02 PERCENT ERROR= -5.3

80AR2	MANE	2.00	131.84	285.54	-1.00	2.00	131.71	286.00	-1.00
112R	MANE	0.75	19.29	361.45	0.93	2.00	19.09	362.00	0.93

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2648E+01 EXCESS=0.0000E+00 OUTFLOW=0.2651E+01 BASIN STORAGE=0.1956E-04 PERCENT ERROR= -0.1

91R	MANE	2.00	12.00	289.13	0.14	2.00	12.00	290.00	0.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6686E+01 EXCESS=0.0000E+00 OUTFLOW=0.6686E+01 BASIN STORAGE=0.1237E-03 PERCENT ERROR= 0.0

160AR	MANE	2.00	12.00	293.13	0.14	2.00	12.00	294.00	0.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6686E+01 EXCESS=0.0000E+00 OUTFLOW=0.6686E+01 BASIN STORAGE=0.1265E-03 PERCENT ERROR= 0.0

110R	MANE	2.00	12.71	261.98	-1.00	2.00	12.71	262.00	-1.00
150AR	MANE	0.92	31.70	297.91	0.81	2.00	31.70	298.00	0.81

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4574E+01 EXCESS=0.0000E+00 OUTFLOW=0.4575E+01 BASIN STORAGE=0.3802E-05 PERCENT ERROR= 0.0

170R	MANE	1.02	70.72	260.43	0.70	2.00	70.68	260.00	0.70

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7894E+01 EXCESS=0.0000E+00 OUTFLOW=0.7895E+01 BASIN STORAGE=0.4527E-05 PERCENT ERROR= 0.0

160AR2	MANE	2.00	3.68	263.70	0.03	2.00	3.67	264.00	0.03

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3627E+00 EXCESS=0.0000E+00 OUTFLOW=0.3634E+00 BASIN STORAGE=0.9201E-05 PERCENT ERROR= -0.2

160BR	MANE	1.12	23.25	268.78	0.13	2.00	23.25	268.00	0.13

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7907E+01 EXCESS=0.0000E+00 OUTFLOW=0.7907E+01 BASIN STORAGE=0.7579E-04 PERCENT ERROR= 0.0

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          190BR  MANE        2.00      1.29    282.46      1.14      2.00      1.28    282.00        1.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1129E+00 EXCESS=0.0000E+00 OUTFLOW=0.1159E+00 BASIN STORAGE=0.2115E-03 PERCENT ERROR=  -2.9

          210CR  MANE        0.59     77.70    260.99     11.15      2.00     77.50    262.00       11.15

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8738E+01 EXCESS=0.0000E+00 OUTFLOW=0.8738E+01 BASIN STORAGE=0.4887E-05 PERCENT ERROR=   0.0

          200AR  MANE        0.45     11.90    253.05      0.16      2.00     11.90    254.00        0.16

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9680E+00 EXCESS=0.0000E+00 OUTFLOW=0.9681E+00 BASIN STORAGE=0.1517E-11 PERCENT ERROR=   0.0

          200BR  MANE        1.10     35.31    257.39      0.14      2.00     35.31    258.00        0.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9048E+01 EXCESS=0.0000E+00 OUTFLOW=0.9048E+01 BASIN STORAGE=0.7840E-04 PERCENT ERROR=   0.0

          210AR  MANE        1.29     38.75    259.84      0.14      2.00     38.74    260.00        0.14

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9392E+01 EXCESS=0.0000E+00 OUTFLOW=0.9392E+01 BASIN STORAGE=0.1027E-03 PERCENT ERROR=   0.0

*** NORMAL END OF HEC-1 ***
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HEC-1 OUTPUT:
GLENDALE WATERSHED, 10-YEAR 6-HOUR STORM
FUTURE CONDITION

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****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*            VERSION 4.0.1E            *
*     Lahey F77L-EM/32 version 5.01    *
*       Dodson & Associates, Inc.      *
*  RUN DATE  02/20/96  TIME  09:33:48  *
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*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 551-1748              *
*                                      *
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X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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

              *DIAGRAM
  1           ID   NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
  2           ID   GLENDALE WATERSHED
  3           ID   FUTURE CONDITION
  4           ID   10-YEAR, 6-HOUR STORM
  5           ID   PHOENIX VALLEY S-GRAPH UNIT HYDROGRAPH
  6           ID   GREEN-AMPT RAINFALL LOSSES
  7           ID   KINEMATIC WAVE ROUTING
  8           ID   **
  9           ID   ** MODEL CALIBRATED BY ADJUSTING Kn VALUES SO THAT LAG TIMES USING CORPS
 10           ID   ** LAG EQUATION MATCH THOSE OBTAINED BY HAND CALCULATION OF STREET VELOCITIES
 11           ID   **
 12           ID   ** AREAS OF FUTURE DEVELOPMENT ARE MODELED AS 10 PERCENT OF THEIR ACTUAL LAND
 13           ID   ** AREA, WITH THAT 10 PERCENT CONTRIBUTING 95 PERCENT (RTIMP = 95 PERCENT)
 14           ID   **
 15           ID   ** CONCEPT/ROUTING STUDY OPTION 2B:
 16           ID   ** EAST DETENTION/SURGE BASIN, ORANGEWOOD STORM DRAIN ALIGNMENT
 17           ID   **
 18           ID   ** FILE OR021396
 19           ID   **
 20           IT       2                    900
 21           IO       5

 22           KK     10S
 23           KM   BASIN 10
 24           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 25           KM    L=     .9470  Lca=     .4640   S=  15.95  Kn=.0551  LAG= 34.30
 26           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 27           KM    ACTUAL BASIN AREA IS 0.2154 SQ MI
 28           BA   .2029
 29           IN      15
 30           KM   RAINFALL DEPTH OF 2.00 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 31           KM   AN AREAL REDUCTION COEFFICIENT OF .959 WAS USED
 32           PB    1.92
 33           KM   THE FOLLOWING PC RECORD USED A 6-HOUR RAINFALL WITH PATTERN NO. 2.36
 34           PC    .000    .011    .017    .027    .039    .050    .060    .070    .081    .092
 35           PC    .104    .119    .140    .184    .271    .459    .685    .822    .888    .929
 36           PC    .949    .962    .974    .988   1.000
 37           LG    .149     .25    6.00    .164   55.99
 38           UI      20      20      20      22      65      75      89      99     109     116
 39           UI     127     140     152     170     202     242     260     224     198     179
 40           UI     165     153     138     125     116     102      95      82      65      52
 41           UI      35      35      33      33      25      20      20      20      11       6
 42           UI       6       6       6       6       6       6       6       6       6       6
 43           UI       6       0       0       0       0       0       0       0       0       0

 44           KK     10D
 45           KM   DIVERT 50 PERCENT OF FLOW FROM 10S SOUTH ON 47TH AVENUE
 46           DT   10DIV
 47           DI       0    1000
 48           DQ       0     500
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 49           KK   10AR1
 50           KM   ROUTE FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 51           RK    1320   .0038    .013            CIRC       5

 52           KK     20S
 53           KM   BASIN 20
 54           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 55           KM    L=    .9091  Lca=    .4545   S=  15.18  Kn=.0550  LAG= 33.79
 56           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 57           KM    ACTUAL BASIN AREA IS 0.2500 SQ MI
 58           BA   .2265
 59           LG    .149    .150    7.30    .099   56.75
 60           UI      23      23      23      28      74      86     103     113     124     134
 61           UI     145     161     175     198     246     279     285     245     217     198
 62           UI     183     168     151     138     125     113     104      86      65      48
 63           UI      40      39      37      36      23      23      23      19       7       7
 64           UI       7       7       7       7       7       7       7       7       7       7

 65           KK     20D
 66           KM   DIVERT 70 PERCENT OF FLOW FROM 20S TOWARDS WEST
 67           DT   20DIV
 68           DI       0    1000
 69           DQ       0     700

 70           KK     15C
 71           KM   COMBINE 10AR1 AND 20D
 72           HC       2

 73           KK   10AR2
 74           KM   ROUTE FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 75           RK    1320   .0038    .013            CIRC       5

 76           KK   20BR1
 77           KM   ROUTE FLOW SOUTH IN FUTURE 51ST AVENUE STORM DRAIN
 78           RK    1320   .0011    .013            CIRC       7

 79           KK     30S
 80           KM   BASIN 30
 81           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 82           KM    L=   1.2595  Lca=    .5871   S=  15.92  Kn=.0552  LAG= 43.94
 83           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 84           BA   .3163
 85           LG     .15     .25    4.80     .28   53.87
 86           UI      24      24      24      24      24      77      85      95     111     119
 87           UI     129     137     145     154     166     181     190     212     243     281
 88           UI     320     305     269     245     226     210     198     188     171     159
 89           UI     149     140     126     118     111      94      79      70      47      43
 90           UI      43      40      40      40      25      24      24      24      24      10
 91           UI       7       7       7       7       7       7       7       7       7       7
 92           UI       7       7       7       7       7       0       0       0       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  93          KK     30D
  94          KM   DIVERT 50 PERCENT OF FLOW FROM 30S TO WEST
  95          DT   30DIV
  96          DI       0    2000
  97          DQ       0    1000

  98          KK     25C
  99          KM   COMBINE 20BR1 AND 30D
 100          HC       2

 101          KK   20BR2
 102          KM   ROUTE FLOW SOUTH IN FUTURE 51ST AVENUE STORM DRAIN
 103          RK    1320   .0011    .013            CIRC       7
              *

 104          KK   10DIV
 105          KM   RETRIEVE DIVERTED FLOW
 106          DR   10DIV

 107          KK   10B1R
 108          KM   ROUTE FLOW SOUTH ON 47TH AVENUE
 109          RK    2640   .0026     .02            TRAP     125     .01

 110          KK  10B2R1
 111          KM   ROUTE FLOW WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 112          RK    1320   .0019    .013            CIRC       7

 113          KK   30DIV
 114          KM   RETRIEVE DIVERTED FLOW
 115          DR   30DIV

 116          KK     16C
 117          KM   COMBINE 10B2R1 AND 30DIV
 118          HC       2

 119          KK  10B2R2
 120          KM   ROUTE FLOW WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 121          RK    1320   .0019    .013            CIRC       7

 122          KK     30C
 123          KM   COMBINE 20BR2 AND 10B2R2
 124          HC       2

 125          KK     30R
 126          KM   ROUTE 30C2 WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 127          RK    2640   .0045    .012            CIRC       8
              *

 128          KK   20DIV
 129          KM   RETRIEVE DIVERTED FLOW
 130          DR   20DIV
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 131          KK    20AR
 132          KM   ROUTE REMAINING FLOW WEST ON BUTLER AVENUE
 133          RK    2640    .004     .02            TRAP     110     .01

 134          KK     40S
 135          KM   BASIN 40
 136          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 137          KM    L=   1.0000  Lca=    .5000   S=  16.70  Kn=.1756  LAG=113.83
 138          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 139          BA   .2500
 140          LG     .23     .15    8.40     .06   34.09
 141          UI       7       7       7       7       7       7       7       7       7       7
 142          UI       7       7       7      23      24      24      24      28      28      28
 143          UI      31      34      34      35      36      36      40      40      41      41
 144          UI      42      44      44      46      46      48      49      51      52      55
 145          UI      55      57      58      59      63      65      58      74      76      84
 146          UI      90      83      95     100      99      94      89      85      81      78
 147          UI      76      73      71      69      67      65      63      62      61      59
 148          UI      58      57      55      53      51      50      48      47      46      45
 149          UI      44      43      42      39      39      37      36      36      34      34
 150          UI      33      28      28      28      23      21      21      21      20      13
 151          UI      13      13      13      13      13      13      12      12      12      12
 152          UI      12      12      12      12       8       7       7       7       7       7
 153          UI       7       7       7       7       7       7       7       4       2       2
 154          UI       2       2       2       2       2       2       2       2       2       2
 155          UI       2       2       2       2       2       2       2       2       2       2
 156          UI       2       2       2       2       2       2       2       2       2       2
 157          UI       2       2       2       2       2       2       2       2       2       0

 158          KK     40C
 159          KM   COMBINE 20AR AND 40S
 160          HC       2

 161          KK     40D
 162          KM   DIVERT 80 PERCENT OF FLOW WEST ON BUTLER AVENUE
 163          DT   40DIV
 164          DI       0    2000
 165          DQ       0    1600

 166          KK    40BR
 167          KM   ROUTE REMAINING FLOW SOUTH ON 55TH AVENUE
 168          RK    2640    .002     .02            TRAP     110     .01

 169          KK    45C1
 170          KM   COMBINE 30R AND 40BR
 171          HC       2

 172          KK     60S
 173          KM   BASIN 60
 174          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 175          KM    L=   1.5000  Lca=    .5606   S=  17.07  Kn=.1798  LAG=141.41
 176          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 177          KM    ACTUAL BASIN AREA IS 0.5000 SQ MI
 178          BA   .4574
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 179          LG    .185    .190    6.60    .143   38.79
 180          UI      11      11      11      11      11      11      11      11      11      11
 181          UI      11      11      11      11      11      11      29      36      36      36
 182          UI      36      40      42      42      42      46      50      50      50      53
 183          UI      53      53      57      58      58      60      61      61      63      64
 184          UI      64      68      68      69      72      72      75      76      79      81
 185          UI      82      83      84      86      88      93      95     100     105     109
 186          UI     113     123     138     119     131     142     147     147     140     134
 187          UI     130     125     120     117     114     110     108     104     102     100
 188          UI      97      96      93      93      89      89      86      86      84      83
 189          UI      79      78      76      74      73      70      70      67      66      66
 190          UI      63      63      62      57      57      57      53      53      53      51
 191          UI      50      50      49      42      42      42      42      32      31      31
 192          UI      31      31      28      19      19      19      19      19      19      19
 193          UI      19      19      18      18      18      18      18      18      18      18
 194          UI      18      17      11      11      11      11      11      11      11      11
 195          UI      11      11      11      11      11      11      11      11       4       3
 196          UI       3       3       3       3       3       3       3       3       3       3
 197          UI       3       3       3       3       3       3       3       3       3       3
 198          UI       3       3       3       3       3       3       3       3       3       3
 199          UI       3       3       3       3       3       3       3       3       3       3
 200          UI       3       3       3       3       3       3       3       3       3       3
 201          UI       3       3       0       0       0       0       0       0       0       0

 202          KK     60D
 203          KM   DIVERT 75 PERCENT OF FLOW TOWARDS WEST
 204          DT   60DIV
 205          DI       0    2000
 206          DQ       0    1500

 207          KK    45C2
 208          KM   COMBINE 45C1 AND 60D
 209          HC       2

 210          KK     45R
 211          KM   ROUTE 45C2 WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 212          RK    2640   .0038    .013            CIRC       8
              *

 213          KK   40DIV
 214          KM   RETRIEVE DIVERTED FLOW
 215          DR   40DIV

 216          KK   40AR1
 217          KM   ROUTE REMAINING FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 218          RK    1320   .0034    .013            CIRC       5

 219          KK     50S
 220          KM   BASIN 50
 221          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 222          KM    L=   1.0000  Lca=    .5000   S=  15.20  Kn=.1599  LAG=105.50
 223          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 224          KM    ACTUAL BASIN AREA IS 0.2500 SQ MI
 225          BA   .1625
 226          LG    .201    .150    8.40    .066   44.65
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 227          UI       5       5       5       5       5       5       5       5       5       5
 228          UI       5       5      15      17      17      18      20      20      20      24
 229          UI      24      24      25      25      27      28      29      29      30      31
 230          UI      31      32      33      34      35      36      38      39      40      41
 231          UI      40      44      47      49      52      54      66      57      66      70
 232          UI      69      65      62      59      57      54      52      50      49      47
 233          UI      46      45      44      43      41      41      40      38      37      35
 234          UI      35      33      32      31      31      30      29      27      27      26
 235          UI      25      25      24      24      21      20      20      17      15      15
 236          UI      15      12       9       9       9       9       9       9       9       9
 237          UI       9       9       9       9       9       8       5       5       5       5
 238          UI       5       5       5       5       5       5       5       5       2       2
 239          UI       2       2       2       2       2       2       2       2       2       2
 240          UI       2       2       2       2       2       2       2       2       2       2
 241          UI       2       2       2       2       2       2       2       2       2       2
 242          UI       2       2       2       2       2       2       2       0       0       0

 243          KK     50D
 244          KM   DIVERT 65 PERCENT OF FLOW TOWARDS WEST
 245          DT   50DIV
 246          DI       0    2000
 247          DQ       0    1000

 248          KK     46C
 249          KM   COMBINE 40AR1 AND 50D
 250          HC       2

 251          KK   40AR2
 252          KM   ROUTE FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 253          RK    1320   .0034    .013            CIRC       5

 254          KK   50BR1
 255          KM   ROUTE FLOW SOUTH IN FUTURE 59TH AVENUE STORM DRAIN
 256          RK    1320   .0027    .013            CIRC       7

 257          KK   60DIV
 258          KM   RETRIEVE DIVERTED FLOW
 259          DR   60DIV

 260          KK     55C
 261          KM   COMBINE 60DIV AND 50BR1
 262          HC       2

 263          KK   50BR2
 264          KM   ROUTE FLOW SOUTH IN FUTURE 59TH AVENUE STORM DRAIN
 265          RK    1320   .0027    .013            CIRC       7

 266          KK     60C
 267          KM   COMBINE 55C AND 50BR2
 268          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 269          KK    60AR
 270          KM   ROUTE REMAINING FLOW WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 271          RK    2640   .0038    .013            CIRC       9
              *

 272          KK   50DIV
 273          KM   RETRIEVE DIVERTED FLOW
 274          DR   50DIV

 275          KK    50AR
 276          KM   ROUTE REMAINING FLOW WEST ON BUTLER AVENUE
 277          RK    2640   .0038     .02            TRAP     110     .01

 278          KK     80S
 279          KM   BASIN 80
 280          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 281          KM    L=   1.0000  Lca=    .5000   S=  18.80  Kn=.0544  LAG= 34.50
 282          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 283          KM    ACTUAL BASIN AREA IS 0.2236 SQ MI
 284          BA   .1494
 285          LG    .144    .150    8.80    .055   67.31
 286          UI      15      15      15      16      48      54      65      72      79      85
 287          UI      92     101     111     123     145     175     192     166     146     133
 288          UI     122     114     102      93      86      76      70      62      50      41
 289          UI      26      26      24      24      20      15      15      15      10       4
 290          UI       4       4       4       4       4       4       4       4       4       4
 291          UI       4       0       0       0       0       0       0       0       0       0

 292          KK     80C
 293          KM   COMBINE 50AR AND 80S
 294          HC       2

 295          KK     80D
 296          KM   DIVERT 50 PERCENT OF FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 297          DT   80DIV
 298          DI       0    2000
 299          DQ       0    1000

 300          KK    80BR
 301          KM   ROUTE RETRIEVED FLOW SOUTH ON 63RD AVENUE
 302          RK    2640   .0023     .02            TRAP     100     .01

 303          KK    85C1
 304          KM   COMBINE 60AR AND 80BR
 305          HC       2

 306          KK    100S
 307          KM   BASIN 100
 308          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 309          KM    L=   1.5000  Lca=    .7500   S=  14.47  Kn=.1533  LAG=138.93
 310          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 311          KM    ACTUAL BASIN AREA IS 0.5000 SQ MI
 312          BA   .4076
 313          LG    .147    .150    8.80    .061   51.14
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 314          UI      10      10      10      10      10      10      10      10      10      10
 315          UI      10      10      10      10      10      10      32      32      32      32
 316          UI      33      38      38      38      38      45      45      45      47      48
 317          UI      48      49      53      53      54      55      55      57      58      58
 318          UI      60      61      62      65      65      68      69      71      73      74
 319          UI      76      76      78      79      84      86      91      95      99     103
 320          UI     113     123     108     121     130     134     133     126     121     116
 321          UI     113     108     105     103      99      96      95      91      90      87
 322          UI      86      84      83      81      80      78      77      76      74      71
 323          UI      70      67      67      64      63      62      60      60      58      57
 324          UI      57      52      52      52      49      48      48      47      45      45
 325          UI      44      38      38      38      38      29      28      28      28      28
 326          UI      24      17      17      17      17      17      17      17      17      17
 327          UI      16      16      16      16      16      16      16      16      16      12
 328          UI      10      10      10      10      10      10      10      10      10      10
 329          UI      10      10      10      10      10       5       3       3       3       3
 330          UI       3       3       3       3       3       3       3       3       3       3
 331          UI       3       3       3       3       3       3       3       3       3       3
 332          UI       3       3       3       3       3       3       3       3       3       3
 333          UI       3       3       3       3       3       3       3       3       3       3
 334          UI       3       3       3       3       3       3       3       3       3

 335          KK    100D
 336          KM   DIVERT 60 PERCENT OF 100S TO WEST
 337          DT  100DIV
 338          DI       0    2000
 339          DQ       0    1200

 340          KK    85C2
 341          KM   COMBINE 85C1 AND 100D
 342          HC       2

 343          KK     85D
 344          KM   DIVERT ALL BUT CAPACITY OF FUTURE 42" NORTHERN STORM DRAIN (42 CFS)
 345          DT   85DIV
 346          DI       0      42    1500
 347          DQ       0       0    1458

 348          KK     85R
 349          KM   ROUTE 85C2 WEST IN FUTURE NORTHERN AVENUE STORM DRAIN
 350          RK    1320   .0008    .013            CIRC       3
              *

 351          KK   80DIV
 352          KM   RETRIEVE DIVERTED FLOW
 353          DR   80DIV

 354          KK     90S
 355          KM   BASIN 90
 356          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 357          KM    L=    .7936  Lca=    .5316   S=  19.78  Kn=.0509  LAG= 29.95
 358          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 359          KM    ACTUAL BASIN AREA IS 0.0525 SQ MI
 360          BA   .0138
 361          LG    .119    .150    8.80    .052   74.33
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 362          UI       2       2       2       4       6       7       8       9       9      10
 363          UI      11      13      15      19      20      17      15      13      12      11
 364          UI      10       9       8       7       6       4       3       3       3       3
 365          UI       2       2       2       1       0       0       0       0       0       0

 366          KK    80C2
 367          KM   COMBINE 80DIV AND 90S
 368          HC       2

 369          KK    80AR
 370          KM   ROUTE REMAINING FLOW WEST IN FUTURE BUTLER AVENUE STORM DRAIN
 371          RK    2640   .0028    .013            CIRC       5

 372          KK    90R1
 373          KM   ROUTE 80AR SOUTH IN FUTURE 67TH AVENUE STORM DRAIN
 374          RK    1320   .0011    .013            CIRC      10

 375          KK  100DIV
 376          KM   RETRIEVE DIVERTED FLOW
 377          DR  100DIV

 378          KK     95C
 379          KM   COMBINE 90R1 AND 100DIV
 380          HC       2

 381          KK    90R2
 382          KM   ROUTE 80AR SOUTH IN FUTURE 67TH AVENUE STORM DRAIN
 383          RK    1320   .0011    .013            CIRC      10

 384          KK    111S
 385          KM   BASIN 111
 386          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 387          KM   L=     .3409  Lca=    .1894   S=   7.92  Kn=.0532  LAG= 18.26
 388          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 389          KM   ACTUAL BASIN AREA = 0.0329 SQ MI
 390          BA   .0144
 391          LG    .136    .150    9.70    .041   90.72
 392          UI       3       3       8      12      14      17      20      25      34      29
 393          UI      23      20      17      14      11       7       5       4       3       3
 394          UI       2       1       1       1       1       1       1       0       0       0

 395          KK    111C
 396          KM   COMBINE 90R2 AND 111S
 397          HC       2

 398          KK    90R3
 399          KM   ROUTE 111C EAST IN FUTURE NORTHERN AVENUE STORM DRAIN
 400          RK    1320   .0011    .013            CIRC       5

 401          KK     95C
 402          KM   COMBINE 85R AND 90R3
 403          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 404          KK     95D
 405          KM   DIVERT ALL BUT CAPACITY OF FUTURE 65TH AVENUE STORM DRAIN (71 CFS)
 406          DT   95DIV
 407          DI       0      71    1500
 408          DQ       0       0    1429

 409          KK     96R
 410          KM   ROUTE 95D SOUTH IN FUTURE 65TH AVENUE STORM DRAIN
 411          RK    1350   .0038    .013            CIRC       4

 412          KK    110S
 413          KM   BASIN 110
 414          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 415          KM    L=   1.0227  Lca=    .4167   S=   7.82  Kn=.1272  LAG= 89.59
 416          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 417          KM    ACTUAL BASIN AREA IS 0.4022 SQ MI
 418          BA   .3758
 419          LG    .149    .150    7.60    .095   55.30
 420          UI      14      14      14      14      14      14      14      14      14      14
 421          UI      37      46      46      51      54      54      64      65      68      69
 422          UI      73      76      78      79      82      83      88      90      93      97
 423          UI     100     105     108     110     114     121     130     141     147     175
 424          UI     160     185     191     181     169     160     152     145     139     134
 425          UI     129     125     120     117     114     111     108     102      99      96
 426          UI      91      89      85      83      81      75      74      70      69      66
 427          UI      65      59      54      54      43      41      41      37      25      25
 428          UI      25      25      25      24      23      23      23      23      23      22
 429          UI      14      14      14      14      14      14      14      14      14      14
 430          UI       6       4       4       4       4       4       4       4       4       4
 431          UI       4       4       4       4       4       4       4       4       4       4
 432          UI       4       4       4       4       4       4       4       4       4       4
 433          UI       4       4       4       0       0       0       0       0       0       0

 434          KK     70S
 435          KM   BASIN 70
 436          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 437          KM    L=   1.3636  Lca=    .4545   S=  17.16  Kn=.0456  LAG= 38.21
 438          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 439          KM    ACTUAL BASIN AREA IS 0.2216 SQ MI
 440          BA   .1602
 441          LG    .146    .230    6.20     .15   72.80
 442          UI      14      14      14      14      34      48      55      66      71      77
 443          UI      82      88      96     105     113     129     157     173     182     158
 444          UI     142     129     120     112     104      93      87      80      72      67
 445          UI      59      49      41      28      25      24      23      23      17      14
 446          UI      14      14      11       4       4       4       4       4       4       4
 447          UI       4       4       4       4       4       4       4       0       0       0

 448          KK    70AR
 449          KM   ROUTE 70C WEST ALONG GLENDALE'S G AVENUE
 450          RK    2450   .0036     .02            TRAP     100     .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 451          KK   70BR1
 452          KM   ROUTE 70AR NORTHWEST IN FUTURE GRAND AVENUE STORM DRAIN
 453          RK    1880   .0021    .013            CIRC     4.5

 454          KK     76C
 455          KM   COMBINE 70BR1 AND 110S
 456          HC       2

 457          KK    115C
 458          KM   COMBINE 76C AND 96R
 459          HC       2

 460          KK    115D
 461          KM   DIVERT ALL BUT CAPACITY OF FUTURE 60" 65TH AVENUE STORM DRAIN
 462          DT  115DIV
 463          DI       0     108    2000
 464          DQ       0       0    1892

 465          KK    110R
 466          KM   ROUTE 100D SOUTH IN FUTURE 65TH AVENUE STORM DRAIN
 467          RK    2640   .0034    .013            CIRC     4.5

 468          KK    125S
 469          KM   BASIN 125
 470          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 471          KM   L=      .4451 Lca=    .3030   S=   20.00 Kn=.0543  LAG= 20.66
 472          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 473          BA   .0268
 474          LG    .143    .250    5.70    .170   76.36
 475          UI       4       4      11      17      22      25      29      33      41      55
 476          UI      50      41      36      31      26      22      18      13       8       7
 477          UI       6       4       4       2       1       1       1       1       1       1

 478          KK   120C1
 479          KM   COMBINE 125S AND 110R
 480          HC       2

 481          KK    120S
 482          KM   BASIN 120
 483          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 484          KM    L=    .4830  Lca=    .2178   S=  18.01  Kn=.0544  LAG= 19.21
 485          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 486          KM    ACTUAL BASIN AREA = 0.0752 SQ MI
 487          BA   .0487
 488          LG    .144    .150    8.80    .050   76.21
 489          UI       9       9      25      36      45      51      60      72      98     104
 490          UI      83      71      60      51      43      34      21      15      14      10
 491          UI       9       5       3       3       3       3       3       3       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 492          KK   120C2
 493          KM   COMBINE 120C1 AND 120S
 494          HC       2

 495          KK    120R
 496          KM   ROUTE FLOW FROM BASIN 120 WESTWARD IN PROPOSED ORANGEWOOD STORM DRAIN
 497          RK    1320   .0038    .013            CIRC     6.5

 498          KK    130S
 499          KM   BASIN 130
 500          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 501          KM    L=    .5000  Lca=    .2500   S=  18.60  Kn=.0539  LAG= 20.22
 502          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 503          KM    ACTUAL BASIN AREA = .0623 SQ MI
 504          BA   .0341
 505          LG    .141    .150    8.80    .050   76.83
 506          UI       6       6      14      23      29      33      38      44      58      72
 507          UI      61      51      45      38      32      27      21      14      10       9
 508          UI       7       6       4       2       2       2       2       2       2       2

 509          KK    130D
 510          KM   DIVERT 90 PERCENT OF FLOW TO WEST
 511          DT  130DIV
 512          DI       0    1000
 513          DQ       0     900

 514          KK   130BR
 515          KM   ROUTE REMAINING FLOW SOUTH ON 69TH AVENUE
 516          RK    1320   .0019    .020            TRAP      90     .01

 517          KK    140S
 518          KM   BASIN 140
 519          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 520          KM    L=    .5000  Lca=    .2500   S=  10.00  Kn=.0552  LAG= 23.29
 521          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 522          BA   .0606
 523          LG     .15     .15    9.70     .04   75.00
 524          UI       9       9      15      31      40      46      52      59      67      81
 525          UI     106     107      88      76      68      59      51      44      38      28
 526          UI      18      15      14      11       9       9       3       3       3       3
 527          UI       3       3       3       3       0       0       0       0       0       0

 528          KK    140C
 529          KM   COMBINE 130BR, 140S, AND 120R
 530          HC       3

 531          KK    140R
 532          KM   ROUTE 140C WEST IN FUTURE ORANGEWOOD STORM DRAIN
 533          RK    1320   .0038    .013            CIRC     6.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 534          KK    150S
 535          KM   BASIN 150
 536          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 537          KM    L=     .5000  Lca=     .2500   S=  12.00  Kn=.0414  LAG= 16.87
 538          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 539          BA   .0622
 540          LG    .050    .150    8.80    .050   95.00
 541          UI      12      14      44      60      71      84     103     145     145     114
 542          UI      96      79      65      52      31      22      20      12      11       4
 543          UI       4       4       4       4       4       0       0       0       0       0

 544          KK    150C
 545          KM   COMBINE 140R AND 150S
 546          HC       2

 547          KK    150D
 548          KM   DIVERT 0 CFS INTO SURGE BASIN
 549          DT  150DIV
 550          DI       0    1740    2500
 551          DQ       0       0       0

 552          KK  130DIV
 553          KM   RETRIEVE DIVERTED FLOW
 554          DR  130DIV

 555          KK   130AR
 556          KM   ROUTE RETRIEVED FLOW WEST ON FRIER DRIVE
 557          RK    1320   .0034     .02            TRAP      90     .01

 558          KK    160S
 559          KM   BASIN 160
 560          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 561          KM    L=     .5000  Lca=     .2500   S=  15.00  Kn=.0521  LAG= 20.34
 562          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 563          KM    ACTUAL BASIN AREA = .0682 SQ MI
 564          BA   .0225
 565          LG    .127    .150    8.80    .050   79.53
 566          UI       4       4       9      15      19      21      25      29      37      47
 567          UI      41      34      30      25      21      18      14       9       7       6
 568          UI       5       4       3       1       1       1       1       1       1       1

 569          KK    160C
 570          KM   COMBINE 130AR AND 160S
 571          HC       2

 572          KK    160R
 573          KM   ROUTE 160C SOUTH ON 71ST AVENUE
 574          RK    1320   .0019     .02            TRAP     105     .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

575           KK    155C
576           KM   COMBINE 160R AND 150RET
577           HC       2

578           KK    155R
579           KM   ROUTE 155C WEST IN PROPOSED ORANGEWOOD STORM DRAIN
580           RK    1320   .0019    .013            CIRC       7

581           KK    170S
582           KM   BASIN 170
583           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
584           KM    L=   1.0000  Lca=    .5000   S=  13.90  Kn=.0498  LAG= 33.45
585           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
586           KM    ACTUAL BASIN AREA = .25 SQ MI
587           BA   .0556
588           LG    .111    .150    8.80    .050   82.77
589           UI       6       6       6       8      18      21      26      28      31      33
590           UI      36      40      44      51      62      71      69      59      53      48
591           UI      45      41      37      33      30      27      24      20      16      10
592           UI      10       9       9       8       6       6       6       3       2       2
593           UI       2       2       2       2       2       2       2       2       2       0

594           KK    170D
595           KM   DIVERT 30 PERCENT OF FLOW TO WEST
596           DT  170DIV
597           DI       0    1000
598           DQ       0     300

599           KK   170BC
600           KM   COMBINE 170D AND 155R
601           HC       2

602           KK   170BR
603           KM   ROUTE 170BC WEST IN PROPOSED ORANGEWOOD STORM DRAIN
604           RK    1320   .0019    .013            CIRC       7

605           KK  170DIV
606           KM   RETRIEVE DIVERTED FLOW
607           DR  170DIV

608           KK   170AR
609           KM   ROUTE RETRIEVED FLOW SOUTH ON 75TH AVENUE
610           RK    1320   .0026     .02            TRAP     125     .01

611           KK    170C
612           KM   COMBINE 170AR AND 170BR
613           HC       2

614           KK    170R
615           KM   ROUTE 170C WEST IN PROPOSED ORANGEWOOD STORM DRAIN
616           RK    1320   .0021    .013            CIRC     7.5
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 617          KK    180S
 618          KM   BASIN 180
 619          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 620          KM    L=   1.0000  Lca=    .5000   S=  14.10  Kn=.0520  LAG= 34.81
 621          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 622          KM    ACTUAL BASIN AREA = .25 SQ MI
 623          BA   .0813
 624          LG    .127    .150    8.80    .053   56.54
 625          UI       8       8       8       8      26      29      35      38      43      45
 626          UI      49      54      59      65      77      92     104      92      81      73
 627          UI      67      62      56      51      47      42      39      35      29      23
 628          UI      16      14      13      13      12       8       8       8       7       2
 629          UI       2       2       2       2       2       2       2       2       2       2
 630          UI       2       0       0       0       0       0       0       0       0       0

 631          KK    180D
 632          KM   DIVERT 55 PERCENT OF FLOW TO WEST
 633          DT  180DIV
 634          DI       0    1000
 635          DQ       0     550

 636          KK   180BC
 637          KM   COMBINE 180D AND 170R
 638          HC       2

 639          KK   180BR
 640          KM   ROUTE 180BC WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 641          RK    1320   .0021    .013            CIRC     7.5

 642          KK  180DIV
 643          KM   RETRIEVE DIVERTED FLOW
 644          DR  180DIV

 645          KK   180AR
 646          KM   ROUTE RETRIEVED FLOW SOUTH ON 79TH AVENUE
 647          RK    1320   .0017     .02            TRAP     105     .01

 648          KK    180C
 649          KM   COMBINE 180AR AND 180BR
 650          HC       2

 651          KK    180R
 652          KM   ROUTE 180C WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 653          RK    1320   .0019    .013            CIRC     7.5

 654          KK    190S
 655          KM   BASIN 190
 656          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 657          KM    L=   1.0000  Lca=    .5000   S=   7.20  Kn=.0519  LAG= 39.47
 658          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 659          KM    ACTUAL BASIN AREA = .25 SQ MI
 660          BA   .0792
 661          LG    .126    .150    8.00    .072   46.72
 662          UI       7       7       7       7      14      22      26      31      33      36
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 663          UI      39      41      44      49      52      57      67      78      90      82
 664          UI      73      66      61      56      53      48      44      41      38      34
 665          UI      32      28      24      19      14      12      12      11      11       9
 666          UI       7       7       7       7       3       2       2       2       2       2
 667          UI       2       2       2       2       2       2       2       2       0       0

 668          KK    190D
 669          KM   DIVERT 100 PERCENT OF FLOW TO WEST
 670          DT  190DIV
 671          DI       0    2000
 672          DQ       0    2000

 673          KK   190BC
 674          KM   COMBINE 190D AND 180R
 675          HC       2

 676          KK   190BR
 677          KM   ROUTE 190BC WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 678          RK    1320   .0019    .013            CIRC     7.5

 679          KK  190DIV
 680          KM   RETRIEVE DIVERTED FLOW
 681          DR  190DIV

 682          KK   190AR
 683          KM   ROUTE RETRIEVED FLOW SOUTH ON 83RD AVENUE
 684          RK    1320   .0015     .02            TRAP     125     .01

 685          KK    190C
 686          KM   COMBINE 190AR AND 190BR
 687          HC       2

 688          KK    190R
 689          KM   ROUTE 190C WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 690          RK    1320   .0063    .013            CIRC     7.5

 691          KK    200S
 692          KM   BASIN 200
 693          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 694          KM    L=   1.0000  Lca=    .5000   S=  12.50  Kn=.0521  LAG= 35.67
 695          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 696          KM    ACTUAL BASIN AREA = .25 SQ MI
 697          BA   .0827
 698          LG    .128    .170    6.80    .117   33.00
 699          UI       8       8       8       8      24      28      33      37      41      45
 700          UI      48      52      58      62      72      87      99      97      84      75
 701          UI      69      64      59      54      49      45      40      37      33      26
 702          UI      22      14      14      13      13      12       8       8       8       7
 703          UI       2       2       2       2       2       2       2       2       2       2
 704          UI       2       2       2       0       0       0       0       0       0       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 705          KK    200D
 706          KM   DIVERT 100 PERCENT OF FLOW TO WEST
 707          DT  200DIV
 708          DI       0    2000
 709          DQ       0    2000

 710          KK   200BC
 711          KM   COMBINE 200D AND 190R
 712          HC       2

 713          KK   200BR
 714          KM   ROUTE 200BC WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 715          RK    1320   .0063    .013            CIRC     7.5

 716          KK  200DIV
 717          KM   RETRIEVE DIVERTED FLOW
 718          DR  200DIV

 719          KK   200AR
 720          KM   ROUTE RETRIEVED FLOW SOUTH ON 87TH AVENUE
 721          RK    1320   .0008     .02            TRAP     105     .01

 722          KK    200C
 723          KM   COMBINE 200AR AND 200BR
 724          HC       2

 725          KK    200R
 726          KM   ROUTE 200C WEST IN PROPOSED ORANGEWOOD STORM DRAIN
 727          RK    1320   .0009    .014            CIRC       9

 728          KK    210S
 729          KM   BASIN 210
 730          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 731          KM    L=   1.0000  Lca=    .5000   S=  13.50  Kn=.0414  LAG= 27.97
 732          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 733          KM    ACTUAL BASIN AREA = .25 SQ MI
 734          BA   .0250
 735          LG     .05     .25    5.70     .17   95.00
 736          UI       3       3       3       8      11      14      16      17      19      21
 737          UI      24      29      36      39      33      28      25      23      20      18
 738          UI      16      14      12       9       6       5       5       5       3       3
 739          UI       3       1       1       1       1       1       1       1       1       1
 740          UI       1       0       0       0       0       0       0       0       0       0

 741          KK    210D
 742          KM   DIVERT 5 PERCENT OF FLOW TO WEST
 743          DT  210DIV
 744          DI       0    2000
 745          DQ       0     100
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  746         KK   210BC
  747         KM   COMBINE 210D AND 200R
  748         HC       2

  749         KK   210BR
  750         KM   ROUTE 210BC WEST IN PROPOSED ORANGEWOOD STORM DRAIN
  751         RK    1320   .0009    .013            CIRC       9

  752         KK  210DIV
  753         KM   RETRIEVE DIVERTED FLOW
  754         DR  210DIV

  755         KK   210AR
  756         KM   ROUTE RETRIEVED FLOW SOUTH ON 91ST AVENUE
  757         RK    1320   .0009     .02            TRAP     125      .01

  758         KK    210C
  759         KM   COMBINE 210AR AND 210BR
  760         HC       2

  761         KK    210R
  762         KM   ROUTE 210C WEST IN PROPOSED ORANGEWOOD BOX CULVERT/CHANNEL
  763         RK    1320   .0007    .020            TRAP      10      .01

  764         KK    220S
  765         KM   BASIN 220
  766         KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  767         KM    L=   1.0000  Lca=    .5000   S=  20.17  Kn=.0414  LAG= 25.89
  768         KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  769         KM    ACTUAL BASIN AREA = .25 SQ MI
  770         BA   .0250
  771         LG     .05     .25    5.70     .17   95.00
  772         UI       3       3       3      11      13      16      18      20      22      25
  773         UI      30      38      42      35      30      27      24      21      19      16
  774         UI      14      11       7       6       5       5       3       3       3       1
  775         UI       1       1       1       1       1       1       1       1       0       0

  776         KK    220D
  777         KM   DIVERT 10 PERCENT OF FLOW TO WEST
  778         DT  220DIV
  779         DI       0    2000
  780         DQ       0     100

  781         KK   220BC
  782         KM   COMBINE 220D AND 210R
  783         HC       2

  784         KK   220BR
  785         KM   ROUTE 220BC WEST IN PROPOSED ORANGEWOOD CHANNEL/BOX CULVERT
  786         RK    1320   .0007    .013            TRAP      10      .01
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 787          KK  220DIV
 788          KM   RETRIEVE DIVERTED FLOW
 789          DR  220DIV

 790          KK   220AR
 791          KM   ROUTE RETRIEVED FLOW SOUTH ON 95TH AVENUE
 792          RK    1320   .0030     .02            TRAP     105     .01

 793          KK    220C
 794          KM   COMBINE 220AR AND 220BR
 795          HC       2

 796          KK    220R
 797          KM   ROUTE 220C WEST IN PROPOSED ORANGEWOOD CHANNEL/BOX CULVERT
 798          RK    1055   .0007    .020            TRAP      10     .01

 799          KK    230S
 800          KM   BASIN 230
 801          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 802          KM    L=    .9167  Lca=    .4167   S=   7.42  Kn=.0414  LAG= 28.26
 803          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 804          KM    ACTUAL BASIN AREA = .1269 SQ MI
 805          BA   .0127
 806          LG     .05     .15    8.00     .07   95.00
 807          UI       2       2       2       4       6       7       8       9       9      11
 808          UI      12      14      17      20      17      15      13      12      11       9
 809          UI       8       7       6       5       4       3       3       2       2       2
 810          UI       2       1       0       0       0       0       0       0       0       0

 811          KK    230D
 812          KM   DIVERT 50 PERCENT OF FLOW TO WEST
 813          DT  230DIV
 814          DI       0    2000
 815          DQ       0    1000

 816          KK   230BC
 817          KM   COMBINE 230D AND 220R
 818          HC       2

 819          KK   230BR
 820          KM   ROUTE 230BC WEST IN PROPOSED ORANGEWOOD CHANNEL/BOX CULVERT
 821          RK    1055   .0007    .020            TRAP      10     .01

 822          KK  230DIV
 823          KM   RETRIEVED DIVERTED FLOW
 824          DR  230DIV

 825          KK    230C
 826          KM   COMBINE 230DIV AND 230BR
 827          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 828          KK   85DIV
 829          KM   RETRIEVE DIVERTED FLOW
 830          DR   85DIV

 831          KK   95DIV
 832          KM   RETRIEVE DIVERTED FLOW
 833          DR   95DIV

 834          KK  115DIV
 835          KM   RETRIEVE DIVERTED FLOW
 836          DR  115DIV

 837          KK    115S
 838          KM   BASIN 115
 839          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 840          KM   L=       .1231 Lca=     .1184    S=   81.23 Kn=.5520  LAG= 69.12
 841          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 842          BA   .0526
 843          LG     .15      .15      9.7     .073       0
 844          UI       3        3        3        3        3        3        3        3        8        8
 845          UI       9       10       11       12       12       13       14       14       15       15
 846          UI      16       17       17       18       19       20       21       22       24       26
 847          UI      31       30       34       33       30       28       26       25       24       23
 848          UI      22       21       20       20       18       18       17       16       15       15
 849          UI      14       13       13       12       12       10       10        8        7        7
 850          UI       5        5        5        5        4        4        4        4        4        3
 851          UI       3        3        3        3        3        3        3        1        1        1
 852          UI       1        1        1        1        1        1        1        1        1        1
 853          UI       1        1        1        1        1        1        1        1        1        1
 854          UI       1        1        1        0        0        0        0        0        0        0

 855          KK    116C
 856          KM   COMBINE 85DIV, 95DIV, 115DIV, AND 115S
 857          KO       1
 858          HC       4
 859          ZZ
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SCHEMATIC DIAGRAM OF STREAM NETWORK

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INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

           (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

 22          10S
               .
               .
 46            .------->   10DIV
 44          10D
               V
               V
 49        10AR1
               .
               .
 52            .         20S
               .           .
               .           .
 67            .           .------->   20DIV
 65            .         20D
               .           .
               .           .
 70          15C............
               V
               V
 73        10AR2
               V
               V
           20BR1
               .
               .
 79            .         30S
               .           .
               .           .
 95            .           .------->   30DIV
 93            .         30D
               .           .
               .           .
 98          25C............
               V
               V
101        20BR2
               .
               .
106            .           .<-------   10DIV
104            .       10DIV
               .           V
               .           V
107            .       10B1R
               .           V
               .           V
110            .      10B2R1
               .           .
               .           .
 5             .           .           .<-------   30DIV
113            .           .       30DIV
               .           .           .
               .           .           .
```

```
116          .         16C............
             .           V
             .           V
119          .      10B2R2
             .           .
             .           .
122        30C............
             V
             V
125        30R
             .
             .
130          .           .<-------   20DIV
128          .       20DIV
             .           V
             .           V
131          .        20AR
             .           .
             .           .
134          .           .         40S
             .           .           .
             .           .           .
158          .         40C............
             .           .
             .           .
163          .           .------->   40DIV
161          .         40D
             .           V
             .           V
166          .        40BR
             .           .
             .           .
169        45C1............
             .
             .
172          .         60S
             .           .
             .           .
204          .           .------->   60DIV
202          .         60D
             .           .
             .           .
207        45C2............
             V
             V
210        45R
             .
             .
215          .           .<-------   40DIV
213          .       40DIV
             .           V
             .           V
216          .       40AR1
             .           .
             .           .
             .           .         50S
             .           .           .
             .           .           .
245          .           .           .------->   50DIV
243          .           .         50D
```

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          .          .          .
          .          .          .
248       .        46C............
          .          V
          .          V
          .      40AR2
          .          V
          .          V
254       .      50BR1
          .          .
          .          .
259       .          .          .<-------   60DIV
257       .          .      60DIV
          .          .          .
          .          .          .
260       .        55C............
          .          V
          .          V
263       .      50BR2
          .          .
          .          .
266     60C............
          V
          V
269     60AR
          .
          .
274       .          .<-------   50DIV
272       .      50DIV
          .          V
          .          V
275       .       50AR
          .          .
          .          .
278       .          .        80S
          .          .          .
          .          .          .
292       .        80C............
          .          .
          .          .
297       .          .------->   80DIV
295       .        80D
          .          V
          .          V
300       .       80BR
          .          .
          .          .
303     85C1...........
          .
          .
306       .       100S
          .          .
          .          .
337       .          .------->  100DIV
335       .       100D
          .          .
          .          .
340     85C2...........
          .
          .
```

```
345          .-------->   85DIV
343        85D
             V
             V
           85R
             .
             .
353          .           .<-------   80DIV
351          .       80DIV
             .           .
             .           .
354          .           .         90S
             .           .           .
             .           .           .
366          .        80C2............
             .           V
             .           V
369          .        80AR
             .           V
             .           V
372          .        90R1
             .           .
             .           .
377          .           .           .<-------  100DIV
375          .           .      100DIV
             .           .           .
             .           .           .
378          .         95C............
             .           V
             .           V
             .        90R2
             .           .
             .           .
384          .           .        111S
             .           .           .
             .           .           .
395          .        111C............
             .           V
             .           V
398          .        90R3
             .           .
             .           .
401        95C............
             .
             .
406          .-------->   95DIV
404        95D
             V
             V
409        96R
             .
             .
412          .        110S
             .           .
             .           .
             .           .         70S
             .           .           V
             .           .           V
448          .           .        70AR
             .           .           V
```

```
          .           .           V
451       .           .       70BR1
          .           .           .
          .           .           .
          .         76C............
          .           .
          .           .
457     115C............
          .
          .
462       .-------> 115DIV
460     115D
          V
          V
465     110R
          .
          .
468       .        125S
          .           .
          .           .
478    120C1............
          .
          .
481       .        120S
          .           .
          .           .
492    120C2............
          V
          V
495     120R
          .
          .
498       .        130S
          .           .
          .           .
511       .           .-------> 130DIV
509       .        130D
          .           V
          .           V
514       .       130BR
          .           .
          .           .
517       .           .        140S
          .           .           .
          .           .           .
528     140C......................
          V
          V
531     140R
          .
          .
534       .        150S
          .           .
          .           .
544     150C............
          .
          .
549       .-------> 150DIV
547     150D
          .
```

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          .
554       .           .<-------  130DIV
552       .      130DIV
          .           V
          .           V
          .       130AR
          .           .
          .           .
558       .           .        160S
          .           .           .
          .           .           .
569       .        160C............
          .           V
          .           V
572       .        160R
          .           .
          .           .
575     155C............
          V
          V
578     155R
          .
          .
581       .        170S
          .           .
          .           .
596       .           .-------> 170DIV
594       .        170D
          .           .
          .           .
      170BC............
          V
          V
602   170BR
          .
          .
607       .           .<-------  170DIV
605       .      170DIV
          .           V
          .           V
608       .       170AR
          .           .
          .           .
611     170C............
          V
          V
614     170R
          .
          .
617       .        180S
          .           .
          .           .
633       .           .-------> 180DIV
631       .        180D
          .           .
          .           .
      180BC............
          V
          V
639   180BR
```

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          .
          .
644       .           .<-------  180DIV
642       .      180DIV
          .           V
          .           V
645       .       180AR
          .           .
          .           .
648     180C............
          V
          V
651     180R
          .
          .
654       .        190S
          .           .
          .           .
670       .           .------->  190DIV
668       .        190D
          .           .
          .           .
673    190BC............
          V
          V
676    190BR
          .
          .
681       .           .<-------  190DIV
679       .      190DIV
          .           V
          .           V
682       .       190AR
          .           .
          .           .
685     190C............
          V
          V
688     190R
          .
          .
691       .        200S
          .           .
          .           .
707       .           .------->  200DIV
705       .        200D
          .           .
          .           .
710    200BC............
          V
          V
713    200BR
          .
          .
718       .           .<-------  200DIV
          .      200DIV
          .           V
          .           V
719       .       200AR
          .           .
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          .           .
722     200C............
          V
          V
        200R
          .
          .
728       .        210S
          .           .
          .           .
743       .           .-------> 210DIV
741       .        210D
          .           .
          .           .
746     210BC...........
          V
          V
749     210BR
          .
          .
754       .           .<------- 210DIV
752       .      210DIV
          .           V
          .           V
755       .       210AR
          .           .
          .           .
758      210C...........
          V
          V
         210R
          .
          .
764       .        220S
          .           .
          .           .
778       .           .-------> 220DIV
776       .        220D
          .           .
          .           .
781     220BC...........
          V
          V
784     220BR
          .
          .
789       .           .<------- 220DIV
787       .      220DIV
          .           V
          .           V
790       .       220AR
          .           .
          .           .
793      220C...........
          V
          V
         220R
          .
          .
799       .        230S
```

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            .           .
            .           .
813         .           .-------> 230DIV
811         .       230D
            .           .
            .           .
816     230BC............
            V
            V
819     230BR
            .
            .
824         .           .<------- 230DIV
822         .      230DIV
            .           .
            .           .
825      230C............
            .
            .
830         .           .<-------  85DIV
828         .       85DIV
            .           .
            .           .
833         .           .           .<-------  95DIV
831         .           .       95DIV
            .           .           .
            .           .           .
836         .           .           .           .<-------  115DIV
834         .           .           .      115DIV
            .           .           .           .
            .           .           .           .
837         .           .           .           .        115S
            .           .           .           .           .
            .           .           .           .           .
855         .       116C.................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              MAY   1991              *
*           VERSION 4.0.1E             *
*     Lahey F77L-EM/32 version 5.01    *
*       Dodson & Associates, Inc.      *
*  RUN DATE  02/20/96  TIME  09:33:48  *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 551-1748             *
*                                      *
****************************************
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```
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT
GLENDALE WATERSHED
FUTURE CONDITION
10-YEAR, 6-HOUR STORM
PHOENIX VALLEY S-GRAPH UNIT HYDROGRAPH
GREEN-AMPT RAINFALL LOSSES
KINEMATIC WAVE ROUTING
**
** MODEL CALIBRATED BY ADJUSTING Kn VALUES SO THAT LAG TIMES USING CORPS
** LAG EQUATION MATCH THOSE OBTAINED BY HAND CALCULATION OF STREET VELOCITIES
**
** AREAS OF FUTURE DEVELOPMENT ARE MODELED AS 10 PERCENT OF THEIR ACTUAL LAND
** AREA, WITH THAT 10 PERCENT CONTRIBUTING 95 PERCENT (RTIMP = 95 PERCENT)
**
** CONCEPT/ROUTING STUDY OPTION 2B:
** EAST DETENTION/SURGE BASIN, ORANGEWOOD STORM DRAIN ALIGNMENT
**
** FILE OR021396
**

21 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          2  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      NQ        900  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      2    0  ENDING DATE
                 NDTIME       0558  ENDING TIME
                 ICENT          19  CENTURY MARK

             COMPUTATION INTERVAL    0.03 HOURS
                  TOTAL TIME BASE   29.97 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

```
*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1
```

*** ***

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          **************
          *            *
855 KK    *      116C  *
          *            *
          **************
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857 KO OUTPUT CONTROL VARIABLES

IPRNT	1	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

858 HC HYDROGRAPH COMBINATION

ICOMP	4	NUMBER OF HYDROGRAPHS TO COMBINE

***

****

HYDROGRAPH AT STATION 116C
SUM OF 4 HYDROGRAPHS

****

DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW	*	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	*	1		0730	226	107.	*	1		1500	451	0.	*	1		2230	676	0.
1		0002	2	0.	*	1		0732	227	101.	*	1		1502	452	0.	*	1		2232	677	0.
1		0004	3	0.	*	1		0734	228	96.	*	1		1504	453	0.	*	1		2234	678	0.
1		0006	4	0.	*	1		0736	229	90.	*	1		1506	454	0.	*	1		2236	679	0.
1		0008	5	0.	*	1		0738	230	85.	*	1		1508	455	0.	*	1		2238	680	0.
1		0010	6	0.	*	1		0740	231	80.	*	1		1510	456	0.	*	1		2240	681	0.
1		0012	7	0.	*	1		0742	232	75.	*	1		1512	457	0.	*	1		2242	682	0.
1		0014	8	0.	*	1		0744	233	70.	*	1		1514	458	0.	*	1		2244	683	0.
1		0016	9	0.	*	1		0746	234	65.	*	1		1516	459	0.	*	1		2246	684	0.
1		0018	10	0.	*	1		0748	235	60.	*	1		1518	460	0.	*	1		2248	685	0.
1		0020	11	0.	*	1		0750	236	55.	*	1		1520	461	0.	*	1		2250	686	0.
1		0022	12	0.	*	1		0752	237	50.	*	1		1522	462	0.	*	1		2252	687	0.
1		0024	13	0.	*	1		0754	238	46.	*	1		1524	463	0.	*	1		2254	688	0.
1		0026	14	0.	*	1		0756	239	42.	*	1		1526	464	0.	*	1		2256	689	0.
1		0028	15	0.	*	1		0758	240	38.	*	1		1528	465	0.	*	1		2258	690	0.
1		0030	16	0.	*	1		0800	241	35.	*	1		1530	466	0.	*	1		2300	691	0.
1		0032	17	0.	*	1		0802	242	32.	*	1		1532	467	0.	*	1		2302	692	0.
1		0034	18	0.	*	1		0804	243	29.	*	1		1534	468	0.	*	1		2304	693	0.
1		0036	19	0.	*	1		0806	244	27.	*	1		1536	469	0.	*	1		2306	694	0.
1		0038	20	0.	*	1		0808	245	24.	*	1		1538	470	0.	*	1		2308	695	0.
1		0040	21	0.	*	1		0810	246	22.	*	1		1540	471	0.	*	1		2310	696	0.
1		0042	22	0.	*	1		0812	247	20.	*	1		1542	472	0.	*	1		2312	697	0.
		0044	23	0.	*	1		0814	248	17.	*	1		1544	473	0.	*	1		2314	698	0.
1		0046	24	0.	*	1		0816	249	15.	*	1		1546	474	0.	*	1		2316	699	0.
1		0048	25	0.	*	1		0818	250	14.	*	1		1548	475	0.	*	1		2318	700	0.
1		0050	26	0.	*	1		0820	251	12.	*	1		1550	476	0.	*	1		2320	701	0.
1		0052	27	0.	*	1		0822	252	10.	*	1		1552	477	0.	*	1		2322	702	0.

1	0054	28	0.	*	1	0824	253	8.	*	1	1554	478	0.	*	1	2324	703	0.
1	0056	29	0.	*	1	0826	254	6.	*	1	1556	479	0.	*	1	2326	704	0.
1	0058	30	0.	*	1	0828	255	5.	*	1	1558	480	0.	*	1	2328	705	0.
1	0100	31	0.	*	1	0830	256	3.	*	1	1600	481	0.	*	1	2330	706	0.
	0102	32	0.	*	1	0832	257	2.	*	1	1602	482	0.	*	1	2332	707	0.
	0104	33	0.	*	1	0834	258	1.	*	1	1604	483	0.	*	1	2334	708	0.
1	0106	34	0.	*	1	0836	259	0.	*	1	1606	484	0.	*	1	2336	709	0.
1	0108	35	0.	*	1	0838	260	0.	*	1	1608	485	0.	*	1	2338	710	0.
1	0110	36	0.	*	1	0840	261	0.	*	1	1610	486	0.	*	1	2340	711	0.
1	0112	37	0.	*	1	0842	262	0.	*	1	1612	487	0.	*	1	2342	712	0.
1	0114	38	0.	*	1	0844	263	0.	*	1	1614	488	0.	*	1	2344	713	0.
1	0116	39	0.	*	1	0846	264	0.	*	1	1616	489	0.	*	1	2346	714	0.
1	0118	40	0.	*	1	0848	265	0.	*	1	1618	490	0.	*	1	2348	715	0.
1	0120	41	0.	*	1	0850	266	0.	*	1	1620	491	0.	*	1	2350	716	0.
1	0122	42	0.	*	1	0852	267	0.	*	1	1622	492	0.	*	1	2352	717	0.
1	0124	43	0.	*	1	0854	268	0.	*	1	1624	493	0.	*	1	2354	718	0.
1	0126	44	0.	*	1	0856	269	0.	*	1	1626	494	0.	*	1	2356	719	0.
1	0128	45	0.	*	1	0858	270	0.	*	1	1628	495	0.	*	1	2358	720	0.
1	0130	46	0.	*	1	0900	271	0.	*	1	1630	496	0.	*	2	0000	721	0.
1	0132	47	0.	*	1	0902	272	0.	*	1	1632	497	0.	*	2	0002	722	0.
1	0134	48	0.	*	1	0904	273	0.	*	1	1634	498	0.	*	2	0004	723	0.
1	0136	49	0.	*	1	0906	274	0.	*	1	1636	499	0.	*	2	0006	724	0.
1	0138	50	0.	*	1	0908	275	0.	*	1	1638	500	0.	*	2	0008	725	0.
1	0140	51	0.	*	1	0910	276	0.	*	1	1640	501	0.	*	2	0010	726	0.
1	0142	52	0.	*	1	0912	277	0.	*	1	1642	502	0.	*	2	0012	727	0.
1	0144	53	0.	*	1	0914	278	0.	*	1	1644	503	0.	*	2	0014	728	0.
1	0146	54	0.	*	1	0916	279	0.	*	1	1646	504	0.	*	2	0016	729	0.
1	0148	55	0.	*	1	0918	280	0.	*	1	1648	505	0.	*	2	0018	730	0.
1	0150	56	0.	*	1	0920	281	0.	*	1	1650	506	0.	*	2	0020	731	0.
1	0152	57	0.	*	1	0922	282	0.	*	1	1652	507	0.	*	2	0022	732	0.
	0154	58	0.	*	1	0924	283	0.	*	1	1654	508	0.	*	2	0024	733	0.
1	0156	59	0.	*	1	0926	284	0.	*	1	1656	509	0.	*	2	0026	734	0.
1	0158	60	0.	*	1	0928	285	0.	*	1	1658	510	0.	*	2	0028	735	0.
1	0200	61	0.	*	1	0930	286	0.	*	1	1700	511	0.	*	2	0030	736	0.
1	0202	62	0.	*	1	0932	287	0.	*	1	1702	512	0.	*	2	0032	737	0.
1	0204	63	0.	*	1	0934	288	0.	*	1	1704	513	0.	*	2	0034	738	0.
1	0206	64	0.	*	1	0936	289	0.	*	1	1706	514	0.	*	2	0036	739	0.
1	0208	65	0.	*	1	0938	290	0.	*	1	1708	515	0.	*	2	0038	740	0.
1	0210	66	0.	*	1	0940	291	0.	*	1	1710	516	0.	*	2	0040	741	0.
1	0212	67	0.	*	1	0942	292	0.	*	1	1712	517	0.	*	2	0042	742	0.
1	0214	68	0.	*	1	0944	293	0.	*	1	1714	518	0.	*	2	0044	743	0.
1	0216	69	0.	*	1	0946	294	0.	*	1	1716	519	0.	*	2	0046	744	0.
1	0218	70	0.	*	1	0948	295	0.	*	1	1718	520	0.	*	2	0048	745	0.
1	0220	71	0.	*	1	0950	296	0.	*	1	1720	521	0.	*	2	0050	746	0.
1	0222	72	0.	*	1	0952	297	0.	*	1	1722	522	0.	*	2	0052	747	0.
1	0224	73	0.	*	1	0954	298	0.	*	1	1724	523	0.	*	2	0054	748	0.
1	0226	74	0.	*	1	0956	299	0.	*	1	1726	524	0.	*	2	0056	749	0.
1	0228	75	0.	*	1	0958	300	0.	*	1	1728	525	0.	*	2	0058	750	0.
1	0230	76	0.	*	1	1000	301	0.	*	1	1730	526	0.	*	2	0100	751	0.
1	0232	77	0.	*	1	1002	302	0.	*	1	1732	527	0.	*	2	0102	752	0.
1	0234	78	0.	*	1	1004	303	0.	*	1	1734	528	0.	*	2	0104	753	0.
1	0236	79	0.	*	1	1006	304	0.	*	1	1736	529	0.	*	2	0106	754	0.
1	0238	80	0.	*	1	1008	305	0.	*	1	1738	530	0.	*	2	0108	755	0.
1	0240	81	0.	*	1	1010	306	0.	*	1	1740	531	0.	*	2	0110	756	0.
1	0242	82	0.	*	1	1012	307	0.	*	1	1742	532	0.	*	2	0112	757	0.
	0244	83	0.	*	1	1014	308	0.	*	1	1744	533	0.	*	2	0114	758	0.
1	0246	84	0.	*	1	1016	309	0.	*	1	1746	534	0.	*	2	0116	759	0.
1	0248	85	0.	*	1	1018	310	0.	*	1	1748	535	0.	*	2	0118	760	0.
1	0250	86	0.	*	1	1020	311	0.	*	1	1750	536	0.	*	2	0120	761	0.
1	0252	87	0.	*	1	1022	312	0.	*	1	1752	537	0.	*	2	0122	762	0.

1	0254	88	0.	*	1	1024	313	0.	*	1	1754	538	0.	*	2	0124	763	0.
1	0256	89	0.	*	1	1026	314	0.	*	1	1756	539	0.	*	2	0126	764	0.
1	0258	90	0.	*	1	1028	315	0.	*	1	1758	540	0.	*	2	0128	765	0.
1	0300	91	0.	*	1	1030	316	0.	*	1	1800	541	0.	*	2	0130	766	0.
1	0302	92	0.	*	1	1032	317	0.	*	1	1802	542	0.	*	2	0132	767	0.
1	0304	93	0.	*	1	1034	318	0.	*	1	1804	543	0.	*	2	0134	768	0.
1	0306	94	0.	*	1	1036	319	0.	*	1	1806	544	0.	*	2	0136	769	0.
1	0308	95	0.	*	1	1038	320	0.	*	1	1808	545	0.	*	2	0138	770	0.
1	0310	96	0.	*	1	1040	321	0.	*	1	1810	546	0.	*	2	0140	771	0.
1	0312	97	0.	*	1	1042	322	0.	*	1	1812	547	0.	*	2	0142	772	0.
1	0314	98	0.	*	1	1044	323	0.	*	1	1814	548	0.	*	2	0144	773	0.
1	0316	99	1.	*	1	1046	324	0.	*	1	1816	549	0.	*	2	0146	774	0.
1	0318	100	2.	*	1	1048	325	0.	*	1	1818	550	0.	*	2	0148	775	0.
1	0320	101	3.	*	1	1050	326	0.	*	1	1820	551	0.	*	2	0150	776	0.
1	0322	102	5.	*	1	1052	327	0.	*	1	1822	552	0.	*	2	0152	777	0.
1	0324	103	6.	*	1	1054	328	0.	*	1	1824	553	0.	*	2	0154	778	0.
1	0326	104	8.	*	1	1056	329	0.	*	1	1826	554	0.	*	2	0156	779	0.
1	0328	105	9.	*	1	1058	330	0.	*	1	1828	555	0.	*	2	0158	780	0.
1	0330	106	11.	*	1	1100	331	0.	*	1	1830	556	0.	*	2	0200	781	0.
1	0332	107	14.	*	1	1102	332	0.	*	1	1832	557	0.	*	2	0202	782	0.
1	0334	108	16.	*	1	1104	333	0.	*	1	1834	558	0.	*	2	0204	783	0.
1	0336	109	19.	*	1	1106	334	0.	*	1	1836	559	0.	*	2	0206	784	0.
1	0338	110	23.	*	1	1108	335	0.	*	1	1838	560	0.	*	2	0208	785	0.
1	0340	111	27.	*	1	1110	336	0.	*	1	1840	561	0.	*	2	0210	786	0.
1	0342	112	32.	*	1	1112	337	0.	*	1	1842	562	0.	*	2	0212	787	0.
1	0344	113	37.	*	1	1114	338	0.	*	1	1844	563	0.	*	2	0214	788	0.
1	0346	114	43.	*	1	1116	339	0.	*	1	1846	564	0.	*	2	0216	789	0.
1	0348	115	56.	*	1	1118	340	0.	*	1	1848	565	0.	*	2	0218	790	0.
1	0350	116	71.	*	1	1120	341	0.	*	1	1850	566	0.	*	2	0220	791	0.
1	0352	117	88.	*	1	1122	342	0.	*	1	1852	567	0.	*	2	0222	792	0.
1	0354	118	108.	*	1	1124	343	0.	*	1	1854	568	0.	*	2	0224	793	0.
1	0356	119	131.	*	1	1126	344	0.	*	1	1856	569	0.	*	2	0226	794	0.
1	0358	120	157.	*	1	1128	345	0.	*	1	1858	570	0.	*	2	0228	795	0.
1	0400	121	185.	*	1	1130	346	0.	*	1	1900	571	0.	*	2	0230	796	0.
1	0402	122	216.	*	1	1132	347	0.	*	1	1902	572	0.	*	2	0232	797	0.
1	0404	123	249.	*	1	1134	348	0.	*	1	1904	573	0.	*	2	0234	798	0.
1	0406	124	287.	*	1	1136	349	0.	*	1	1906	574	0.	*	2	0236	799	0.
1	0408	125	327.	*	1	1138	350	0.	*	1	1908	575	0.	*	2	0238	800	0.
1	0410	126	370.	*	1	1140	351	0.	*	1	1910	576	0.	*	2	0240	801	0.
1	0412	127	415.	*	1	1142	352	0.	*	1	1912	577	0.	*	2	0242	802	0.
1	0414	128	462.	*	1	1144	353	0.	*	1	1914	578	0.	*	2	0244	803	0.
1	0416	129	511.	*	1	1146	354	0.	*	1	1916	579	0.	*	2	0246	804	0.
1	0418	130	560.	*	1	1148	355	0.	*	1	1918	580	0.	*	2	0248	805	0.
1	0420	131	609.	*	1	1150	356	0.	*	1	1920	581	0.	*	2	0250	806	0.
1	0422	132	654.	*	1	1152	357	0.	*	1	1922	582	0.	*	2	0252	807	0.
1	0424	133	695.	*	1	1154	358	0.	*	1	1924	583	0.	*	2	0254	808	0.
1	0426	134	733.	*	1	1156	359	0.	*	1	1926	584	0.	*	2	0256	809	0.
1	0428	135	769.	*	1	1158	360	0.	*	1	1928	585	0.	*	2	0258	810	0.
1	0430	136	803.	*	1	1200	361	0.	*	1	1930	586	0.	*	2	0300	811	0.
1	0432	137	834.	*	1	1202	362	0.	*	1	1932	587	0.	*	2	0302	812	0.
1	0434	138	861.	*	1	1204	363	0.	*	1	1934	588	0.	*	2	0304	813	0.
1	0436	139	883.	*	1	1206	364	0.	*	1	1936	589	0.	*	2	0306	814	0.
1	0438	140	901.	*	1	1208	365	0.	*	1	1938	590	0.	*	2	0308	815	0.
1	0440	141	913.	*	1	1210	366	0.	*	1	1940	591	0.	*	2	0310	816	0.
1	0442	142	919.	*	1	1212	367	0.	*	1	1942	592	0.	*	2	0312	817	0.
1	0444	143	920.	*	1	1214	368	0.	*	1	1944	593	0.	*	2	0314	818	0.
1	0446	144	917.	*	1	1216	369	0.	*	1	1946	594	0.	*	2	0316	819	0.
1	0448	145	910.	*	1	1218	370	0.	*	1	1948	595	0.	*	2	0318	820	0.
1	0450	146	901.	*	1	1220	371	0.	*	1	1950	596	0.	*	2	0320	821	0.
1	0452	147	890.	*	1	1222	372	0.	*	1	1952	597	0.	*	2	0322	822	0.

1	0454	148	878.	*	1	1224	373	0.	*	1	1954	598	0.	*	2	0324	823	0.
1	0456	149	864.	*	1	1226	374	0.	*	1	1956	599	0.	*	2	0326	824	0.
1	0458	150	849.	*	1	1228	375	0.	*	1	1958	600	0.	*	2	0328	825	0.
1	0500	151	832.	*	1	1230	376	0.	*	1	2000	601	0.	*	2	0330	826	0.
	0502	152	814.	*	1	1232	377	0.	*	1	2002	602	0.	*	2	0332	827	0.
	0504	153	795.	*	1	1234	378	0.	*	1	2004	603	0.	*	2	0334	828	0.
1	0506	154	777.	*	1	1236	379	0.	*	1	2006	604	0.	*	2	0336	829	0.
1	0508	155	759.	*	1	1238	380	0.	*	1	2008	605	0.	*	2	0338	830	0.
1	0510	156	742.	*	1	1240	381	0.	*	1	2010	606	0.	*	2	0340	831	0.
1	0512	157	725.	*	1	1242	382	0.	*	1	2012	607	0.	*	2	0342	832	0.
1	0514	158	709.	*	1	1244	383	0.	*	1	2014	608	0.	*	2	0344	833	0.
1	0516	159	694.	*	1	1246	384	0.	*	1	2016	609	0.	*	2	0346	834	0.
1	0518	160	679.	*	1	1248	385	0.	*	1	2018	610	0.	*	2	0348	835	0.
1	0520	161	664.	*	1	1250	386	0.	*	1	2020	611	0.	*	2	0350	836	0.
1	0522	162	650.	*	1	1252	387	0.	*	1	2022	612	0.	*	2	0352	837	0.
1	0524	163	637.	*	1	1254	388	0.	*	1	2024	613	0.	*	2	0354	838	0.
1	0526	164	624.	*	1	1256	389	0.	*	1	2026	614	0.	*	2	0356	839	0.
1	0528	165	613.	*	1	1258	390	0.	*	1	2028	615	0.	*	2	0358	840	0.
1	0530	166	602.	*	1	1300	391	0.	*	1	2030	616	0.	*	2	0400	841	0.
1	0532	167	592.	*	1	1302	392	0.	*	1	2032	617	0.	*	2	0402	842	0.
1	0534	168	582.	*	1	1304	393	0.	*	1	2034	618	0.	*	2	0404	843	0.
1	0536	169	573.	*	1	1306	394	0.	*	1	2036	619	0.	*	2	0406	844	0.
1	0538	170	565.	*	1	1308	395	0.	*	1	2038	620	0.	*	2	0408	845	0.
1	0540	171	557.	*	1	1310	396	0.	*	1	2040	621	0.	*	2	0410	846	0.
1	0542	172	550.	*	1	1312	397	0.	*	1	2042	622	0.	*	2	0412	847	0.
1	0544	173	543.	*	1	1314	398	0.	*	1	2044	623	0.	*	2	0414	848	0.
1	0546	174	537.	*	1	1316	399	0.	*	1	2046	624	0.	*	2	0416	849	0.
1	0548	175	531.	*	1	1318	400	0.	*	1	2048	625	0.	*	2	0418	850	0.
1	0550	176	524.	*	1	1320	401	0.	*	1	2050	626	0.	*	2	0420	851	0.
1	0552	177	518.	*	1	1322	402	0.	*	1	2052	627	0.	*	2	0422	852	0.
	0554	178	512.	*	1	1324	403	0.	*	1	2054	628	0.	*	2	0424	853	0.
1	0556	179	505.	*	1	1326	404	0.	*	1	2056	629	0.	*	2	0426	854	0.
1	0558	180	499.	*	1	1328	405	0.	*	1	2058	630	0.	*	2	0428	855	0.
1	0600	181	491.	*	1	1330	406	0.	*	1	2100	631	0.	*	2	0430	856	0.
1	0602	182	484.	*	1	1332	407	0.	*	1	2102	632	0.	*	2	0432	857	0.
1	0604	183	477.	*	1	1334	408	0.	*	1	2104	633	0.	*	2	0434	858	0.
1	0606	184	469.	*	1	1336	409	0.	*	1	2106	634	0.	*	2	0436	859	0.
1	0608	185	460.	*	1	1338	410	0.	*	1	2108	635	0.	*	2	0438	860	0.
1	0610	186	450.	*	1	1340	411	0.	*	1	2110	636	0.	*	2	0440	861	0.
1	0612	187	441.	*	1	1342	412	0.	*	1	2112	637	0.	*	2	0442	862	0.
1	0614	188	431.	*	1	1344	413	0.	*	1	2114	638	0.	*	2	0444	863	0.
1	0616	189	421.	*	1	1346	414	0.	*	1	2116	639	0.	*	2	0446	864	0.
1	0618	190	410.	*	1	1348	415	0.	*	1	2118	640	0.	*	2	0448	865	0.
1	0620	191	400.	*	1	1350	416	0.	*	1	2120	641	0.	*	2	0450	866	0.
1	0622	192	389.	*	1	1352	417	0.	*	1	2122	642	0.	*	2	0452	867	0.
1	0624	193	379.	*	1	1354	418	0.	*	1	2124	643	0.	*	2	0454	868	0.
1	0626	194	368.	*	1	1356	419	0.	*	1	2126	644	0.	*	2	0456	869	0.
1	0628	195	358.	*	1	1358	420	0.	*	1	2128	645	0.	*	2	0458	870	0.
1	0630	196	347.	*	1	1400	421	0.	*	1	2130	646	0.	*	2	0500	871	0.
1	0632	197	336.	*	1	1402	422	0.	*	1	2132	647	0.	*	2	0502	872	0.
1	0634	198	326.	*	1	1404	423	0.	*	1	2134	648	0.	*	2	0504	873	0.
1	0636	199	315.	*	1	1406	424	0.	*	1	2136	649	0.	*	2	0506	874	0.
1	0638	200	305.	*	1	1408	425	0.	*	1	2138	650	0.	*	2	0508	875	0.
1	0640	201	295.	*	1	1410	426	0.	*	1	2140	651	0.	*	2	0510	876	0.
1	0642	202	285.	*	1	1412	427	0.	*	1	2142	652	0.	*	2	0512	877	0.
	0644	203	275.	*	1	1414	428	0.	*	1	2144	653	0.	*	2	0514	878	0.
1	0646	204	266.	*	1	1416	429	0.	*	1	2146	654	0.	*	2	0516	879	0.
1	0648	205	256.	*	1	1418	430	0.	*	1	2148	655	0.	*	2	0518	880	0.
1	0650	206	246.	*	1	1420	431	0.	*	1	2150	656	0.	*	2	0520	881	0.
1	0652	207	236.	*	1	1422	432	0.	*	1	2152	657	0.	*	2	0522	882	0.

1	0654	208	227.	*	1	1424	433	0.	*	1	2154	658	0.	*	2	0524	883	0.
1	0656	209	218.	*	1	1426	434	0.	*	1	2156	659	0.	*	2	0526	884	0.
1	0658	210	209.	*	1	1428	435	0.	*	1	2158	660	0.	*	2	0528	885	0.
1	0700	211	202.	*	1	1430	436	0.	*	1	2200	661	0.	*	2	0530	886	0.
1	0702	212	195.	*	1	1432	437	0.	*	1	2202	662	0.	*	2	0532	887	0.
1	0704	213	187.	*	1	1434	438	0.	*	1	2204	663	0.	*	2	0534	888	0.
1	0706	214	180.	*	1	1436	439	0.	*	1	2206	664	0.	*	2	0536	889	0.
1	0708	215	174.	*	1	1438	440	0.	*	1	2208	665	0.	*	2	0538	890	0.
1	0710	216	167.	*	1	1440	441	0.	*	1	2210	666	0.	*	2	0540	891	0.
1	0712	217	160.	*	1	1442	442	0.	*	1	2212	667	0.	*	2	0542	892	0.
1	0714	218	154.	*	1	1444	443	0.	*	1	2214	668	0.	*	2	0544	893	0.
1	0716	219	148.	*	1	1446	444	0.	*	1	2216	669	0.	*	2	0546	894	0.
1	0718	220	141.	*	1	1448	445	0.	*	1	2218	670	0.	*	2	0548	895	0.
1	0720	221	135.	*	1	1450	446	0.	*	1	2220	671	0.	*	2	0550	896	0.
1	0722	222	129.	*	1	1452	447	0.	*	1	2222	672	0.	*	2	0552	897	0.
1	0724	223	124.	*	1	1454	448	0.	*	1	2224	673	0.	*	2	0554	898	0.
1	0726	224	118.	*	1	1456	449	0.	*	1	2226	674	0.	*	2	0556	899	0.
1	0728	225	112.	*	1	1458	450	0.	*	1	2228	675	0.	*	2	0558	900	0.
				*					*					*				

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PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	29.97-HR
920.	4.73	(CFS)	302.	75.	60.	60.
		(INCHES)	53.312	53.312	53.312	53.312
		(AC-FT)	150.	150.	150.	150.

CUMULATIVE AREA = 0.05 SQ MI

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	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	10S	142.	4.40	29.	7.	6.	0.20		
DIVERSION TO	10DIV	71.	4.40	15.	4.	3.	0.20		
HYDROGRAPH AT	10D	71.	4.40	15.	4.	3.	0.20		
ROUTED TO	10AR1	71.	4.43	15.	4.	3.	0.20		
HYDROGRAPH AT	20S	175.	4.40	36.	9.	7.	0.23		
DIVERSION TO	20DIV	122.	4.40	25.	6.	5.	0.23		
HYDROGRAPH AT	20D	52.	4.40	11.	3.	2.	0.23		
2 COMBINED AT	15C	123.	4.43	25.	6.	5.	0.43		
ROUTED TO	10AR2	123.	4.43	25.	6.	5.	0.43		
ROUTED TO	20BR1	123.	4.47	25.	6.	5.	0.43		
HYDROGRAPH AT	30S	180.	4.57	42.	11.	8.	0.32		
DIVERSION TO	30DIV	90.	4.57	21.	5.	4.	0.32		
HYDROGRAPH AT	30D	90.	4.57	21.	5.	4.	0.32		
2 COMBINED AT	25C	211.	4.50	46.	12.	9.	0.75		
ROUTED TO	20BR2	211.	4.53	46.	12.	9.	0.75		
HYDROGRAPH AT	10DIV	71.	4.40	15.	4.	3.	0.00		
ROUTED TO	10B1R	71.	4.63	15.	4.	3.	0.00		
ROUTED TO	10B2R1	71.	4.67	15.	4.	3.	0.00		
HYDROGRAPH AT	30DIV	90.	4.57	21.	5.	4.	0.00		
2 COMBINED AT	16C	159.	4.60	35.	9.	7.	0.00		
ROUTED TO	10B2R2	159.	4.63	35.	9.	7.	0.00		
2 COMBINED AT	30C	367.	4.57	82.	21.	17.	0.75		
ROUTED TO	30R	367.	4.60	82.	21.	17.	0.75		
HYDROGRAPH AT	20DIV	122.	4.40	25.	6.	5.	0.00		
ROUTED TO	20AR	122.	4.53	25.	6.	5.	0.00		
HYDROGRAPH AT	40S	89.	5.67	34.	9.	7.	0.25		

2 COMBINED AT	40C	160.	4.60	59.	15.	12.	0.25
DIVERSION TO	40DIV	128.	4.60	47.	12.	10.	0.25
HYDROGRAPH AT	40D	32.	4.60	12.	3.	2.	0.25
ROUTED TO	40BR	32.	4.90	12.	3.	2.	0.25
2 COMBINED AT	45C1	389.	4.63	92.	24.	19.	1.00
HYDROGRAPH AT	60S	125.	6.13	56.	15.	12.	0.46
DIVERSION TO	60DIV	93.	6.13	42.	11.	9.	0.46
HYDROGRAPH AT	60D	31.	6.13	14.	4.	3.	0.46
2 COMBINED AT	45C2	402.	4.63	104.	27.	22.	1.45
ROUTED TO	45R	401.	4.67	104.	27.	22.	1.45
HYDROGRAPH AT	40DIV	128.	4.60	47.	12.	10.	0.00
ROUTED TO	40AR1	128.	4.60	47.	12.	10.	0.00
HYDROGRAPH AT	50S	64.	5.53	24.	6.	5.	0.16
DIVERSION TO	50DIV	32.	5.53	12.	3.	2.	0.16
HYDROGRAPH AT	50D	32.	5.53	12.	3.	2.	0.16
2 COMBINED AT	46C	145.	4.63	59.	15.	12.	0.16
ROUTED TO	40AR2	144.	4.67	59.	15.	12.	0.16
ROUTED TO	50BR1	144.	4.67	59.	15.	12.	0.16
HYDROGRAPH AT	60DIV	93.	6.13	42.	11.	9.	0.00
2 COMBINED AT	55C	200.	5.83	100.	26.	21.	0.16
ROUTED TO	50BR2	200.	5.83	100.	26.	21.	0.16
2 COMBINED AT	60C	583.	4.70	204.	53.	43.	1.62
ROUTED TO	60AR	582.	4.73	204.	53.	43.	1.62
HYDROGRAPH AT	50DIV	32.	5.53	12.	3.	2.	0.00
ROUTED TO	50AR	32.	5.80	12.	3.	2.	0.00
HYDROGRAPH AT	80S	121.	4.40	26.	7.	5.	0.15
2 COMBINED AT	80C	125.	4.43	36.	10.	8.	0.15
DIVERSION TO	80DIV	62.	4.43	18.	5.	4.	0.15
HYDROGRAPH AT	80D	62.	4.43	18.	5.	4.	0.15
ROUTED TO	80BR	62.	4.63	18.	5.	4.	0.15

2 COMBINED AT	85C1	644.	4.70	222.	58.	47.	1.76
HYDROGRAPH AT	100S	138.	6.10	62.	16.	13.	0.41
DIVERSION TO	100DIV	83.	6.10	37.	10.	8.	0.41
HYDROGRAPH AT	100D	55.	6.10	25.	7.	5.	0.41
2 COMBINED AT	85C2	668.	4.70	247.	65.	52.	2.17
DIVERSION TO	85DIV	626.	3.23	205.	51.	41.	2.17
HYDROGRAPH AT	85D	42.	3.23	42.	14.	11.	2.17
ROUTED TO	85R	42.	3.30	42.	14.	11.	2.17
HYDROGRAPH AT	80DIV	62.	4.43	18.	5.	4.	0.00
HYDROGRAPH AT	90S	12.	4.33	3.	1.	1.	0.01
2 COMBINED AT	80C2	74.	4.40	21.	5.	4.	0.01
ROUTED TO	80AR	74.	4.47	21.	5.	4.	0.01
ROUTED TO	90R1	74.	4.50	21.	5.	4.	0.01
HYDROGRAPH AT	100DIV	83.	6.10	37.	10.	8.	0.00
2 COMBINED AT	95C	104.	4.57	58.	15.	12.	0.01
ROUTED TO	90R2	104.	4.60	58.	15.	12.	0.01
HYDROGRAPH AT	111S	14.	4.13	3.	1.	1.	0.01
2 COMBINED AT	111C	111.	4.57	60.	16.	13.	0.03
ROUTED TO	90R3	111.	4.60	60.	16.	13.	0.03
2 COMBINED AT	95C	153.	4.60	102.	29.	24.	2.20
DIVERSION TO	95DIV	82.	3.77	35.	9.	7.	2.20
HYDROGRAPH AT	95D	71.	3.77	67.	21.	17.	2.20
ROUTED TO	96R	71.	3.80	67.	21.	17.	2.20
HYDROGRAPH AT	110S	170.	5.30	58.	15.	12.	0.38
HYDROGRAPH AT	70S	118.	4.47	27.	7.	5.	0.16
ROUTED TO	70AR	118.	4.60	27.	7.	5.	0.16
ROUTED TO	70BR1	118.	4.63	27.	7.	5.	0.16
2 COMBINED AT	76C	239.	4.97	85.	22.	17.	0.54
2 COMBINED AT	115C	310.	4.97	150.	42.	34.	2.74
DIVERSION TO	115DIV	202.	3.80	56.	14.	11.	2.74

HYDROGRAPH AT	115D	108.	3.80	94.	28.	23.	2.74
ROUTED TO	110R	108.	3.87	94.	28.	23.	2.74
HYDROGRAPH AT	125S	24.	4.17	5.	1.	1.	0.03
2 COMBINED AT	120C1	132.	4.17	98.	30.	24.	2.76
HYDROGRAPH AT	120S	47.	4.13	9.	2.	2.	0.05
2 COMBINED AT	120C2	179.	4.17	106.	32.	25.	2.81
ROUTED TO	120R	179.	4.17	106.	32.	25.	2.81
HYDROGRAPH AT	130S	32.	4.17	6.	2.	1.	0.03
DIVERSION TO	130DIV	29.	4.17	6.	1.	1.	0.03
HYDROGRAPH AT	130D	3.	4.17	1.	0.	0.	0.03
ROUTED TO	130BR	3.	4.53	1.	0.	0.	0.03
HYDROGRAPH AT	140S	56.	4.20	11.	3.	2.	0.06
3 COMBINED AT	140C	235.	4.20	117.	35.	28.	2.91
ROUTED TO	140R	235.	4.23	117.	35.	28.	2.91
HYDROGRAPH AT	150S	63.	4.10	13.	3.	3.	0.06
2 COMBINED AT	150C	296.	4.17	129.	38.	30.	2.97
DIVERSION TO	150DIV	0.	4.17	0.	0.	0.	2.97
HYDROGRAPH AT	150D	296.	4.17	129.	38.	30.	2.97
HYDROGRAPH AT	130DIV	29.	4.17	6.	1.	1.	0.00
ROUTED TO	130AR	29.	4.27	6.	1.	1.	0.00
HYDROGRAPH AT	160S	21.	4.17	4.	1.	1.	0.02
2 COMBINED AT	160C	50.	4.23	10.	2.	2.	0.02
ROUTED TO	160R	50.	4.33	10.	2.	2.	0.02
2 COMBINED AT	155C	342.	4.20	138.	40.	32.	2.99
ROUTED TO	155R	342.	4.23	138.	40.	32.	2.99
HYDROGRAPH AT	170S	47.	4.40	11.	3.	2.	0.06
DIVERSION TO	170DIV	14.	4.40	3.	1.	1.	0.06
HYDROGRAPH AT	170D	33.	4.40	7.	2.	1.	0.06
2 COMBINED AT	170BC	373.	4.23	145.	42.	34.	3.05
ROUTED TO	170BR	373.	4.27	145.	42.	34.	3.05

HYDROGRAPH AT	170DIV	14.	4.40	3.	1.	1.	0.00
ROUTED TO	170AR	14.	4.60	3.	1.	1.	0.00
2 COMBINED AT	170C	383.	4.27	148.	43.	34.	3.05
ROUTED TO	170R	383.	4.30	148.	43.	34.	3.05
HYDROGRAPH AT	180S	64.	4.40	13.	3.	3.	0.08
DIVERSION TO	180DIV	35.	4.40	7.	2.	1.	0.08
HYDROGRAPH AT	180D	29.	4.40	6.	2.	1.	0.08
2 COMBINED AT	180BC	410.	4.30	154.	45.	36.	3.13
ROUTED TO	180BR	410.	4.33	154.	45.	36.	3.13
HYDROGRAPH AT	180DIV	35.	4.40	7.	2.	1.	0.00
ROUTED TO	180AR	35.	4.57	7.	2.	1.	0.00
2 COMBINED AT	180C	441.	4.33	161.	46.	37.	3.13
ROUTED TO	180R	441.	4.37	161.	46.	37.	3.13
HYDROGRAPH AT	190S	57.	4.50	12.	3.	2.	0.08
DIVERSION TO	190DIV	57.	0.03	12.	3.	2.	0.08
HYDROGRAPH AT	190D	0.	0.03	0.	0.	0.	0.08
2 COMBINED AT	190BC	441.	4.37	161.	46.	37.	3.21
ROUTED TO	190BR	440.	4.40	161.	46.	37.	3.21
HYDROGRAPH AT	190DIV	57.	4.50	12.	3.	2.	0.00
ROUTED TO	190AR	57.	4.63	12.	3.	2.	0.00
2 COMBINED AT	190C	490.	4.40	173.	50.	40.	3.21
ROUTED TO	190R	490.	4.43	173.	50.	40.	3.21
HYDROGRAPH AT	200S	56.	4.43	11.	3.	2.	0.08
DIVERSION TO	200DIV	56.	0.03	11.	3.	2.	0.08
HYDROGRAPH AT	200D	0.	0.03	0.	0.	0.	0.08
2 COMBINED AT	200BC	490.	4.43	173.	50.	40.	3.29
ROUTED TO	200BR	489.	4.43	173.	50.	40.	3.29
HYDROGRAPH AT	200DIV	56.	4.43	11.	3.	2.	0.00
ROUTED TO	200AR	56.	4.60	11.	3.	2.	0.00
2 COMBINED AT	200C	541.	4.47	184.	52.	42.	3.29

ROUTED TO	200R	541.	4.50	184.	52.	42.	3.29
HYDROGRAPH AT	210S	22.	4.30	5.	1.	1.	0.03
DIVERSION TO	210DIV	1.	4.30	0.	0.	0.	0.03
HYDROGRAPH AT	210D	21.	4.30	5.	1.	1.	0.03
2 COMBINED AT	210BC	560.	4.47	188.	53.	43.	3.32
ROUTED TO	210BR	560.	4.50	188.	53.	43.	3.32
HYDROGRAPH AT	210DIV	1.	4.30	0.	0.	0.	0.00
ROUTED TO	210AR	1.	5.13	0.	0.	0.	0.00
2 COMBINED AT	210C	560.	4.50	188.	53.	43.	3.32
ROUTED TO	210R	559.	4.53	188.	53.	43.	3.32
HYDROGRAPH AT	220S	23.	4.23	5.	1.	1.	0.03
DIVERSION TO	220DIV	1.	4.23	0.	0.	0.	0.03
HYDROGRAPH AT	220D	22.	4.23	5.	1.	1.	0.03
2 COMBINED AT	220BC	576.	4.53	192.	55.	44.	3.34
ROUTED TO	220BR	576.	4.53	192.	55.	44.	3.34
HYDROGRAPH AT	220DIV	1.	4.23	0.	0.	0.	0.00
ROUTED TO	220AR	1.	4.77	0.	0.	0.	0.00
2 COMBINED AT	220C	576.	4.53	193.	55.	44.	3.34
ROUTED TO	220R	576.	4.57	193.	55.	44.	3.34
HYDROGRAPH AT	230S	12.	4.30	3.	1.	1.	0.01
DIVERSION TO	230DIV	6.	4.30	1.	0.	0.	0.01
HYDROGRAPH AT	230D	6.	4.30	1.	0.	0.	0.01
2 COMBINED AT	230BC	581.	4.57	194.	55.	44.	3.35
ROUTED TO	230BR	580.	4.60	194.	55.	44.	3.35
HYDROGRAPH AT	230DIV	6.	4.30	1.	0.	0.	0.00
2 COMBINED AT	230C	585.	4.60	195.	55.	44.	3.35
HYDROGRAPH AT	85DIV	626.	4.70	205.	51.	41.	0.00
HYDROGRAPH AT	95DIV	82.	4.60	35.	9.	7.	0.00
HYDROGRAPH AT	115DIV	202.	4.97	56.	14.	11.	0.00
HYDROGRAPH AT	115S	22.	4.97	5.	1.	1.	0.05

4 COMBINED AT	116C	920.	4.73	302.	75.	60.	0.05

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
10AR1	MANE	0.72	70.86	265.96	0.68	2.00	70.85	266.00	0.68

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7321E+01 EXCESS=0.0000E+00 OUTFLOW=0.7322E+01 BASIN STORAGE=0.1043E-10 PERCENT ERROR= 0.0

10AR2	MANE	0.70	122.95	266.87	0.55	2.00	122.92	266.00	0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1271E+02 EXCESS=0.0000E+00 OUTFLOW=0.1271E+02 BASIN STORAGE=0.5747E-10 PERCENT ERROR= 0.0

20BR1	MANE	1.07	122.88	268.21	0.56	2.00	122.83	268.00	0.56

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1271E+02 EXCESS=0.0000E+00 OUTFLOW=0.1271E+02 BASIN STORAGE=0.1676E-09 PERCENT ERROR= 0.0

20BR2	MANE	1.00	211.27	272.20	0.58	2.00	211.24	272.00	0.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2320E+02 EXCESS=0.0000E+00 OUTFLOW=0.2321E+02 BASIN STORAGE=0.5213E-09 PERCENT ERROR= 0.0

10B1R	MANE	1.88	70.88	277.28	-1.00	2.00	70.84	278.00	-1.00
10B2R1	MANE	0.91	70.78	279.35	-1.00	2.00	70.76	280.00	-1.00
10B2R2	MANE	0.88	159.30	278.40	-1.00	2.00	159.27	278.00	-1.00
30R	MANE	0.90	366.76	275.58	1.03	2.00	366.71	276.00	1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4104E+02 EXCESS=0.0000E+00 OUTFLOW=0.4105E+02 BASIN STORAGE=0.3385E-04 PERCENT ERROR= 0.0

20AR	MANE	2.00	121.95	272.77	-1.00	2.00	121.86	272.00	-1.00
40BR	MANE	2.00	32.01	294.02	0.45	2.00	32.01	294.00	0.45

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5988E+01 EXCESS=0.0000E+00 OUTFLOW=0.5983E+01 BASIN STORAGE=0.2151E-02 PERCENT ERROR= 0.0

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          45R  MANE        1.07    401.37    280.30      0.70      2.00    401.21    280.00        0.70

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5425E+02 EXCESS=0.0000E+00 OUTFLOW=0.5425E+02 BASIN STORAGE=0.9089E-04 PERCENT ERROR=   0.0

         40AR1  MANE        0.75    128.10    276.56     -1.00      2.00    128.09    276.00       -1.00

         40AR2  MANE        0.75    144.50    279.12      3.47      2.00    144.44    280.00        3.47

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3006E+02 EXCESS=0.0000E+00 OUTFLOW=0.3006E+02 BASIN STORAGE=0.1293E-04 PERCENT ERROR=   0.0

         50BR1  MANE        0.80    144.39    280.91      3.47      2.00    144.35    280.00        3.47

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3006E+02 EXCESS=0.0000E+00 OUTFLOW=0.3006E+02 BASIN STORAGE=0.1389E-04 PERCENT ERROR=   0.0

         50BR2  MANE        0.79    199.65    351.19      5.97      2.00    199.63    350.00        5.97

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5171E+02 EXCESS=0.0000E+00 OUTFLOW=0.5171E+02 BASIN STORAGE=0.1423E-04 PERCENT ERROR=   0.0

          60AR  MANE        0.84    582.39    283.00      1.23      2.00    582.09    284.00        1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1060E+03 EXCESS=0.0000E+00 OUTFLOW=0.1060E+03 BASIN STORAGE=0.1060E-03 PERCENT ERROR=   0.0

          50AR  MANE        2.00     32.03    346.98     -1.00      2.00     32.02    348.00       -1.00

          80BR  MANE        1.92     62.39    279.13      1.20      2.00     62.32    278.00        1.20

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9576E+01 EXCESS=0.0000E+00 OUTFLOW=0.9570E+01 BASIN STORAGE=0.3027E-02 PERCENT ERROR=   0.0

          85R  MANE        1.61     42.00    310.66      0.23      2.00     42.00    310.00        0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2684E+02 EXCESS=0.0000E+00 OUTFLOW=0.2684E+02 BASIN STORAGE=0.1911E-03 PERCENT ERROR=   0.0

          80AR  MANE        1.57     74.08    267.28     14.73      2.00     74.02    268.00       14.73

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1084E+02 EXCESS=0.0000E+00 OUTFLOW=0.1084E+02 BASIN STORAGE=0.2362E-04 PERCENT ERROR=   0.0

          90R1  MANE        1.14     73.97    270.14     14.73      2.00     73.97    270.00       14.73
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CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1084E+02 EXCESS=0.0000E+00 OUTFLOW=0.1084E+02 BASIN STORAGE=0.1661E-04 PERCENT ERROR= 0.0

90R2	MANE	0.98	103.87	275.85	41.06	2.00	103.86	276.00	41.07

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3022E+02 EXCESS=0.0000E+00 OUTFLOW=0.3022E+02 BASIN STORAGE=0.1697E-04 PERCENT ERROR= 0.0

90R3	MANE	1.10	110.96	276.31	21.04	2.00	110.95	276.00	21.04

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3165E+02 EXCESS=0.0000E+00 OUTFLOW=0.3165E+02 BASIN STORAGE=0.1969E-04 PERCENT ERROR= 0.0

96R	MANE	0.78	71.00	227.60	0.35	2.00	71.00	228.00	0.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4115E+02 EXCESS=0.0000E+00 OUTFLOW=0.4115E+02 BASIN STORAGE=0.1086E-03 PERCENT ERROR= 0.0

70AR	MANE	2.00	117.71	275.56	1.58	2.00	117.64	276.00	1.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1350E+02 EXCESS=0.0000E+00 OUTFLOW=0.1352E+02 BASIN STORAGE=0.5722E-03 PERCENT ERROR= -0.1

70BR1	MANE	1.21	117.61	278.43	1.58	2.00	117.58	278.00	1.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1352E+02 EXCESS=0.0000E+00 OUTFLOW=0.1353E+02 BASIN STORAGE=0.2265E-04 PERCENT ERROR= 0.0

110R	MANE	1.42	108.00	231.91	0.39	2.00	108.00	232.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5625E+02 EXCESS=0.0000E+00 OUTFLOW=0.5624E+02 BASIN STORAGE=0.2374E-03 PERCENT ERROR= 0.0

120R	MANE	0.68	178.59	250.43	0.42	2.00	178.59	250.00	0.42

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6302E+02 EXCESS=0.0000E+00 OUTFLOW=0.6301E+02 BASIN STORAGE=0.1094E-03 PERCENT ERROR= 0.0

130BR	MANE	2.00	3.24	272.58	0.18	2.00	3.24	272.00	0.18

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3151E+00 EXCESS=0.0000E+00 OUTFLOW=0.3183E+00 BASIN STORAGE=0.1527E-03 PERCENT ERROR= -1.1

140R	MANE	0.64	235.33	253.18	0.44	2.00	235.23	254.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6890E+02 EXCESS=0.0000E+00 OUTFLOW=0.6890E+02 BASIN STORAGE=0.1124E-03 PERCENT ERROR= 0.0

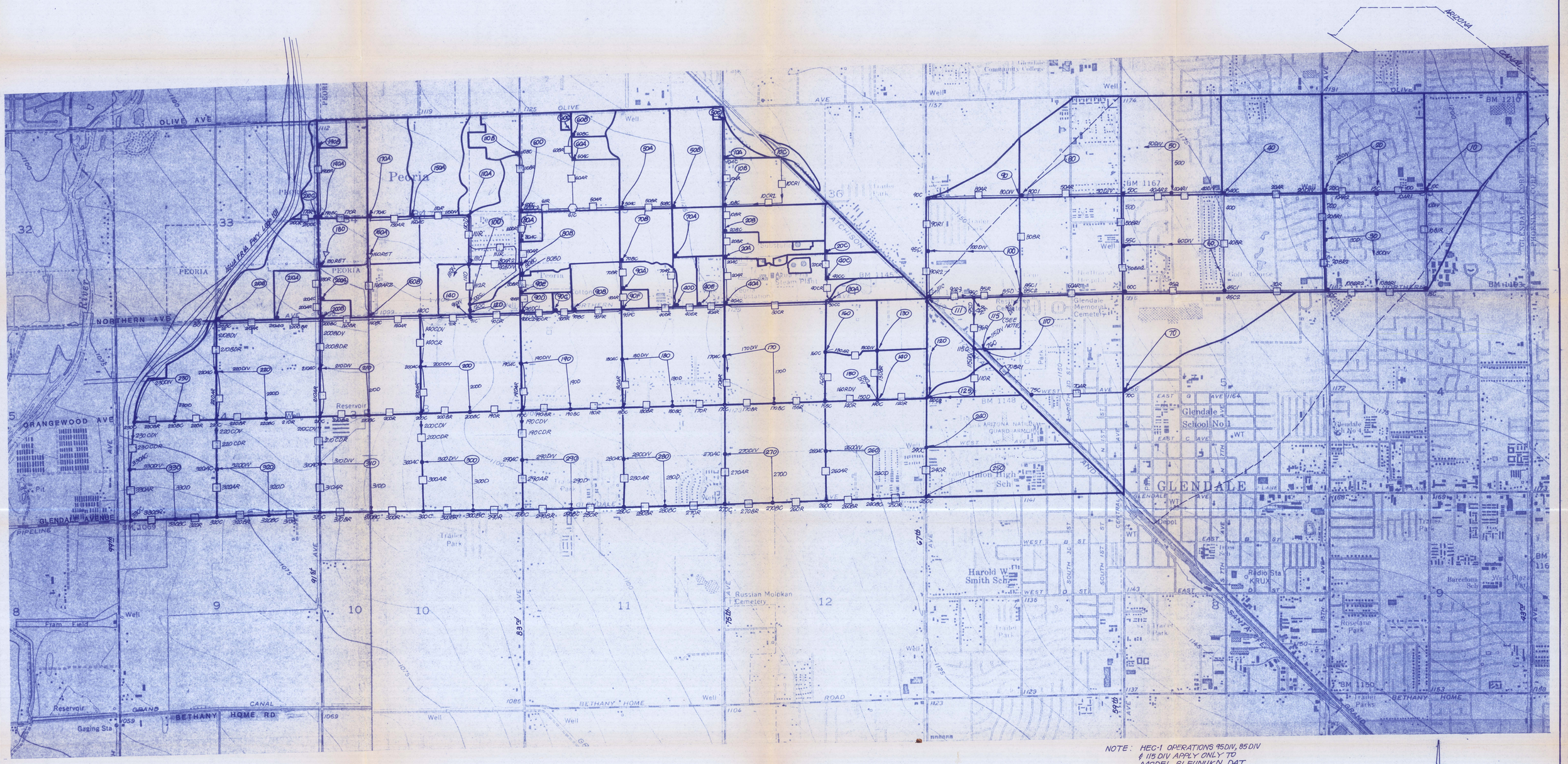
130AR	MANE	2.00	29.18	255.22	-1.00	2.00	29.18	256.00	-1.00

```
160R  MANE        2.00     50.18    260.34      4.12      2.00     50.13    260.00        4.12

NUITY SUMMARY (AC-FT) - INFLOW=0.4942E+01 EXCESS=0.0000E+00 OUTFLOW=0.4950E+01 BASIN STORAGE=0.4725E-03 PERCENT ERROR=  -0.2

155R  MANE        0.66    342.07    253.78      0.50      2.00    342.06    254.00        0.50

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8009E+02 EXCESS=0.0000E+00 OUTFLOW=0.8009E+02 BASIN STORAGE=0.1554E-03 PERCENT ERROR=   0.0

170BR  MANE       0.71    372.71    255.72      0.52      2.00    372.68    256.00        0.52

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8379E+02 EXCESS=0.0000E+00 OUTFLOW=0.8379E+02 BASIN STORAGE=0.1592E-03 PERCENT ERROR=   0.0

170AR  MANE       2.17     14.05    275.74     -1.00      2.00     14.04    276.00       -1.00

170R  MANE        0.74    382.52    257.87      0.53      2.00    382.51    258.00        0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8538E+02 EXCESS=0.0000E+00 OUTFLOW=0.8538E+02 BASIN STORAGE=0.1550E-03 PERCENT ERROR=   0.0

180BR  MANE       0.67    410.16    259.52      0.53      2.00    410.03    260.00        0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8841E+02 EXCESS=0.0000E+00 OUTFLOW=0.8840E+02 BASIN STORAGE=0.1579E-03 PERCENT ERROR=   0.0

180AR  MANE       2.00     35.32    273.15     -1.00      2.00     35.26    274.00       -1.00

180R  MANE        0.70    440.56    261.92      0.55      2.00    440.55    262.00        0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9211E+02 EXCESS=0.0000E+00 OUTFLOW=0.9211E+02 BASIN STORAGE=0.1702E-03 PERCENT ERROR=   0.0

190BR  MANE       0.61    440.40    262.99      0.54      2.00    440.05    264.00        0.54

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9212E+02 EXCESS=0.0000E+00 OUTFLOW=0.9211E+02 BASIN STORAGE=0.1717E-03 PERCENT ERROR=   0.0

190AR  MANE       1.94     57.01    277.92     -1.00      2.00     56.99    278.00       -1.00

190R  MANE        0.45    489.82    265.19      0.57      2.00    489.64    266.00        0.57

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9820E+02 EXCESS=0.0000E+00 OUTFLOW=0.9819E+02 BASIN STORAGE=0.1104E-03 PERCENT ERROR=   0.0
```

```
        200BR  MANE        0.45    489.50    266.67      0.56      2.00    489.43    266.00        0.56

NUITY SUMMARY (AC-FT) - INFLOW=0.9820E+02 EXCESS=0.0000E+00 OUTFLOW=0.9819E+02 BASIN STORAGE=0.1114E-03 PERCENT ERROR=   0.0

        200AR  MANE        1.97     56.08    274.35     -1.00      2.00     56.07    276.00       -1.00

         200R  MANE        0.96    541.20    268.84      0.59      2.00    540.96    270.00        0.59

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1035E+03 EXCESS=0.0000E+00 OUTFLOW=0.1035E+03 BASIN STORAGE=0.2622E-03 PERCENT ERROR=   0.0

        210BR  MANE        0.85    559.55    270.12      0.60      2.00    559.53    270.00        0.60

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1058E+03 EXCESS=0.0000E+00 OUTFLOW=0.1058E+03 BASIN STORAGE=0.2522E-03 PERCENT ERROR=   0.0

        210AR  MANE        2.00      1.12    307.61     -1.00      2.00      1.12    308.00       -1.00

         210R  MANE        0.99    559.38    271.83      0.60      2.00    559.30    272.00        0.60

TINUITY SUMMARY (AC-FT) - INFLOW=0.1060E+03 EXCESS=0.0000E+00 OUTFLOW=0.1060E+03 BASIN STORAGE=0.1714E-02 PERCENT ERROR=   0.0

        220BR  MANE        0.71    575.90    273.01      0.61      2.00    575.76    272.00        0.61

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1083E+03 EXCESS=0.0000E+00 OUTFLOW=0.1083E+03 BASIN STORAGE=0.1398E-02 PERCENT ERROR=   0.0

        220AR  MANE        2.00      1.15    287.73     -1.00      2.00      1.15    288.00       -1.00

         220R  MANE        0.78    576.30    273.88      0.61      2.00    576.28    274.00        0.61

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1085E+03 EXCESS=0.0000E+00 OUTFLOW=0.1085E+03 BASIN STORAGE=0.1577E-02 PERCENT ERROR=   0.0

        230BR  MANE        0.74    580.64    275.74      0.61      2.00    580.47    276.00        0.61

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1091E+03 EXCESS=0.0000E+00 OUTFLOW=0.1091E+03 BASIN STORAGE=0.1709E-02 PERCENT ERROR=   0.0


*** NORMAL END OF HEC-1 ***
```

HEC-1 INPUT/OUTPUT ON DISKETTES

EXHIBIT A: HEC-1 SCHEMATIC DIAGRAM



NOTE: HEC-1 OPERATIONS 95DIV, 85DIV & 115DIV APPLY ONLY TO MODEL GLFUNUKN.DAT

N

MAR 1 5 1996

LEGEND

———	SUB-BASIN BOUNDARY
(240)	SUB-BASIN
□ 45R	CHANNEL OR PIPE ROUTE
● 190C	COMBINE HYDROGRAPHS
165D	DIVERSION HYDROGRAPH
165DIV	DIVERTED HYDROGRAPH
— — —	EXISTING CONDITION SUB-BASIN BOUNDARY

Revised 11/2/95

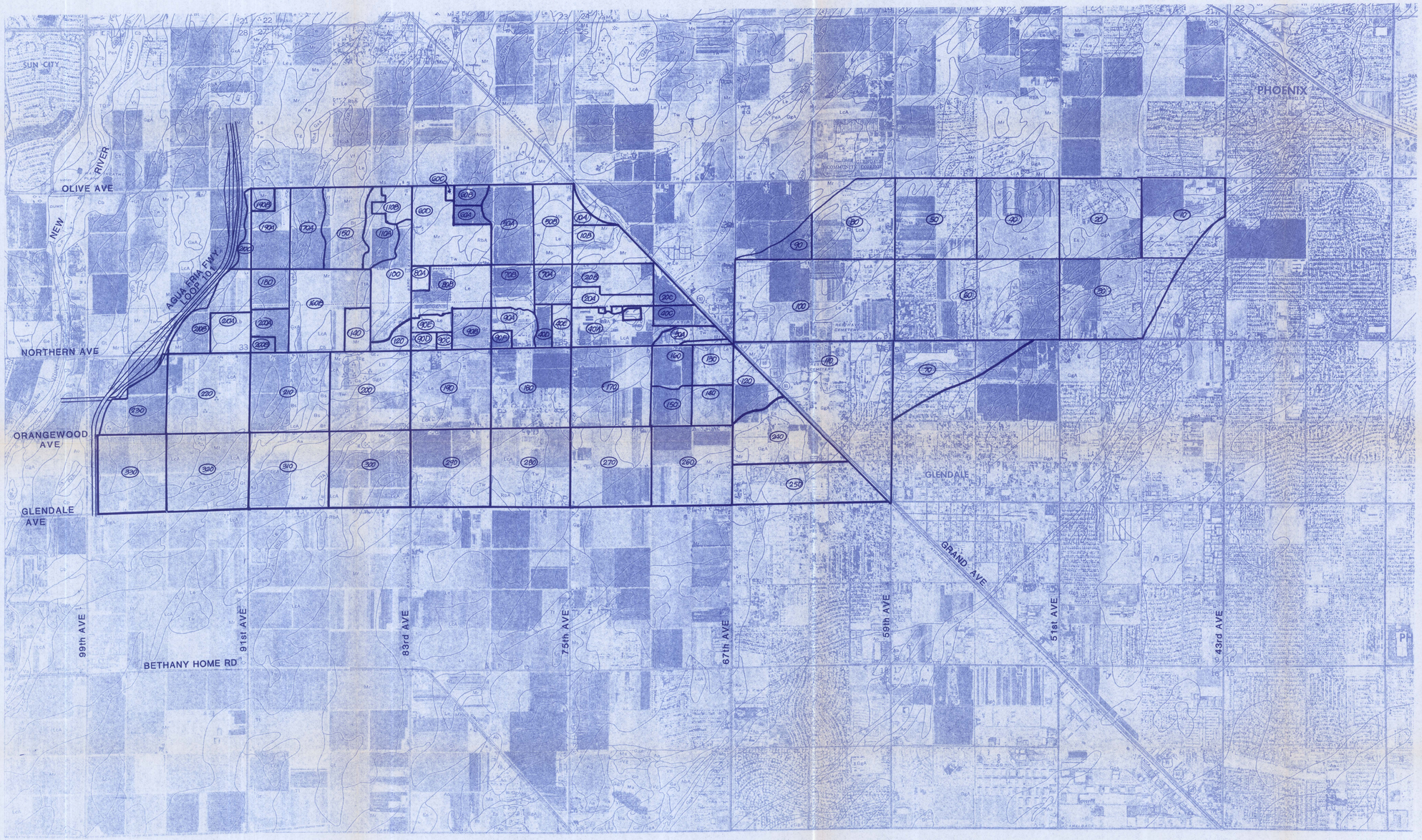
NORTHERN-ORANGEWOOD STORM DRAIN PROJECT

HEC-1 SCHEMATIC DIAGRAM

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 234-1344

SCALE 1"=1000'	Exhibit A
DATE 2/96	JOB NO. 94153
DESIGN AJR	CHECK AGP
DRAWN JTB	FILE ----

EXHIBIT B: SOIL MAP



LEGEND

GgA	SCS SOIL MAP UNIT
(20)	SUB-BASIN IDENTIFICATION
———	SUB-BASIN BOUNDARY

MAR 1 5 1996

N

1 ½ ¼ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000

11-6-95 ~ Revised

NORTHERN-ORANGEWOOD STORM DRAIN PROJECT

SOIL MAP

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors
(602) 234-1344

SCALE 1":1667'±	EXHIBIT B
DATE MARCH, '95	JOB NO. 94153
DESIGN / DRAWN	CHECK / FILE

BASE MAP SOURCE: SOIL CONSERVATION SERVICE,
SOIL SURVEY OF MARICOPA COUNTY, ARIZONA, CENTRAL PART

SUB-BASIN K_n CALIBRATION CALCULATIONS

WOOD/PATEL ASSOCIATES
Civil Engineers
Hydrologists
Land Surveyors

PROJECT Northern/Orangewood
PROJECT NO. 94153 SHEET NO. 1 OF 2
CALCULATED BY AJR DATE 11/95
CHECKED BY TJP DATE 1/96

CALIBRATION OF SUB-BASIN Kn VALUES:

GLENDALE SUB-BASIN 30:

Estimate of average sub-basin flow velocity

drainage path length = 6650 ft.; Lca = 3100 ft; S = .00235 ft/ft
avg. lot detention time = 10 min. (assume)
avg. street velocity = 1.7 fps at curb-full flow
(see attached street capacity worksheet)

At 1.7 fps, travel time = $\frac{6650}{1.7(60)}$ = 65 min.

Including lot detention time, total travel time = 65+10 = 75 min.

Therefore $V_{avg} = \frac{6650}{75(60)} = 1.5$ fps.

Calculation of new Kn value:

use Corps lag equation $Lag = 24 K_n \left(\frac{L L_{ca}}{S^{0.5}}\right)^{0.38}$

assume Lag = 0.6 * Tc
= 0.6 * total travel time over drainage path length
= 0.6 * (75 min)
= 45 min.

Solving Corps lag equation for Kn,

$$\frac{45}{60} = 24 K_n \left(\frac{1.2595 * 0.5871}{(12.39)^{0.5}}\right)^{0.38}$$

new Kn = 0.0553
original Kn = 0.02
} ratio = 2.76

∴ Factor of 2.76 applied to all Glendale sub-basin Kn values.

CALIBRATION OF SUB-BASIN Kn VALUES (CONTINUED):

PEORIA SUB-BASIN 210B (FUTURE DEVELOPMENT LAND USE ONLY)

Estimate of average sub-basin flow velocity

drainage path length = 5250 ft.; L_{ca} = 2500 ft.; S = 0.0028 ft/ft.
no lot detention time for fut. development sub-basins
avg. street velocity = 1.3 fps at 4" curb-full flow
(see attached street capacity worksheet)

At 1.3 fps, total travel time = $\frac{5250}{1.3(60)}$ = 67.1 min.

Calculation of future development (Peoria) Kn value:

Tc = 67.1 min

Lag = 0.6 * 67.1 = 40.3 min

use Corps lag equation, solve for Kn:

$$\frac{40.3}{60} = 24\,Kn\left(\frac{(0.9943)(0.4735)}{14.78^{0.5}}\right)^{0.38}$$

Kn = 0.0621 (use for Peoria future development areas)

For other Peoria land uses, use Glendale Kn values

Street Capacity Computations

Description: Calculation of Street Flow Conveyance Capacity - Glendale Watershed and Peoria Watershed (non-future-development areas)

References: Federal Highway Administration, Hydraulic Engineering Circular No. 12, "Drainage of Highway Pavements", March 1984

Date: 02/09/96

Known Values:

Depth of Flow =	0.5	ft
Cross Slope =	0.02	ft/ft
Street Width (F/C to F/C) =	25	ft
Manning's "n" Value=	0.02	

Calculated Values:

Referenced Equations:

Q = 0.56 * (Sx^1.67) * (S^0.5) * (T^2.67) / n for flow below crown (FHWA Procedure)

Q = 1.486 * A * (R^0.67) * (S^0.5) / n for flow above crown (Manning's equation)

where
Q = flow rate, cfs
Sx = cross slope, ft/ft
S = longitudinal slope, ft/ft
T = width of flow, ft
A = conveyance area, sq ft
R = hydraulic radius, ft

Longitudinal Slope ft/ft	*Conveyance Area sq ft*	*Velocity fps*	*Hydraulic Capacity cfs*	*1/2 Street Hydraulic Capacity, cfs*
0.0000	9.38	0.00	0	0
0.0005	9.38	0.84	8	4
0.0010	9.38	1.19	11	6
0.0015	9.38	1.45	14	7
0.0020	9.38	1.68	16	8
0.0025	9.38	1.88	18	9
0.0030	9.38	2.05	19	10
0.0035	9.38	2.22	21	10
0.0040	9.38	2.37	22	11
0.0045	9.38	2.52	24	12
0.0050	9.38	2.65	25	12
0.0055	9.38	2.78	26	13
0.0060	9.38	2.91	27	14
0.0065	9.38	3.02	28	14
0.0070	9.38	3.14	29	15
0.0075	9.38	3.25	30	15
0.0080	9.38	3.35	31	16
0.0085	9.38	3.46	32	16
0.0090	9.38	3.56	33	17
0.0095	9.38	3.66	34	17
0.0100	9.38	3.75	35	18
0.0180	9.38	5.03	47	24
0.0280	9.38	6.28	59	29
0.0380	9.38	7.31	69	34
0.0480	9.38	8.22	77	39
0.0580	9.38	9.03	85	42

Street Capacity Computations

Description: Calculation of Street Flow Conveyance Capacity - Peoria Future Development Areas

References: Federal Highway Administration, Hydraulic Engineering Circular No. 12, "Drainage of Highway Pavements", March 1984

Date: 02/09/96

Known Values:

Depth of Flow =	0.33	ft
Cross Slope =	0.02	ft/ft
Street Width (F/C to F/C) =	25	ft
Manning's "n" Value=	0.02	

Calculated Values:

Referenced Equations:

Q = 0.56 * (Sx^1.67) * (S^0.5) * (T^2.67) / n for flow below crown (FHWA Procedure)

Q = 1.486 * A * (R^0.67) * (S^0.5) / n for flow above crown (Manning's equation)

where
Q = flow rate, cfs
Sx = cross slope, ft/ft
S = longitudinal slope, ft/ft
T = width of flow, ft
A = conveyance area, sq ft
R = hydraulic radius, ft

Longitudinal Slope ft/ft	*Conveyance Area sq ft*	*Velocity fps*	*Hydraulic Capacity cfs*	*1/2 Street Hydraulic Capacity, cfs*
0.0000	5.13	0.00	0	0
0.0005	5.13	0.56	3	1
0.0010	5.13	0.80	4	2
0.0015	5.13	0.98	5	3
0.0020	5.13	1.13	6	3
0.0025	5.13	1.26	6	3
0.0030	5.13	1.38	7	4
0.0035	5.13	1.49	8	4
0.0040	5.13	1.60	8	4
0.0045	5.13	1.69	9	4
0.0050	5.13	1.79	9	5
0.0055	5.13	1.87	10	5
0.0060	5.13	1.96	10	5
0.0065	5.13	2.04	10	5
0.0070	5.13	2.11	11	5
0.0075	5.13	2.19	11	6
0.0080	5.13	2.26	12	6
0.0085	5.13	2.33	12	6
0.0090	5.13	2.40	12	6
0.0095	5.13	2.46	13	6
0.0100	5.13	2.52	13	6
0.0180	5.13	3.39	17	9
0.0280	5.13	4.22	22	11
0.0380	5.13	4.92	25	13
0.0480	5.13	5.53	28	14
0.0580	5.13	6.08	31	16

APPENDIX II - CONCEPT/ROUTING STUDY ALTERNATIVES

Peoria Watershed

- Peoria Watershed Storm Drain System — Option A - See Table II-1, Plate II-3; Option B - See Table II-2, Plate II-3

Glendale Watershed — Summary See Table II-3

- Orangewood Alignment — Option 1A - See Table II-4, Plate II-2; Option 1B - See Table II-5, Plate II-2; Option 2A - See Table II-6, Plate II-1; Option 2B - See Table II-7, Plate II-1
- Glendale Avenue Alignment — See Table II-8, Plate II-3

Pipe Unit Costs — Table II-9

Pipe Material Cost

Estimate of Construction Contingencies — Table II-10

Northern/Orangewood ADMP Facilities Cost Analysis — Table II-11

Northern/Orangewood Recommended Option Facilities, Expanded Area — Table II-12

Unit Prices from *Glendale-Peoria ADMP* — Table 19

Wood/Patel & Associates

TABLE II-1

Option A

Peoria Watershed Storm Drain System

Peoria Watershed Storm Drain Alignment (SEE PLATE II-3) ***Northern Avenue; 83rd Avenue to the AFF Channel;Butler;Peoria Laterals*** 14-Mar-96

Manning's "n"= 0.013 09:51 AM

STORM SEWER LINE STATION LOCATION	PIPE #	STORM SEWER STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2 v^2/2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
Northern Ave Alignment																				
@ AFF Pipe		-251					1079.2		1083.70	1083.70				1083.70	***1083.70***	***1088.0***	ok	8.8		
			60	U	1551	0.0007													EXISTING	0
93rd Ave (13+00)		1300					1080.2	**92**	1085.97	1085.63	1085.27	0.4	ok	1085.63	***1085.97***	***1094.0***	ok	13.8		
			60	U	1160	0.0006													EXISTING	0
91st Ave (24+60)		2460					1080.9	**89**	1087.29	1086.97	1085.96	1.0	ok	1086.97	***1087.29***	***1095.5***	ok	14.6		
			60	U	14	0.1643													EXISTING	0
@ Sta (24+74)		2474					1083.2	**77**	1087.22	1086.99	1088.25	-1.3	ocf	1088.25	***1088.49***	***1095.5***	ok	12.3		
			60	U	26	0.0077													EXISTING	0
@ Sta (25+00)		2500					1083.4	**77**	1087.25	1087.01	1088.45	-1.4	ocf	1088.45	***1088.69***	***1095.6***	ok	12.2		
			60	U	75	0.0080													EXISTING	0
@ Sta (25+75)		2575					1084.0	**77**	1087.31	1087.07	1089.05	-2.0	ocf	1089.05	***1089.29***	***1096.0***	ok	12.0		
			60	U	225	0.0007													EXISTING	0
@ Sta (28+00)		2800					1084.2	**77**	1087.51	1087.27	1089.21	-1.9	ocf	1089.21	***1089.45***	***1096.0***	ok	11.8		
	10		**60**	U	1020	0.0005													132	134854
91st Ave to 89th Ave		3820					1084.7	**77**	1088.40	1088.16	1089.72	-1.6	ocf	1089.72	***1089.96***	***1098.0***	ok	13.3		
	11		**54**	U	2640	0.0005													119	313720
89th Ave to 85th Ave		6460					1086.0	**73**	1092.10	1091.78	1090.56	1.2	ok	1091.78	***1092.10***	***1096.0***	ok	10.0		
	12		**72**	U	1320	0.0005													157	207305
85th Ave to 83rd Ave		7780					1086.7	**214**	1096.02	1095.13	1092.83	2.3	ok	1095.13	***1096.02***	***1102.0***	ok	15.3		
																			TOTAL	$655,880
															STORM DRAIN SYSTEM WITH CONTINGENCY				40 %	***$918,232***
Peoria Laterals																				
@ Northern & 85th Ave							1086.0	**73.0**	1092.1	1091.8	1090.6	1.2	ok	1091.8	1092.1	1096.0	ok	10.0		
	13		**24**	R	1320	0.0064													69	91739
85th, Northern to Elec Corr		1320					1094.5	**19**	1101.58	1101.01	1096.61	4.4	ok	1101.01	***1101.58***	***1106.0***	ok	11.5		
	14		**66**	R	1320	0.0010													121	159725
Elec Corridor, 83rd to 85th		2640					1095.8	**132**	1103.52	1103.04	1101.40	1.6	ok	1103.04	***1103.52***	***1106.0***	ok	10.2		
															STORM DRAIN SYSTEM WITH CONTINGENCY				***TOTAL*** 40 %	$251,465 ***$352,050***
Butler Drive Alignment																				
@ AFF Channel		0					1089.0	**78**	1092.50	1092.50				1092.50	***1092.50***	***1102.0***	ok	13.0		
	21		**48**	R	840	0.0065													91	76475
AFF to 91st Ave		840					1094.5	**78**	1095.56	1094.96	1098.62	-3.7	ocf	1098.62	***1099.22***	***1102.8***	ok	8.3		
	22		**42**	U	1320	0.0020													105	138822
91st Ave to 89th Ave		2160					1097.1	**71**	1102.34	1101.50	1100.81	0.7	ok	1101.50	***1102.34***	***1105.8***	ok	8.7		
	23		**36**	U	1100	0.0020													100	109867
89th Ave to 87th Ave		3260					1099.3	**32**	1104.33	1104.01	1102.40	1.6	ok	1104.01	***1104.33***	***1107.0***	ok	7.7		
															STORM DRAIN SYSTEM WITH CONTINGENCY				***TOTAL*** 40 %	$325,164 ***$455,230***

Note: R = Rural Section
U = Urban Section

DETENTION BASIN

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
18 AC (+/-) PEORIA BASIN	LAND	23	$27,437	$630,502
EXCAVATION	CY	225,000	$3	$675,000
BASIN TOTAL				***$1,305,502***

COST OF RIGHT OF WAY PURCHASE

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
BUTLER, 91st TO AFF	41,265	$0.37	$15,326
RIGHT OF WAY TOTAL			***$15,000***

STORM DRAIN W/CONTINGENCIES	***$1,726,000***
BASIN AND RIGHT OF WAY TOTAL	***$1,320,502***
GRAND TOTAL	***$3,046,502***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

q:\northern\reportiii1.wq2

TABLE II-2

Option B

Peoria Watershed Storm Drain System

Peoria Watershed Storm Drain Alignment (SEE PLATE II-3)

Northern Avenue; 83rd Avenue to the AFF Channel;Butler;Peoria Laterals

14-Mar-96

09:57 AM

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STORM SEWER STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2 v^2/2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
Northern Ave Alignment																				
@ AFF Pipe		-251					1079.2		1083.70	1083.70				1083.70	***1083.70***	***1088.0***	ok	8.8		
			60	U	1551	0.0007													EXISTING	0
93rd Ave (13+00)		1300					1080.2	**36**	1084.05	1083.99	1085.21	-1.2	ocf	1085.21	***1085.26***	***1094.0***	ok	13.8		
			60	U	1160	0.0006													EXISTING	0
91st Ave (24+60)		2460					1080.9	**33**	1084.22	1084.18	1085.91	-1.7	ocf	1085.91	***1085.95***	***1095.5***	ok	14.6		
			60	U	14	0.1643													EXISTING	0
@ Sta (24+74)		2474					1083.2	**33**	1084.23	1084.18	1088.21	-4.0	ocf	1088.21	***1088.25***	***1095.5***	ok	12.3		
			60	U	26	0.0077													EXISTING	0
@ Sta (25+00)		2500					1083.4	**33**	1084.23	1084.19	1088.41	-4.2	ocf	1088.41	***1088.45***	***1095.6***	ok	12.2		
			60	U	75	0.0080													EXISTING	0
@ Sta (25+75)		2575					1084.0	**33**	1084.24	1084.20	1089.01	-4.8	ocf	1089.01	***1089.05***	***1096.0***	ok	12.0		
			60	U	225	0.0007													EXISTING	0
@ Sta (28+00)		2800					1084.2	**33**	1084.28	1084.23	1089.17	-4.9	ocf	1089.17	***1089.21***	***1096.0***	ok	11.8		
	10		**27**	U	1020	0.0005													83	85056
91st Ave to 89th Ave		3820					1084.7	**21**	1089.32	1088.89	1087.01	1.9	ok	1088.89	***1089.32***	***1098.0***	ok	13.3		
	11		**27**	U	2640	0.0005													83	220145
89th Ave to 85th Ave		6460					1086.0	**12**	1092.96	1092.82	1088.27	4.6	ok	1092.82	***1092.96***	***1096.0***	ok	10.0		
	12		**72**	U	1320	0.0005													157	207305
85th Ave to 83rd Ave		7780					1086.7	**214**	1097.07	1096.18	1092.83	3.4	ok	1096.18	***1097.07***	***1102.0***	ok	15.3		
															STORM DRAIN SYSTEM				*TOTAL*	$512,507
															WITH CONTINGENCY				40 %	***$717,510***
Peoria Laterals																				
@ Northern & 85th Ave							1086.0	**12.0**	1093.0	1092.8	1088.3	4.6	ok	1092.8	1093.0	1096.0	ok	10.0		
	13		**24**	R	1320	0.0064													69	91739
85th, Northern to Elec. Corridor		1320					1094.5	**19**	1102.63	1102.06	1096.61	5.4	ok	1102.06	***1102.63***	***1106.0***	ok	11.5		
	14		**66**	R	1320	0.0010													121	159725
Elec.Corridor, 83rd to 85th		2640					1095.8	**132**	1104.57	1104.09	1101.40	2.7	ok	1104.09	***1104.57***	***1106.0***	ok	10.2		
															STORM DRAIN SYSTEM				*TOTAL*	$251,465
															WITH CONTINGENCY				40 %	***$352,050***
Butler Drive Alignment																				
@ AFF Channel		0					1089.0	**78**	1092.50	1092.50				1092.50	***1092.50***	***1102.0***	ok	13.0		
	21		**48**	R	840	0.0065													91	76475
AFF to 91st Ave		840					1094.5	**78**	1095.56	1094.96	1098.62	-3.7	ocf	1098.62	***1099.22***	***1102.8***	ok	8.3		
	22		**42**	U	1320	0.0020													105	138822
91st Ave to 89th Ave		2160					1097.1	**71**	1102.34	1101.50	1100.77	0.7	ok	1101.50	***1102.34***	***1105.8***	ok	8.7		
	23		**36**	U	1100	0.0020													100	109867
89th Ave to 87th Ave		3260					1099.3	**32**	1104.33	1104.01	1102.40	1.6	ok	1104.01	***1104.33***	***1107.0***	ok	7.7		
															STORM DRAIN SYSTEM				*TOTAL*	$325,164
															WITH CONTINGENCY				40 %	***$455,230***

Note: R = Rural Section
U = Urban Section

DETENTION BASIN

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
18AC (+/-) PEORIA BASIN	LAND	23	$27,437	$630,502
EXCAVATION	CY	225,000	$3	$675,000
BASIN TOTAL				***$1,305,502***

COST OF RIGHT OF WAY PURCHASE

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
BUTLER, 91st TO AFF	41,265	$0.37	$15,326
RIGHT OF WAY TOTAL			***$15,000***

STORM DRAIN W/CONTINGENCIES	***$1,525,000***
BASIN AND RIGHT OF WAY TOTAL	***$1,320,502***
GRAND TOTAL	***$2,845,502***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement is appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

NORTHERN/ORANGEWOOD PROJECT
ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT

14-Mar-96

TABLE II-3

PROPOSED ALTERNATIVE COST ANALYSIS SUMMARY TABLE

Name	*Basin Location*	*Probable Cost*
Option 1A	West Basin Box Culvert - 91st Ave to Agua Fria Freeway Channel	$12,723,000
Option 1B	West Basin Open Channel - 91st Ave to Agua Fria Freeway Channel	$11,475,000
Option 2A	East Basin Box Culvert - 91st Ave to Agua Fria Freeway Channel	$14,479,000
Option 2B	East Basin Open Channel - 91st Ave to Agua Fria Freeway Channel	$12,114,000

TABLE II-4

Option 1A: Glendale Watershed Storm Drain System (with West Basin)

& Box Culvert Between 91st Avenue and the Agua Fria Freeway Channel

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT
(SEE PLATE II-2)

15-Mar-96

Manning's "n"= 0.013

10:11 AM

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
Orangewood Alignment																				
AFF Channel Outlet		0					1070.0		1076.00	1076.00				1076.00	***1076.00***	***1081***	ok	11.0		
used 1-10x8	1		Box	R	4750	0.0007													450	2137500
91 st Ave		4750					1073.5	**348**	1079.50	1079.50	1079.50	0.0	ok	1079.50	***1080.02***	***1085***	ok	11.5		
	2		90	R	2640	0.0009													220	581578
87th Ave		7390					1076.0	**321**	1084.92	1084.10	1083.66	0.4	ok	1084.10	***1084.92***	***1088***	ok	12.0		
	3		66	R	2640	0.0063													121	319450
83rd Ave		10030					1092.5	**249**	1100.25	1098.55	1098.34	0.2	ok	1098.55	***1100.25***	***1106***	ok	13.5		
	4		66	R	2640	0.0019													121	319450
79th Ave		12670					1097.5	**176**	1106.62	1105.76	1103.17	2.6	ok	1105.76	***1106.62***	***1114***	ok	16.5		
	5		66	U	2640	0.0021													145	381784
75th Ave		15310					1103.0	**127**	1109.97	1109.52	1108.59	0.9	ok	1109.52	***1109.97***	***1121***	ok	18.0		
	6		60	U	2640	0.0019													132	349034
71st Ave		17950					1108.0	**94**	1113.30	1112.95	1113.07	-0.1	ok	1113.07	***1113.43***	***1127***	ok	19.0		
	7		48	U	1320	0.0030													110	145842
69th Ave		19270					1112.0	**68**	1116.34	1115.89	1116.09	-0.2	ok	1116.09	***1116.55***	***1130***	ok	18.0		
	8		108	R	1980	0.0020													276	546481
66th Ave		21250					1116.0	**1036**	1133.60	1129.48	1125.82	3.7	ok	1129.48	***1133.60***	***1138***	ok	22.0		
Alignment as Noted	9		120	R	1320	0.0030													345	455334
Along 66th to Frier		22570					1120.0	**1017**	1137.06	1134.46	1130.52	3.9	ok	1134.46	***1137.06***	***1140***	ok	20.0		
	10		126	U	660	0.0015													384	253334
Along Frier to Grand		23230					1121.0	**1017**	1138.52	1136.38	1131.93	4.4	ok	1136.38	***1138.52***	***1142***	ok	21.0		

STORM DRAIN SYSTEM WITH CONTINGENCY — *TOTAL* $5,489,787; 40 % ***$7,685,702***

City of Glendale																				
	11		132	R	1320	0.0030													397	524061
Along 65th to Northern		1320					1125.0	**767**	1139.09	1138.08	1136.20	1.9	ok	1138.08	***1139.09***	***1145***	ok	20.0		
	12		60	U	1320	0.0083													132	174517
67th Ave to 65th Ave		1320					1136.0	**110**	1140.91	1140.42	1141.10	-0.7	ok	1141.10	***1141.58***	***1143***	ok	7.0		
	13		102	U	1320	0.0045													294	387805
65th Ave to 63rd Ave		1320					1131.0	**660**	1145.17	1143.07	1139.92	3.1	ok	1143.07	***1145.17***	***1147***	ok	16.0		

STORM DRAIN SYSTEM WITH CONTINGENCY — *TOTAL* $1,086,383; 40 % ***$1,520,936***

ADOT (Grand Avenue)																				
	14		60	U	1880	0.0048													132	248554
63rd Ave		1880					1130.0	**116**	1140.63	1140.09	1135.11	5.0	ok	1140.09	***1140.63***	***1145***	ok	15.0		

Note: R = Rural Section
U = Urban Section

STORM DRAIN SYSTEM WITH CONTINGENCY — *TOTAL* $248,554; 40 % ***$347,976***

COST OF WEST BASIN PER PURCHASE PRICE:

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COS*	*COST*
35 AC BASIN	LAND	36.92	$42,338	$1,563,119
BASIN EXCAVATION	CY	486,000	$3	$1,458,000

BASIN TOTAL ***$3,021,119***

COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
65th Ave - Northern to Frier Dr	26,400	$1.03	$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	$1.03	$13,636
66th Ave - Frier to Orangewood	26,400	$1.03	$27,271
83rd Ave to AFF Channel	211,200	$0.37	$78,440
RIGHT OF WAY TOTAL			***$146,618***

STORM DRAIN W/CONTINGENCIES	***$9,555,000***
BASIN AND RIGHT OF WAY TOTAL	***$3,168,000***
GRAND TOTAL	***$12,723,000***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

TABLE II-5

Option 1B: Glendale Watershed Storm Drain System (with West Basin)

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT
(SEE PLATE II-2)

& Open Channel Between 91st Avenue and the Agua Fria Freeway Channel

15-Mar-96

10:11 AM

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	LINE #	STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVER	PIPE UNIT PRICE $	PIPE COST $
Orangewood Alignment																				
AFF Channel Outlet		0					1070.0		1074.00	1074.00				1074.00	***1074.00***	***1081***	ok	11.0		
Open Channel	1		Trap	R	4750	0.0007													189	897,750
91 st Ave		4750					1073.5	**348**	1077.50	1077.50	1077.50	0.0	ok	1077.50	***1078.02***	***1085***	ok	11.5		
	2		84	R	2640	0.0009													198	523,910
87th Ave		7390					1076.0	**321**	1085.22	1084.14	1083.22	0.9	ok	1084.14	***1085.22***	***1088***	ok	12.0		
	3		66	R	2640	0.0063													121	319,450
83rd Ave		10030					1092.5	**249**	1100.29	1098.59	1098.34	0.2	ok	1098.59	***1100.29***	***1106***	ok	13.5		
	4		66	R	2640	0.0019													121	319,450
79th Ave		12670					1097.5	**176**	1106.66	1105.81	1103.17	2.6	ok	1105.81	***1106.66***	***1114***	ok	16.5		
	5		66	U	2640	0.0021													145	381,784
75th Ave		15310					1103.0	**127**	1110.01	1109.57	1108.59	1.0	ok	1109.57	***1110.01***	***1121***	ok	18.0		
	6		60	U	2640	0.0019													132	349,034
71st Ave		17950					1108.0	**94**	1113.34	1112.99	1113.07	-0.1	ok	1113.07	***1113.43***	***1127***	ok	19.0		
	7		48	U	1320	0.0030													110	145,842
69th Ave		19270					1112.0	**68**	1116.38	1115.93	1116.09	-0.2	ok	1116.09	***1116.55***	***1130***	ok	18.0		
	8		108	R	1980	0.0020													276	546,481
66th Ave		21250					1116.0	**1036**	1133.64	1129.52	1125.82	3.7	ok	1129.52	***1133.64***	***1138***	ok	22.0		
Alignment as Noted	9		120	R	1320	0.0030													345	455,334
Along 66th to Frier		22570					1120.0	**1017**	1137.10	1134.50	1130.52	4.0	ok	1134.50	***1137.10***	***1140***	ok	20.0		
	10		120	U	660	0.0015													384	253,334
Along Frier to Grand		23230					1121.0	**1017**	1139.59	1136.99	1131.52	5.5	ok	1136.99	***1139.59***	***1142***	ok	21.0		
																			STORM DRAIN SYSTEM	*TOTAL* $4,192,369
																			WITH CONTINGENCY	40 % ***$5,869,317***
City of Glendale																				
	11		144	R	1320	0.0030													443	585,021
Along 65th to Northern		1320					1125.0	**767**	1138.78	1138.06	1137.14	0.9	ok	1138.06	***1138.78***	***1145***	ok	20.0		
	12		60	U	1320	0.0083													132	174,517
67th Ave to 65th Ave		1320					1136.0	**110**	1140.89	1140.40	1141.10	-0.7	ok	1141.10	***1141.58***	***1143***	ok	7.0		
	13		120	U	1320	0.0045													384	506,667
63rd Ave to 65th Ave		1320					1131.0	**660**	1141.26	1140.16	1141.22	-1.1	ocf	1141.22	***1142.32***	***1147***	ok	16.0		
																			STORM DRAIN SYSTEM	*TOTAL* $1,266,205
																			WITH CONTINGENCY	40 % ***$1,772,688***
ADOT (Grand Avenue)																				
	14		60	U	1880	0.0048													132	248,554
63rd Ave to 65th Ave		1880					1130.0	**116**	1141.24	1140.70	1135.11	5.6	ok	1140.70	***1141.24***	***1145***	ok	15.0		
																			STORM DRAIN SYSTEM	*TOTAL* $248,554
																			WITH CONTINGENCY	40 % ***$347,976***

Note: R = Rural Section
U = Urban Section

COST OF WEST BASIN PER PURCHASE PRICE:

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
35 AC BASIN	LAND	36.92	$42,253	$1,559,988
BASIN EXCAVATION	CY	486,000	$3	$1,458,000
CHANNEL EX TO AFF	CY	74,000	$3	$222,000
BASIN TOTAL				***$3,240,000***

COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
65th Ave - Northern to Frier Dr	26,400	$1.03	$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	$1.03	$13,636
66th Ave - Frier to Orangewood	26,400	$1.03	$27,271
83rd Ave to AFF Channel	475,200	$0.37	$176,489
RIGHT OF WAY TOTAL			***$245,000***

STORM DRAIN W/CONTINGENCIES	***$7,990,000***
BASIN AND RIGHT OF WAY TOTAL	***$3,485,000***
GRAND TOTAL	***$11,475,000***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

TABLE II-6

Option 2A: Glendale Watershed Storm Drain System (with East Basin)

& Box Culvert Between 91st Avenue and Agua Fria Freeway Channel

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT
(SEE PLATE II-1)

15-Mar-96

10:10 AM

Manning's "n"= 0.013

	STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND VS. EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
	Orangewod Alignment																				
1	AFF Channel Outlet		0					1070.0		1075.00	1075.00	1075.00			1075.00	***1075.00***	***1081***	ok	11.0		
	used 2-8x6	1		**BOX**	R	4750	0.0007													580	2755000
2	91 st Ave		4750					1073.5	**583**	1078.50	1078.50	1078.50	0.0	ok	1078.50	***1079.32***	***1085***	ok	11.5		
		2		**108**	R	2640	0.0009													276	728642
3	87th Ave		7390					1076.0	**562**	1085.04	1083.83	1085.24	-1.4	ocf	1085.24	***1086.45***	***1088***	ok	12.0		
		3		**90**	R	2640	0.0063													220	581578
4	83rd Ave		10030					1092.5	**492**	1096.56	1094.63	1100.39	-5.8	ocf	1100.39	***1102.31***	***1106***	ok	13.5		
		4		**90**	R	2640	0.0019													220	581578
5	79th Ave		12670					1097.5	**443**	1104.95	1103.39	1105.31	-1.9	ocf	1105.31	***1106.87***	***1114***	ok	16.5		
		5		**90**	U	2640	0.0021													252	665911
6	75th Ave		15310					1103.0	**412**	1112.31	1110.96	1110.77	0.2	ok	1110.96	***1112.31***	***1121***	ok	18.0		
		6		**84**	U	2640	0.0019													229	604577
7	71st Ave		17950					1108.0	**374**	1121.44	1119.98	1115.29	4.7	ok	1119.98	***1121.44***	***1127***	ok	19.0		
		7		**78**	U	2640	0.0038													175	460714
8	67th Ave		20590					1118.0	**236**	1126.09	1125.30	1124.66	0.6	ok	1125.30	***1126.09***	***1130***	ok	12.0		
		8		**60**	R	660	0.0015													110	72592
9	66th Ave		21250					1119.0	**179**	1129.70	1128.41	1124.26	4.1	ok	1128.41	***1129.70***	***1138***	ok	19.0		
	Alignment as Noted	9		**54**	R	1320	0.0038													98	129360
*	Along 66th to Frier		22570					1124.0	**108**	1133.08	1132.37	1128.64	3.7	ok	1132.37	***1133.08***	***1140***	ok	16.0		
		10		**54**	U	660	0.0030													119	78430
*	Along Frier to Grand		23230					1126.0	**108**	1135.06	1134.35	1130.64	3.7	ok	1134.35	***1135.06***	***1142***	ok	16.0		
																STORM DRAIN SYSTEM				*TOTAL*	$6,658,381
																WITH CONTINGENCY				40 %	***$9,321,734***
	City of Glendale																				
		11		**48**	R	1320	0.0038													91	120175
	Along 65th to Northern		24550					1131.0	**71**	1138.05	1137.55	1135.10	2.5	ok	1137.55	***1138.05***	***1145***	ok	14.0		
		12		**60**	U	1320	0.0038													132	174517
	Northern 67th to 65th		25870					1136.0	**111**	1140.44	1139.94	1141.10	-1.2	ocf	1141.10	***1141.60***	***1143***	ok	7.0		
		13		**36**	R	1320	0.0008													83	109841
	Northern 63rd to 65th		1320					1132.0	**42**	1143.30	1142.75	1135.11	7.6	ok	1142.75	***1143.30***	***1147***	ok	15.0		
																STORM DRAIN SYSTEM				*TOTAL*	$404,533
																WITH CONTINGENCY				40 %	***$566,346***
	ADOT (Grand Avenue)																				
		14		**54**	U	1880	0.0021													119	223407
	Grand Ave 63rd to 65th		1880					1130.0	**117**	1141.81	1140.97	1134.67	6.3	ok	1140.97	***1141.81***	***1145***	ok	15.0		
																STORM DRAIN SYSTEM				*TOTAL*	$223,407
																WITH CONTINGENCY				40 %	***$312,770***

Note: R = Rural Section
U = Urban Section

REVISED COSTS OF EAST BASIN:

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
39 AC(+/-) BASIN	LAND	39	$56,400	$2,199,600
BASIN EXCAVATION	CY	650,000	$3	$1,950,000
BASIN TOTAL				*$4,149,600*

COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
Frier Dr - 65th Ave to 66th Av	9,900	$1.03	$10,227
66th Ave - Frier to Orangewo	19,800	$1.03	$20,453
83rd Ave to AFF Channel	264,000	$0.37	$98,050
RIGHT OF WAY TOTAL			*$128,730*

STORM DRAIN W/CONTINGENCIES	***$10,201,000***
BASIN AND RIGHT OF WAY TOTAL	***$4,278,000***
GRAND TOTAL	***$14,479,000***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

TABLE

Option 2B: Glendale Watershed Storm Drain System (with East Basin)

& Open Channel Between 91st Avenue and the Agua Fria Freeway Channel

15-Mar-96

10:10 AM

ORANGEWOOD AVENUE STORM DRAIN ALIGNMENT
(SEE PLATE II-1)

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2vel hd	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	CHECK NAT GRND W/EGL (c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
Orangewood Alignment																				
AFF Channel Outlet		0					1070.0		1074.00	1074.00				1074.00	***1074.00***	***1081***	ok	11.0		
Open Channel	1		Trap	R	4750	0.0007													219	1,040,250
91 st Ave		4750					1073.5	**583**	1077.50	1077.50	1077.50	0.0	ok	1077.50	***1077.92***	***1085***	ok	11.5		
	2		102	R	2640	0.0009													259	683944
87th Ave		7390					1076.0	**562**	1086.25	1084.73	1084.80	-0.1	ok	1084.80	***1086.33***	***1088***	ok	12.0		
	3		90	R	2640	0.0063													220	581578
83rd Ave		10030					1092.5	**492**	1097.46	1095.53	1100.39	-4.9	ocf	1100.39	***1102.31***	***1106***	ok	13.5		
	4		90	R	2640	0.0019													220	581578
79th Ave		12670					1097.5	**443**	1105.85	1104.29	1105.31	-1.0	ocf	1105.31	***1106.87***	***1114***	ok	16.5		
	5		90	U	2640	0.0021													252	665911
75th Ave		15310					1103.0	**412**	1113.21	1111.86	1110.77	1.1	ok	1111.86	***1113.21***	***1121***	ok	18.0		
	6		84	U	2640	0.0019													229	604577
71st Ave		17950					1108.0	**374**	1122.34	1120.87	1115.29	5.6	ok	1120.87	***1122.34***	***1127***	ok	19.0		
	7		78	U	2640	0.0038													175	460714
67th Ave		20590					1118.0	**236**	1126.99	1126.20	1124.66	1.5	ok	1126.20	***1126.99***	***1130***	ok	12.0		
	8		60	R	660	0.0015													110	72592
66th Ave		21250					1119.0	**179**	1130.60	1129.31	1124.26	5.0	ok	1129.31	***1130.60***	***1138***	ok	19.0		
Alignment as Noted	9		54	R	1320	0.0038													98	129360
Along 66th to Frier		22570					1124.0	**108**	1133.98	1133.27	1128.64	4.6	ok	1133.27	***1133.98***	***1140***	ok	16.0		
	10		54	U	660	0.0030													119	78430
Along Frier to Grand		23230					1126.0	**108**	1135.96	1135.25	1130.64	4.6	ok	1135.25	***1135.96***	***1142***	ok	16.0		
															STORM DRAIN SYSTEM				*TOTAL*	$4,898,933
															WITH CONTINGENCY				40 %	***$6,858,506***
City of Glendale																				
	11		48	R	1320	0.0038													91	120175
Along 65th to Northern		24550					1131.0	**71**	1138.95	1138.45	1135.10	3.4	ok	1138.45	***1138.95***	***1145***	ok	14.0		
	12		60	U	1320	0.0038													132	174517
Northern 67th to 65th		25870					1136.0	**111**	1141.34	1140.84	1141.10	-0.3	ok	1141.10	***1141.60***	***1143***	ok	7.0		
	13		36	R	1320	0.0008													83	109841
Northern 63rd to 65th		27190					1132.0	**42**	1144.20	1143.65	1135.11	8.5	ok	1143.65	***1144.20***	***1147***	ok	15.0		
															STORM DRAIN SYSTEM				*TOTAL*	$404,533
															WITH CONTINGENCY				40 %	***$566,346***
ADOT (Grand Avenue)																				
	14		54	U	1880	0.0021													119	223407
Grand Ave 63rd to 65th		1880					1130.0	**117**	1142.71	1141.87	1134.67	7.2	ok	1141.87	***1142.71***	***1145***	ok	15.0		
															STORM DRAIN SYSTEM				*TOTAL*	$223,407
															WITH CONTINGENCY				40 %	***$312,770***

Note: R = Rural Section
U = Urban Section

REVISED COSTS OF EAST BASIN:

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
39 AC(+/-) BASIN	LAND	39	$56,400	$2,199,600
BASIN EXCAVATION	CY	650,000	$3	$1,950,000
BASIN TOTAL				***$4,149,600***

COSTS OF STORM DRAIN RIGHT OF WAY PURCHASE:

DESCRIPTION	*AREA SF*	*UNIT COST*	*COST*
Frier Dr - 65th Ave to 66th Ave	9,900	$1.03	$10,197
66th Ave - Frier to Orangewood	19,800	$1.03	$20,394
83rd Ave to AFF Channel	528,000	$0.37	$196,099
RIGHT OF WAY TOTAL			***$226,690***

STORM DRAIN W/CONTINGENCIES	***$7,738,000***
BASIN AND RIGHT OF WAY TOTAL	***$4,376,000***
GRAND TOTAL	***$12,114,000***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appears here.

TABLE II-8

Glendale Avenue Alignment, Glendale Watershed Storm Drain System

SAME AS ORANGEWOOD AVE ALIGNMENT WITH WEST BASIN OPTION DOWNSTREAM TO 83RD AVENUE
THEN SOUTH ON 83RD AVE TO GLENDALE AVE AND WEST ON GLENDALE AVE TO THE AFF CHANNEL

14-Mar-96

SEE PLATE II-3

10:47 AM

Manning's "n"= 0.013

STORM SEWER LINE STATION LOCATION	PIPE #	STATION	PIPE DIA (in)		REACH LENGTH (ft)	SLOPE OF REACH (ft/ft)	INVERT ELEV (ft)	DESIGN Q (cfs)	PREL GRADE LINE ELEV ENERGY	PREL GRADE LINE ELEV HYDRAULIC	CHECK D+INV +.2 v^2/2g	(a)	(b)	CONTROL HGL	CONTROL EGL	NATURAL GROUND ELEVATION	(c)	DEPTH TO INVERT	PIPE UNIT PRICE $	PIPE COST $
Glendale Ave Alignment																				
AFF Cha Outlet @ 98th Ave.		0					1052.0		1060.00	1060.00				1060.00	***1060.00***	***1067***	ok	15.0		
	41		**102**	U	2100	0.0019													294	616963
95 th Ave		2100					1056.0	**483**	1065.37	1064.25	1064.73	-0.5	ok	1064.73	***1065.85***	***1068***	ok	12.0		
	42,43		**90**	U	8000	0.0034													252	2017912
83rd Ave @ Glendale		10100					1083.0	**451**	1093.37	1091.75	1090.82	0.9	ok	1091.75	***1093.37***	***1095***	ok	12.0		
	44		**66**	U	2640	0.0036													145	381784
83rd Ave @ Orangewood		12740					1092.5	**221**	1104.47	1103.13	1098.27	4.9	ok	1103.13	***1104.47***	***1106***	ok	13.5		
Orangewood Alignment			**66**	R	2640	0.0019													121	319450
79th Ave	**4**	15380					1097.5	**176**	1111.20	1110.35	1103.17	7.2	ok	1110.35	***1111.20***	***1114***	ok	16.5		
			60	U	2640	0.0021													132	349034
75th Ave	**5**	18020					1103.0	**127**	1117.25	1116.60	1108.13	8.5	ok	1116.60	***1117.25***	***1121***	ok	18.0		
			54	U	2640	0.0019													119	313720
71st Ave	**6**	20660					1108.0	**94**	1123.14	1122.60	1112.61	10.0	ok	1122.60	***1123.14***	***1127***	ok	19.0		
			48	U	1320	0.0030													110	145842
69th Ave	**7**	21980					1112.0	**68**	1125.99	1125.54	1116.09	9.4	ok	1125.54	***1125.99***	***1130***	ok	18.0		
			126	R	1980	0.0020													345	683001
66th Ave	**8**	23960					1116.0	**1035**	1133.72	1131.50	1126.94	4.6	ok	1131.50	***1133.72***	***1138***	ok	22.0		
Alignment as Noted			**126**	R	1320	0.0030													345	455334
Along 66th to Frier	**9**	25280					1120.0	**1017**	1137.48	1135.34	1130.93	4.4	ok	1135.34	***1137.48***	***1140***	ok	20.0		
			126	U	660	0.0015													384	253334
Along Frier to Grand	**10**	25940					1121.0	**1017**	1139.40	1137.26	1131.93	5.3	ok	1137.26	***1139.40***	***1142***	ok	21.0		
																			TOTAL	$5,536,375
															STORM DRAIN SYSTEM WITH CONTINGENCY				40 %	***$7,750,924***
City of Glendale																				
			126	R	1320	0.0030													345	455334
Along 65th to Northern	**11**	27260					1125.0	**767**	1140.66	1139.44	1135.74	3.7	ok	1139.44	***1140.66***	***1145***	ok	20.0		
			60	U	1320	0.0076													132	174517
67th Ave to 65th Ave	**12**	28580					1135.0	**110**	1142.28	1141.79	1140.10	1.7	ok	1141.79	***1142.28***	***1143***	ok	8.0		
			114	U	1320	0.0045													345	456008
65th Ave to 63rd Ave	**13**	1320					1131.0	**660**	1143.55	1142.20	1140.77	1.4	ok	1142.20	***1143.55***	***1147***	ok	16.0		
																			TOTAL	$1,085,859
															STORM DRAIN SYSTEM WITH CONTINGENCY				40 %	***$1,520,203***
ADOT (Grand Avenue)																				
			60	U	1880	0.0048													132	248554
65th Ave to 63rd Ave	**14**	1880					1130.0	**116**	1141.51	1140.97	1135.11	5.9	ok	1140.97	***1141.51***	***1145***	ok	15.0		
																			TOTAL	$248,554
															STORM DRAIN SYSTEM WITH CONTINGENCY				40 %	***$347,976***

Note: R = Rural Section
U = Urban Section

COST OF WEST BASIN PER PURCHASE PRICE:

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
35 AC BASIN	LAND	36.92	$42,253	$1,559,988
BASIN EXCAVATION	CY	486,000	$3	$1,458,000

BASIN TOTAL ***$3,018,000***

COST OF STORM DRAIN RIGHT OF WAY PURCHASE:

DESCRIPTION	*AREA SF*	*UNIT COS*	*COST*
65th Ave - Northern to Frier Dr	26,400	$1.03	$27,271
Frier Dr - 65th Ave to 66th Ave	13,200	$1.03	$13,636
66th Ave - Frier to Orangewoo	26,400	$1.03	$27,271

RIGHT OF WAY TOTAL ***$68,000***

COST OF MODIFYING AFF OUTFALL CHANNEL

DESCRIPTION	*ITEM*	*UNIT*	*UNIT COST*	*COST*
Glendale Ave to	Lining SF	60,768	$3	$182,304
Bethany Home Road	Excav CY	24,906	$3	$74,718
AFF CHANNEL MODIFICATION TOTAL				***$257,022***

STORM DRAIN W/CONTINGENCIES	***$9,619,000***
BASIN, R/W AND AFF CHANNEL TOTAL	***$3,343,000***
GRAND TOTAL	***$12,962,000***

Only major friction losses have been considered in the computation of the hydraulic grade line. Minor losses have been ignored.
(a) This column depicts the diffference between the calculated hydraulic grade & the elevation of (top of pipe + 0.2 v^2/2g)
(b) If HGL is significantly lower than the top of pipe elevation, open channel flow may exist, "ocf" statement then appears here.
(c) If natural ground is lower than EGL, "pb" statement appear here.

TABLE II-9

03/06/96

PIPE UNIT COSTS (a) :

NORTHERN/ORANGEWOOD PROJECT

ESTIMATED UNIT COSTS

INPUT RECEIVED FROM HYDRO-CONDUIT/PULICE CONSTRUCTION

PIPE SIZE ft	PIPE SIZE inches	USE MATERIAL COST JAN 1996	PIPE CONDUIT URBAN SECTION BEDDING CY	BEDDING COST @ 10.23	EXPORT DIRT CY	HAUL COST @ 2	PVMT REPLACE SY	PVMT REPLACE @ 25	(a) TOTAL COST INCLUDING TRENCHING @ $35 TO $45	RURAL SECTION TOTAL COST including TRENCHING @ $35 TO $45
2.0	24	30	0.35	4	0.47	1	0.6	14	$83	$69
2.5	30	36	0.41	4	0.59	1	0.6	15	$92	$76
3.0	36	42	0.47	5	0.73	1	0.7	17	$100	$83
3.5	42	45	0.52	5	0.88	2	0.7	18	$105	$87
4.0	48	48	0.58	6	1.05	2	0.8	19	$110	$91
4.5	54	54	0.64	7	1.23	2	0.8	21	$119	$98
5.0	60	65	0.70	7	1.42	3	0.9	22	$132	$110
5.5	66	75	0.76	8	1.64	3	0.9	24	$145	$121
6.0	72	85	0.81	8	1.86	4	1.0	25	$157	$132
6.5	78	100	0.87	9	2.10	4	1.1	26	$175	$148
7.0	84	125	2.09	21	3.52	7	1.2	31	$229	$198
7.5	90	145	2.21	23	3.85	8	1.3	32	$252	$220
8.0	96	165	2.33	24	4.19	8	1.3	33	$276	$242
8.5	102	180	2.44	25	4.54	9	1.4	35	$294	$259
9.0	108	195	2.56	26	4.91	10	1.4	36	$312	$276
9.5	114	225	2.67	27	5.30	11	1.5	38	$345	$308
10.0	120	260	2.79	29	5.70	11	1.6	39	$384	$345
11.0	132	308	3.02	31	6.54	13	1.7	42	$439	$397
12.0	144	350	3.26	33	7.44	15	1.8	44	$488	$443

(a) COSTS RELATED TO TRAFFIC,MAJOR UTILITY RELOCATION/CONFLICT,MAJOR INTERSECTIONS ETC. ARE NOT INCLUDED IN THIS ESTIMATE.
TRENCHING DEPTH IS ASSUMED TO BE 20'(ave)

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TABLE II-10

03/06/96

ESTIMATE FOR CONSTRUCTION CONTINGENCIES

ITEM	*ENGINEER'S ESTIMATES*	
120" PIPE UNIT COST;COST FOR L=6847'	$694	$4,501,978
TOTAL PROJECT COST		***$5,030,547***
CONTINGENCIES		11.74

BID TABULATIONS ON CACTUS ROAD STORM DRAIN PROJECT

DATA PROVIDED BY FCDMC *BID DATE: FEB 2,95*

ITEM	*SUNDT*		*McGRAND*		*BENTSON*		*CS & W*		*PULICE*		*PACIFIC*	
120" PIPE UNIT COST;COST FOR L=6847'	$336	$2,179,632	$366	$2,309,372	$356	$2,309,372	$367	$2,383,194	$432	$2,802,384	$410	$2,659,670
TOTAL PROJECT COST		***$2,724,700***		***$2,914,237***		***$2,988,572***		***$3,060,946***		***$3,329,170***		***$3,370,951***
CONTINGENCIES		25.01		26.19		29.41		28.44		18.80		26.74

ITEM	*BARNARD*		*CS McCROSSAN*		*PCL CIVIL*		*ACHEN*		*WHEELER*		*PIERSON*	
120" PIPE UNIT COST;COST FOR L=6847'	$460	$2,984,020	$439	$2,847,793	$413	$2,679,131	$486	$3,149,438	$478	$3,100,786	$576	$3,736,512
TOTAL PROJECT COST		***$3,477,892***		***$3,483,930***		***$3,548,342***		***$3,698,063***		***$3,687,270***		***$4,576,839***
CONSTRUCTION CONTINGENCIES		16.55		22.34		32.44		17.42		18.91		22.49

CONSTRUCTION CONTINGENCIES	***23.73 AVE ALL BIDS***

NOTE: ContIngencies include all other pertinent costs related to catch basins,trenching,mobilization, pavement replacement,utility relocations,manholes,misc removals, traffic, bedding, dirt export etc.

TABLE II-11

03/14/96
10:49 AM

NORTHERN/ORANGEWOOD ADMP FACILITIES COST ANALYSIS

This tabulation represents the cost analysis for the recommended ADMP facilities from the Glendale-Peoria ADMP. All data are taken from the ADMP, including pipe alignments, sizes, unit costs, basin sizes and land prices.

The primary purpose of this tabulation is to clarify the cost budgets and the City distribution of cost as presented in the ADMP. It should also be used as a yardstick for the cost comparison with the WPA Concept/Routing Study results.

PEORIA WATERSHED
COST ANALYSIS FROM GLENDALE-PEORIA ADMP

PIPE ID	STORM DRAIN LINE AND LOCATION	PIPE DIA (in)	REACH LENGTH (ft)	UNIT COST	COST	40% CONTINGENCY	TOTAL COST	% OF TOTAL COST
	CITY OF PEORIA							
185	91st Ave	72	2,640	$210	$554,400	$221,760	$776,160	
694	Northern Ave	60	1,320	$160	$211,200	$84,480	$295,680	
692	Northern Ave	54	2,640	$140	$369,600	$147,840	$517,440	
	STORM DRAIN TOTAL						**$1,589,000**	**7%**
	DETENTION BASIN							
	18 AC Basin and Improvements		18 Acres		$48,000	$864,000	$1,210,000	
	BASIN TOTAL						**$1,210,000**	**5%**
	PEORIA TOTAL						***$2,799,000***	***13%***

GLENDALE WATERSHED
COST ANALYSIS FROM GLENDALE-PEORIA ADMP

PIPE ID	STORM DRAIN LINE AND LOCATION	PIPE DIA (in)	REACH LENGTH (ft)	UNIT COST	COST	40% CONTINGENCY	TOTAL COST	% OF TOTAL COST
	ORANGEWOOD AVE ALIGNMENT							
180	99th Ave	102	1,960	$360	$705,600	$282,240	$987,840	
182	1/2 mi west of 91th Ave	108	2,640	$390	$1,029,600	$411,840	$1,441,440	
184	91st Ave	114	2,640	$420	$1,108,800	$443,520	$1,552,320	
186	1/2 mi west of 83th Ave	90	2,640	$290	$765,600	$306,240	$1,071,840	
188	83rd Ave	72	2,640	$210	$554,400	$221,760	$776,160	
190	1/2 mi west of 75th Ave	78	2,640	$235	$620,400	$248,160	$868,560	
192	75th Ave	84	2,640	$260	$686,400	$274,560	$960,960	
194	1/2 mi west of 67th Ave	72	2,640	$210	$554,400	$221,760	$776,160	
196,198	Orangewood & 67th Ave	144	5,280	$600	$3,168,000	$1,267,200	$4,435,200	
	STORM DRAIN TOTAL						**$12,870,000**	**58%**
	DETENTION BASIN							
	35 AC Basin and Improvements		35 Acres		$134,408	$4,704,280	$6,586,000	
	BASIN TOTAL						**$6,586,000**	**30%**
	GLENDALE TOTAL						***$19,456,000***	***87%***
	GLENDALE-PEORIA ADMP GRAND TOTAL						***$22,255,000***	***100%***

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TABLE II-12

NORTHERN/ORANGEWOOD ADMP VS RECOMMENDED OPTION FACILITIES: COST ANALYSIS COMPARISON

EXPANDED AREA

NORTHERN/ORANGEWOOD ADMP FACILITY

PEORIA WATERSHED COST ANALYSIS FROM GLENDALE-PEORIA ADMP

PIPE ID	STORM DRAIN LINE AND LOCATION	PIPE DIA (in)	REACH LENGTH (ft)	UNIT COST	COST	40% CONTINGENCY	TOTAL COST	PERCENT OF TOTAL COST
	CITY OF PEORIA							
185	91st Ave	72	2,640	$210	$554,400	$221,760	$776,160	
694	Northern Ave	60	1,320	$160	$211,200	$84,480	$295,680	
692	Northern Ave	54	2,640	$140	$369,600	$147,840	$517,440	
993	Northern Ave	120	1,320	$450	$594,000	$237,600	$831,600	
693	Butler Ave	42	3,900	$100	$390,000	$156,000	$546,000	
	STORM DRAIN TOTAL						**$2,967,000**	**11%**
	DETENTION BASIN							
	18 AC Basin and Improvements		18 Acres		$48,000	$864,000	$1,210,000	
	BASIN TOTAL						**$1,210,000**	**4%**
	PEORIA TOTAL						***$4,177,000***	**15%**

GLENDALE WATERSHED COST ANALYSIS FROM GLENDALE-PEORIA ADMP

PIPE ID	STORM DRAIN LINE AND LOCATION	PIPE DIA (in)	REACH LENGTH (ft)	UNIT COST	COST	40% CONTINGENCY	TOTAL COST	PERCENT OF TOTAL COST
	ORANGEWOOD AVE ALIGNMENT							
180	99th Ave	102	1,960	$360	$705,600	$282,240	$987,840	
182	1/2 mi west of 91th Ave	108	2,640	$390	$1,029,600	$411,840	$1,441,440	
184	91st Ave	114	2,640	$420	$1,108,800	$443,520	$1,552,320	
186	1/2 mi west of 83th Ave	90	2,640	$290	$765,600	$306,240	$1,071,840	
188	83rd Ave	72	2,640	$210	$554,400	$221,760	$776,160	
190	1/2 mi west of 75th Ave	78	2,640	$235	$620,400	$248,160	$868,560	
192	75th Ave	84	2,640	$260	$686,400	$274,560	$960,960	
194	1/2 mi west of 67th Ave	72	2,640	$210	$554,400	$221,760	$776,160	
196,198	Orangewood & 67th Ave	144	5,280	$600	$3,168,000	$1,267,200	$4,435,200	
209	1/2 mi west of 63rd Ave	120	2640	$450	$1,188,000	$475,200	$1,663,200	
281	Grand Ave	108	3700	$390	$1,443,000	$577,200	$2,020,200	
	STORM DRAIN TOTAL						**$16,554,000**	**61%**
	DETENTION BASIN							
	35 AC Basin and Improvements		35 Acres		$134,408	$4,704,280	$6,586,000	
	BASIN TOTAL						**$6,586,000**	**24%**
	GLENDALE TOTAL						***$23,140,000***	**85%**
	GLENDALE-PEORIA ADMP GRAND TOTAL						***$27,317,000***	**100%**

NORTHERN/ORANGEWOOD RECOMMENDED OPTION

PEORIA WATERSHED COSTS FROM WOOD/PATEL STUDY ANALYSIS

STORM DRAIN LINE	TOTAL COST	PERCENT OF TOTAL COST
Storm Drain Costs from Table II-2, Peoria Watershed Storm Drain System, Option B	**$1,525,000**	**10%**
Storm Drain R/W Costs from Table II-2, Peoria Watershed Storm Drain System, Option B	**$15,000**	**0.1%**
DETENTION BASIN		
Detention Basin Costs from Table II-2, Peoria Watershed Storm Drain System, Option B	**$1,305,500**	**9%**
PEORIA TOTAL	***$2,845,500***	**19%**

GLENDALE WATERSHED COSTS FROM WOOD/PATEL STUDY ANALYSIS

STORM DRAIN LINE	TOTAL COST	PERCENT OF TOTAL COST
Storm Sewer Costs from Table II-7, Glendale Watershed Storm Drain System, Option 2B	**$7,738,000**	**52%**
Storm Sewer R/W Costs from Table II-7, Glendale Watershed Storm Drain System, Option 2B	**$226,690**	**2%**
DETENTION BASIN		
Detention Basin Costs from Table II-7, Glendale Watershed Storm Drain System, Option 2B	**$4,149,600**	**28%**
GLENDALE TOTAL	***$12,114,290***	**81%**
GLENDALE-PEORIA ADMP GRAND TOTAL	***$14,959,790***	**100%**

TABLE 19

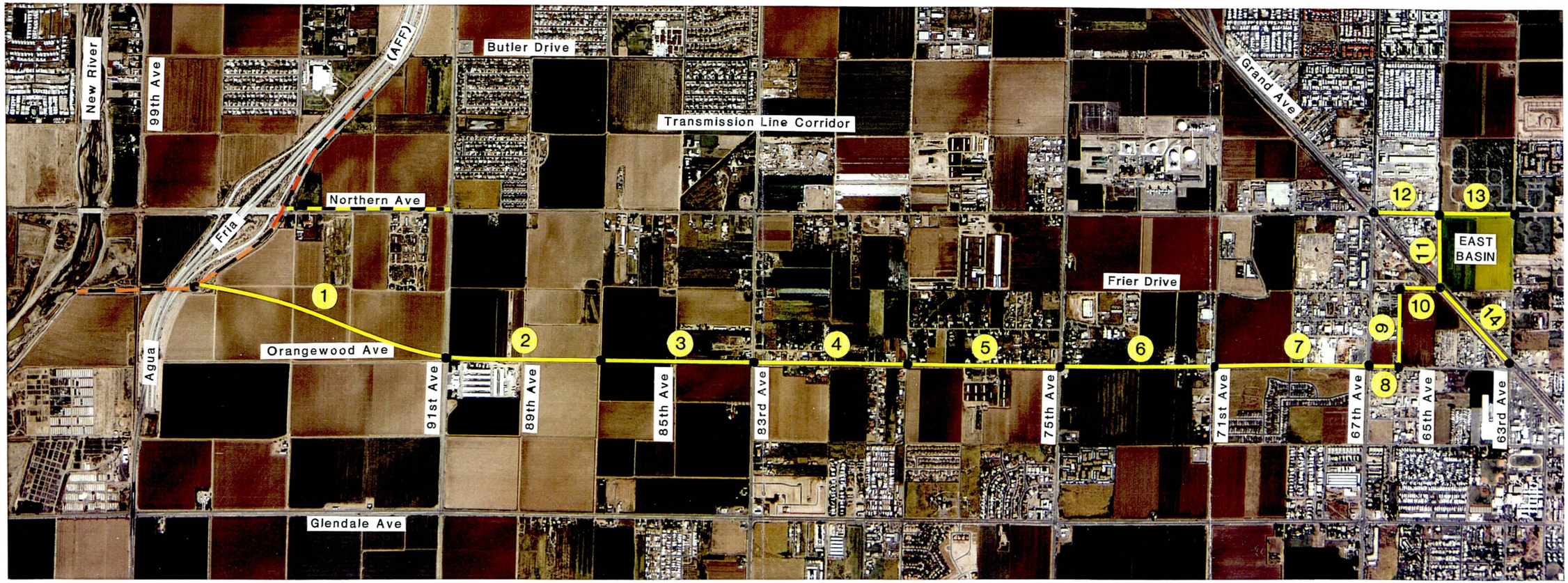
CAPITAL COSTS FOR SOUTH
PEORIA/GLENDALE PIPES

Pipe Size (ft)	Unit Price (dollars)	Total Length (ft)	Amount (dollars)
2.0	63	2640	166,000
2.5	71	9040	642,000
3.0	84	7080	595,000
3.5	100	22430	2,243,000
4.0	120	31500	3,780,000
4.5	140	41210	5,769,000
5.0	160	17530	2,805,000
5.5	185	19350	3,580,000
6.0	210	31620	6,640,000
6.5	235	26450	6,216,000
7.0	260	25220	6,557,000
7.5	290	14720	4,269,000
8.0	320	10560	3,379,000
8.5	360	1960	706,000
9.0	390	13820	5,390,000
9.5	420	7430	3,121,000
10.0	450	11700	5,265,000
12.0	600	5280	3,168,000
Subtotal			64,291,000
Engineering, legal, administration	(20%)		12,858,200
Contingencies	(20%)		12,858,200
TOTAL			90,007,400

NORTHERN/ORANGEWOOD STORM DRAIN PROJECT

CONCEPT/ROUTING STUDY

Contract FCD 94-12



LEGEND

Existing	Proposed
Storm Drain Pipe	Storm Drain Pipe
AFF Outlet Channel	Detention/Surge Basin
	4 Orangewood Avenue Storm Drain Pipe #

NOTE: See Pertinent Table II for Pipe #'s, Sizes and Flows.

N

½ Mile

ORANGEWOOD ALIGNMENT

WITH BASIN EAST OF GRAND AVENUE

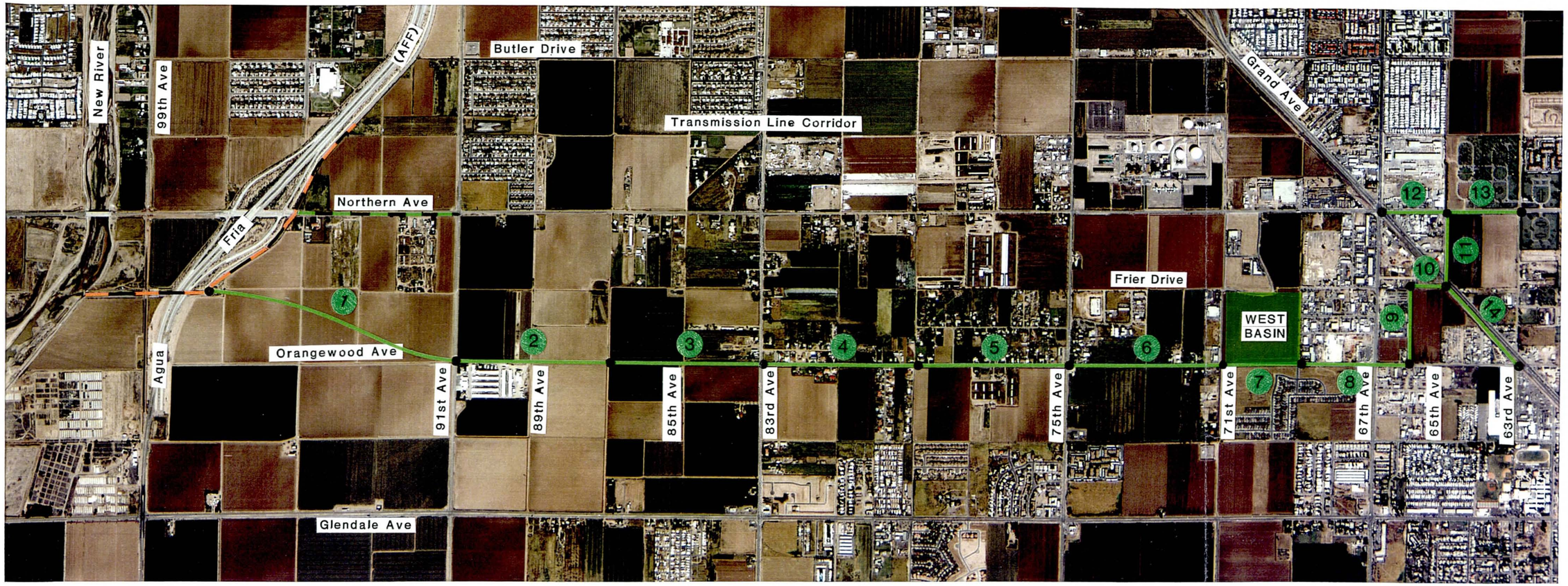
Wood, Patel & Associates, Inc.

PLATE II-1

NORTHERN/ORANGEWOOD STORM DRAIN PROJECT

CONCEPT/ROUTING STUDY

Contract FCD 94-12



LEGEND

Existing	Proposed
Storm Drain Pipe	Storm Drain Pipe
AFF Outlet Channel	Detention Surge Basin
	4 Orangewood Avenue Storm Drain Pipe #

NOTE: See Pertinent Table II for Pipe #'s, Sizes and Flows.

N

½ Mile

ORANGEWOOD ALIGNMENT

WITH BASIN WEST OF GRAND AVENUE

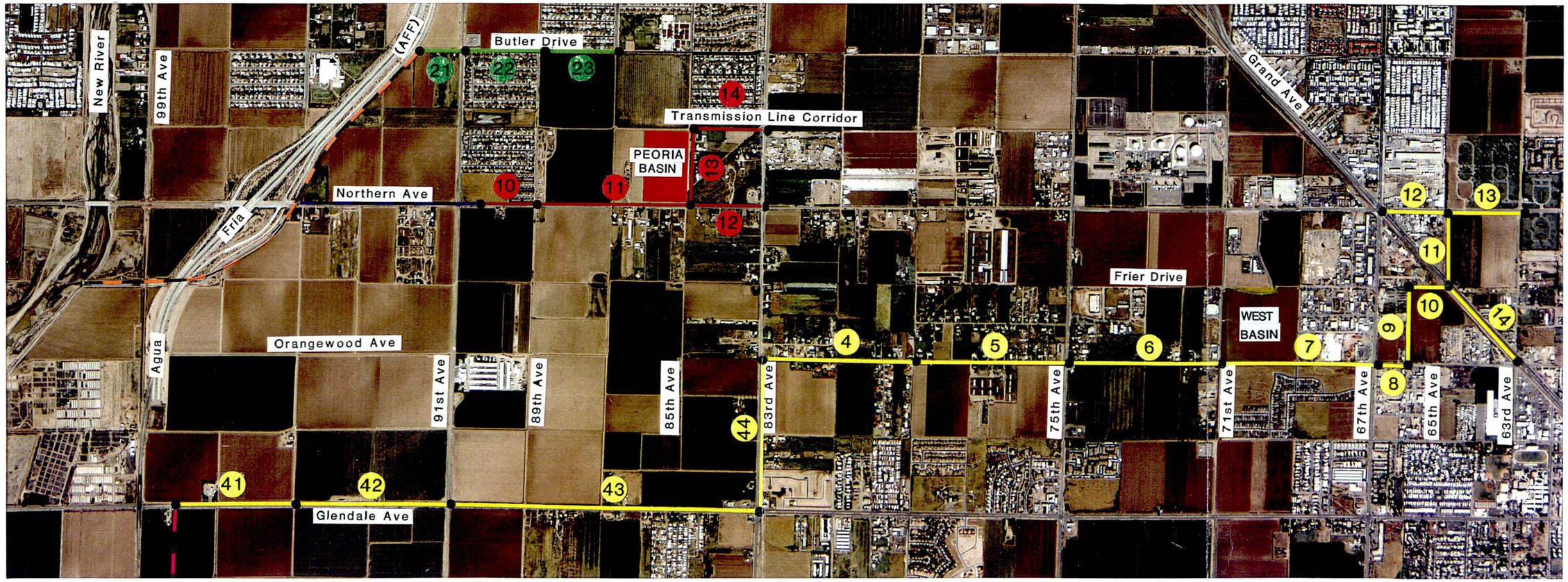
Wood, Patel & Associates, Inc.

PLATE II-2

NORTHERN/ORANGEWOOD STORM DRAIN PROJECT

CONCEPT/ROUTING STUDY

Contract FCD 94-12



LEGEND

Existing

- Storm Drain Pipe
- AFF Outlet Channel

NOTE: See Pertinent Table II for Pipe #'s, Sizes and Flows.

Proposed

- Storm Drain Pipe
- Detention/Surge Basin
- Future Outfall Channel
- 3 Butler Drive Storm Drain Pipe #
- 10 Northern Avenue Storm Drain Pipe #
- 44 Glendale Avenue Storm Drain Pipe #

N

½ Mile

BUTLER AVENUE, NORTHERN AVENUE AND GLENDALE AVENUE ALIGNMENTS

Wood, Patel & Associates, Inc.

PLATE II-3

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Stanley Smith, P.E., Acting Chief Engineer and General Manager

CONCEPT/ROUTING STUDY

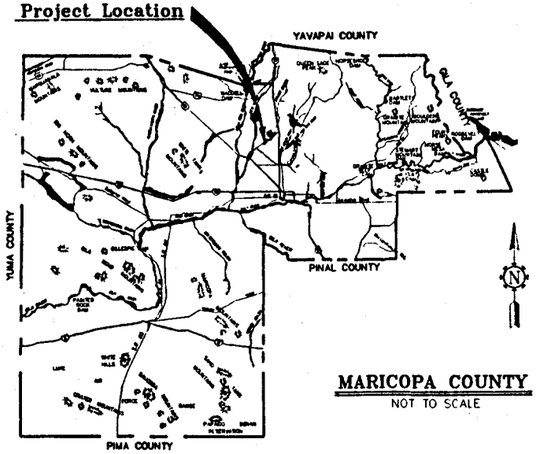
for

NORTHERN/ORANGEWOOD STORM DRAIN PROJECT

FCD 94-12

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

Project Location



MARICOPA COUNTY

NOT TO SCALE

PRELIMINARY
NOT FOR CONSTRUCTION
OR RECORDING

WOOD,PATEL & ASSOC., INC. 1550 EAST MISSOURI, SUITE 203 PHOENIX, ARIZONA (602)234-1344		
DESIGN	BY JGT	DATE 02-96
DESIGN CHK	ACP	02-96
PLANS	R REED	02-96
PLANS CHK.	ACP	02-96
SUBMITTED BY:		DATE:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Northern/Orangewood Storm Drain Project

NORTHERN/ORANGEWOOD STORMDRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

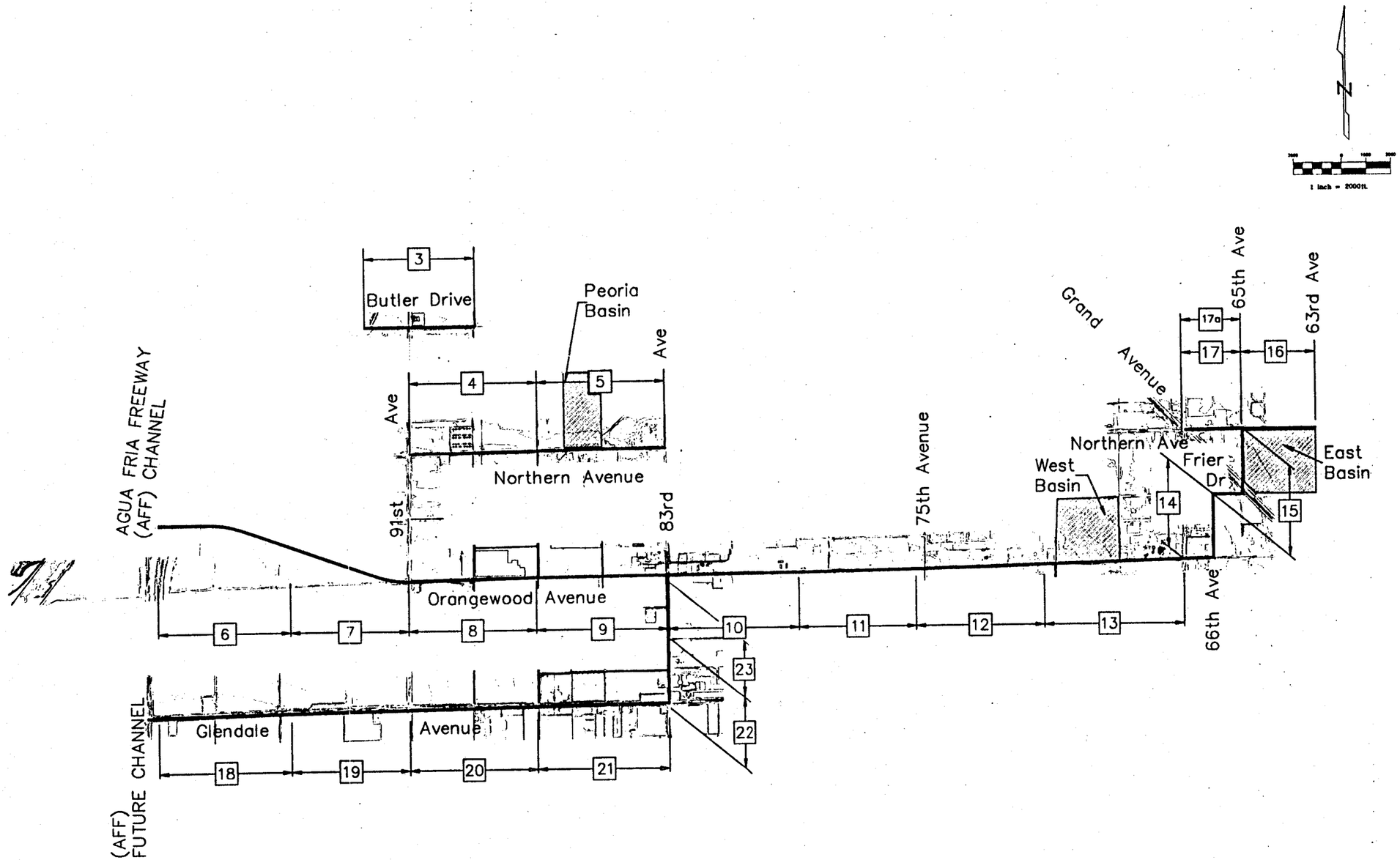
RECOMMENDED BY: DATE:

APPROVED BY: DATE:

CHIEF ENGINEER AND GENERAL MANAGER

SHEET 1 of 23

FILE NAME: 950112\0112COVER PROJ. # 94153.00



INDEX MAP

1 SHEET NUMBER

NO.	REVISION	BY	DATE
1			
2			
3			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	JGT	
DRAWN	R REED	
CHECKED	ACP	

WOOD,PATEL & ASSOC., INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602)234-1344

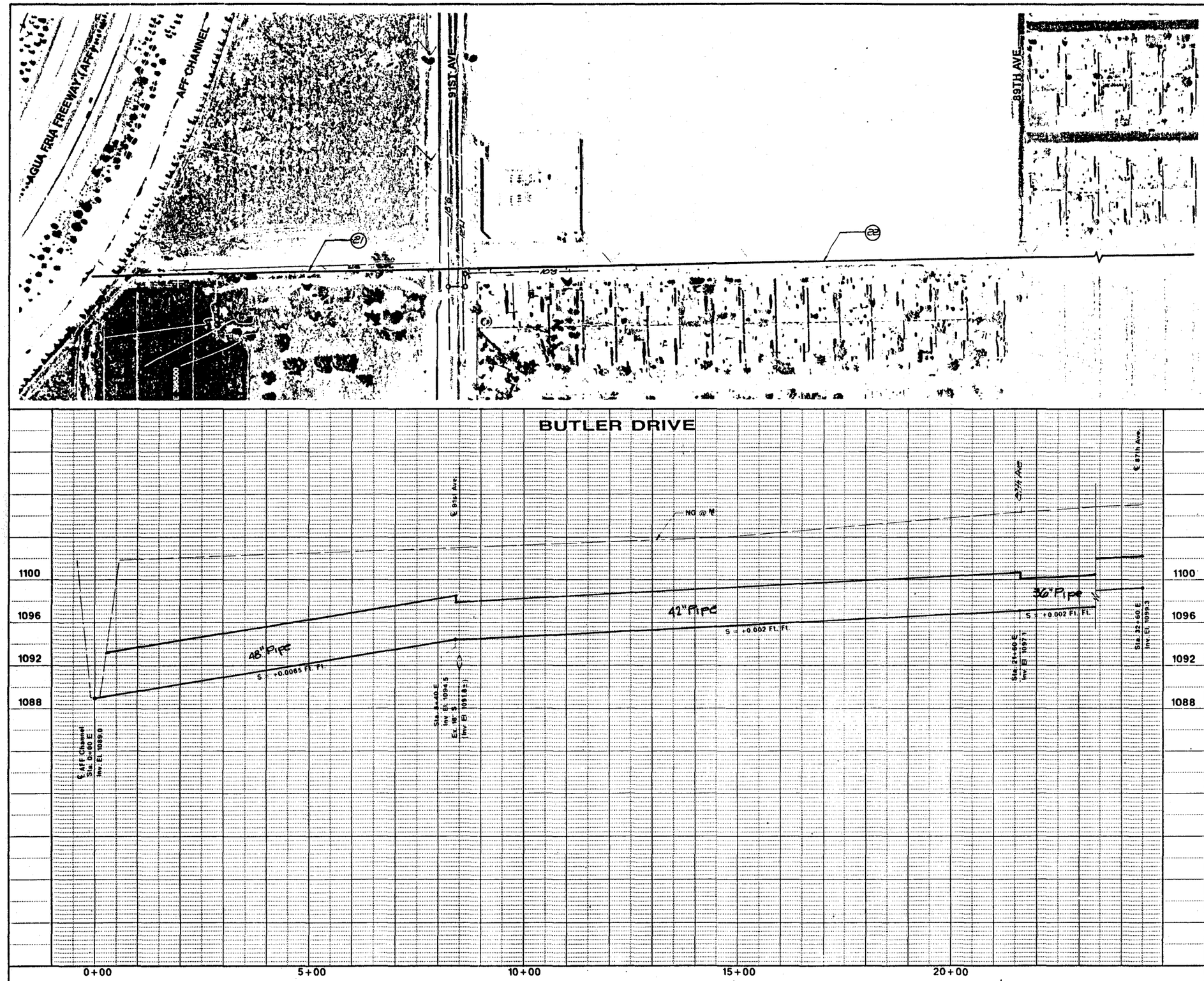
263-1100

WOOD/PATEL PROJECT NO. 94153.00

SHEET OF 2

TRACS NO.

PROJ. #94153.00 FILE NAME: N:\950112\



☐ REMOVE ☐

○ CONSTRUCT ○

21 Proposed Storm Drain Pipe Number

22 Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

N

Two working days before you dig
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

NO.	REVISION	DATE
3		
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

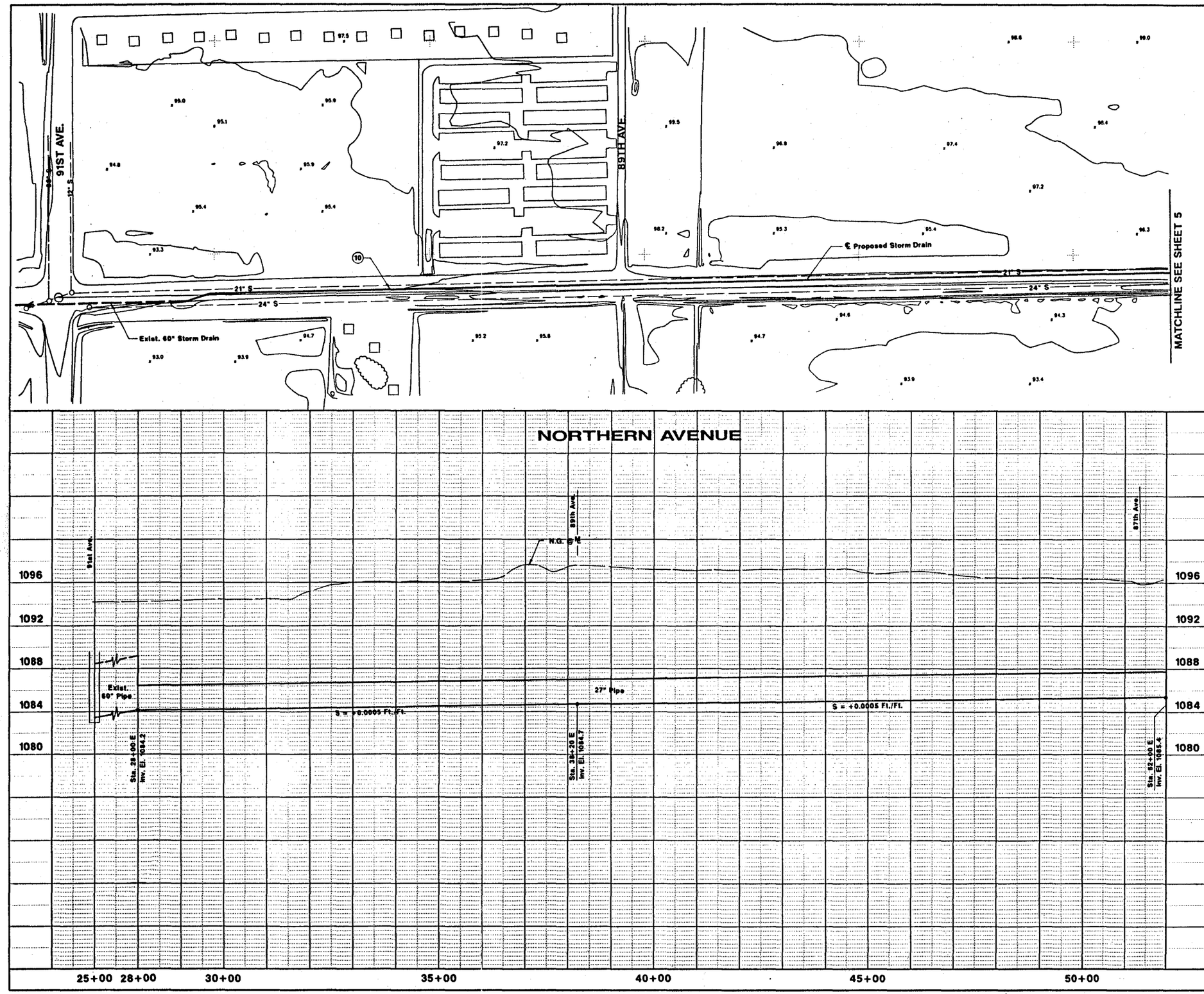
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 3



REMOVE

CONSTRUCT

(10) Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

CALL FOR THE BLUE STAKES
263-1100
CALL COLLECT

NO.	REVISION	DATE
3		
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

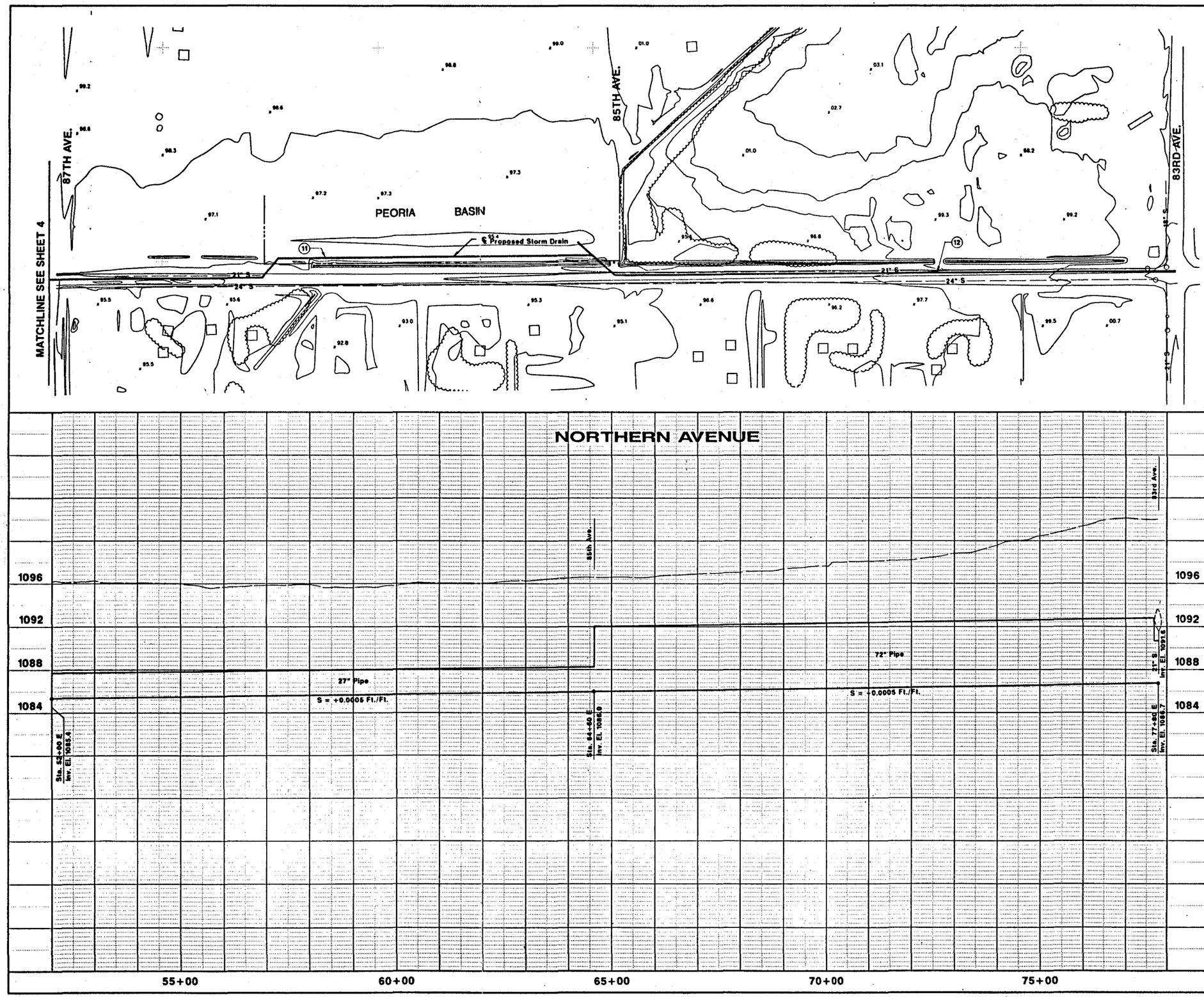
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 4



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○ CONSTRUCT ○

(11) Proposed Storm Drain Pipe Number

(12) Proposed Storm Drain Pipe Number

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Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

Two working days before you dig CALL FOR THE BLUE STAKES 263-1100 Maricopa County CALL COLLECT

NO.	REVISION		DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

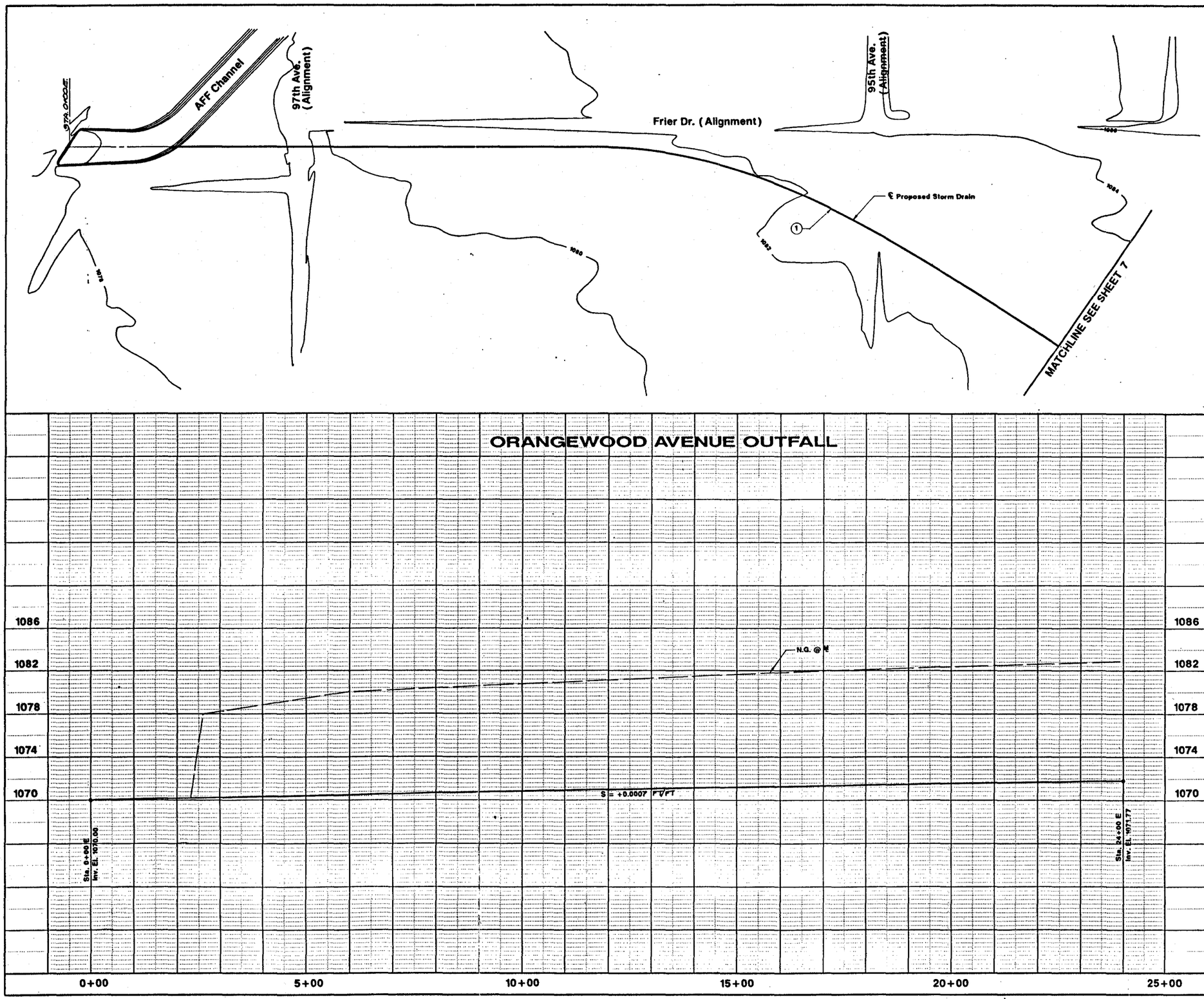
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 5



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○ CONSTRUCT ○

① Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

CALL TOP THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

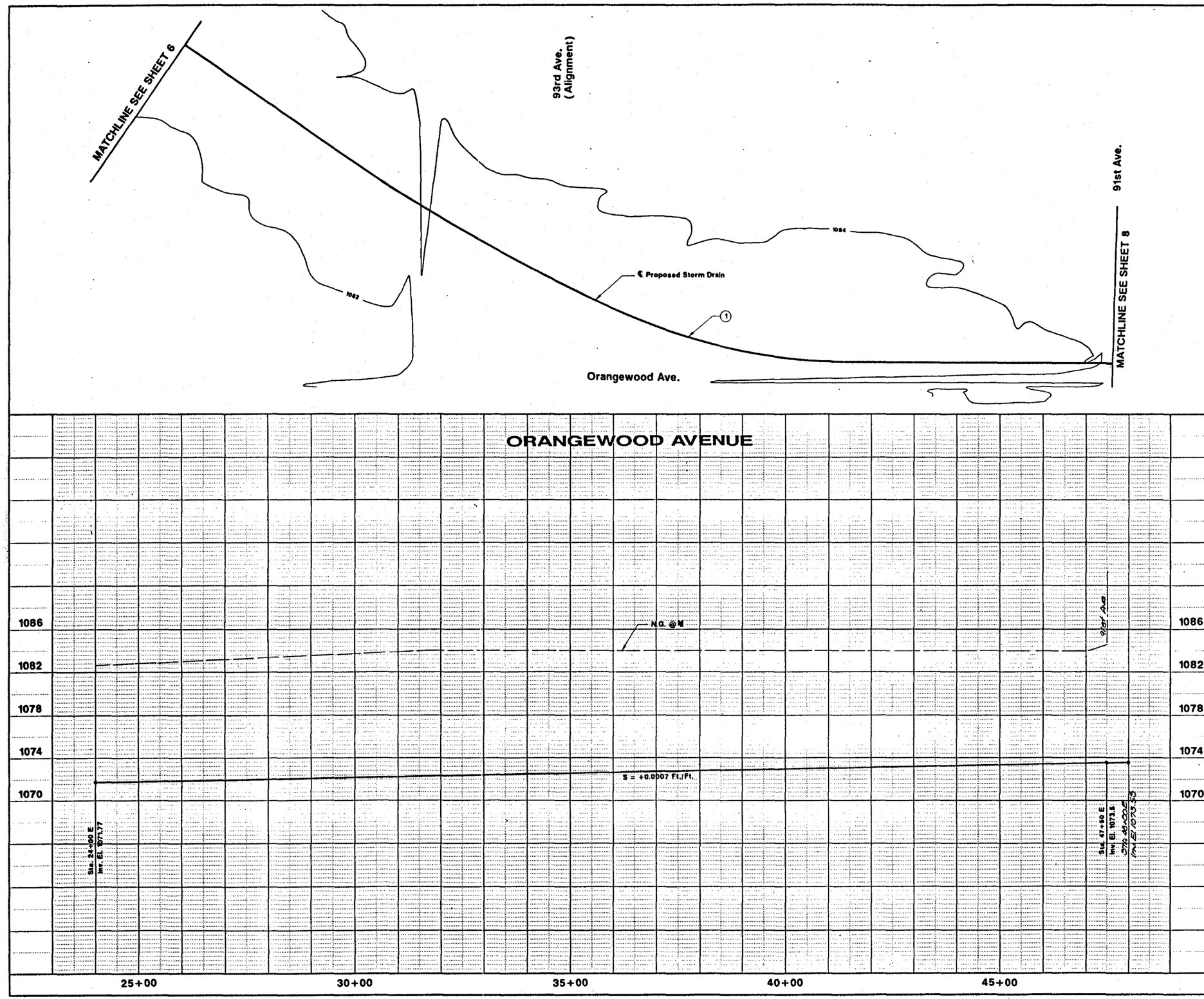
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 6



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○ CONSTRUCT ○

(1) Proposed Storm Drain Pipe Number

N

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Hor. Scale in Feet

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Vert. Scale in Feet

CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

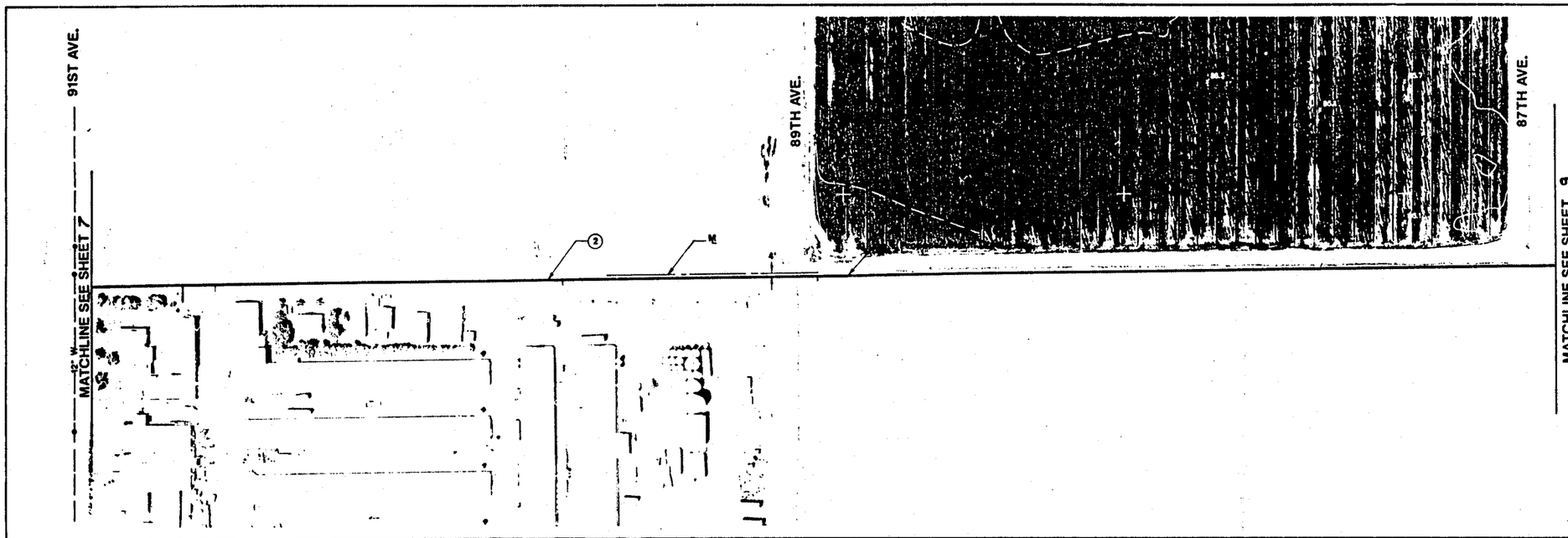
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 7



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○ CONSTRUCT ○

② Proposed Storm Drain Pipe Number

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Hor. Scale In Feet

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Vert. Scale In Feet

263-1100

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

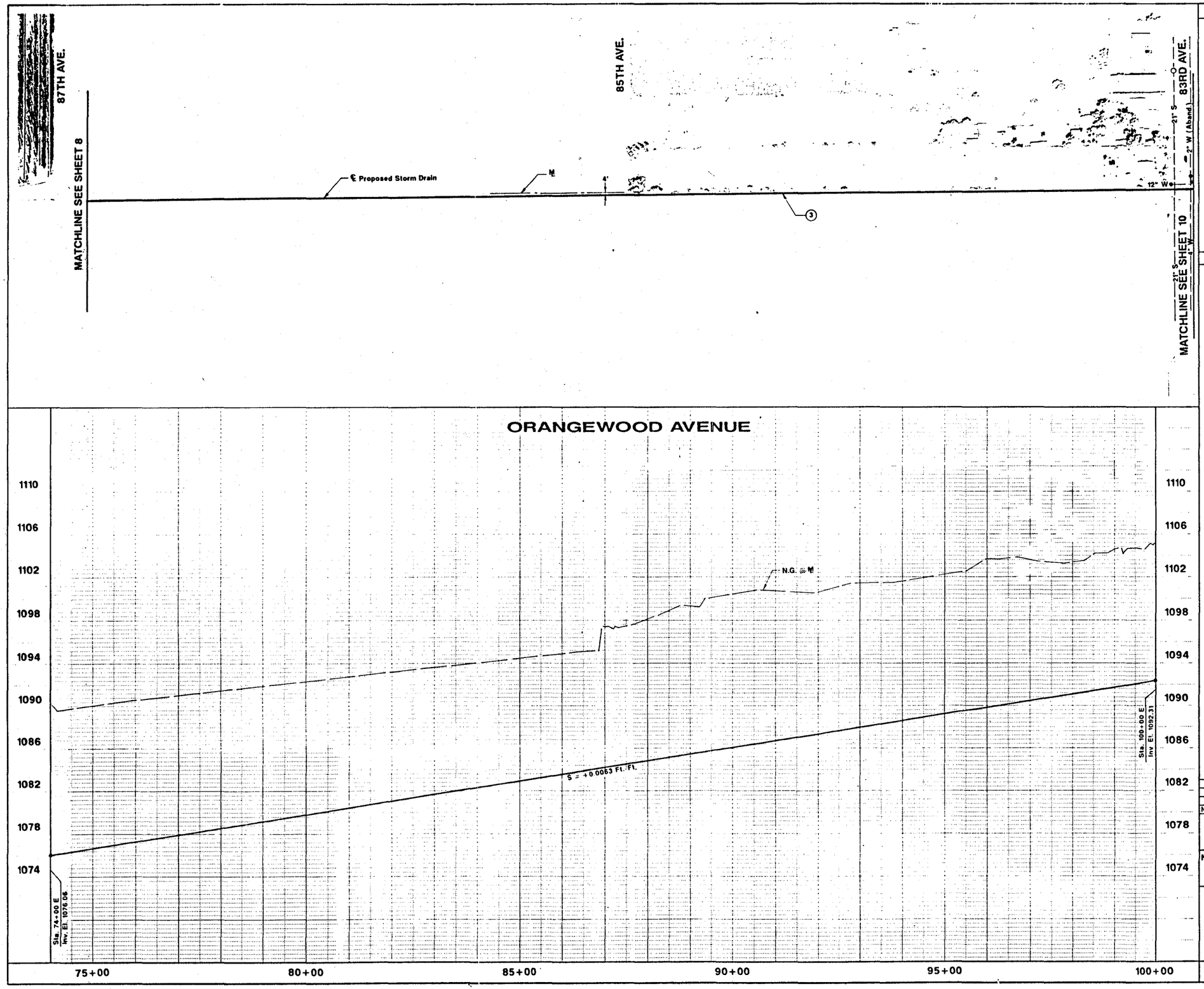
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 8



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○ CONSTRUCT ○

③ Proposed Storm Drain Pipe Number

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Hor. Scale In Feet

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Vert. Scale In Feet

263-1100

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

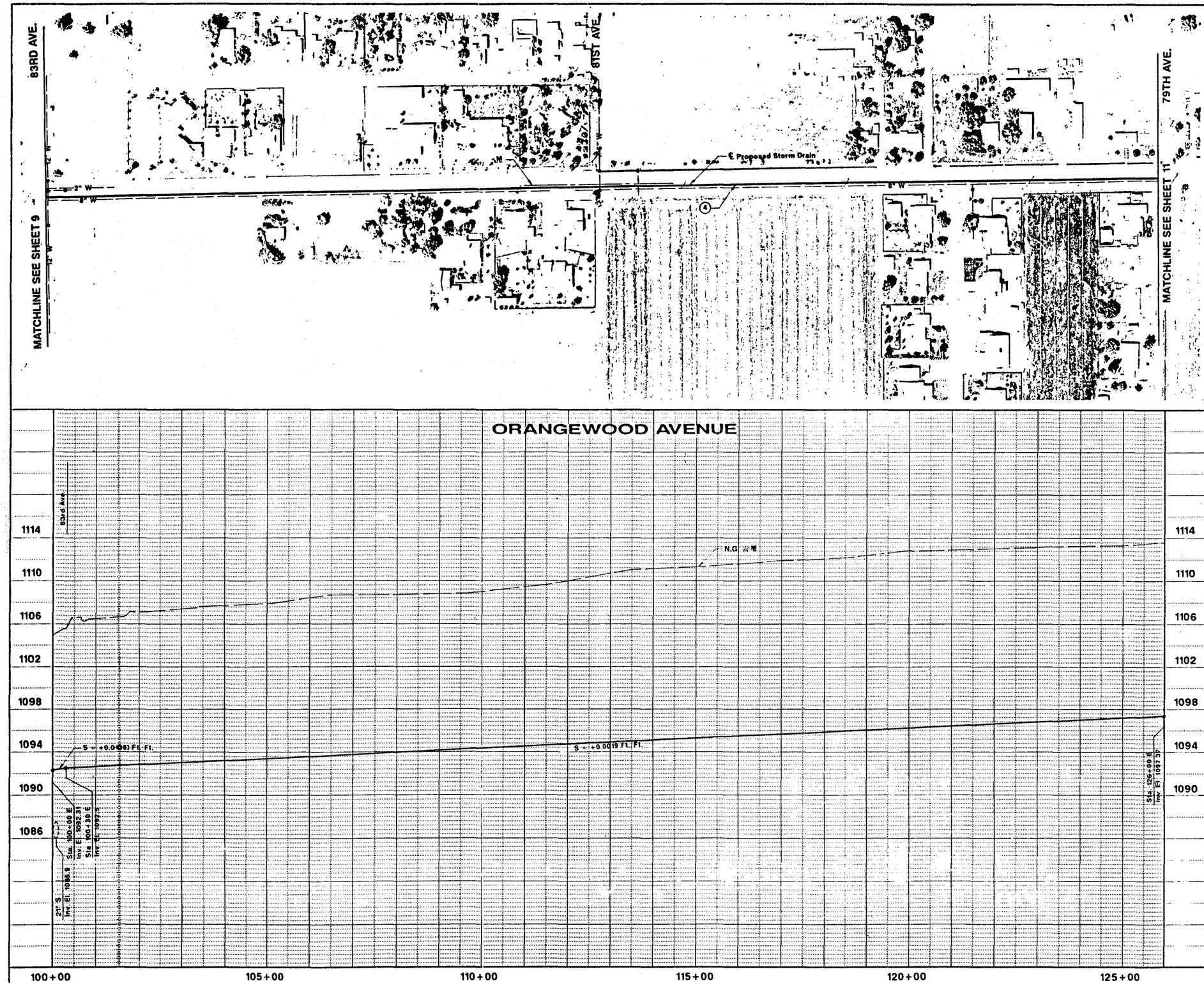
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1565 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 9



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○ CONSTRUCT ○

④ Proposed Storm Drain Pipe Number

N

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Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

263-1100

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

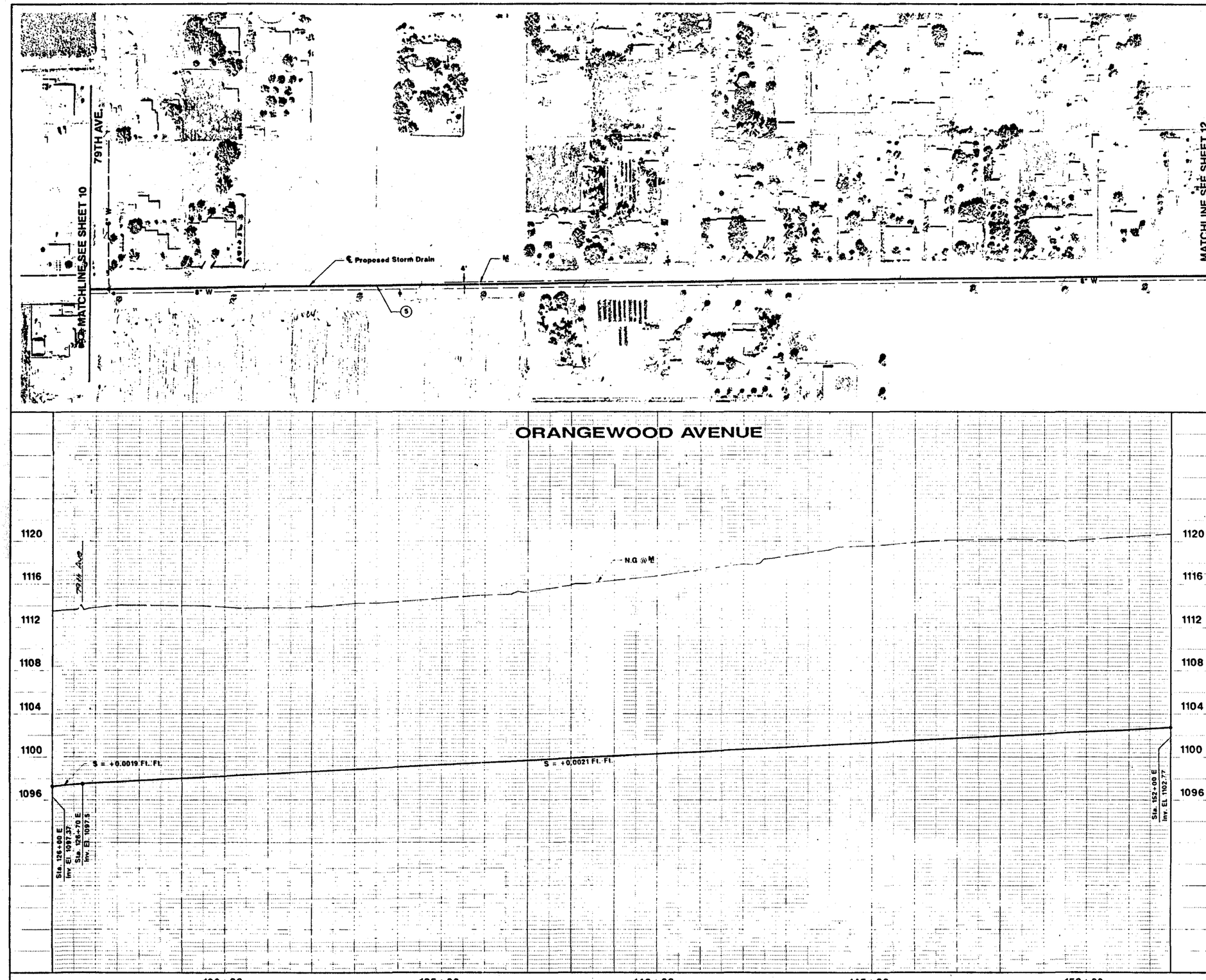
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 10



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○ CONSTRUCT ○

(5) Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

263-1100

NO.	REVISION	DATE
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

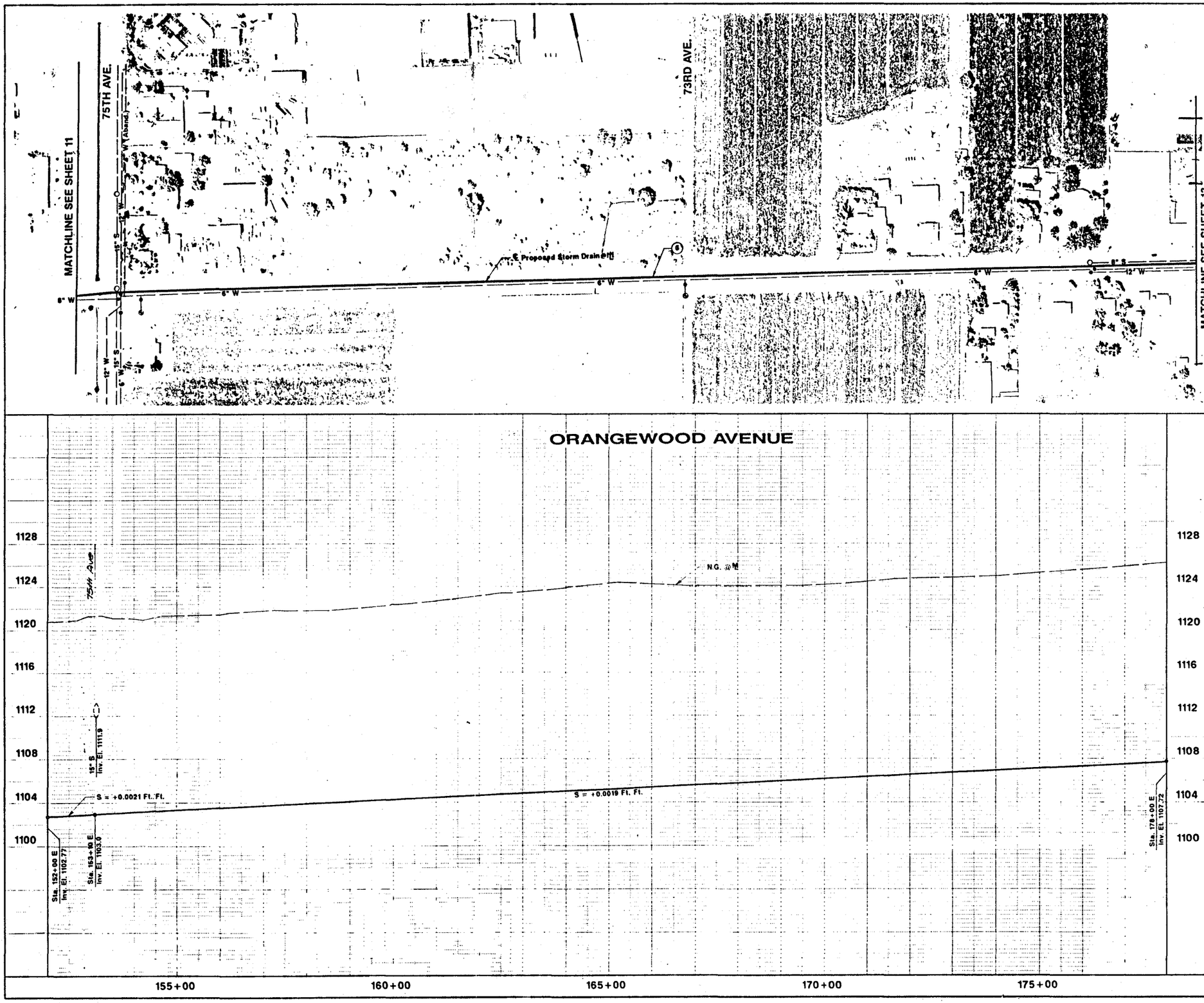
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHONEIX, ARIZONA (602)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 11



☐ REMOVE ☐

○ CONSTRUCT ○

6 Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale In Feet

2 0 2 4
Vert. Scale In Feet

263-1100

NO.	REVISION	DATE
3		
2		
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

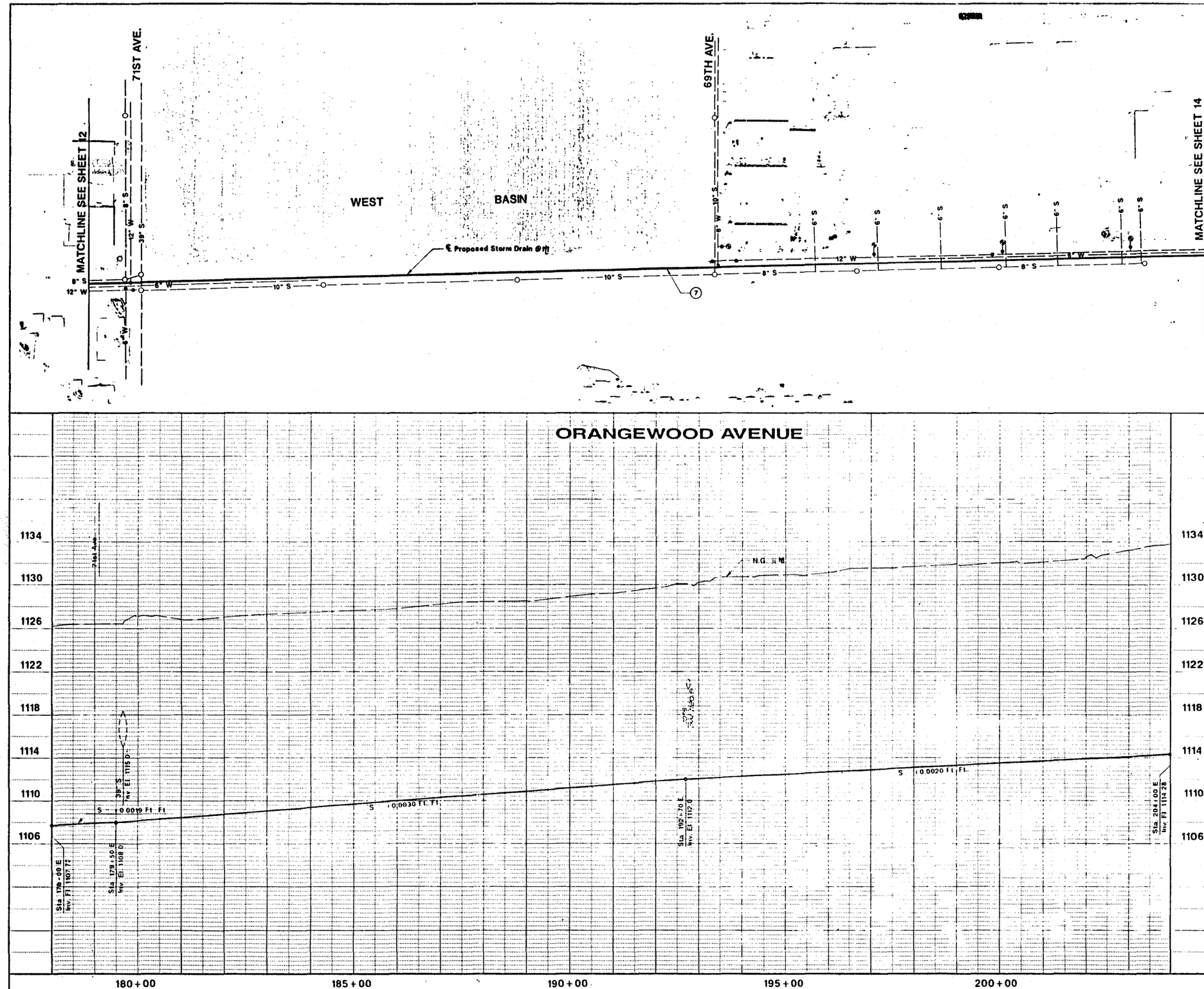
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2 96
CHECKED	ACP	2 96

WOOD, PATEL & ASSOCIATES, INC.
[illegible] EAST MOUNTAIN VIEW, SUITE 203
PHOENIX, ARIZONA [illegible]

WOOD/PATEL PROJECT NO. 94153.00

SHEET 12



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CONSTRUCT

⑦ Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale in Feet
2 0 2 4
Vert. Scale in Feet

263-1100

NO.	REVISION	DATE
3		
2		
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

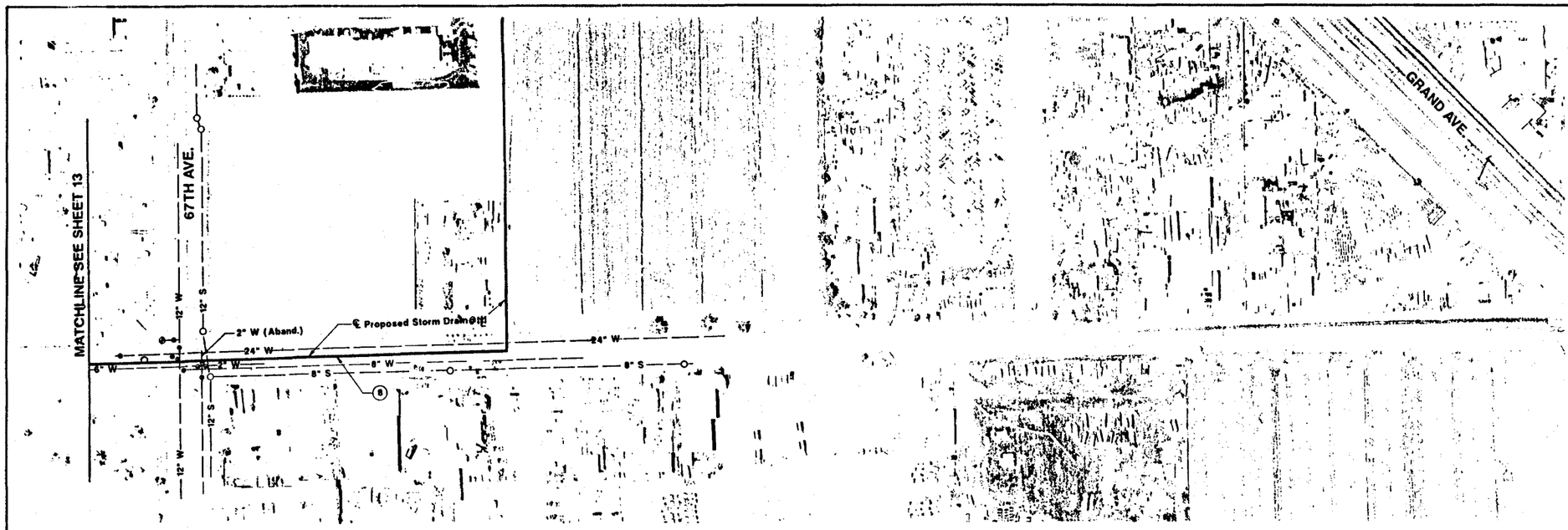
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

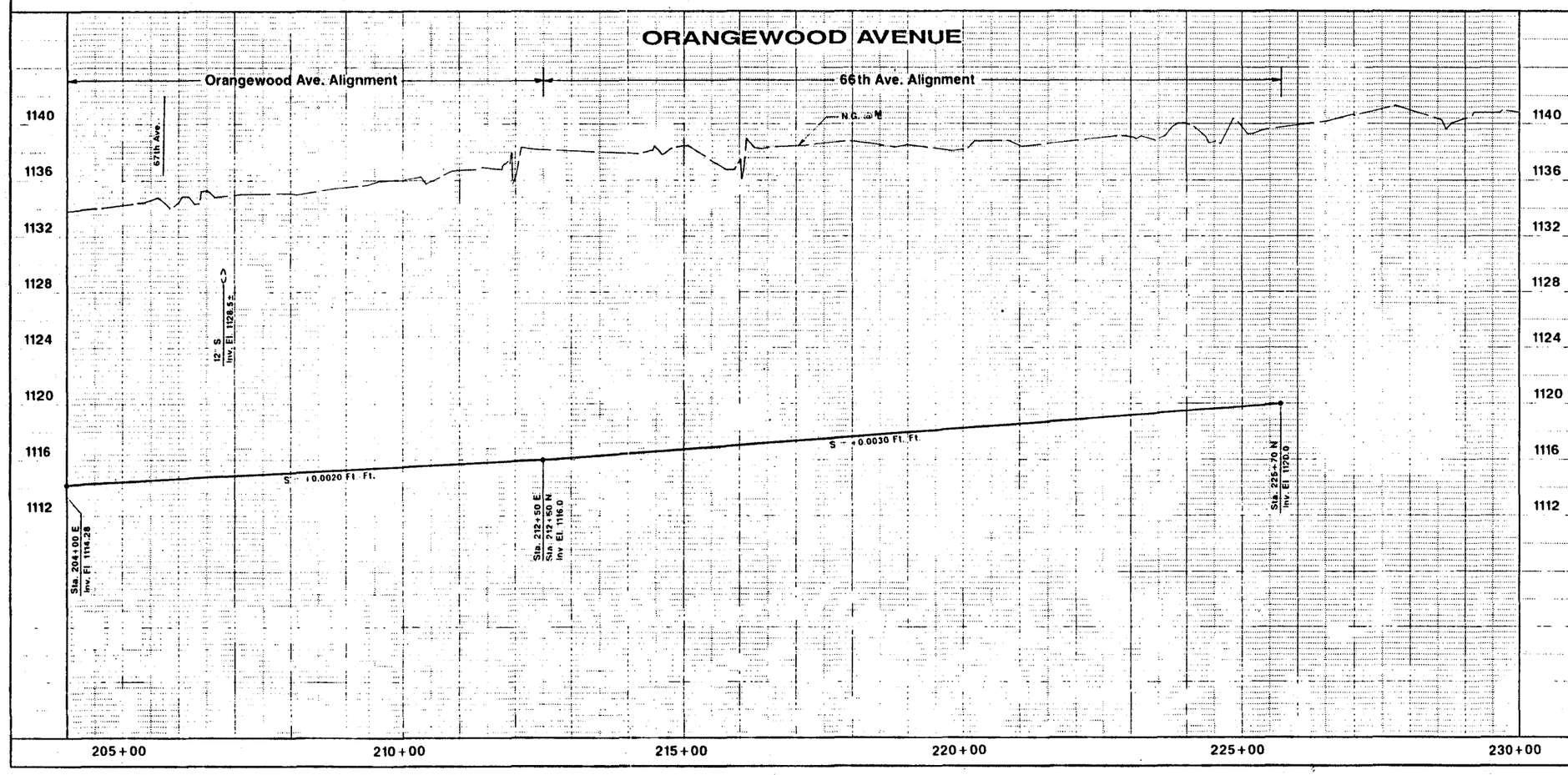
	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 13





☐ REMOVE ☐

○ CONSTRUCT ○

Ⓑ Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale in Feet
2 0 2 4
Vert. Scale in Feet

N

263-1100

NO.	REVISION	DATE
3		
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FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

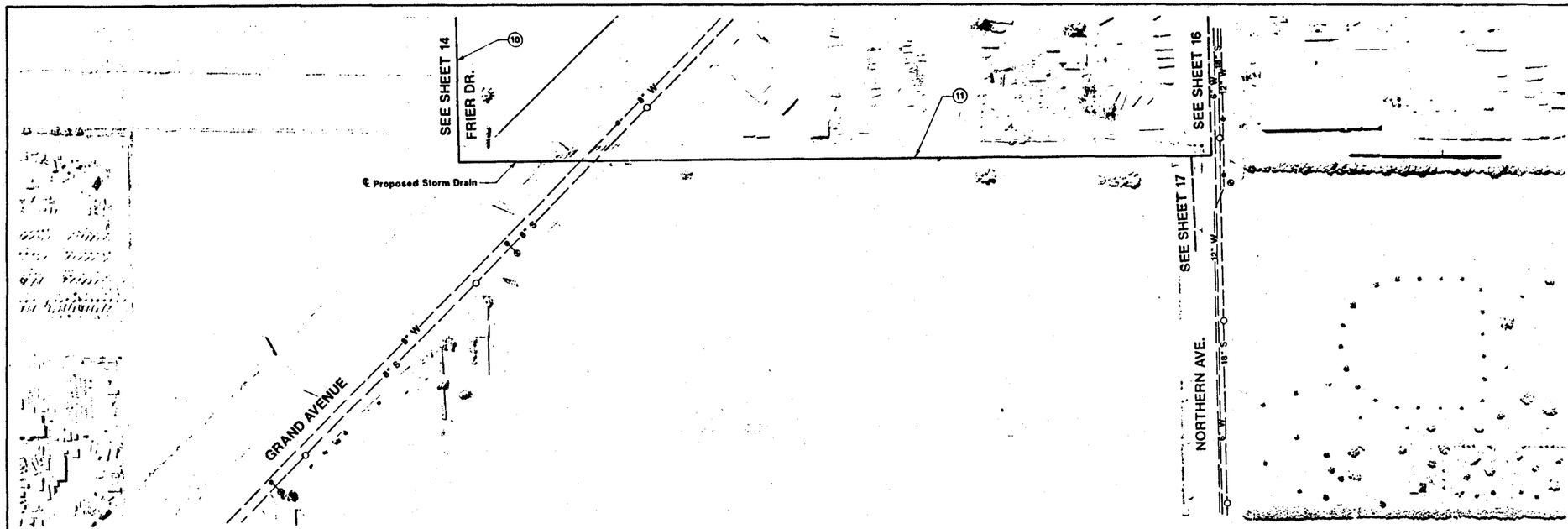
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

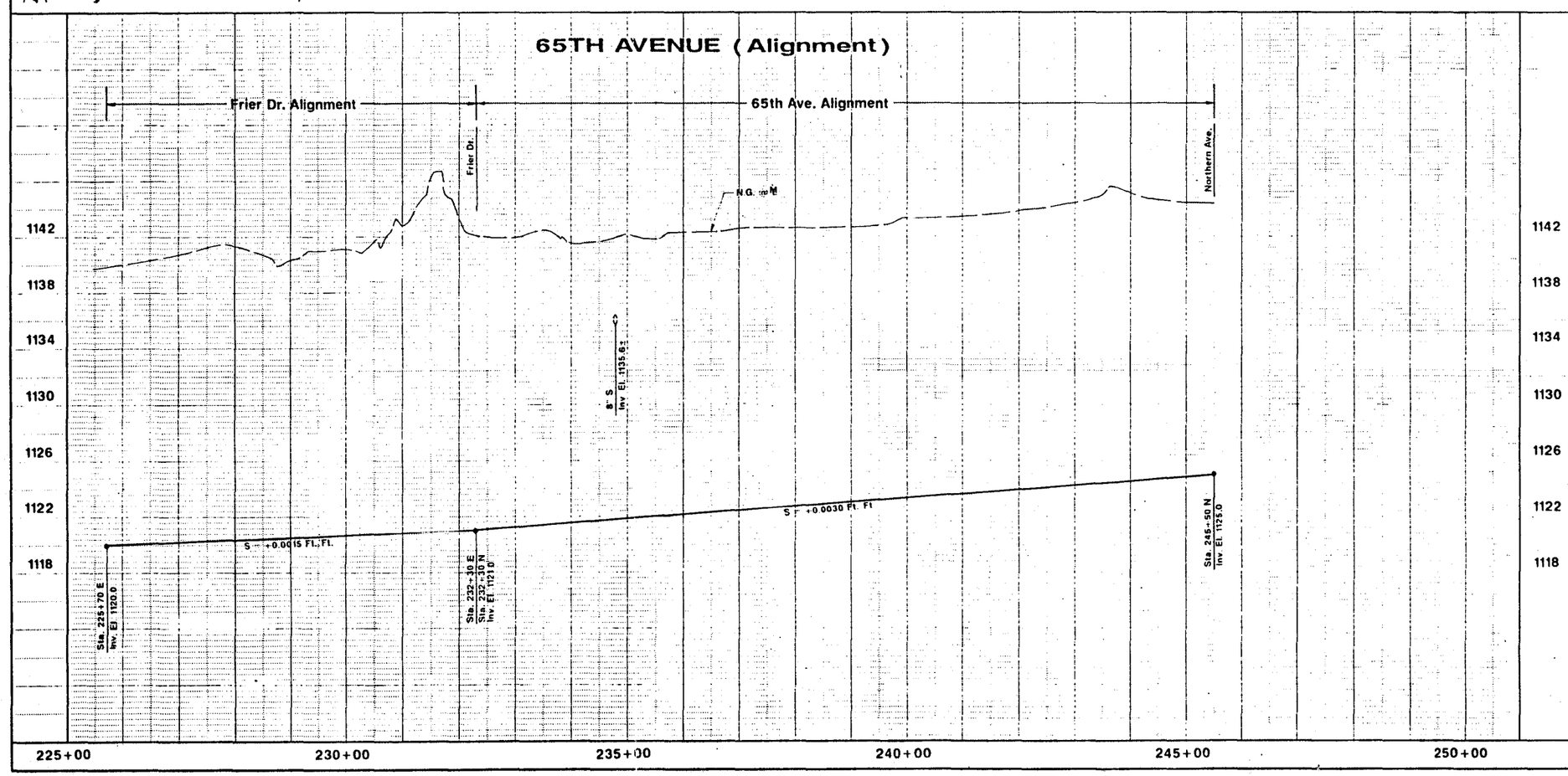
	BY	DATE
DESIGNED	JGT	2·96
DRAWN	R. REED	2·96
CHECKED	ACP	2·96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA [illegible]

WOOD/PATEL PROJECT NO. 94153.00

SHEET 14





☐ REMOVE ☐

○ CONSTRUCT ○

⑩ Proposed Storm Drain Pipe No.

⑪ Proposed Storm Drain Pipe No.

N

50 0 50 100
Hor. Scale In Feet

2 0 2 4
Vert. Scale In Feet

263-1100

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

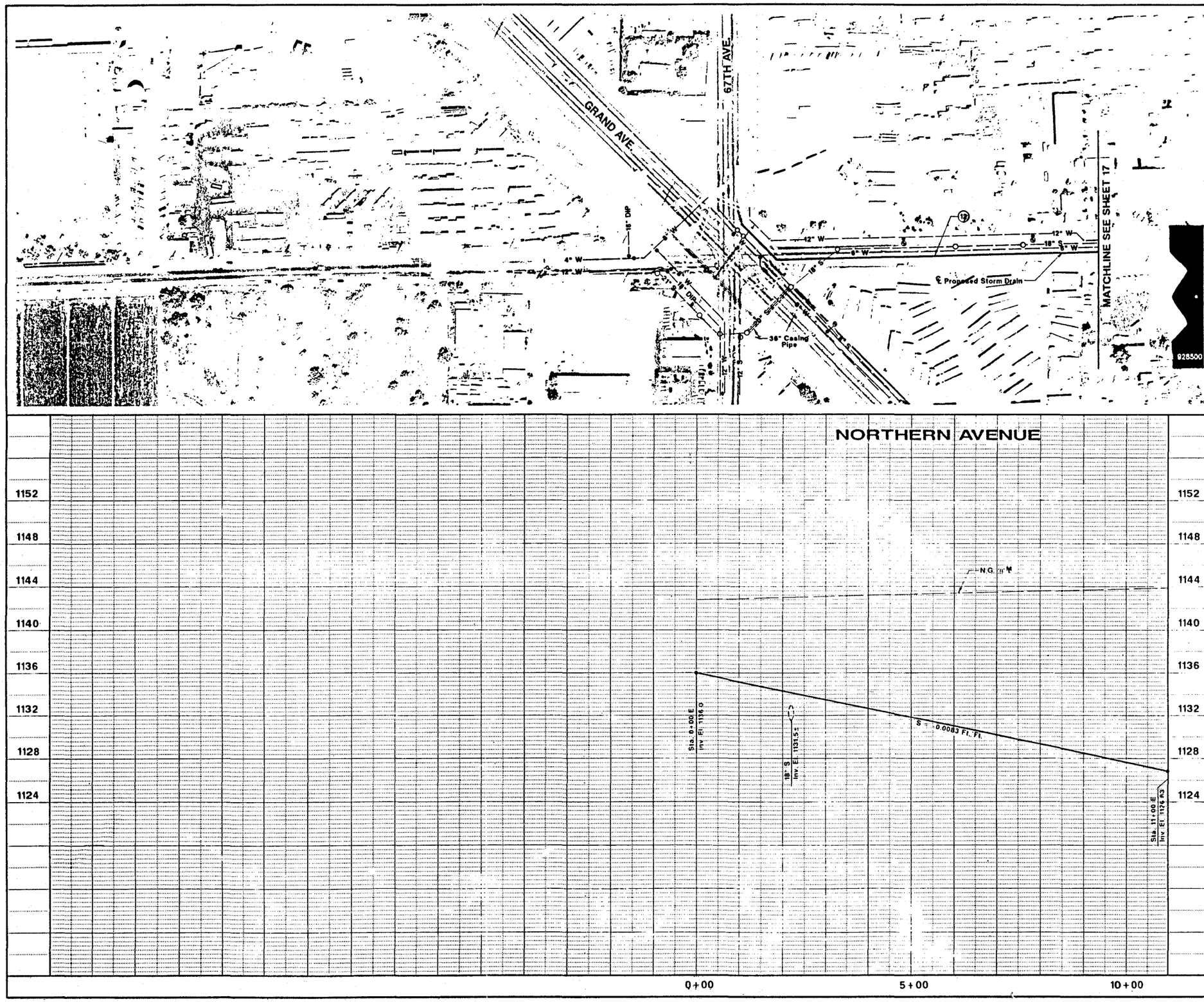
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.

WOOD/PATEL PROJECT NO. 94153.00

SHEET 15



☐ REMOVE ☐

○ CONSTRUCT ○

(12) Proposed Storm Drain Pipe No

50 0 50 100
Hor. Scale in Feet
2 0 2 4
Vert. Scale in Feet

N

263-1100

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

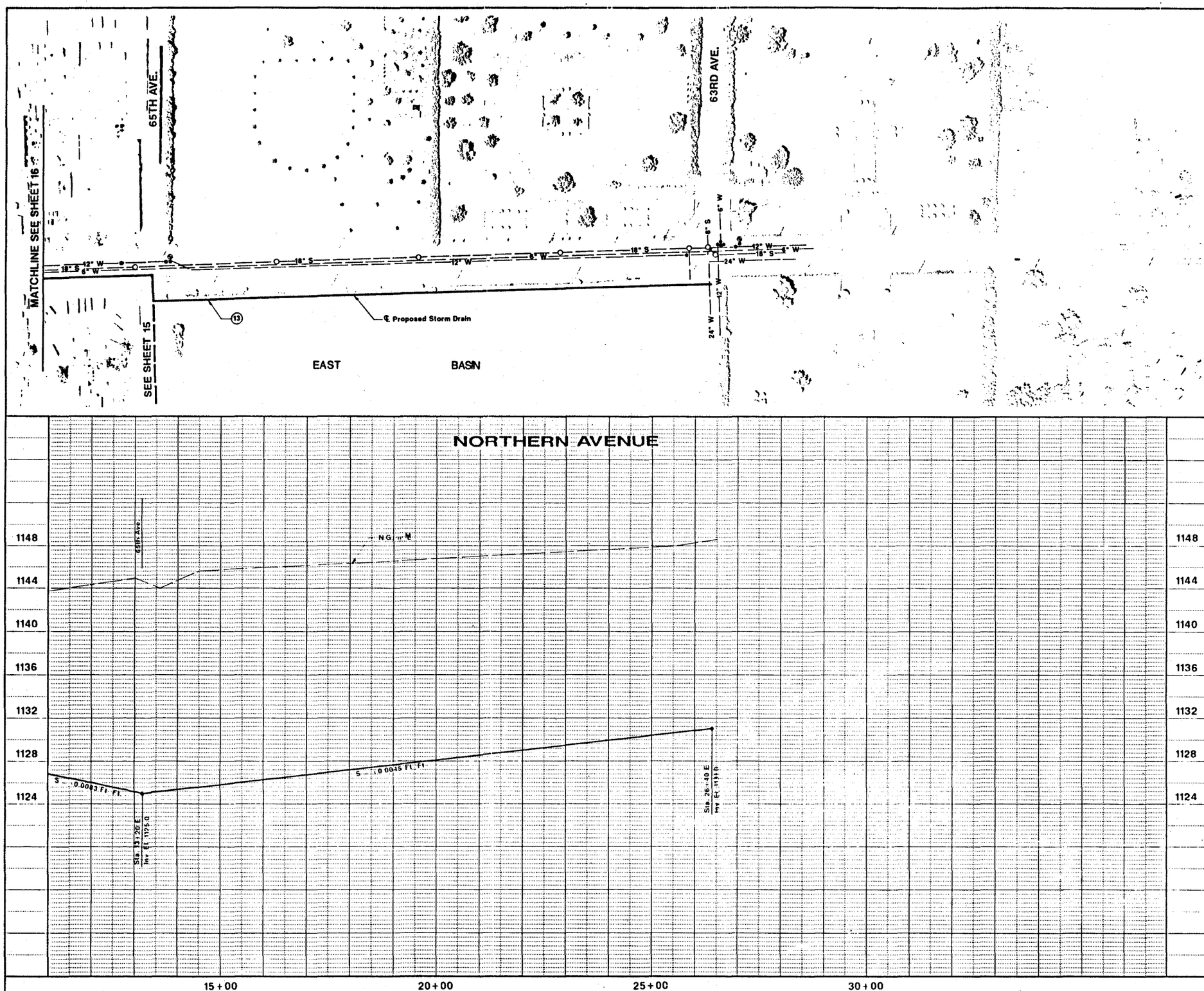
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.

WOOD/PATEL PROJECT NO. 94153.00

SHEET 16



REMOVE

CONSTRUCT

(13) Proposed Storm Drain Pipe No.

50 0 50 100
Hor. Scale In Feet
2 0 2 4
Vert. Scale In Feet

N

CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
CALL COLLECT

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

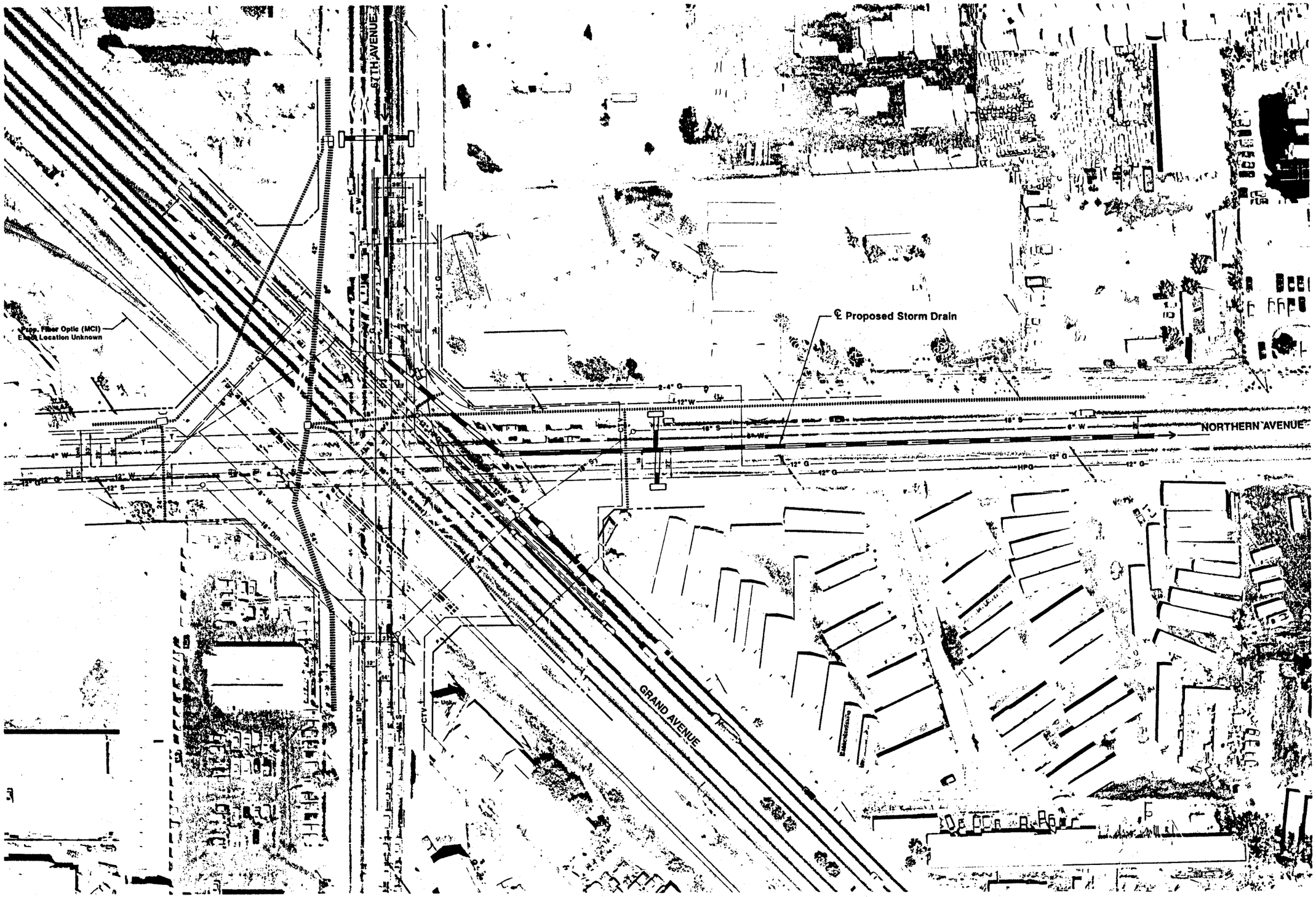
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602)234-1344

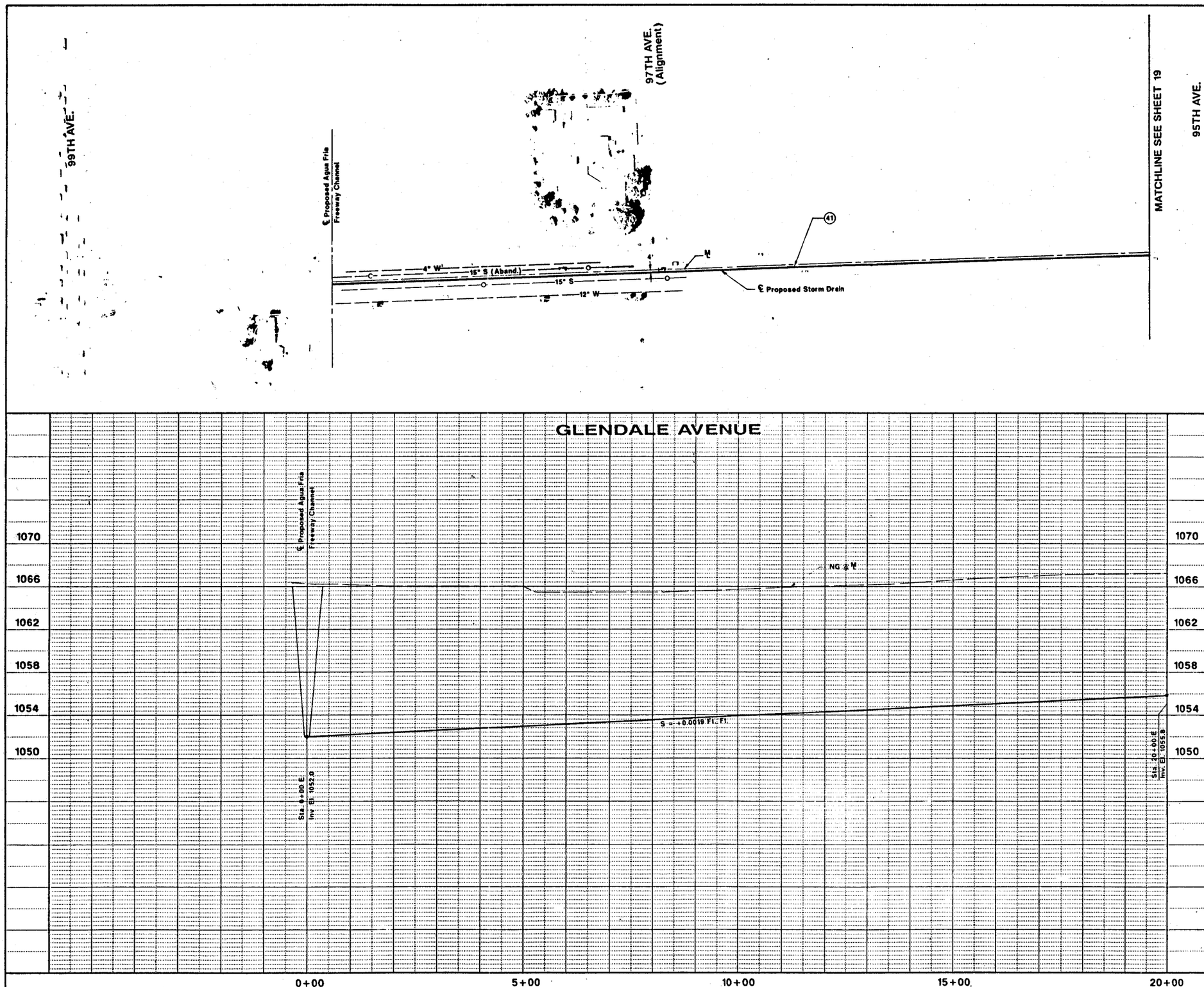
WOOD/PATEL PROJECT NO. 94153.00

SHEET 17



NORTHERN AT GRAND AVENUE 0 20' 40' 80' KENNEY AERIAL MAPPING INC.

SHEET 17A



☐ REMOVE ☐

○ CONSTRUCT ○

(41) Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale In Feet
2 0 2 4
Vert. Scale In Feet

N

Two working days before you dig CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center CALL COLLECT

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

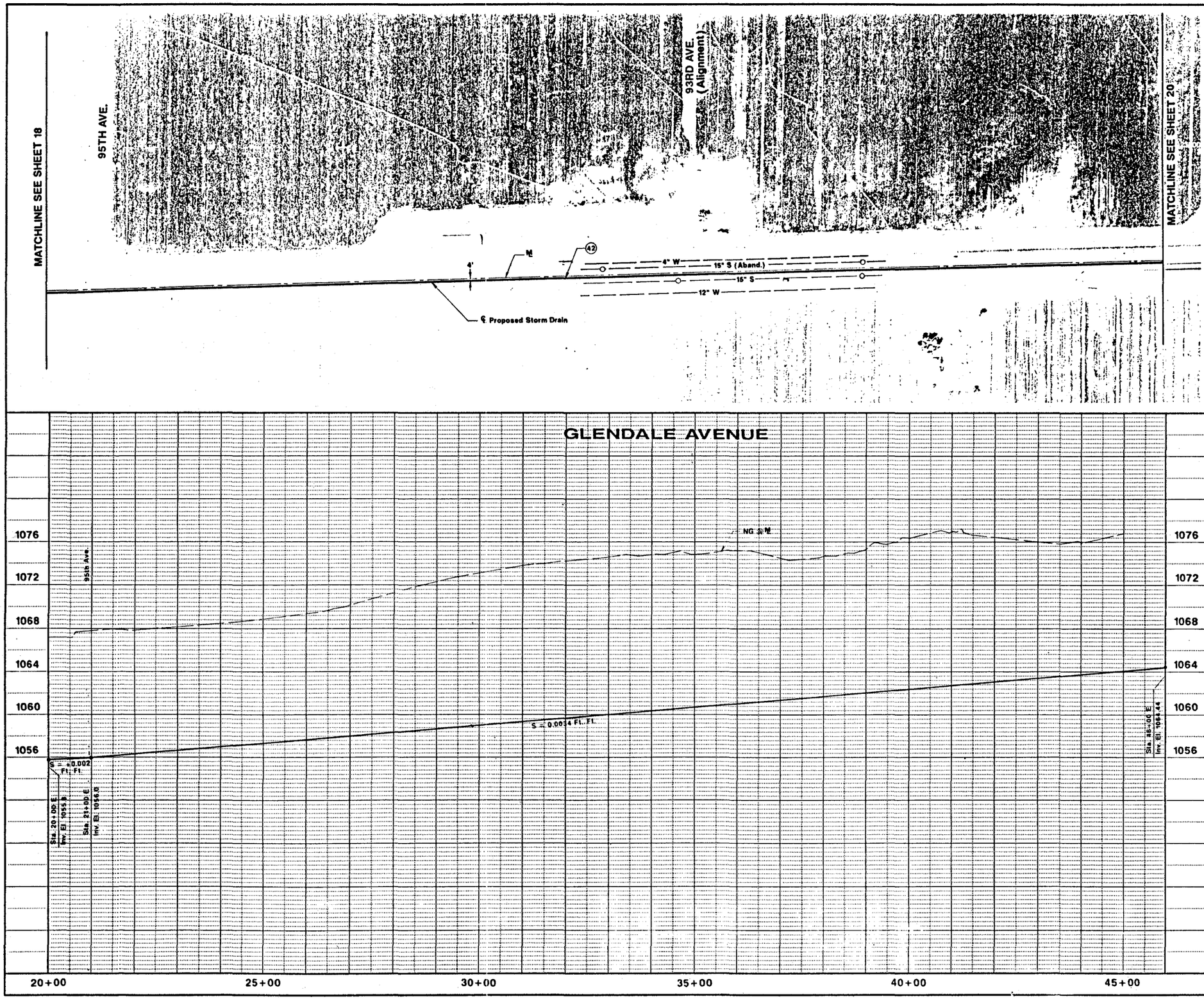
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA 602)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 18



☐ REMOVE ☐

○ CONSTRUCT ○

(42) Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale In Feet
2 0 2 4
Vert. Scale In Feet

N

Two working days before you dig CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center CALL COLLECT

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

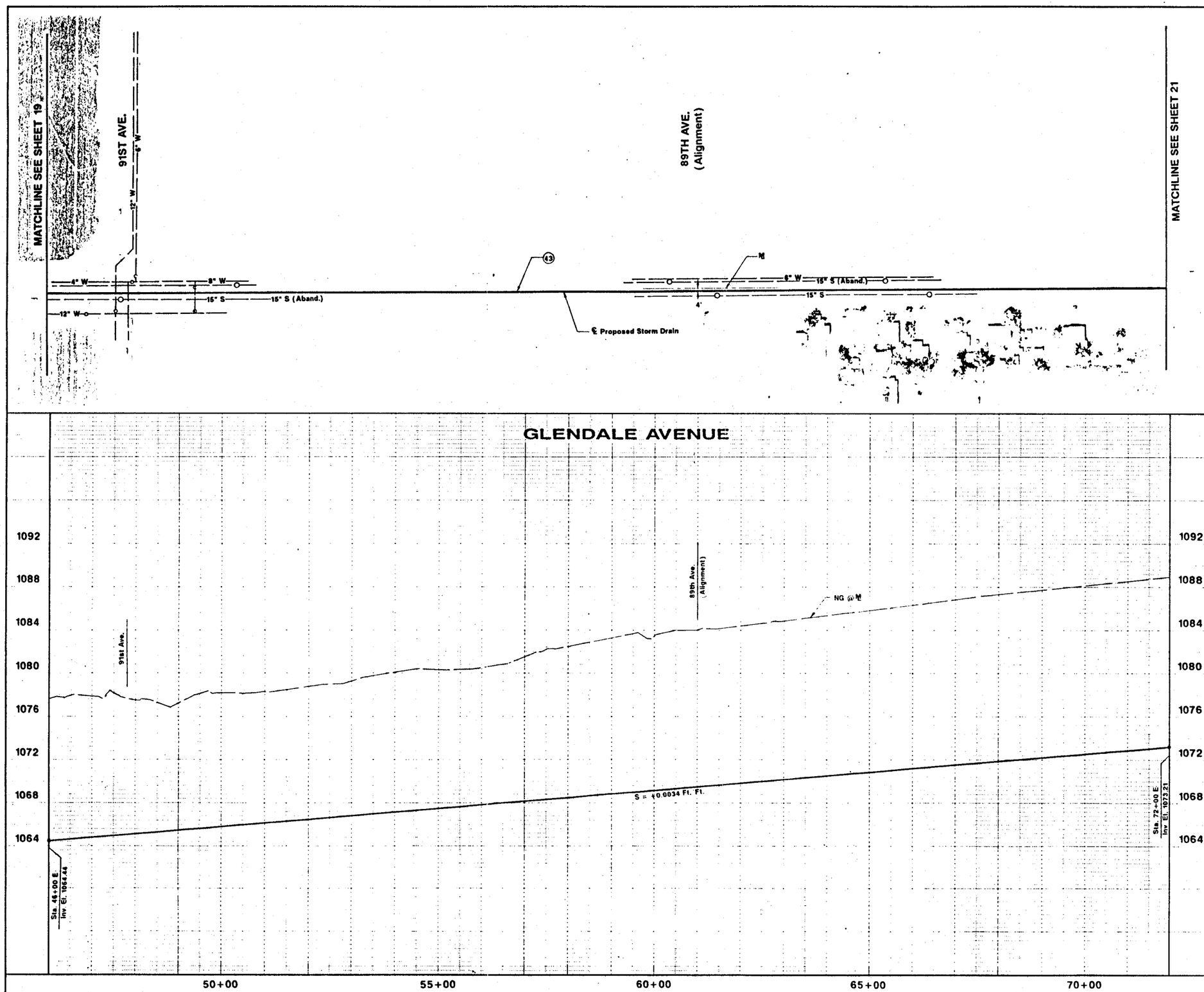
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 19



☐ REMOVE ☐

○ CONSTRUCT ○

(43) Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale in Feet
2 0 2 4
Vert. Scale in Feet

N

263-1100

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

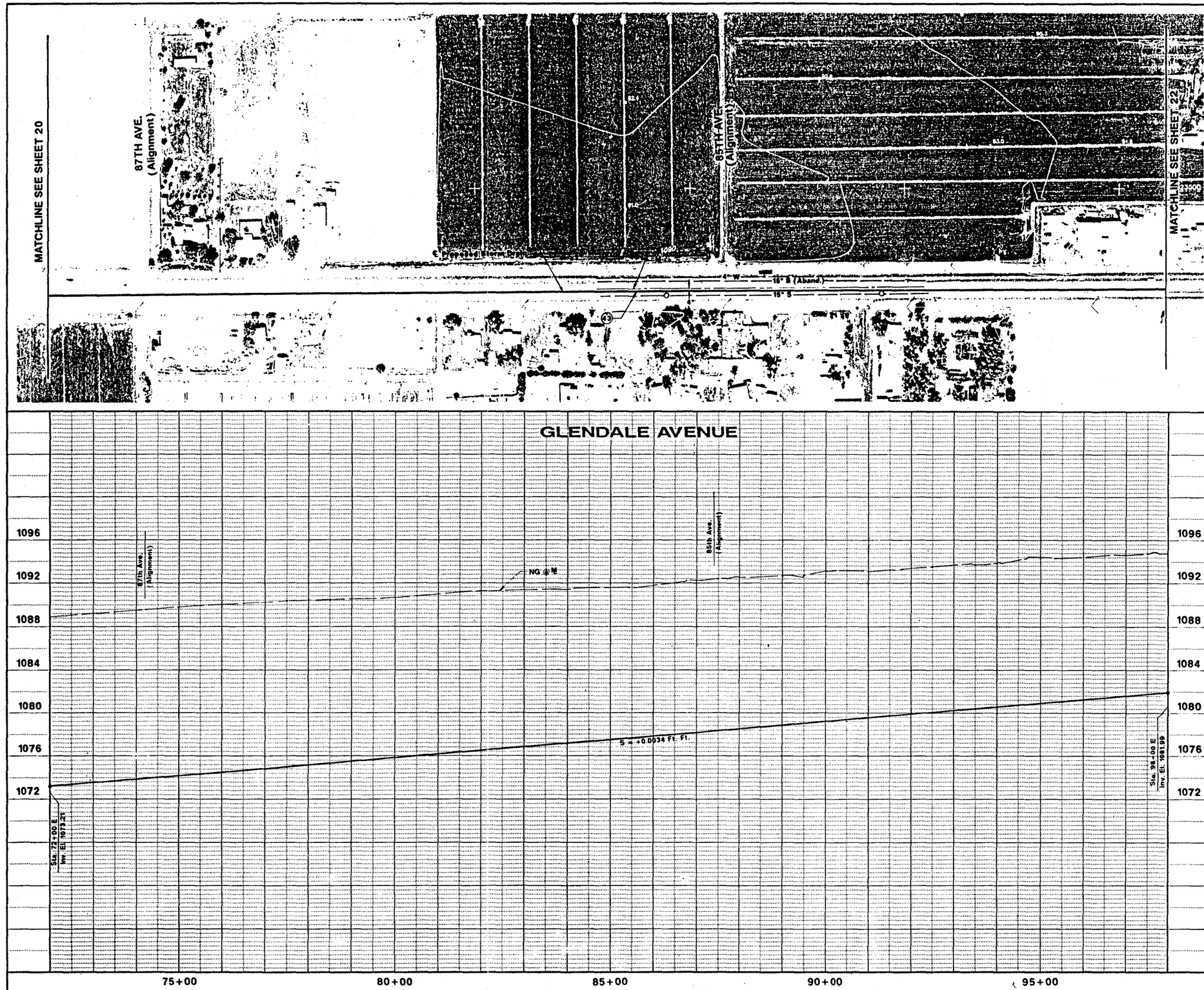
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	
DRAWN	R. REED	
CHECKED	ACP	

WOOD, PATEL & ASSOCIATES, INC.

WOOD/PATEL PROJECT NO. 94153.00

SHEET
20



☐ REMOVE ☐

○ CONSTRUCT ○

(43) Proposed Storm Drain Pipe Number

50 0 50 100
Hor. Scale In Feet
2 0 2 4
Vert. Scale In Feet

N

263-1100

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

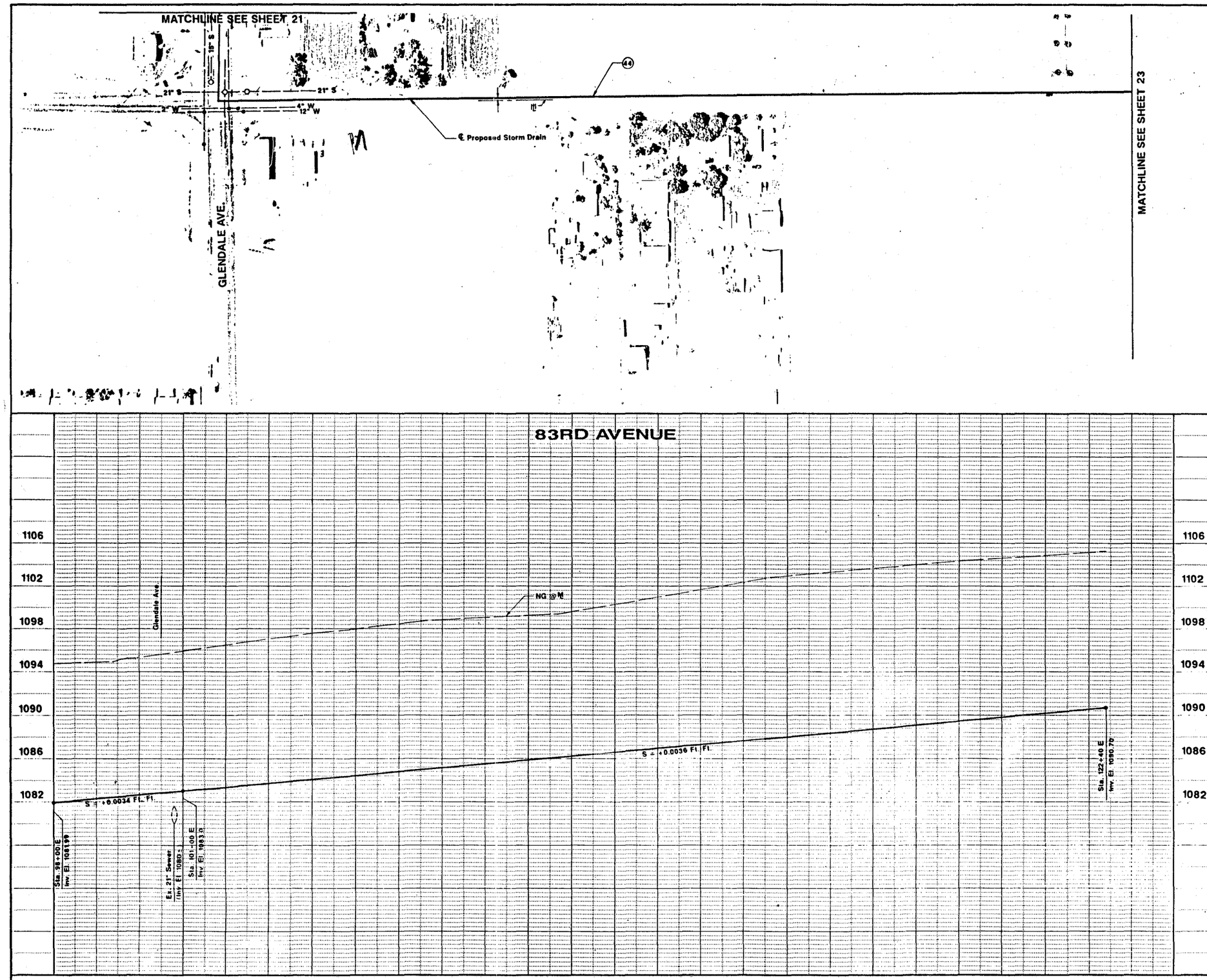
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2 96
DRAWN	R. REED	2 96
CHECKED	ACP	2 96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (622)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 21



☐ REMOVE ☐

○ CONSTRUCT ○

(44) Proposed Storm Drain Pipe Number

Z

50 0 50 100
Hor. Scale in Feet
2 0 2 4
Vert. Scale in Feet

263-1100

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

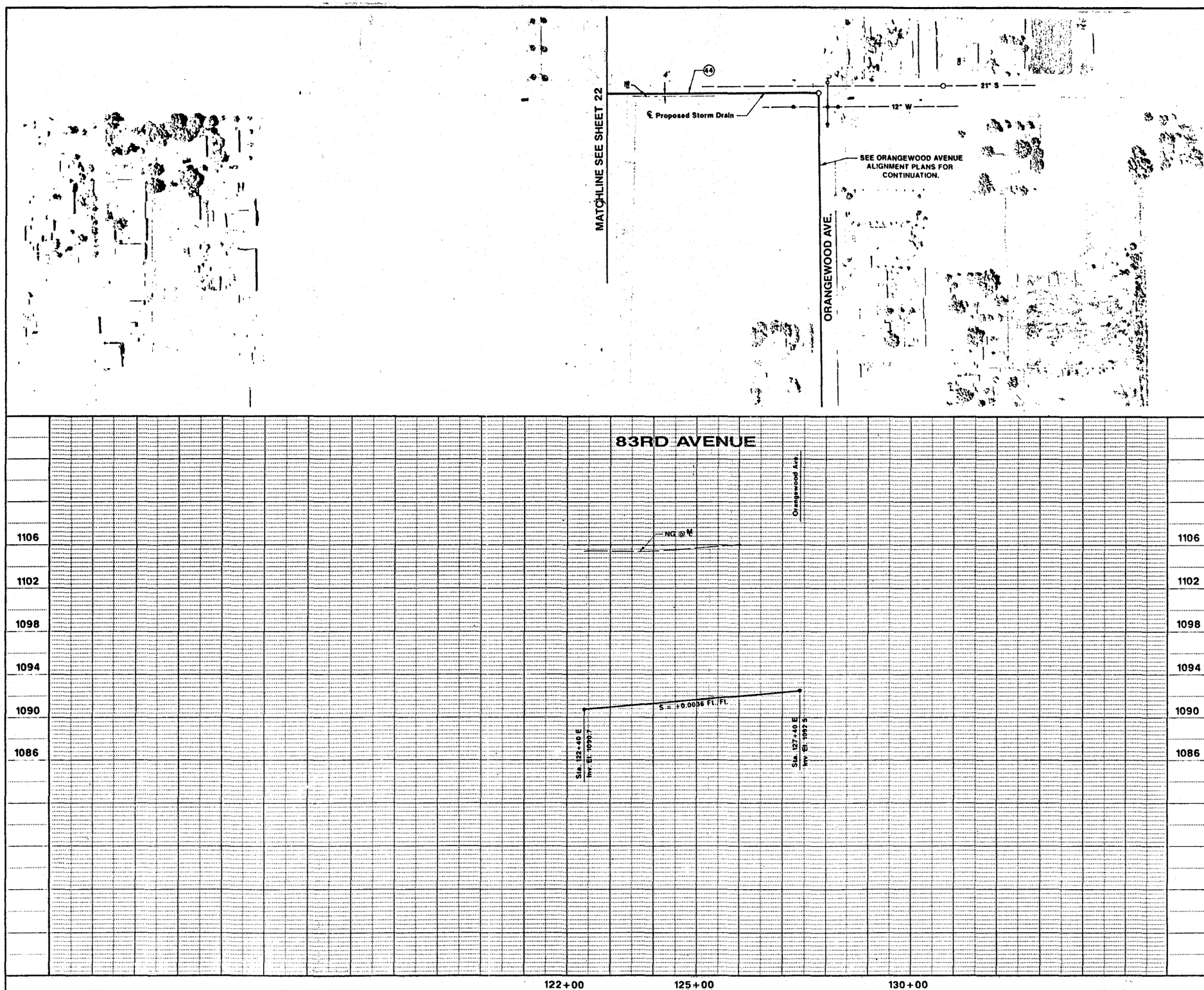
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2-96
CHECKED	ACP	2-96

WOOD, PATEL & ASSOCIATES, INC.

WOOD/PATEL PROJECT NO. 94153.00

SHEET 22



☐ REMOVE ☐

○ CONSTRUCT ○

(44) Proposed Storm Drain Pipe Number

N

50 0 50 100
Hor. Scale in Feet

2 0 2 4
Vert. Scale in Feet

Two working days before you dig
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center
U.A.L. COLORADO

NO.	REVISION	DATE
3		
2		
1		

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

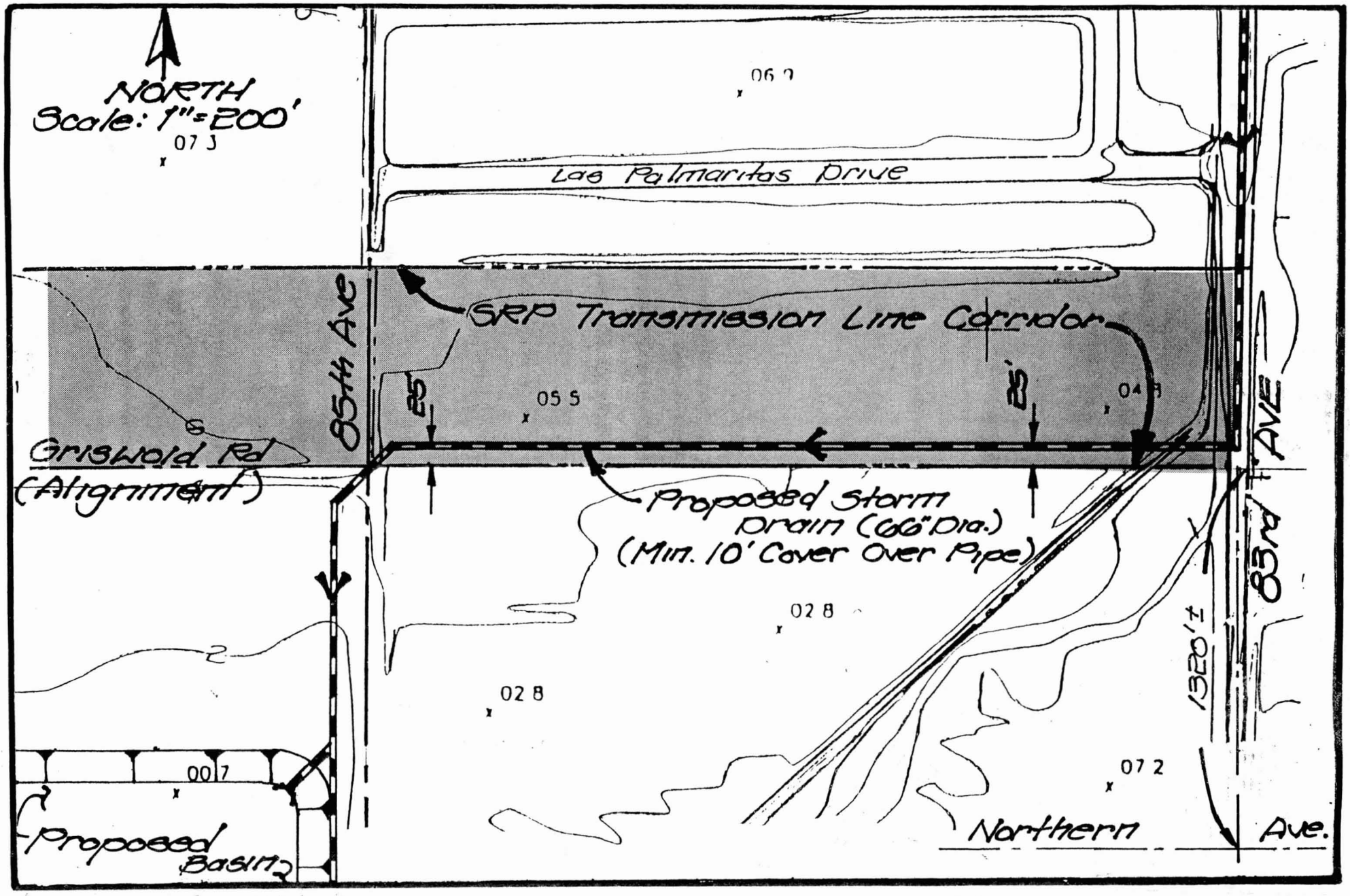
NORTHERN/ORANGEWOOD STORM DRAIN PROJECT
FCD 94-12
PHASE 1 CONCEPT/ROUTING STUDY

	BY	DATE
DESIGNED	JGT	2-96
DRAWN	R. REED	2 96
CHECKED	ACP	2 96

WOOD, PATEL & ASSOCIATES, INC.
1550 EAST MISSOURI, SUITE 203
PHOENIX, ARIZONA (602)234-1344

WOOD/PATEL PROJECT NO. 94153.00

SHEET 23



Wood/Patel & Associates
4/3/96 JGT
Northern/Orangewood # 94153