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DRAINAGE REPORT FOR ELLSWORTH ROAD – UNIVERSITY DRIVE TO MCLELLAN ROAD

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DRAINAGE REPORT FOR ELLSWORTH ROAD – UNIVERSITY DRIVE TO MCLELLAN ROAD

Prepared for:

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION

Prepared by:

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JUNE 8, 1999

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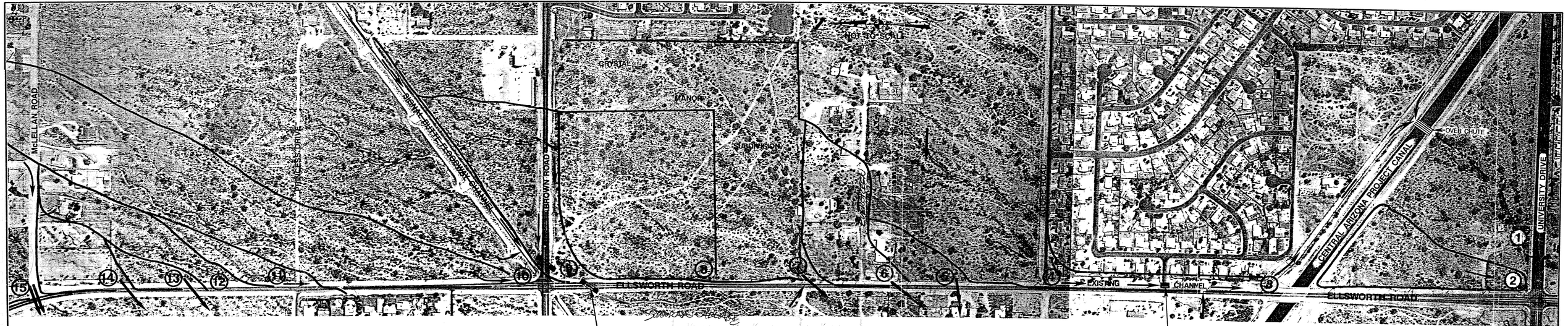


ELLSWORTH ROAD

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN RD
DRAINAGE AREA MAP

Figure 2

SHT 1 OF 1

I INTRODUCTION

1.1 Project Description

The proposed roadway improvements include reconstruction and widening of Ellsworth Road between University Drive and McLellan Road. The proposed roadway modifications include:

1. Widening to 5 lanes between University Drive and Adobe Road;
2. Widening to an ultimate 7-lane section between Adobe Road and Brown Road (the southbound lanes would be only constructed to a 5-lane section between Adobe Road and Elmwood Road);
3. Reconstruction and widening of the road to a 5-lane section between Brown Road and Princess Drive; and
4. Reconstruction and widening of the road to a 7-lane section along the segment between Princess Drive and McLellan Road.
5. Reconstruction of Adobe Road for the segment between Ellsworth Road and 94th Street, a distance of approximately 600 meters.

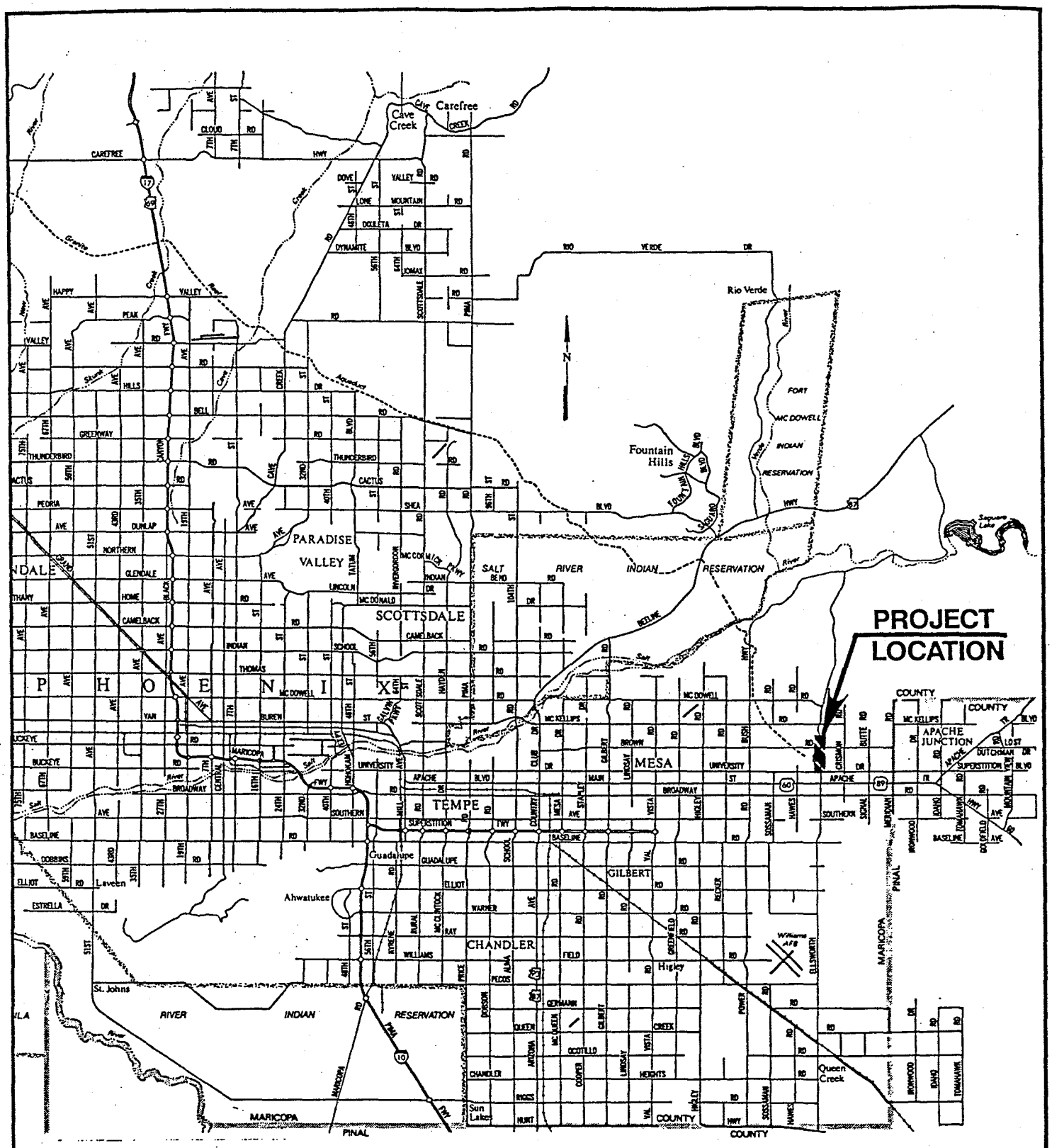
The project will provide additional roadway capacity, multiple-use lanes for alternative modes, storm drains, roadside landscaping, and pedestrian facilities that are not included in the existing roadway.

1.2 Project Location

The proposed study area starts at the University Drive/Ellsworth Road intersection and extends north thereof for a distance of about 2500 meters. The north limit of the study extends approximately 150 meters north of the McLellan Road intersection. A taper to existing pavement width will be provided along the segment north of McLellan Road. A location map for the project is given on Figure 1.

1.3 Report Objectives

The purpose of this report is to determine the location and magnitude of cross drainage which currently affects the study area. Methods and locations for conveying this runoff beneath the proposed roadway are identified. In those areas where new development is occurring, the Maricopa County Department of Transportation assumes that cross drainage will be accommodated by adjoining subdivision development drainage facilities. Requirements for draining the pavement in accordance with Maricopa County roadway design standards have been identified.



LOCATION MAP

ELLSWORTH ROAD

University Drive To McLellan Drive

Figure 1.1

MARICOPA COUNTY

II CROSS DRAINAGE

2.1 Introduction

Cross drainage affecting the project area emanates primarily from land areas north and east of the project. This area is undergoing rapid change due to ongoing development. Some of the watersheds toward the north end of the project remain natural while those south of Brown Road are already urbanized.

2.2 Methodology

The watershed areas which contribute cross drainage to the project were identified from field investigations, U.S.G.S. quadrangle sheets, and aerial photography provided by the City of Mesa. There are several previous drainage reports which have been developed by Maricopa County and in association with the recently completed development projects. These reports include:

1. The Southeast Mesa Area Drainage Master Plan (FCD#95-32), February 12, 1997;
2. Preliminary Drainage Report for Sierra Heights and Sierra Estates prepared by Coe & Van Lo Consultants, Inc., April 8, 1997; and
3. Grading and Drainage Report for Sonora Park, Pausell & Associates, LLC, June 12, 1996.

The hydrologic and hydraulic calculations which were conducted as a part of this study were done in English units. These results were then converted to metric units to fulfill Maricopa County requirements.

2.3 Watershed Characteristics

A map delineating the boundaries of the watershed areas contributing runoff to Ellsworth Road are delineated on Figure 2 of this report. This map identifies 16 points of concentration for the offsite watershed areas. All of the watercourses associated with the cross drainage emanate from the Signal Butte area northeast of the project. The watercourses all drain southwesterly across Ellsworth Road within shallow dip sections or drain south along the east side of the road until a point of confluence with some other wash is reached. Some of the existing subdivision developments such as Crystal Manor, Sonora Park, and Sierra Heights have altered local drainage patterns adjoining Ellsworth Road. Generally, the subdivisions are designed to intercept the runoff along their north boundary, divert it west, then south along Ellsworth Road to a dip section. The drainage reports for these subdivisions were reviewed in order to obtain offsite discharge information or confirm calculations conducted as a part of the roadway design project.

2.4 Peak Discharge Computations

The rational formula procedures as given in the *Drainage Design Manual for Maricopa County, Volume I, Hydrology* were used to develop discharge rates for the 10-, 50-, and 100-year return period events. This procedure was used at all points of concentration except Concentration Point #4 which is located at the intersection of Ellsworth Road and Adobe Road. The area of this watershed exceeds 65 hectares, which is the upper limit of the drainage area where the rational formula can be applied. The discharge

rate for Concentration Point #4 was derived from previous study information developed as a part of the Southeast Mesa Area Drainage Master Plan Study (FCD#95-32).

Table 1 summarizes the discharge computations for the 10-, 50-, and 100-year return period events. Hydrologic computation sheets for the discharge determinations are provided in Appendix A.

2.5 Cross Drainage Conveyance Plan

Concentration Point #1 - Concentration Point #1 is located along University Drive about 200 feet east of the intersection with Ellsworth Road. Concentration Point #1 receives runoff from a drainage area of 204.6 hectares and generates a 50-year return period discharge of 16.05 m^3/sec. This runoff crosses University Drive in a dip section and does not impact directly upon Ellsworth Road. The Flood Control District of Maricopa County (FCDMC) is currently planning a regional retention/detention facility at the northeast corner of the Ellsworth Road/University Drive intersection. This basin would accommodate runoff draining to Concentration Point #1. No additional improvements are being proposed as a part of the Ellsworth Road project for accommodating this flow.

Concentration Point #2 - Concentration Point #2 is located at the northeast corner of the intersection of Ellsworth Road and University Drive. This concentration point receives runoff from a 2.54-hectare area and generates a 50-year discharge of 0.48 m^3/sec This runoff drains directly into the Ellsworth Road/University Drive intersection. A 610 millimeter diameter storm drain pipe must be installed beginning at the northeast corner of the intersection to convey this flow south to an existing channel.

Concentration Point #3 - Concentration Point #3 is located along the east side of Ellsworth Road just north of the Central Arizona Project (CAP) canal. Runoff draining to Concentration Point #3 arrives at this location within an existing drainageway which has been constructed on the east side of Ellsworth Road between Adobe Road and the CAP canal. The 50-year discharge at Concentration Point #3 as derived from the Southeast Mesa Area Drainage Study is 7.77 m^3/sec. The existing channel cross section does not have adequate capacity to convey this runoff. This report recommends lining the channel section between Adobe Road and the CAP canal with concrete. This will increase capacity and aid in the conveyance of sediment which has been occurring within the existing channel bottom. Additional capacity is also needed because the flow will increase due to the Ellsworth Road pavement drainage system. The proposed channel cross section includes a 7.5-meter topwidth, 1:1 sideslopes, and depth of 1.0 meter. This channel cross section provides a capacity of 12.6 m^3/sec with 0.3 meter freeboard.

The existing four 1.5 meter by 0.9 meter ACMP storm drain pipes beneath Dennis Street should be replaced with a 3-cell, 1.8 meter by 1.2 meter CBC. The existing culverts cause a constriction of the channel which reduces flow capacity, increases water surface elevations, and causes sediment deposition. Hydraulic computations for the proposed channel section and culvert replacement at Dennis Street are provided in Appendix B.

TABLE 1 – 10-, 50-, and 100-YEAR DISCHARGE VALUES

Concentration Point ID	Drainage Area (acres)	10-Year m^3/sec	50-Year m^3/sec	100-Year m^3/sec
1	204.61	9.38	16.05	19.65
2	2.54	0.28	0.48	0.57
3	189.10	4.52	7.77	9.57
4	189.10	4.52	7.77	9.57
5	0.92	0.11	0.20	0.23
6	2.80	0.31	0.54	0.62
7	7.24	0.76	1.33	1.61
8	7.24	0.76	1.33	1.61
9	3.53	0.37	0.65	0.79
10	11.37	0.90	1.61	1.95
11	0.56	0.06	0.11	0.14
12	2.08	0.23	0.37	0.45
13	0.60	0.08	0.14	0.17
14	1.31	0.17	0.28	0.34
15	7.59	0.74	1.27	1.56
16	6.27	0.68	0.68	1.50

$m^3 \times 35.3 = cfs$

per second

Concentration Point #4 - The 50-year discharge at Concentration Point #4 is 7.77 m^3/sec. Of this total, 6.12 cubic meter originate from an existing gunite-lined channel which was constructed along the east side of Ellsworth Road in conjunction with the Sonoran Park subdivision. The remainder (1.65 m^3/sec) originates from Adobe Road. A new 2-cell, 2.4 meter by 0.9 meter box culvert must be constructed beneath Adobe Road on the east side of Ellsworth Road to convey flow emanating from the existing gunite-lined channel into the drainageway along the south side of Adobe Road. This culvert will have a drop inlet on the north side of Adobe Road to lower the water surface elevation and facilitate construction of the 2-cell, 2.4 meter by 0.9 meter culvert beneath Adobe Road. Hydraulic computations for the proposed culvert structure are provided in Appendix B.

Concentration Point #5 - Runoff arriving at Concentration Point #5 has been intercepted by the existing gunite-lined drainageway along the east side of Ellsworth Road. No additional recommendations are provided herein for conveyance of runoff arriving at Concentration Point #5.

Concentration Point #6 - The 50-year discharge at Concentration Point #6 was computed by the FCDMC rational method to be 0.54 m^3/sec. An area drain will be constructed at the intersection of Evergreen Road and Ellsworth Road to intercept this offsite runoff and convey it to the pavement storm drain system. This catch basin will be located at station 6+303. The catch basin type is a MAG Type 535. A 760 mm diameter storm drain lateral is required to convey this offsite flow into the storm drain mainline.

Concentration Point #7 - The 50-year discharge at Concentration Point #7 was computed by the FCDMC rational method to be 1.33 m^3/sec. Concentration Point #7 is located at the southwest corner of the Crystal Manor subdivision. Runoff arriving at this concentration point will be conveyed beneath Ellsworth Road in two 965 mm x 610 mm oval concrete pipes. The use of an oval type pipe at this location is needed to minimize raising the pavement grade. Hydraulic computations for the cross drain pipes at Concentration Point #7 were computed using the program HY-8. Computation sheets for the culvert analysis are provided in Appendix B.

Concentration Point #8 - Concentration Point #8 is located at the northwest corner of the Crystal Manor subdivision. There is an existing landscaped swale which conveys runoff from Concentration Point #8 to Concentration Point #7. No modifications to the existing swale will be made between Concentration Point #8 and Concentration Point #7.

Concentration Point #9 - The 50-year discharge at Concentration Point #9 was computed by the FCDMC method to be 0.65 m^3/sec. Concentration Point #9 is located at a point approximately 60 meters south of the intersection with Brown Road. The Giant ga station at the southeast corner directs runofff from the north side of Brown Road through the gas station and outlets into the existing pipes beneath Ellsworth Road at CP# 9. There are two 610 mm storm drain pipes which convey this runoff beneath Ellsworth Road. The Giant Gas station project will utilize one pipe and abandon the

second. The remaining culvert should be extended as needed to accommodate the road widening project.

Concentration Point #10 - Maricopa County has directed Earth Tech to exclude drainage improvements for runoff arriving at Concentration Point #10. This direction is based upon the assumption that future development of the property along the east side of Ellsworth Road between the Signal Butte floodway channel and Princess Drive will be directed into the existing flood control channel by the developer of that property.

Concentration Points #11, #12, #13, and #14 - Maricopa County has directed Earth Tech to exclude drainage improvements for runoff arriving at Concentration Points #11, #12, #13, and #14. This direction is based upon the assumption that future development of the property along the east side of Ellsworth Road between the Signal Butte floodway channel and Princess Drive will be directed into the existing flood control channel by the developer of that property.

Concentration Point #15 - Concentration Point #15 is located at the intersection with McLellan Drive. The 50-year return period discharge at Concentration Point #15 was computed by the FCDMC method to be 1.27 m^3/sec. The runoff originates from McLellan Road east of Ellsworth Road and from an existing dirt road which runs north/south along the east side of Ellsworth Road. The proposed method of accommodating this runoff is to collect it within the pavement drainage storm drain system and convey it south to the Signal Butte floodway channel. The inlet for this storm drain would consist of a MAG Type 535 catch basin which crosses McLellan Road on the east side of Ellsworth Road. Hydraulic computations for determining the catch basin inlet capacity are given in Appendix B.

Concentration Point #16 - Concentration Point #16 is located along Ellsworth Road about 150 meters north of the McLellan Road intersection. The 50-year discharge at Concentration Point #16 is 0.68 m^3/sec. This runoff will be conveyed beneath McLellan Road in two 610 mm RCP storm drain pipes. Hydraulic computations for determining the capacity of the proposed cross culverts are provided in Appendix B.

III PAVEMENT DRAINAGE

3.1 Introduction

Pavement storm drain facilities are included in the roadway improvement project. The scope of the pavement drainage improvements meet the minimum standards for compliance with Maricopa County roadway improvements. For those segments of road where the current improvements call for widening to a 5-lane section, the Maricopa County Department of Transportation directed Earth Tech to locate catch basins 14.33 meters off centerline. This places the catch basins on the roadway shoulder. The intent of this approach is to provide a catch basin location that will accommodate future widening of the pavement to 7 lanes without reconstruction of the inlet. Earth Tech has not made a determination as to whether or not the location and elevation of the catch basins will conform to the requirements for future widening of the road. As a minimum the storm drain lateral would not need to be constructed in the future.

3.2 Methodology

The methodology for determining catch basin locations is outlined in the *Drainage Design Manual for Maricopa County, Volume II, Hydraulics* (January 28, 1996). Chapter 3 of this document describes drainage standards and design procedures for pavement drainage. The design storm frequency for the pavement drainage improvements is the 10-year return period event. The criteria calls for containment of the 10-year return period storm within the curb while maintaining 1 dry 3.6-meter wide driving lane in each direction.

The procedures used in this study were to first determine the maximum allowable spacing for catch basins while complying with the previously-described pavement drainage criteria. The capacity of the gutter was determined based upon proposed roadway slopes and the allowable spread which is 7.6 meters. The allowable spread will result in a water surface elevation equivalent to the top-of-curb height. The longitudinal slopes of the proposed roadway vary from 0.3% to 3.0%. At these slopes, the roadway gutter has a capacity that varies between 0.42 m^3/sec and 1.1 m^3/sec. The allowable catch basin interval for these discharges varies from 1280 meters to 4024 meters. This exceeds the interval which Earth Tech recommends since it would result in large amounts of flow accumulating in Ellsworth Road at the intersection with cross streets. As such, catch basins were placed upstream of the cross street intersections and at a few locations where offsite flow will be conveyed into the storm drain. Catch basins were also located where the roadway transitions from a 7-lane to a 5-lane section and the curb ends.

3.3 Description of Pavement Drainage System

University Drive to CAP Canal - This segment of Ellsworth Road will be constructed as 5 lanes without curb and gutter. Runoff from the pavement will drain into swales along the roadway shoulder. These swales will convey the runoff south to MAG Type 535 area drains on the roadway shoulders just north of University Drive. These catch basins will be connected by a 24-inch diameter RCP which conveys flow to the existing channel south of University Drive.

CAP Canal to Adobe Road - The northbound lanes will be constructed with curb and gutter. Runoff along this side of the road will drain to 2 catch basins which discharge into the concrete channel along the east side of Ellsworth Road. The southbound lanes will be constructed without curb and gutter. Area drains will be placed in the roadway shoulder at the same location as the catch basins for the northbound lanes. These catch basins will be connected with an 460 mm RCP which discharges into the concrete channel along the east side of Ellsworth Road.

Adobe Road - A 610 to 910 mm diameter RCP will be placed in Adobe Road between 94th Street and Ellsworth Road. This storm drain will receive runoff from the surge basin just west of 94th Street. This surge basin discharges 59 cfs into Adobe Road, which then drains west to the channel along the east side of Ellsworth Road. Catch basins for the storm drain will be placed adjoining the surge basin, at station 1+385, and at the sag point in Ellsworth Road which is approximately 50 meters east of Ellsworth Road.

Adobe Road to Brown Road - A pavement drainage system will be constructed along the segment of Ellsworth Road between Adobe Road and station 6+535 (just north of Fairfield Street). This storm drain system will collect pavement drainage and deliver it to the concrete channel along the east side of Ellsworth Road south of Adobe Road. The diameter of this storm drain will vary from 460 mm at the north end to 910 mm at the south end. Catch basins will be placed north (upstream) of intersecting streets, at locations where the curb ends, and where minor amounts of offsite drainage pass onto Ellsworth Road.

Brown Road to McLellan Road - A pavement storm drain system will be constructed along the segment of Ellsworth Road between Brown Road and McLellan Road. The north limit of this storm drain system is at the intersection with McLellan Road (Concentration Point #15). At this location, a modified MAG Type 535 catch basin will be constructed across McLellan Road to intercept runoff from Concentration Point #15. From this point of beginning, the storm drain will lead south and collect pavement drainage at several catch basin locations. These catch basins are located north of intersecting streets (upstream) and where there are minor amounts of offsite runoff entering Ellsworth Road. This segment of Ellsworth Road will be constructed to the 5-lane section without curb and gutter. Therefore, all catch basins will be area drains located 14.33 meters east or west of centerline. The diameter of the storm drain is 910 mm.

3.4 Hydraulic Analysis

The hydraulic analysis for the storm drain system was conducted using FHWA computer program HYDRAIN. Input/output for the HYDRAIN model are provided in Appendix ~~C~~ B of this report. The hydraulic grade line for the storm drain system is shown on a reduced set of the storm drain plans in Appendix ~~D~~ C of this report.

Note: The HGL is not shown on storm drain plans.

APPENDIX A

HYDROLOGIC CHARTS AND DATA SHEETS

*** O U T P U T D A T A ***
REVISED JUNE 1988 TO UPDATE COMPUTATION OF SHORT-DURATION VALUES

PRECIPITATION FREQUENCY VALUES FOR ELLSWORTH ROAD
PRIMARY ZONE NUMBER= 7
SHORT-DURATION ZONE NUMBER= 8

LATITUDE 33.25N LONGITUDE 111.35W ELEVATION 1500 FEET

POINT VALUES

RETURN PERIOD

DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	
5-MIN	.37	.46	.53	.62	.70	.77	.94	5-MIN
10-MIN	.55	.70	.80	.95	1.07	1.18	1.45	10-MIN
15-MIN	.67	.87	1.01	1.21	1.36	1.52	1.87	15-MIN
30-MIN	.89	1.17	1.36	1.63	1.85	2.05	2.54	30-MIN
1-HR	1.08	1.44	1.69	2.03	2.30	2.57	3.18	1-HR
2-HR	1.14	1.54	1.81	2.19	2.49	2.78	3.45	2-HR
3-HR	1.18	1.60	1.89	2.30	2.61	2.92	3.63	3-HR
6-HR	1.25	1.73	2.05	2.49	2.84	3.18	3.97	6-HR
12-HR	1.30	1.83	2.19	2.68	3.05	3.43	4.30	12-HR
24-HR	1.35	1.93	2.32	2.86	3.27	3.68	4.63	24-HR

* IF YOUR SITE IS IN ARIZONA OR NEW MEXICO, PLEASE CONSULT THE FOLLOWING PAPER FOR REVISED DEPTH-AREA VALUES:
DEPTH-AREA RATIOS IN THE SEMI-ARID SOUTHWEST UNITED STATES
NOAA TECHNICAL MEMORANDUM NWS HYDRO-40
ZEHR AND MYERS
AUGUST 1984

INPUT DATA

PROJECT NAME=ELLSWORTH ROAD
ZONE= 7 SHORT-DURATION ZONE= 8
LATITUDE= 33.25 LONGITUDE= 111.35 ELEVATION= 1500
2-YR, 6-HR PCPN= 1.25 100-YR, 6-HR PCPN= 3.18
2-YR, 24-HR PCPN= 1.35 100-YR, 24-HR PCPN= 3.68

* * * * E N D OF R U N * * * *

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 2

Project Name: ELSWORTH ROAD Subarea id: 2

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	6.28	acres
Watercourse Length	1000.0	feet
Top Elevation	18.0	feet
Bottom Elevation	0.0	feet
Slope	.01800	feet/feet
Roughness Coefficient (Kb)	.06904	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	8	10	14	17	20
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	12.5	11.0	10.3	9.4	8.9	8.4
i (in/hr)	2.6	3.7	4.4	5.6	6.4	7.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 5

Project Name: ELSWORTH ROAD Subarea id: 5

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	2.28	acres
Watercourse Length	460.0	feet
Top Elevation	8.0	feet
Bottom Elevation	0.0	feet
Slope	.01739	feet/feet
Roughness Coefficient (Kb)	.07508	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	3	4	6	7	8
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	8.4	7.4	6.9	6.4	6.0	5.7
i (in/hr)	3.1	4.3	5.2	6.4	7.4	8.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 6

Project Name: ELSWORTH ROAD Subarea id: 6

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	6.92	acres
Watercourse Length	1000.0	feet
Top Elevation	18.0	feet
Bottom Elevation	0.0	feet
Slope	.01800	feet/feet
Roughness Coefficient (Kb)	.06846	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	9	11	15	19	22
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	12.4	11.0	10.3	9.3	8.9	8.4
i (in/hr)	2.7	3.7	4.4	5.6	6.4	7.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 8

Project Name: ELSWORTH ROAD Subarea id: 8

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	17.88	acres
Watercourse Length	1200.0	feet
Top Elevation	21.0	feet
Bottom Elevation	0.0	feet
Slope	.01750	feet/feet
Roughness Coefficient (Kb)	.06279	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	16	22	27	38	47	57
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	13.3	11.7	11.0	10.0	9.5	9.0
i (in/hr)	2.6	3.6	4.3	5.5	6.3	7.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 9

Project Name: ELSWORTH ROAD Subarea id: 9

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	8.72	acres
Watercourse Length	1100.0	feet
Top Elevation	19.0	feet
Bottom Elevation	0.0	feet
Slope	.01727	feet/feet
Roughness Coefficient (Kb)	.06708	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	8	11	13	18	23	28
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	13.2	11.6	10.9	9.9	9.4	8.9
i (in/hr)	2.6	3.6	4.3	5.5	6.3	7.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 10

Project Name: ELSWORTH ROAD Subarea id: 10

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	28.10	acres
Watercourse Length	3300.0	feet
Top Elevation	58.0	feet
Bottom Elevation	0.0	feet
Slope	.01758	feet/feet
Roughness Coefficient (Kb)	.06009	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	18	26	32	45	57	69
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	24.4	21.3	19.7	18.0	16.9	15.9
i (in/hr)	1.8	2.6	3.2	4.1	4.9	5.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 11

Project Name: ELSWORTH ROAD Subarea id: 11

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	1.38	acres
Watercourse Length	750.0	feet
Top Elevation	13.0	feet
Bottom Elevation	0.0	feet
Slope	.01733	feet/feet
Roughness Coefficient (Kb)	.07808	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	5
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	11.5	10.2	9.5	8.7	8.2	7.8
i (in/hr)	2.7	3.8	4.5	5.8	6.6	7.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 12

Project Name: ELSWORTH ROAD Subarea id: 12

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	5.14	acres
Watercourse Length	1120.0	feet
Top Elevation	20.0	feet
Bottom Elevation	0.0	feet
Slope	.01786	feet/feet
Roughness Coefficient (Kb)	.07023	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	5	6	8	11	13	16
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	13.6	12.0	11.2	10.2	9.7	9.1
i (in/hr)	2.5	3.5	4.2	5.4	6.2	7.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 13

Project Name: ESLWORTH ROAD Subarea id: 13

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	1.48	acres
Watercourse Length	480.0	feet
Top Elevation	8.5	feet
Bottom Elevation	0.0	feet
Slope	.01771	feet/feet
Roughness Coefficient (Kb)	.07766	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	3	4	5	5
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	8.7	7.7	7.2	6.6	6.3	6.0
i (in/hr)	3.1	4.3	5.1	6.3	7.3	8.4

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 14

Project Name: ELSWORTH ROAD Subarea id: 14

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	3.23 acres
Watercourse Length	600.0 feet
Top Elevation	11.0 feet
Bottom Elevation	0.0 feet
Slope	.01833 feet/feet
Roughness Coefficient (Kb)	.07300
10-Year, 6-Hour Rainfall	2.05 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	5	6	8	10	12
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	9.4	8.4	7.8	7.2	6.8	6.4
i (in/hr)	3.0	4.1	4.9	6.2	7.1	8.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 06-20-1997

LOCATION DATA

Location: CONCENTRATION POINT 15

Project Name: ELSWORTH ROAD Subarea id: 15

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	18.75	acres
Watercourse Length	1700.0	feet
Top Elevation	30.0	feet
Bottom Elevation	0.0	feet
Slope	.01765	feet/feet
Roughness Coefficient (Kb)	.06251	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	15	21	26	36	45	55
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	16.3	14.4	13.4	12.2	11.6	11.0
i (in/hr)	2.3	3.2	3.9	5.0	5.8	6.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: CP # 16

Project Name: ELLSWORTH RD Subarea id: 16

Drainage Area Cover: DESERT BRUSH

DESIGN DATA

Drainage Area	15.50	acres
Watercourse Length	1400.0	feet
Top Elevation	80.0	feet
Bottom Elevation	0.0	feet
Slope	.05714	feet/feet
Roughness Coefficient (Kb)	.08000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	15	21	24	35	44	53
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	10.9	9.6	9.2	8.2	7.8	7.4
i (in/hr)	2.8	3.9	4.4	5.9	6.7	7.8

APPENDIX B

CULVERT ANALYSIS AND CHANNEL DESIGN CALCULATIONS

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+217.4 TO 5+345
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.365
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	32.202
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	5.152
FLOW in Gutter-CFS--Q	=	6.420
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	6.687
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+345 TO 5+510
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	3.015
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	47.858
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	7.657
FLOW in Gutter-CFS--Q	=	9.541
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	9.939
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+510 TO 5+573.5
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.940
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	26.722
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	4.276
FLOW in Gutter-CFS--Q	=	5.327
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	5.549
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+573.8 TO 5+613.5
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.050
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	6.163
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	0.986
FLOW in Gutter-CFS--Q	=	1.229
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	1.280
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+613.5 TO 5+690
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.300
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	15.096
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	2.415
FLOW in Gutter-CFS--Q	=	3.010
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	3.135
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- GUTTER FLOW CAPACITY
LOCATION - 5+690 TO 5+865
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.306
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	31.498
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	5.040
FLOW in Gutter-CFS--Q	=	6.279
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	6.541
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD. TRACS NO.-
HIGHWAY NAME- STREET FLOW CAPACITY DESIGNER -
LOCATION - 5+865 TO 6+000 CHECKER -
VER 2.23 May 1992

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.896
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	37.952
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	6.072
FLOW in Gutter-CFS--Q	=	7.566
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	7.881
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 6+000 TO 6+125
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.600
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	21.349
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	3.416
FLOW in Gutter-CFS--Q	=	4.256
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	4.434
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD.
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 6+125 TO 6+375
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.200
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	30.193
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	4.831
FLOW in Gutter-CFS--Q	=	6.019
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	6.270
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 64375 TO 64515
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.143
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	40.348
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	6.456
FLOW in Gutter-CFS--Q	=	8.044
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	8.379
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD.
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 6+515 TO 6+590
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.330
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	31.786
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	5.086
FLOW in Gutter-CFS--Q	=	6.337
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	6.601
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD.
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 6+590 TO 7+270
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.118
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	40.112
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	6.418
FLOW in Gutter-CFS--Q	=	7.997
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	8.330
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 7+270 TO 7+600
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.643
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	35.329
SPREAD-Ft.--T	=	25.000
Average Velocity-V-fps	=	5.653
FLOW in Gutter-CFS--Q	=	7.043
% Flow in Gutter-CFS--Eo	=	19.936
Velocity of Flow in Gutter-fps	=	7.337
Depth at Curb Line-Inches--d	=	6.000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 54613.5 TO 54690
VER 2.23 May 1992
SPREAD - 15FT

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.300
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	3.866
SPREAD-Ft.--T	=	15.000
Average Velocity-V-fps	=	1.718
FLOW in Gutter-CFS--Q	=	1.226
% Flow in Gutter-CFS--Eo	=	31.723
Velocity of Flow in Gutter-fps	=	2.190
Depth at Curb Line-Inches--d	=	3.600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+690 TO 5+865
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

SPREAD - 15FT

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.306
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	8.067
SPREAD-Ft.--T	=	15.000
Average Velocity-V-fps	=	3.585
FLOW in Gutter-CFS--Q	=	2.559
% Flow in Gutter-CFS--Eo	=	31.723
Velocity of Flow in Gutter-fps	=	4.570
Depth at Curb Line-Inches--d	=	3.600

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

04-24-1999

PROJECT NAME- ELLSWORTH RD.
HIGHWAY NAME- STREET FLOW CAPACITY
LOCATION - 5+865 TO 6+000
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.896
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	9.720
SPREAD-Ft.--T	=	15.000
Average Velocity-V-fps	=	4.320
FLOW in Gutter-CFS--Q	=	3.083
% Flow in Gutter-CFS--Eo	=	31.723
Velocity of Flow in Gutter-fps	=	5.506
Depth at Curb Line-Inches--d	=	3.600

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: 5+225 L&R

Project Name: PAVEMENT/SHOULD Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.52	acres
Watercourse Length	410.0	feet
Top Elevation	6.0	feet
Bottom Elevation	0.0	feet
Slope	.01463	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	4
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	5.7	5.1	5.0	5.0	5.0	5.0
i (in/hr)	3.7	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~5+700~~ 5+689 L&R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	1.05	acres
Watercourse Length	410.0	feet
Top Elevation	1.5	feet
Bottom Elevation	0.0	feet
Slope	.00366	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	4	6	8	9
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	9.4	8.3	7.9	7.1	6.8	6.4
i (in/hr)	3.0	4.1	4.7	6.2	7.1	8.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~5+825~~ 5+827 L&R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.84	acres
Watercourse Length	656.0	feet
Top Elevation	8.5	feet
Bottom Elevation	0.0	feet
Slope	.01296	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	5	6	8
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	7.8	6.9	6.5	6.0	5.7	5.4
i (in/hr)	3.2	4.4	5.2	6.6	7.6	8.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~5+025~~ 6+018.5 L&R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.23	acres
Watercourse Length	213.0	feet
Top Elevation	2.0	feet
Bottom Elevation	0.0	feet
Slope	.00939	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	2	2
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+090~~ 6+071.7 R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.28	acres
Watercourse Length	262.0	feet
Top Elevation	2.0	feet
Bottom Elevation	0.0	feet
Slope	.00763	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	2	2	3
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.5	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8

LOCATION DATA 6+102.5

Location: ~~6+100~~ L

Project Name: PAVEMENT/SHOULD Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.84	acres
Watercourse Length	656.0	feet
Top Elevation	7.0	feet
Bottom Elevation	0.0	feet
Slope	.01067	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	3	4	6	7
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	8.4	7.4	7.0	6.4	6.1	5.7
i (in/hr)	3.1	4.3	5.0	6.4	7.4	8.5

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+170~~ 6+169 R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.48	acres
Watercourse Length	443.0	feet
Top Elevation	5.0	feet
Bottom Elevation	0.0	feet
Slope	.01129	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	5
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	6.5	5.8	5.4	5.0	5.0	5.0
i (in/hr)	3.5	4.7	5.7	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+305~~ 6+302.5 R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.37	acres
Watercourse Length	427.0	feet
Top Elevation	6.5	feet
Bottom Elevation	0.0	feet
Slope	.01522	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	2	3	4
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.7	5.1	5.0	5.0	5.0	5.0
i (in/hr)	3.6	4.9	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+360~~ 6+351 L

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.23	acres
Watercourse Length	213.0	feet
Top Elevation	5.0	feet
Bottom Elevation	0.0	feet
Slope	.02347	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	2	2
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+410~~ 6+404 R

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.46	acres
Watercourse Length	427.0	feet
Top Elevation	9.0	feet
Bottom Elevation	0.0	feet
Slope	.02108	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	4
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.1	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+425~~ 6+423 L

Project Name: ELLSWORTH RD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.32	acres
Watercourse Length	295.0	feet
Top Elevation	6.5	feet
Bottom Elevation	0.0	feet
Slope	.02203	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	2	2	3	3
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~6+515~~ 6+511.5 L & R

Project Name: ELLSWORTH ROAD Subarea id: ááááááááá

Drainage Area Cover: PAVEMENT

DESIGN DATA

Drainage Area	0.97	acres
Watercourse Length	902.0	feet
Top Elevation	19.0	feet
Bottom Elevation	0.0	feet
Slope	.02106	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	3	4	4	6	7	9
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	7.9	7.0	6.6	6.0	5.7	5.4
i (in/hr)	3.2	4.4	5.2	6.5	7.5	8.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: 6+830 L&R

Project Name: áááááááááááááá Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.61	acres
Watercourse Length	475.0	feet
Top Elevation	10.0	feet
Bottom Elevation	0.0	feet
Slope	.02105	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	3	3	4	5
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	5.4	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: 6+975 L&R

Project Name: áááááááááááááá Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.56	acres
Watercourse Length	433.0	feet
Top Elevation	9.0	feet
Bottom Elevation	0.0	feet
Slope	.02079	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	2	2	3	4	5
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	5.2	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA 74110

Location: ~~74107~~ L&R

Project Name: áááááááááááááá Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.50	acres
Watercourse Length	387.0	feet
Top Elevation	8.0	feet
Bottom Elevation	0.0	feet
Slope	.02067	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	4
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.8	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~7+225~~ 7+224 L&R

Project Name: PAVEMENT Subarea id: áááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.87	acres
Watercourse Length	803.0	feet
Top Elevation	13.0	feet
Bottom Elevation	0.0	feet
Slope	.01619	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	2	3	4	5	7	8
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	8.1	7.2	6.8	6.2	5.9	5.6
i (in/hr)	3.2	4.4	5.1	6.5	7.5	8.6

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA 7+417

Location: ~~7+470~~ L (AREA DRAIN)

Project Name: áááááááááááááá Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.24	acres
Watercourse Length	427.0	feet
Top Elevation	7.0	feet
Bottom Elevation	0.0	feet
Slope	.01639	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	1	1	1	2	2
C	0.750	0.750	0.750	0.825	0.900	0.938
Tc (min)	5.6	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	5.0	5.9	6.9	7.9	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: CMG Date: 5/8/99

LOCATION DATA

Location: ~~7+470~~ 7+417 L&R

Project Name: áááááááááááááá Subarea id: ááááááááá

Drainage Area Cover: ááááááááááááááááááááááááááááá

DESIGN DATA

Drainage Area	0.46	acres
Watercourse Length	426.0	feet
Top Elevation	7.0	feet
Bottom Elevation	0.0	feet
Slope	.01643	feet/feet
Roughness Coefficient (Kb)	.04000	
10-Year, 6-Hour Rainfall	2.05	inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	1	2	2	3	4	4
C	0.850	0.850	0.850	0.935	1.020	1.063
Tc (min)	5.6	5.0	5.0	5.0	5.0	5.0
i (in/hr)	3.7	5.0	5.9	6.9	7.9	8.9

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 7+610 TO 7+470

Q	D	S	n	d
45.00	2.37	.0160	.0130	2.37

V	A	WP	Rh	TW
10.20	4.41	7.45	.59	.00

Dc	F#	Hv	Hsp
2.29	.94	1.61	3.98

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 7+470 TO 7+377

Q	D	S	n	d
51.00	2.48	.0160	.0130	2.48

V	A	WP	Rh	TW
10.52	4.85	7.80	.62	.00

Dc	F#	Hv	Hsp
2.41	.95	1.72	4.20

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 7+377 TO 7+225

Q	D	S	n	d
52.00	2.50	.0160	.0130	2.50

V	A	WP	Rh	TW
10.57	4.92	7.86	.63	.00

Dc	F#	Hv	Hsp
2.43	.95	1.74	4.24

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 7+255 TO 7+107

Q	D	S	n	d
60.00	2.64	.0160	.0130	2.64

V	A	WP	Rh	TW
10.96	5.47	8.29	.66	.00

Dc	F#	Hv	Hsp
2.58	.96	1.87	4.51

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH RD

PROJECT LOCATION: 7+107 TO 6+975

Q	D	S	n	d
68.00	2.63	.0210	.0130	2.63

V	A	WP	Rh	TW
12.52	5.43	8.26	.66	.00

Dc	F#	Hv	Hsp
2.75	1.09	2.43	5.06

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH RD

PROJECT LOCATION: 6+975 TO 6+830

Q	D	S	n	d
76.00	2.74	.0210	.0130	2.74

V	A	WP	Rh	TW
12.88	5.90	8.61	.69	.00

Dc	F#	Hv	Hsp
2.88	1.10	2.57	5.32

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH RD

PROJECT LOCATION: 6+830 TO 6+780

SHOULD THIS BE 3.0'?

Q	D	S	n	d
84.00	2.85	.0210	.0130	2.85

V	A	WP	Rh	TW
13.20	6.37	8.94	.71	.00

Dc	F#	Hv	Hsp
3.00	1.10	2.71	5.55

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ellsworth road

PROJECT LOCATION: 6+540 TO 6+515

Q	D	S	n	d
10.00	1.36	.0150	.0130	1.36

V	A	WP	Rh	TW
6.83	1.46	4.29	.34	.00

Dc	F#	Hv	Hsp
1.24	.83	.73	2.09

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+515 TO 6+425

Q	D	S	n	d
14.00	1.55	.0150	.0130	1.55

V	A	WP	Rh	TW
7.43	1.88	4.86	.39	.00

Dc	F#	Hv	Hsp
1.42	.85	.86	2.41

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+425 TO 6+410

Q	D	S	n	d
16.00	1.63	.0150	.0130	1.63

V	A	WP	Rh	TW
7.69	2.08	5.11	.41	.00

Dc	F#	Hv	Hsp
1.50	.85	.92	2.55

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+410 TO 6+360

Q	D	S	n	d
18.00	1.70	.0150	.0130	1.70

V	A	WP	Rh	TW
7.92	2.27	5.35	.43	.00

Dc	F#	Hv	Hsp
1.57	.86	.97	2.67

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+360 TO 6+305

Q	D	S	n	d
19.00	1.74	.0150	.0130	1.74

V	A	WP	Rh	TW
8.02	2.37	5.45	.43	.00

Dc	F#	Hv	Hsp
1.61	.86	1.00	2.74

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+305 TO 6+170

Q	D	S	n	d
43.00	2.36	.0150	.0130	2.36

V	A	WP	Rh	TW
9.84	4.37	7.41	.59	.00

Dc	F#	Hv	Hsp
2.24	.91	1.50	3.86

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+170 TO 6+100

Q	D	S	n	d
45.00	2.40	.0150	.0130	2.40

V	A	WP	Rh	TW
9.95	4.52	7.54	.60	.00

Dc	F#	Hv	Hsp
2.29	.91	1.54	3.94

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+100 TO 6+090

Q	D	S	n	d
51.00	2.99	.0060	.0130	2.99

V	A	WP	Rh	TW
7.28	7.00	9.38	.75	.00

Dc	F#	Hv	Hsp
2.30	.60	.82	3.81

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+090 TO 6+025

Q	D	S	n	d
52.00	3.01	.0060	.0130	3.01

V	A	WP	Rh	TW
7.32	7.10	9.45	.75	.00

Dc	F#	Hv	Hsp
2.32	.60	.83	3.84

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 6+025 TO 5+990

Q	D	S	n	d
54.00	3.05	.0060	.0130	3.05

V	A	WP	Rh	TW
7.39	7.31	9.58	.76	.00

Dc	F#	Hv	Hsp
2.35	.61	.85	3.90

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH ROAD

PROJECT LOCATION: 5+990 TO OUTLET

Q	D	S	n	d
60.00	3.17	.0060	.0130	3.17

V	A	WP	Rh	TW
7.59	7.91	9.97	.79	.00

Dc	F#	Hv	Hsp
2.46	.61	.89	4.07

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

MANNINGS RATING FOR CIRCULAR SECTION

PROJECT NAME: ELLSWORTH RD

PROJECT LOCATION: ADOBE RD. STORM DRAIN

Q	D	S	n	d
45.58	3.00	.0047	.0130	3.00

V	A	WP	Rh	TW
6.45	7.07	9.42	.75	.00

Dc	F#	Hv	Hsp
2.17	.53	.65	3.65

Q = DISCHARGE (CFS)
D = DIAMETER (FT)
S = SLOPE (FT/FT)
n = ROUGHNESS COEFFICIENT
d = DEPTH (FT)
V = VELOCITY (FT/S)
A = AREA (SQ. FT.)
WP = WETTED PERIMETER (FT)
Rh = HYDRAULIC RADIUS (FT)
TW = TOPWIDTH (FT)
Dc = CRITICAL DEPTH (FT)
F# = FROUDE NUMBER
Hv = VELOCITY HEAD (FT)
Hsp = SPECIFIC HEAD (FT)

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - AUDOE RD.
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

STA

CURB OPENING W/ GRATE--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480

GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Effective Perimeter--Ft.	=	7.300
CLOGGING FACTOR--CURB OPEN.	=	0.800
CLOGGING FACTOR--CURB OPEN.	=	0.800
Local Gutter Depression-Inches	=	2.000
Flow-CFS--Q	=	45.000

LENGTH	Q(Curb Op)	Q(Grate)	d(inches)	SPREAD,
3.083	11.465	33.533	31.286	122.0
6.583	19.251	25.748	20.572	77.3
9.583	25.382	19.617	17.452	64.3
13.583	31.391	13.607	14.053	50.2
20.583	36.744	8.257	10.562	35.6

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - ADOBE RD STA 1+374 & STA 1+234
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.705
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	25.000
SPREAD-Ft.--T	=	25.734
Average Velocity-V-fps	=	3.775
FLOW in Gutter-CFS--Q	=	4.851
% Flow in Gutter-CFS--Eo	=	19.405
Velocity of Flow in Gutter-fps	=	4.903
Depth at Curb Line-Inches--d	=	6.176

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	6.176
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	43.003
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)
3.500	0.114	2.853	6.151	9.005	15.995
6.500	0.207	5.176	5.824	11.000	14.000
10.500	0.324	8.094	5.379	13.473	11.527
17.500	0.508	12.696	4.578	17.275	7.725

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - ADOBE RD
VER 2.23 May 1992
STATION 1+500

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.693
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	45.000
SPREAD-Ft.--T	=	27.221
Average Velocity-V-fps	=	6.073
FLOW in Gutter-CFS--Q	=	8.286
% Flow in Gutter-CFS--Eo	=	18.412
Velocity of Flow in Gutter-fps	=	7.900
Depth at Curb Line-Inches--d	=	6.533

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	6.533
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	72.954
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)
3.500	0.068	3.061	6.793	9.854	35.146
6.500	0.125	5.608	6.653	12.261	32.739
10.500	0.198	8.893	6.457	15.351	29.649
17.500	0.319	14.335	6.093	20.427	24.573

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 51689 Left & Right Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Flow-CFS--Q	=	8.000
Local Gutter Depression-Inches	=	2.000
CLOGGING FACTOR--CURB OPEN.	=	0.800

LENGTH	d(weir)	d(orifice)	d(INLET)	SPREAD
3.083	9.010	16.880	16.880	61.999
6.583	6.804	5.996	6.804	20.018
9.583	5.728	2.830	5.728	15.534
13.583	4.801	1.408	4.801	11.669
20.583	3.823	0.613	3.823	7.594

*** d(INLET) is Greater of WEIR or ORIFICE Depth.! ***

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- Ellsworth RD
HIGHWAY NAME-
LOCATION - 5+825 Right Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.306
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	3.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.720
Manning's 'N	=	0.016
Flow-CFS--Q	=	6.000
SPREAD-Ft.--T	=	13.424
Average Velocity-V-fps	=	3.330
FLOW in Gutter-CFS--Q	=	2.943
% Flow in Gutter-CFS--Eo	=	49.057
Velocity of Flow in Gutter-fps	=	4.114
Depth at Curb Line-Inches--d	=	3.222

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	3.222
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	22.842
CLOGGING FACTOR--GRATE	=	0.500
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.210	1.258	2.914	4.173	1.827	69.55
6.500	0.372	2.231	2.583	4.814	1.186	80.23
10.500	0.562	3.371	2.104	5.475	0.525	91.25
17.500	0.819	4.913	1.050	5.963	0.037	99.38

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+00.19 Left & Right Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.600
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	2.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.000
SPREAD-Ft.--T	=	7.933
Average Velocity-V-fps	=	1.589
FLOW in Gutter-CFS--Q	=	0.539
% Flow in Gutter-CFS--Eo	=	53.921
Velocity of Flow in Gutter-fps	=	1.944
Depth at Curb Line-Inches--d	=	1.904

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	1.904
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	6.462
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.640	0.640	0.360	1.000	0.000	100.00
6.500	0.947	0.947	0.053	1.000	0.000	100.00
10.500	1.000	1.000	0.000	1.000	0.000	100.00
17.500	1.000	1.000	0.000	1.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+07 Right Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	0.600
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	2.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	1.000
SPREAD-Ft.--T	=	7.933
Average Velocity-V-fps	=	1.589
FLOW in Gutter-CFS--Q	=	0.539
% Flow in Gutter-CFS--Eo	=	53.921
Velocity of Flow in Gutter-fps	=	1.944
Depth at Curb Line-Inches--d	=	1.904

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	1.904
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	6.462
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.640	0.640	0.360	1.000	0.000	100.00
6.500	0.947	0.947	0.053	1.000	0.000	100.00
10.500	1.000	1.000	0.000	1.000	0.000	100.00
17.500	1.000	1.000	0.000	1.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+169 RT. Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.200
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	9.034
Average Velocity-V-fps	=	2.451
FLOW in Gutter-CFS--Q	=	0.974
% Flow in Gutter-CFS--Eo	=	48.697
Velocity of Flow in Gutter-fps	=	3.031
Depth at Curb Line-Inches--d	=	2.168

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	2.168
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	11.215
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.404	0.807	1.118	1.925	0.075	96.26
6.500	0.674	1.348	0.651	2.000	0.000	99.99
10.500	0.917	1.834	0.166	2.000	0.000	100.00
17.500	1.000	2.000	0.000	2.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+703 [illegible]
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.140
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	8.105
Average Velocity-V-fps	=	3.044
FLOW in Gutter-CFS--Q	=	1.061
% Flow in Gutter-CFS--Eo	=	53.034
Velocity of Flow in Gutter-fps	=	3.732
Depth at Curb Line-Inches--d	=	1.945

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	1.945
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	12.765
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.360	0.719	1.222	1.941	0.059	97.05
6.500	0.610	1.220	0.780	2.000	0.000	100.00
10.500	0.855	1.710	0.290	2.000	0.000	100.00
17.500	1.000	2.000	0.000	2.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+75 Left Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.140
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	8.105
Average Velocity-V-fps	=	3.044
FLOW in Gutter-CFS--Q	=	1.061
% Flow in Gutter-CFS--Eo	=	53.034
Velocity of Flow in Gutter-fps	=	3.732
Depth at Curb Line-Inches--d	=	1.945

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	1.945
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	12.765
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.360	0.719	1.222	1.941	0.059	97.05
6.500	0.610	1.220	0.780	2.000	0.000	100.00
10.500	0.855	1.710	0.290	2.000	0.000	100.00
17.500	1.000	2.000	0.000	2.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+424 Left Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.140
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	8.105
Average Velocity-V-fps	=	3.044
FLOW in Gutter-CFS--Q	=	1.061
% Flow in Gutter-CFS--Eo	=	53.034
Velocity of Flow in Gutter-fps	=	3.732
Depth at Curb Line-Inches--d	=	1.945

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	1.945
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	12.765
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.360	0.719	1.222	1.941	0.059	97.05
6.500	0.610	1.220	0.780	2.000	0.000	100.00
10.500	0.855	1.710	0.290	2.000	0.000	100.00
17.500	1.000	2.000	0.000	2.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 6+512 L&R Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.140
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.000
SPREAD-Ft.--T	=	10.511
Average Velocity-V-fps	=	3.620
FLOW in Gutter-CFS--Q	=	1.722
% Flow in Gutter-CFS--Eo	=	43.044
Velocity of Flow in Gutter-fps	=	4.526
Depth at Curb Line-Inches--d	=	2.523

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	2.523
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	19.092
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.248	0.993	2.093	3.086	0.914	77.15
6.500	0.436	1.743	1.777	3.521	0.479	88.01
10.500	0.648	2.591	1.310	3.901	0.099	97.52
17.500	0.907	3.629	0.371	4.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - Cat 830 L&R Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	2.140
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	3.000
SPREAD-Ft.--T	=	9.436
Average Velocity-V-fps	=	3.369
FLOW in Gutter-CFS--Q	=	1.411
% Flow in Gutter-CFS--Eo	=	47.020
Velocity of Flow in Gutter-fps	=	4.180
Depth at Curb Line-Inches--d	=	2.265

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	2.265
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	16.119
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.291	0.872	1.716	2.588	0.412	86.26
6.500	0.504	1.512	1.361	2.873	0.127	95.77
10.500	0.734	2.203	0.797	3.000	0.000	100.00
17.500	0.974	2.922	0.078	3.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 7+224 L&R Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.640
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	4.000
SPREAD-Ft.--T	=	11.049
Average Velocity-V-fps	=	3.277
FLOW in Gutter-CFS--Q	=	1.652
% Flow in Gutter-CFS--Eo	=	41.290
Velocity of Flow in Gutter-fps	=	4.109
Depth at Curb Line-Inches--d	=	2.652

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	2.652
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	18.036
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.262	1.048	2.094	3.142	0.858	78.55
6.500	0.458	1.831	1.752	3.583	0.417	89.58
10.500	0.676	2.706	1.225	3.930	0.070	98.26
17.500	0.932	3.730	0.270	4.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 7+417 L&R Gutter
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

CURB OPENING W/ GRATE--ON GRADE

GUTTER FLOW HYDRAULICS
GUTTER DESCRIPTION

Roadway Grade-% Per cent--G	=	1.640
Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	4.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480
Manning's 'N	=	0.016
Flow-CFS--Q	=	2.000
SPREAD-Ft.--T	=	8.520
Average Velocity-V-fps	=	2.755
FLOW in Gutter-CFS--Q	=	1.020
% Flow in Gutter-CFS--Eo	=	51.010
Velocity of Flow in Gutter-fps	=	3.392
Depth at Curb Line-Inches--d	=	2.045

CURB OPENING--ADOT STD. C-15.40
GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	3.300
Grate Width---Ft.	=	2.000
Grate Area--Sq. Ft.	=	6.600
Splash-Over Velocity--FPS	=	4.000
Depth at INLET Curb Line-Inches--d	=	2.045
Local Gutter Depression-Inches	=	2.000
Length of opening: TOTAL Intercept--Ft.	=	12.019
CLOGGING FACTOR--GRATE	=	0.600
CLOGGING FACTOR--CURB OPEN.	=	0.800

CURB OPENING:

LENGTH	Efficiency	Q(C.O.)	Q(GRATE)	Q(INT.)	Q(By-Pass)	% CAPT.
3.500	0.380	0.759	1.183	1.942	0.058	97.12
6.500	0.639	1.279	0.721	2.000	0.000	100.00
10.500	0.885	1.769	0.231	2.000	0.000	100.00
17.500	1.000	2.000	0.000	2.000	0.000	100.00

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DEVELOPMENT GROUP
BRIDGE DRAINAGE SERVICES

05-08-1999

PROJECT NAME- ELLSWORTH RD
HIGHWAY NAME-
LOCATION - 7600 MCLELLAN RD
VER 2.23 May 1992

TRACS NO.-
DESIGNER -
CHECKER -

GRATE INLET--IN SUMP

GUTTER FLOW HYDRAULICS

GUTTER DESCRIPTION

Roadway Cross-Slope-Ft./Ft.--Sx	=	0.020
Shoulder Width-Ft.--	=	2.000
Shoulder Slope-Ft./Ft.--Ss	=	0.020
Gutter Width-Ft.--W	=	2.000
Gutter Slope-Ft./Ft.--Sw	=	0.020
Gutter Depression-Inches--	=	0.480

GRATE TYPE: NON-STD. GRATE

Grate Length--Ft.	=	2.000
Grate Width---Ft.	=	20.000
Grate Area--Sq. Ft.	=	40.000
Effective Perimeter--Ft.	=	42.000
CLOGGING FACTOR--GRATE	=	0.500
Local Gutter Depression-Inches	=	0.000
Depth at INLET Curb Line-Inches--d	=	12.000
Depth at C.G. of Grate Flow--In.	=	9.800
SPREAD-Ft.--T	=	50.000
FLOW INTERCEPTED--WEIR FLOW--CFS	=	45.675
FLOW INTERCEPTED--ORIFICE FLOW--CFS	=	96.743

Q(INLET)=45.675 cfs is Based on WEIR flow

WH / CROSS-LOCATION FILE
±6+375

CURRENT DATE: 05-19-1999 FILE DATE: 05-19-1999
CURRENT TIME: 10:17:27 FILE NAME: ELLS7

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULVERT NO.	SITE DATA: INLET ELEV. (m)	OUTLET ELEV. (m)	CULVERT LENGTH (m)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE MATERIAL	SPAN (mm)	RISE (mm)	MANNING n	INLET TYPE
1	0.70	0.00	60.05	2	RCPE	965	610	.012	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (m3/s) FILE: ELLS7 DATE: 05-19-1999

ELEV (m)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
0.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.86	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.93	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.99	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.04	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.09	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.14	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.18	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.23	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.27	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1.31	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ELLS7 DATE: 05-19-1999

HEAD ELEV (m)	HEAD ERROR (m)	TOTAL FLOW (m3/s)	FLOW ERROR (m3/s)	% FLOW ERROR
0.70	0.000	0.00	0.00	0.00
0.86	0.000	0.13	0.00	0.00
0.93	0.000	0.26	0.00	0.00
0.99	0.000	0.39	0.00	0.00
1.04	0.000	0.52	0.00	0.00
1.09	0.000	0.65	0.00	0.00
1.14	0.000	0.78	0.00	0.00
1.18	0.000	0.91	0.00	0.00
1.23	0.000	1.04	0.00	0.00
1.27	0.000	1.17	0.00	0.00
1.31	0.000	1.30	0.00	0.00

<1> TOLERANCE (m) = 0.003 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-19-1999 FILE DATE: 05-19-1999
CURRENT TIME: 10:17:27 FILE NAME: ELLS7

PERFORMANCE CURVE FOR CULVERT 1 - 2(965 mm BY 610 mm) RCPE

DIS-CHARGE FLOW (m3/s)	HEAD-WATER ELEV. (m)	INLET CONTROL DEPTH (m)	OUTLET CONTROL DEPTH (m)	FLOW TYPE <F4>	NORMAL DEPTH (m)	CRIT. DEPTH (m)	OUTLET DEPTH (m)	TW DEPTH (m)	OUTLET VEL. (m/s)	TW VEL. (m/s)
0.00	0.70	0.00	-0.70	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.13	0.86	0.16	-0.33	1-S2n	0.09	0.12	0.06	0.10	2.54	0.40
0.26	0.93	0.23	-0.30	1-S2n	0.12	0.17	0.12	0.15	1.80	0.51
0.39	0.99	0.29	-0.27	1-S2n	0.15	0.21	0.12	0.18	2.75	0.59
0.52	1.04	0.34	-0.23	1-S2n	0.18	0.25	0.16	0.22	2.52	0.65
0.65	1.09	0.39	-0.19	1-S2n	0.20	0.28	0.16	0.25	3.13	0.70
0.78	1.14	0.44	-0.15	1-S2n	0.22	0.31	0.19	0.27	3.00	0.74
0.91	1.18	0.48	-0.10	1-S2n	0.24	0.34	0.22	0.30	2.93	0.78
1.04	1.23	0.52	-0.04	1-S2n	0.26	0.37	0.26	0.32	2.69	0.81
1.17	1.27	0.57	0.01	1-S2n	0.27	0.39	0.27	0.34	2.81	0.84
1.30	1.31	0.61	0.07	1-S2n	0.29	0.41	0.26	0.36	3.33	0.87

El. inlet face invert 0.70 m El. outlet invert 0.00 m
El. inlet throat invert 0.00 m El. inlet crest 0.00 m

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

INLET STATION	0.00 m
INLET ELEVATION	0.70 m
OUTLET STATION	60.05 m
OUTLET ELEVATION	0.00 m
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0117
CULVERT LENGTH ALONG SLOPE	60.05 m

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

BARREL SHAPE	ELLIPTICAL
BARREL SPAN	965 mm
BARREL RISE	610 mm
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 05-19-1999 FILE DATE: 05-19-1999
CURRENT TIME: 10:17:27 FILE NAME: ELLS7

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áááááááááááááááááááááááááá TAILWATER áááááááááááááááááááááááááá
ááá

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	3.05 m
SIDE SLOPE H/V (X:1)	3.0
CHANNEL SLOPE V/H (m /m)	0.005
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	0.00 m
CULVERT NO.1 OUTLET INVERT ELEVATION	0.00 m

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

FLOW (m3/s)	W.S.E. (m)	FROUDE NUMBER	DEPTH (m)	VEL. (m/s)	SHEAR (Pa)
0.00	0.00	0.000	0.00	0.00	0.00
0.13	0.10	0.411	0.10	0.40	4.74
0.26	0.15	0.429	0.15	0.51	7.13
0.39	0.18	0.438	0.18	0.59	9.05
0.52	0.22	0.444	0.22	0.65	10.63
0.65	0.25	0.448	0.25	0.70	12.07
0.78	0.27	0.451	0.27	0.74	13.41
0.91	0.30	0.454	0.30	0.78	14.60
1.04	0.32	0.456	0.32	0.81	15.75
1.17	0.34	0.458	0.34	0.84	16.81
1.30	0.36	0.459	0.36	0.87	17.81

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áááááááááááááááááááááááááá ROADWAY OVERTOPPING DATA áááááááááááááááááááááááááá
ááá

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	60.05 m
CREST LENGTH	30.48 m
OVERTOPPING CREST ELEVATION	1.01 m

ááá

ELLSWORTH RD. 50 YR EVENT
CROSS-SECTION - DRAINAGEWAY BETWEEN ADOBE ROAD AND CAP CANAL

STA:	.00	3.00	22.00	25.00
ELEV:	3.00	.00	.00	3.00

DISCHARGE = 275. WSEL = 1.50 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

		TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS)	=	275.44	275.44
VELOCITY (FT/S)	=	8.96	8.96
AREA (SQUARE FT)	=	30.76	30.76
TOPWIDTH (FT)	=	22.00	22.00
DEPTH (FT)	=	1.50	1.50
HYD. DEPTH (FT)	=	1.40	1.40
WET. PERIM. (FT)	=	23.24	23.24
HYD. RADIUS (FT)	=	1.32	1.32
FROUDE NUMBER	=	1.33	1.33
MANNINGS N VALUE	=	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 25.00

ELLSWORTH RD. 100YR. EVENT
CROSS-SECTION - DRAINAGEWAY BETWEEN ADOBE ROAD AND CAP CANAL

STA:	.00	3.00	22.00	25.00
ELEV:	3.00	.00	.00	3.00

DISCHARGE = 445. WSEL = 2.00 SLOPE = .0100

SECTION AND SUBSECTION HYDRAULIC DATA

		TOTAL SECTION	SUBSECTION #: 1
DISCHARGE (CFS)	=	445.17	445.17
VELOCITY (FT/S)	=	10.60	10.60
AREA (SQUARE FT)	=	42.00	42.00
TOPWIDTH (FT)	=	23.00	23.00
DEPTH (FT)	=	2.00	2.00
HYD. DEPTH (FT)	=	1.83	1.83
WET. PERIM. (FT)	=	24.66	24.66
HYD. RADIUS (FT)	=	1.70	1.70
FROUDE NUMBER	=	1.38	1.38
MANNINGS N VALUE	=	.0200	.0200

SUBSECTION 1 = STATION .00 TO STATION 25.00

APPENDIX C

DRAINAGE SYSTEM PLANS

DGN =\\phos01\work\31861\CADD\Civil\PLANS\Ellsd01a.dgn
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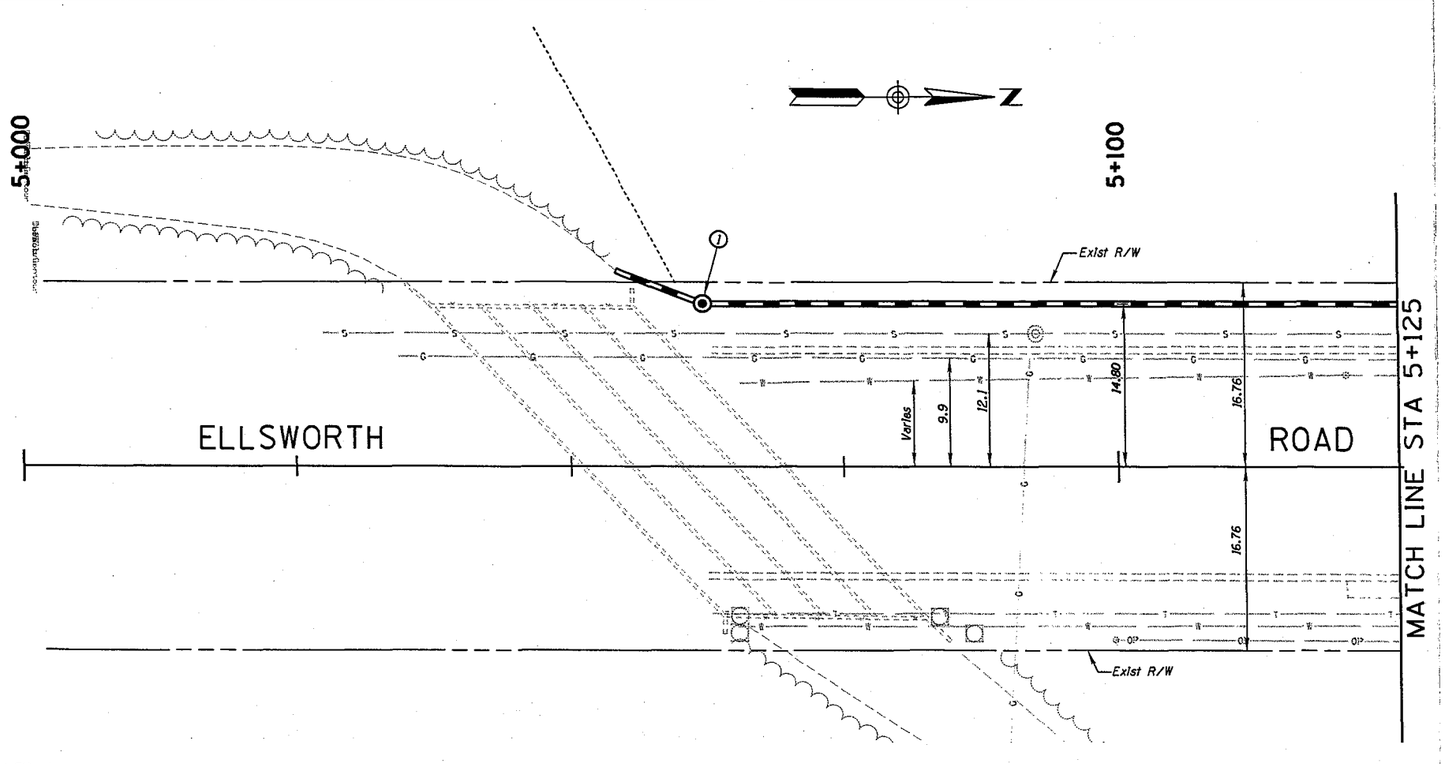
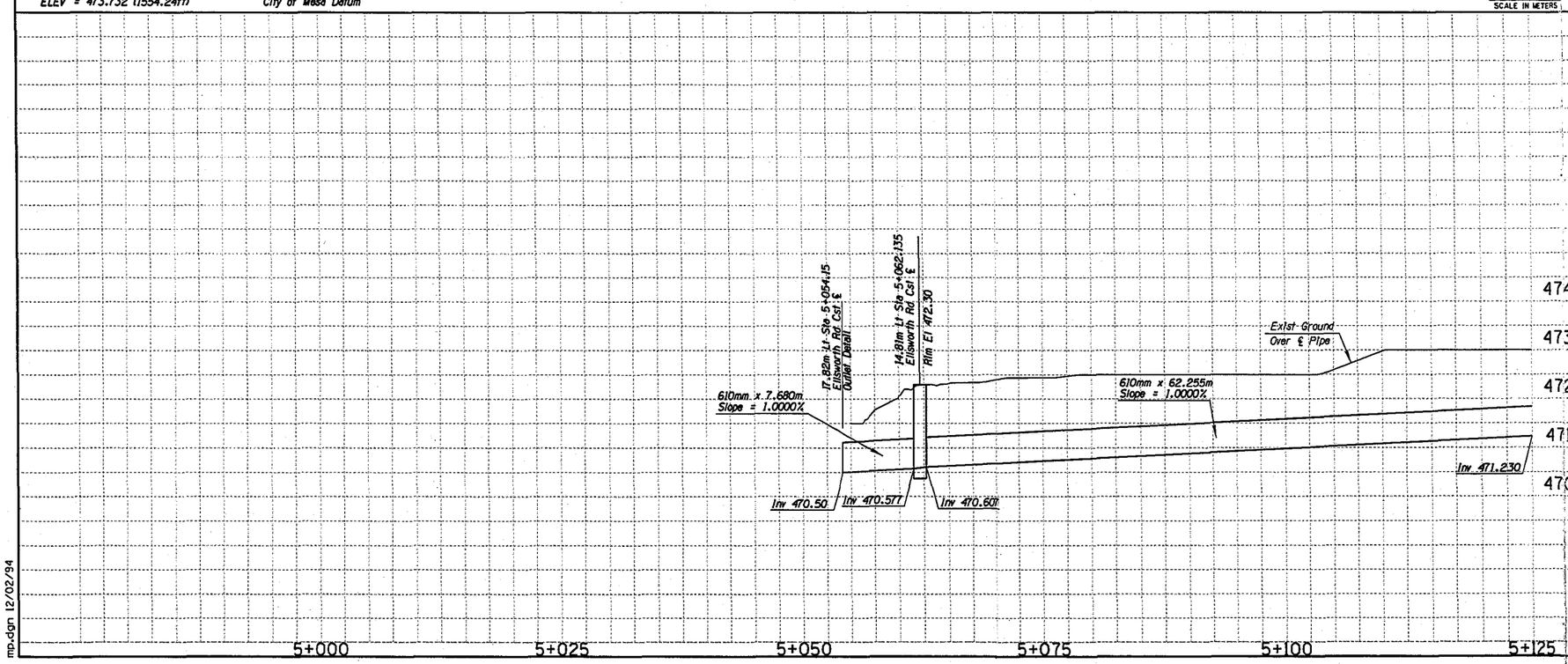


▲ BM-
Brass Cap In HH at Intersection of
University Dr & Ellsworth Rd
ELEV = 473.732 (1554.24ft)

Project BM-
Chiseled Square on Top of Curb
@ NW Cor University & Ellsworth
ELEV = 473.772 (1554.37ft)
City of Mesa Datum

SCALE: Hor=1:250
Vert=1:50
5 0 5 10
SCALE IN METERS



F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

(1) Sta 5+062, 14.8m Lt, New MH per MAG Det 520 & 522 1 Ea

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

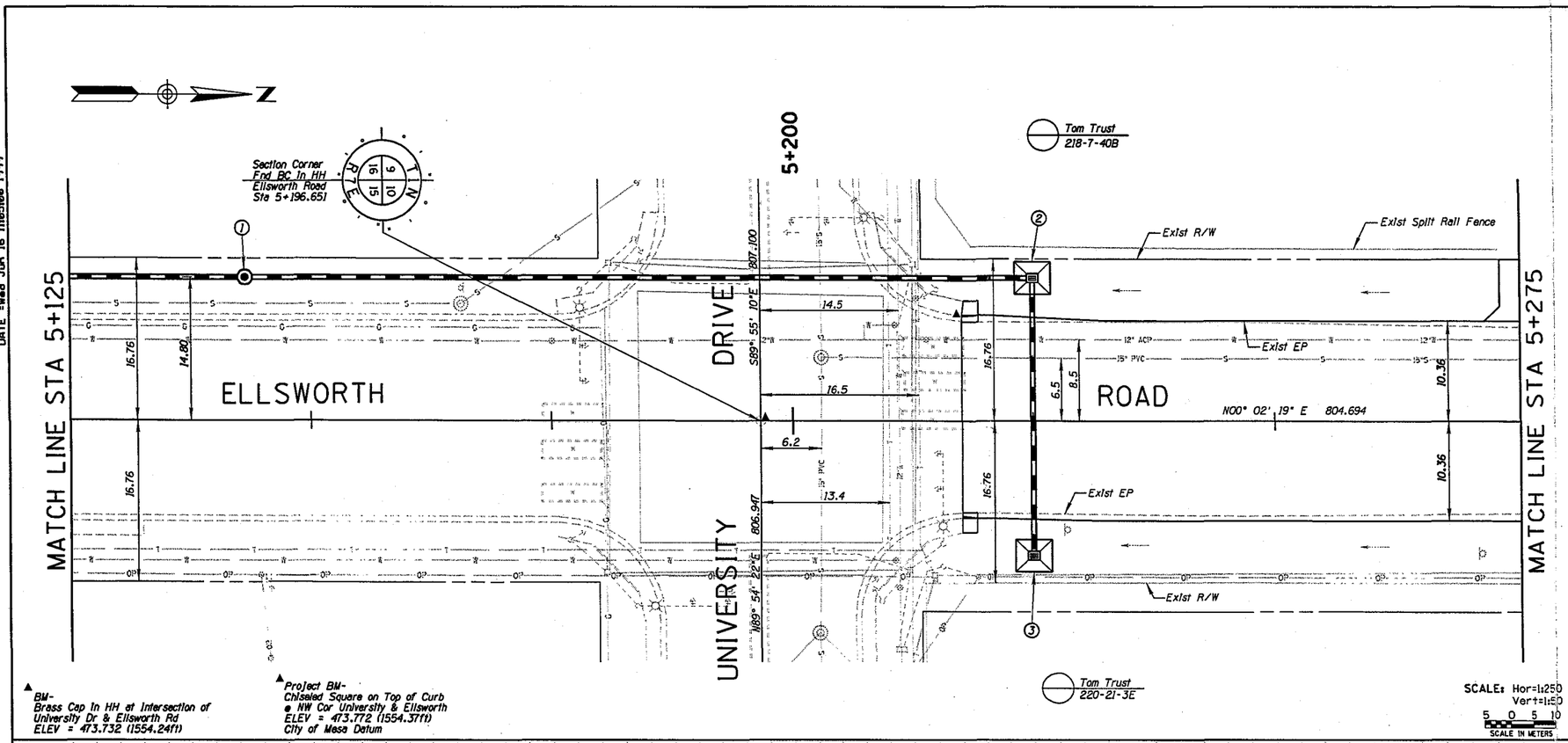
ELLSWORTH ROAD STORM DRAIN
STA. 5+054 TO STA 5+125

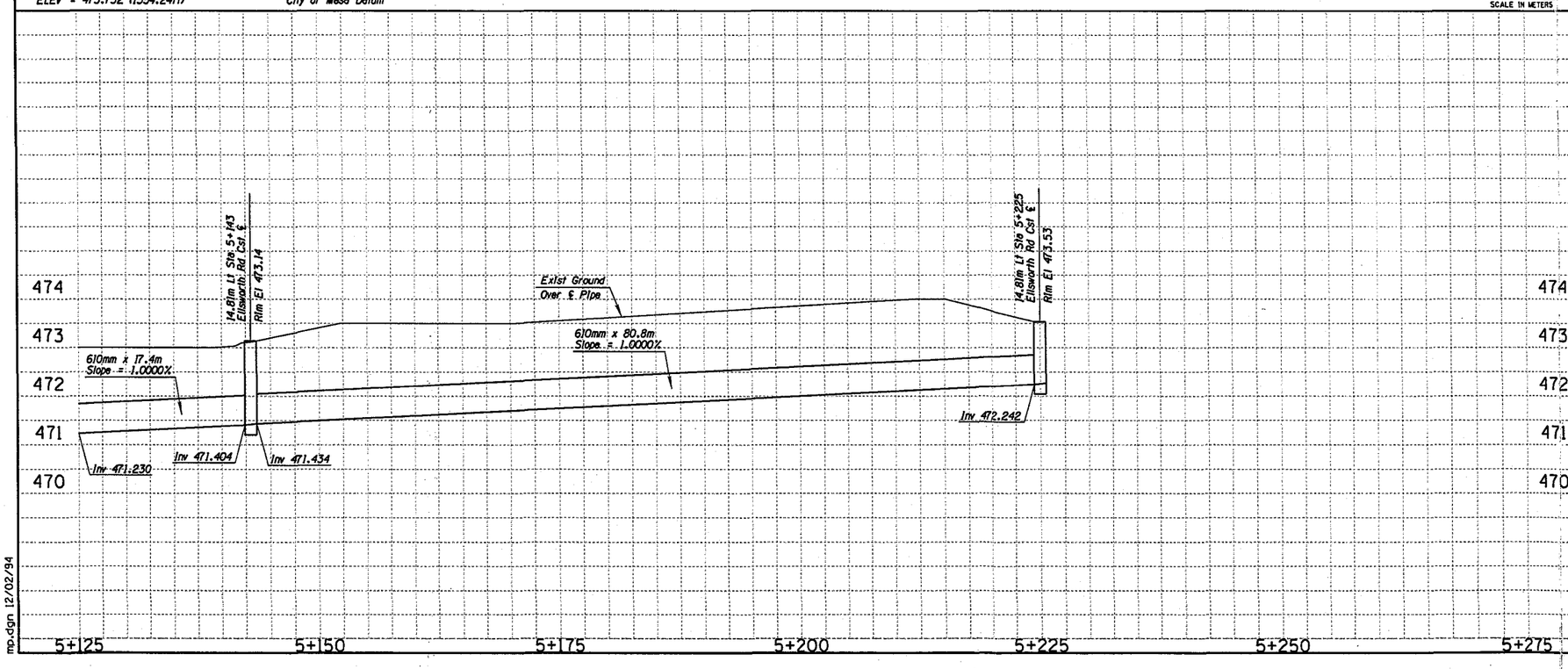
SHEET OF
1

TRACS NO.

mp.dgn 12/02/94

DGN =\\phos01\work\31861\CADD\Civil\PLANS\Elsd01.dgn
DATE =Wed Jun 16 11:05:08 1999





mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

○ CONSTRUCTION ○

1. Sta 5+143, 14.8m Lt, New MH per MAG Det 520 & 522
2. Sta 5+225, 14.33m Lt, Install New CB per ADOT C-15.80
3. Sta 5+225, 14.33m Rt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 5+125 to STA 5+275.000

SHEET OF 2

TRACS NO.

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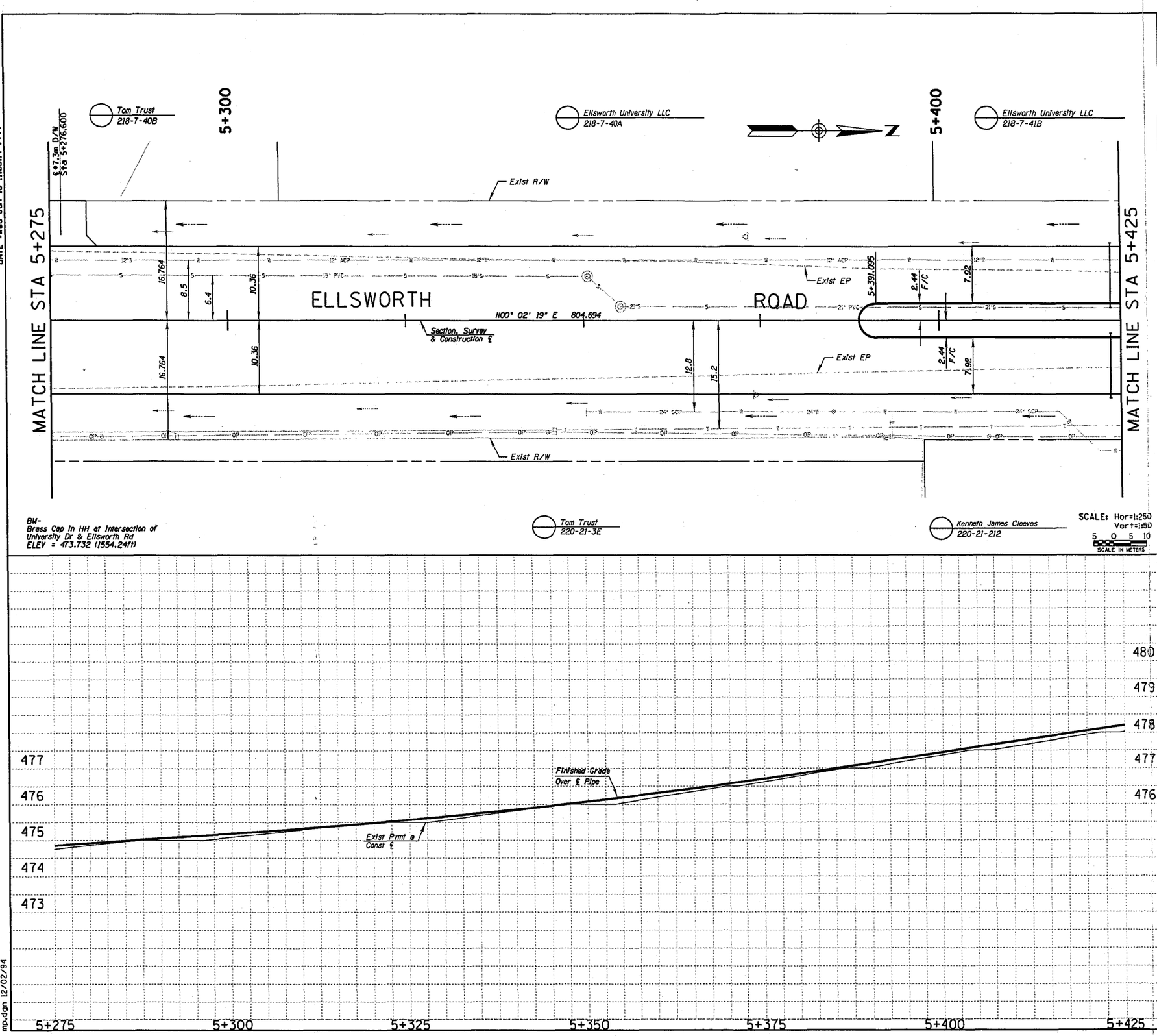

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA. 5+275.000 to STA 5+425.000

SHEET OF 3

TRACS NO.

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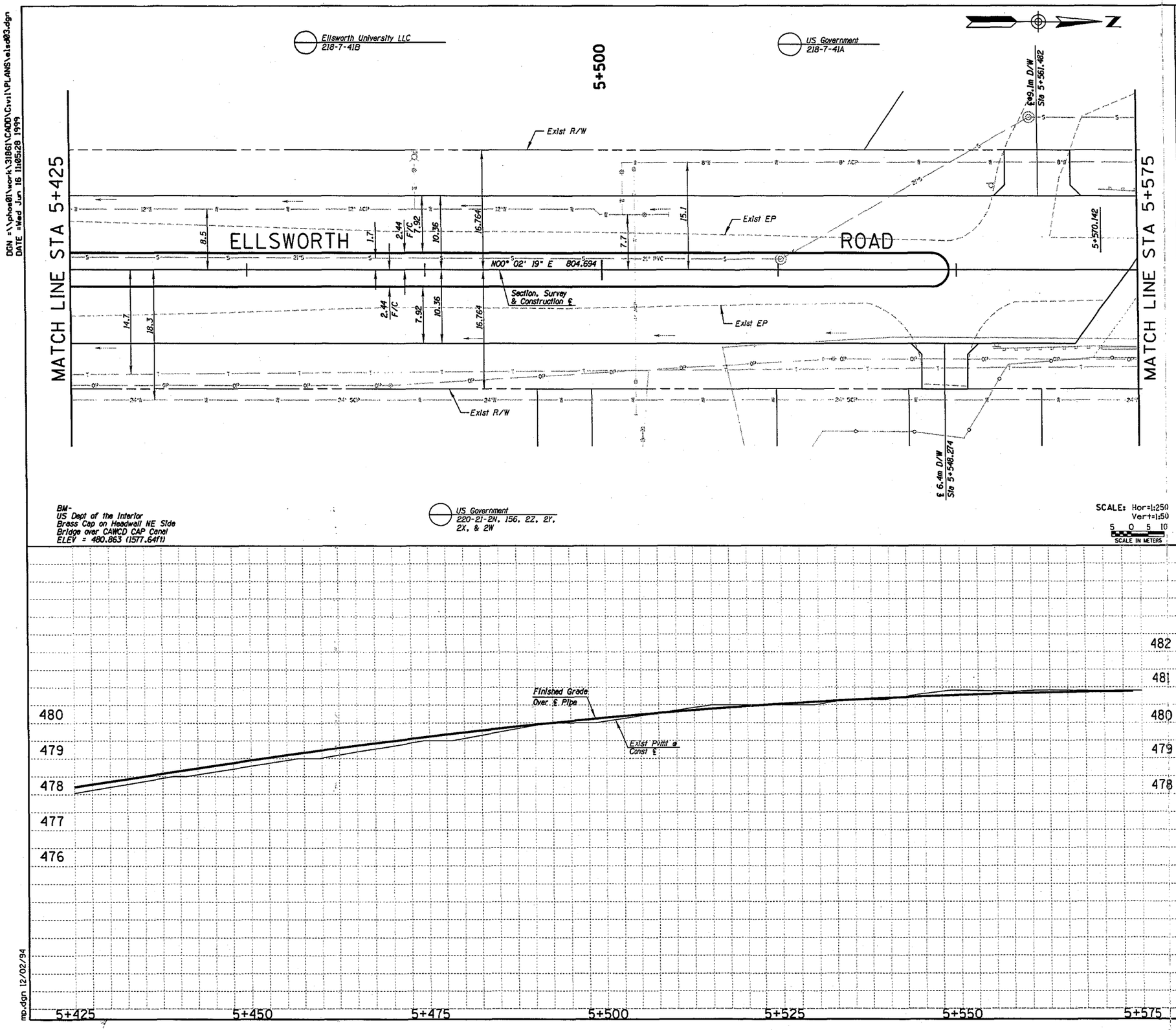

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA.5+425.000 TO STA 5+575.000

SHEET OF
4

TRACS NO.

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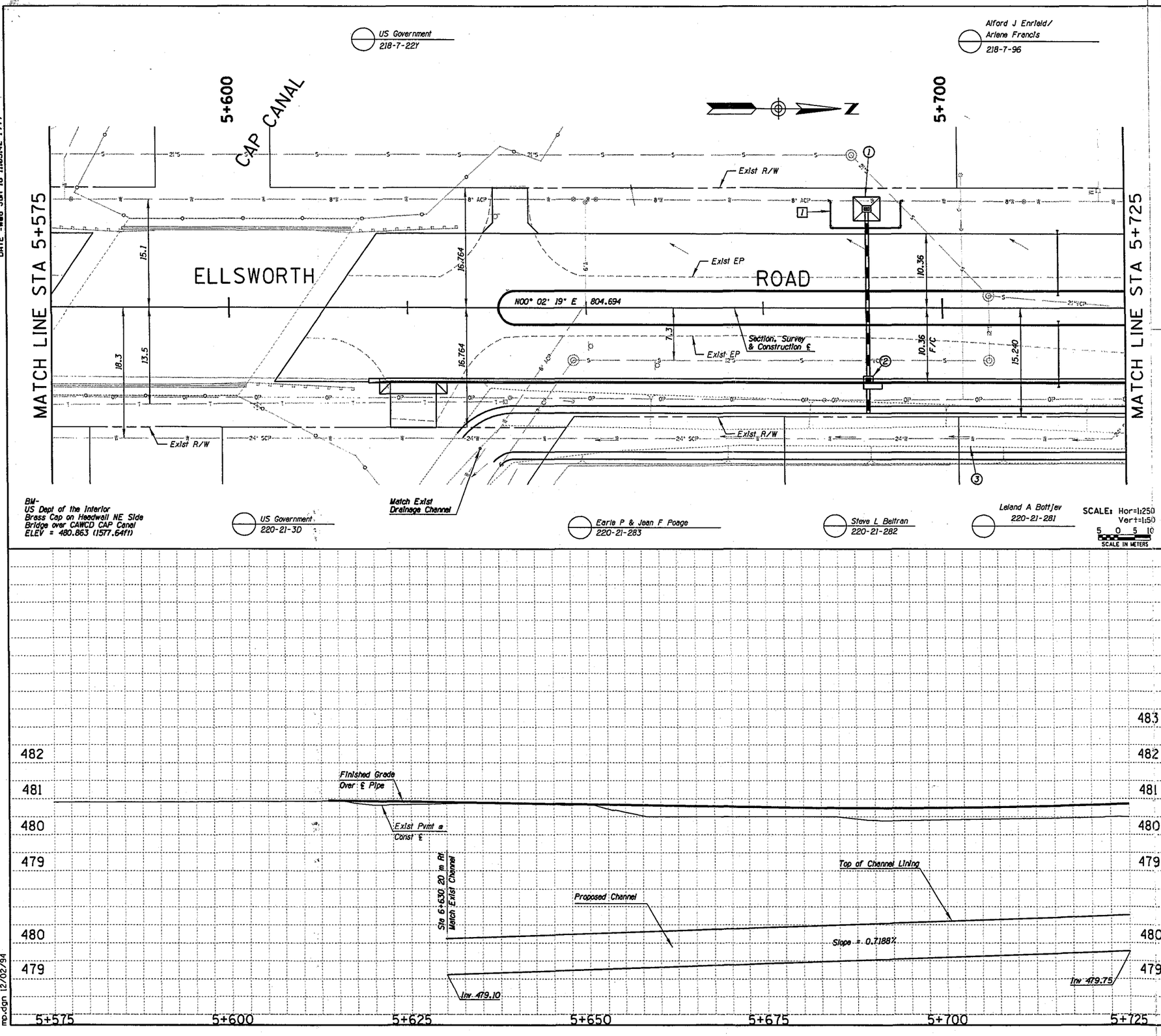

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

7 Relocate 8" ACP Water

◯ CONSTRUCTION ◯

1. Sta 5+689.6, 14.33m Lt, Install New CB per ADOT C-15.80.
2. Sta 5+689.6, 10.36m Rt, Install New CB per Mesa Std Det 533-1
3. Proposed Drainage Channel

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA. 5+575.000 to 5+725.000

SHEET OF 5

TRACS NO.

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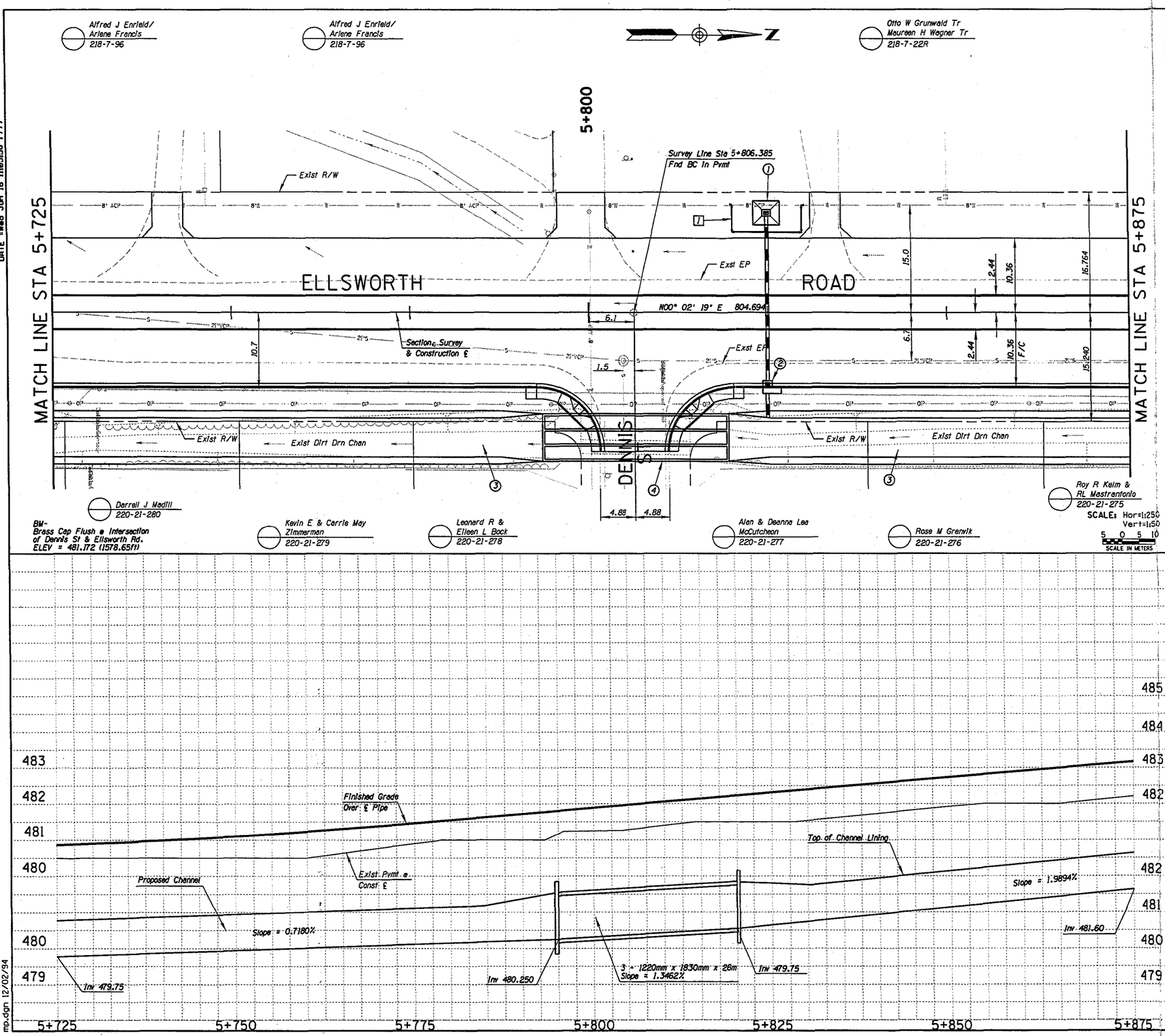

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

1 Relocate 8" ACP Water

◯ CONSTRUCTION ◯

1. Sta 5+825, 14.33m Lt. Install New CB per ADOT C-15.80.
2. Sta 5+825, 14.33m Lt. Install New CB per Mesa Std Det 533-1
3. Proposed Drainage Channel
4. New 3 - 1830 mm x 1220 mm x 26 m CBC

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 5+725.000 to STA 5+875.000

SHEET OF 6

TRACS NO.

mp.dgn 12/02/94

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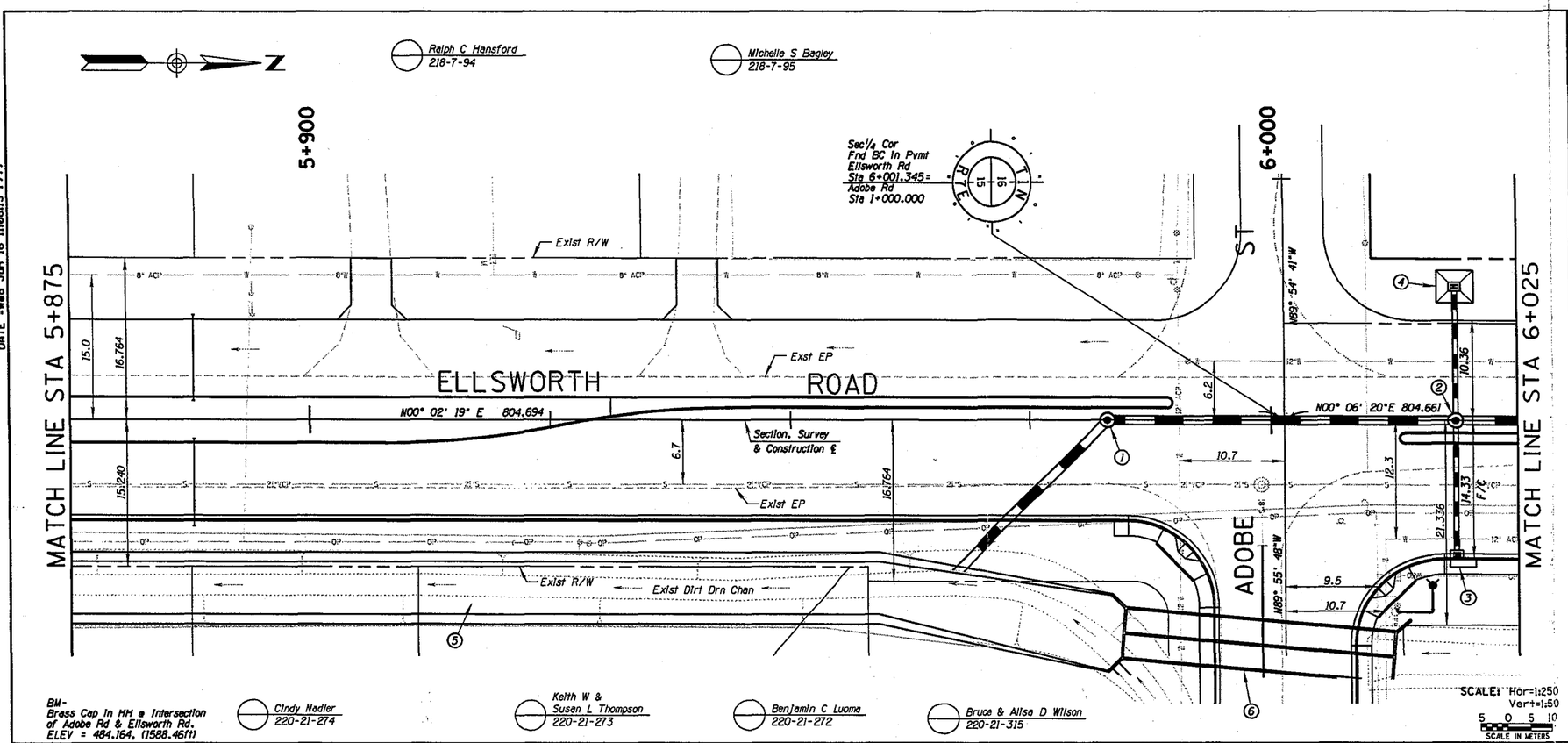

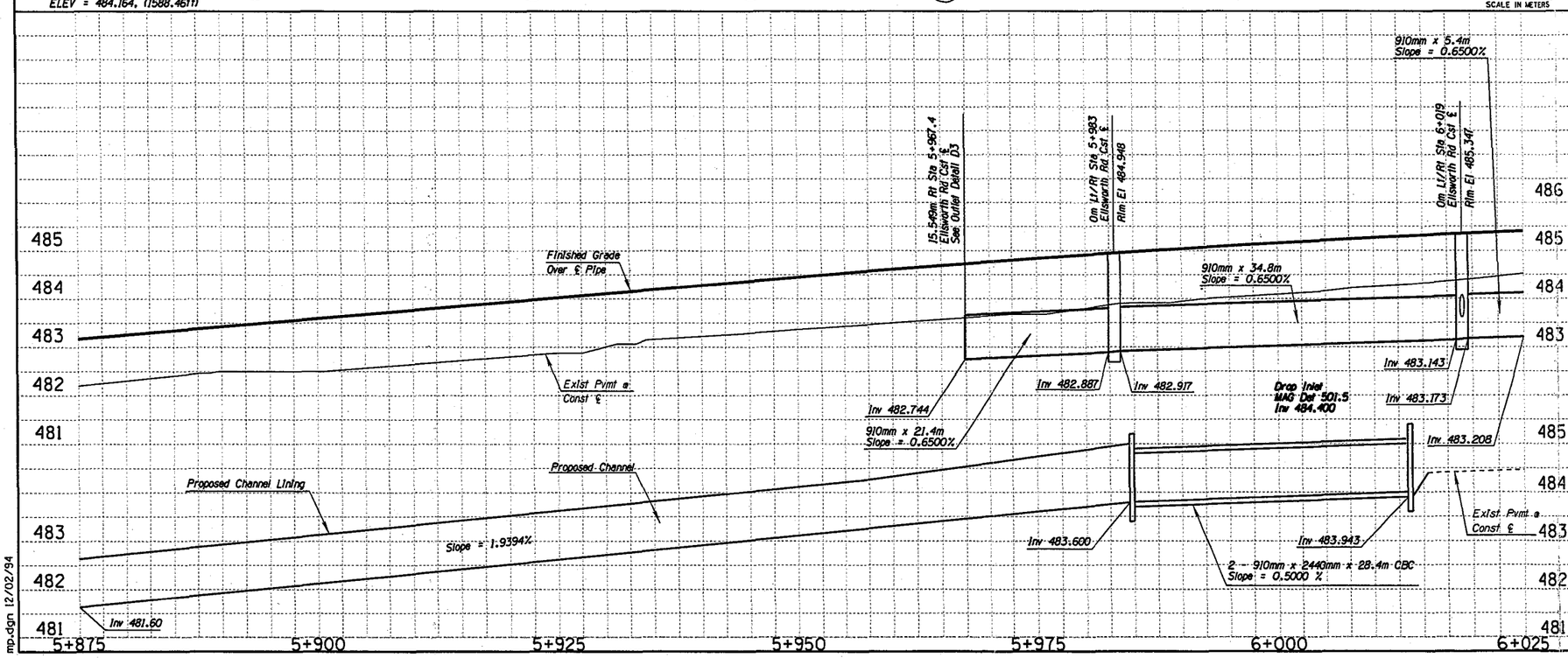

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

1. Sta 5+983, 0m Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+019, 0m Lt/Rt New MH per MAG Det 520 & 522
3. Sta 6+019, 14.33m Rt, Install New CB per ADOT C-15.80.
4. Sta 6+019, 14.33m Lt, Install New CB per ADOT C-15.80.
5. Proposed Drainage Channel
6. New 2 - 2440 mm x 910 mm x 28.4 m CBC

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 5+875.000 to STA 6+025.000

SHEET OF 7

TRACS NO.

mp.dgn 12/02/94

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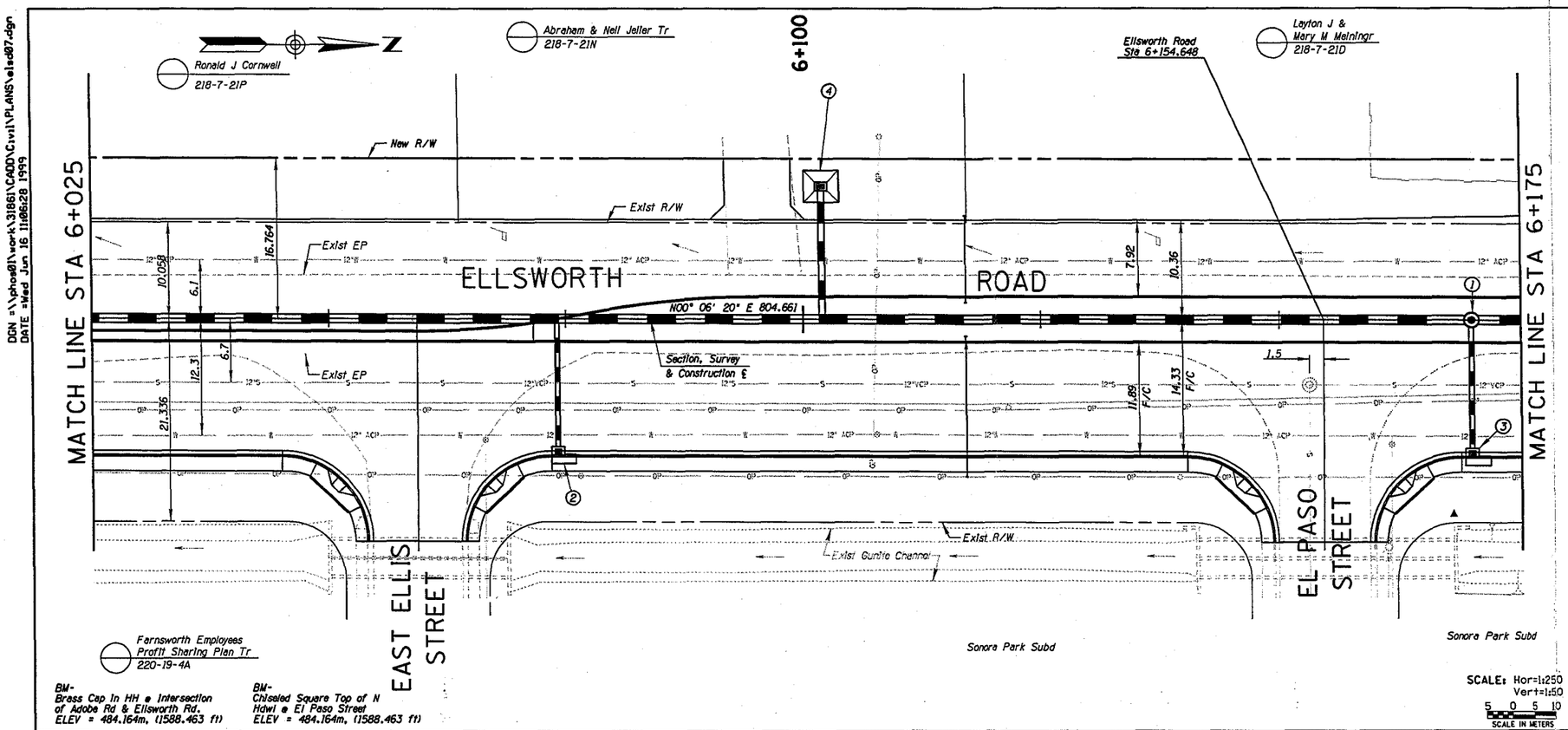

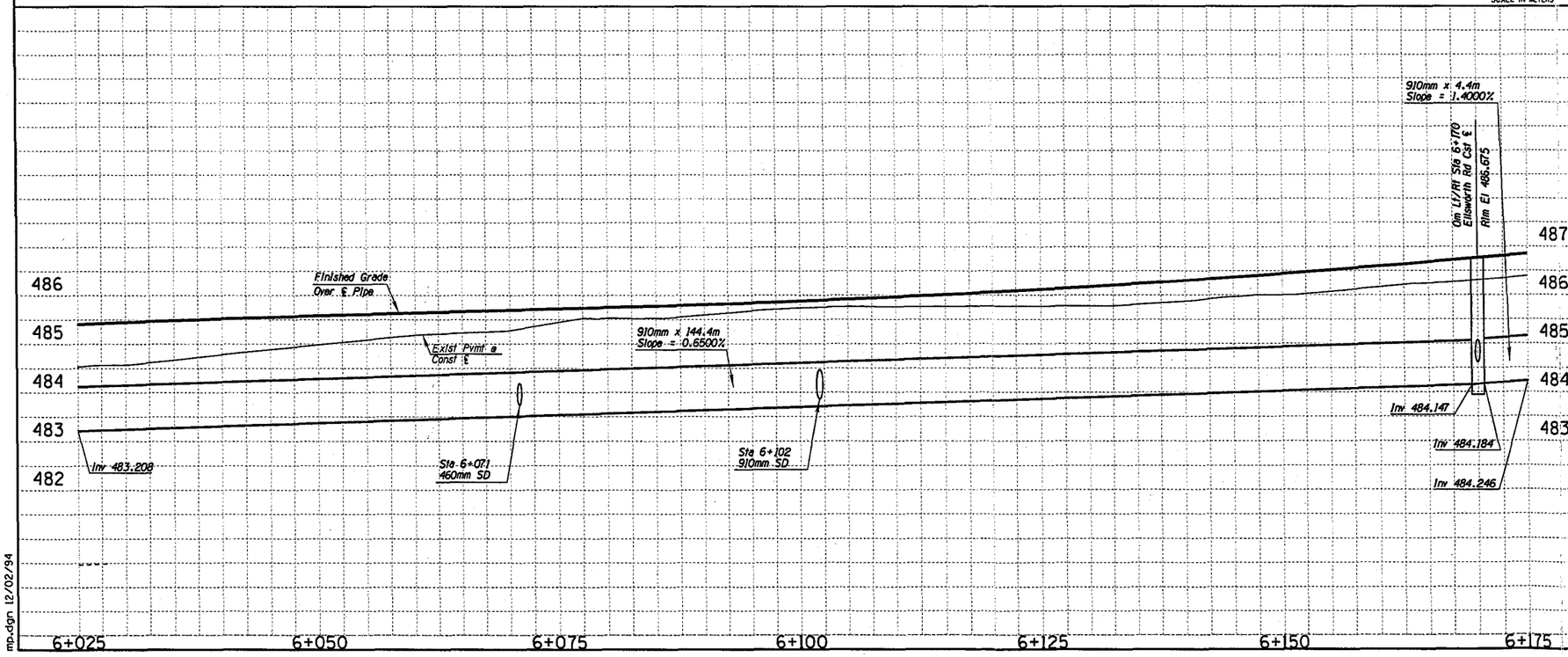

md.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

CONSTRUCTION

1. Sta 6+170, Om Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+074 14.33m Rt, Install New CB per Mesa Std Det 533-1
3. Sta 6+170 14.33m Rt, Install New CB per Mesa Std Det 533-1
4. Sta 6+102, 14.33m Lt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA. 6+025.000 TO STA 6+175.000

SHEET OF 8

TRACS NO.

DGN =\\phoa01\work\31861\CADD\Civil\PLANS\elsd08.dgn
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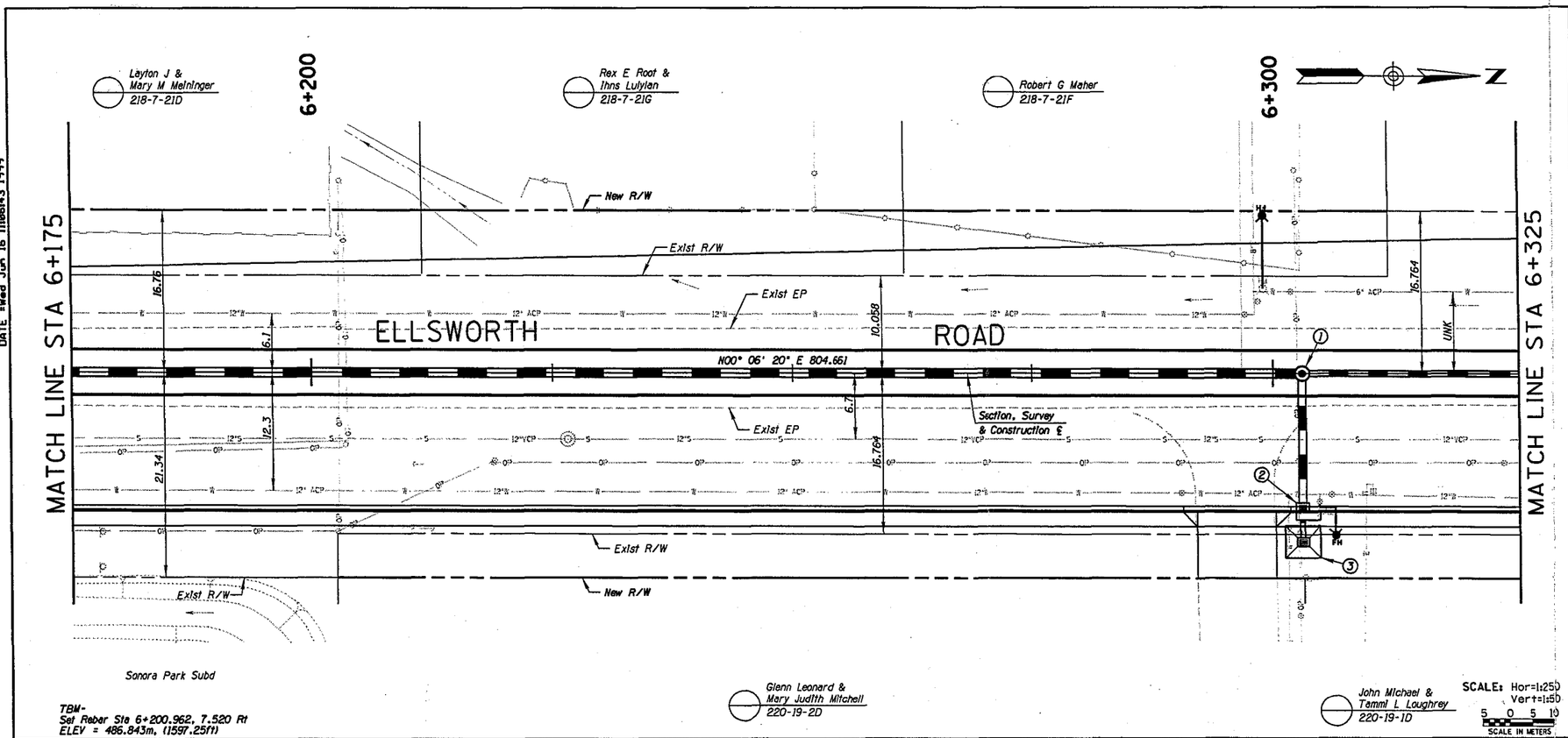
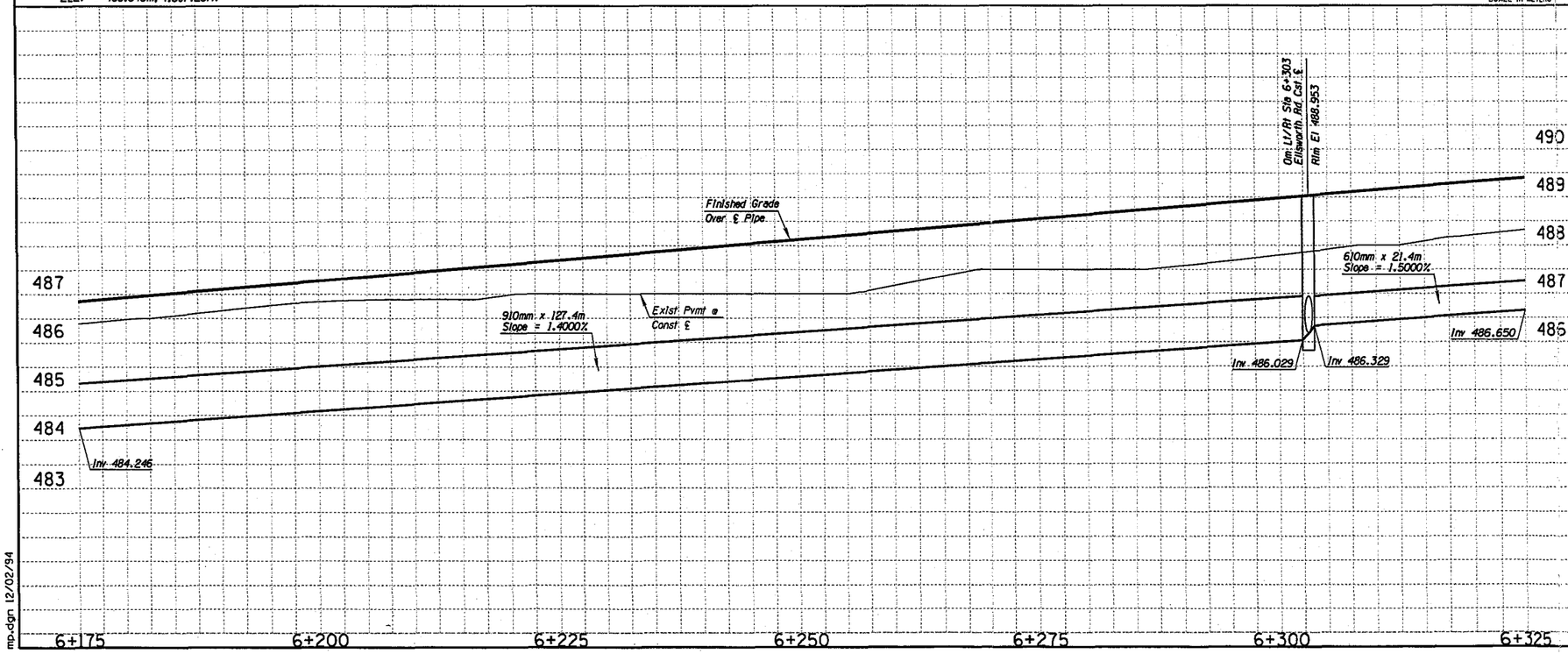
F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐



TBM-
Set Rebar Sta 6+200.962, 7.520 Rt
ELEV = 486.843m, (1597.25ft)



CONSTRUCTION

1. Sta 6+303, Om Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+303 14.33m Rt, Install New CB per Mesa Std Det 533-1
3. Sta 6+303, 18m Rt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 6+175.000 TO STA 6+325.000

SHEET OF 9

TRACS NO.

mp.dgn 12/02/94

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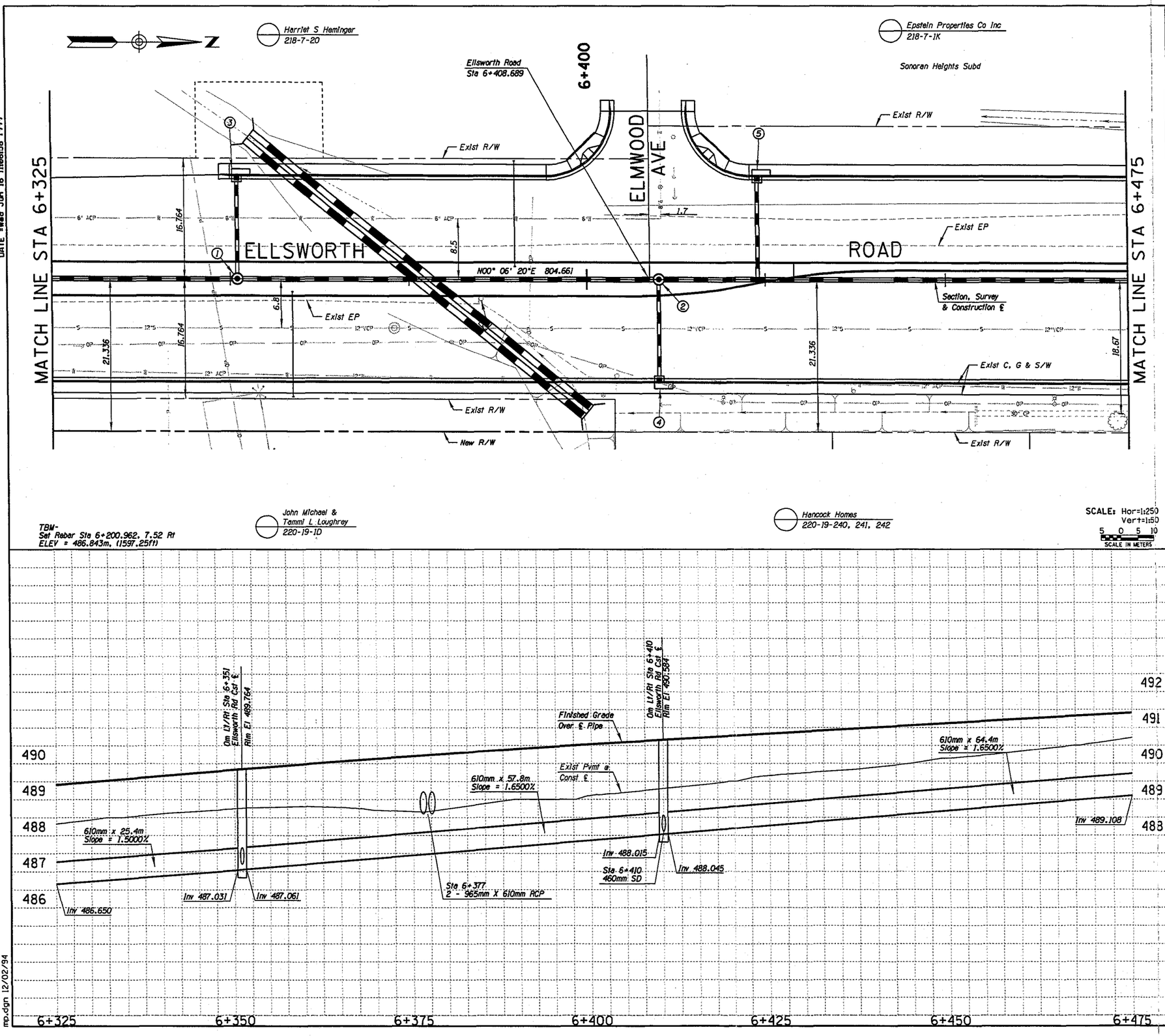

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

CONSTRUCTION

1. Sta 6+351, 0m Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+440, 0m Lt/Rt New MH per MAG Det 520 & 522
3. Sta 6+351 14.33m Lt, Install New CB per Mesa Std Det 533-1
4. Sta 6+410 14.33m Rt, Install New CB per Mesa Std Det 533-1
5. Sta 6+424 14.33m lt, Install New CB per Mesa Std Det 533-1

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA. 6+325.000 TO STA 6+475.000

SHEET OF 10

TRACS NO.

mp.dgn 12/02/94

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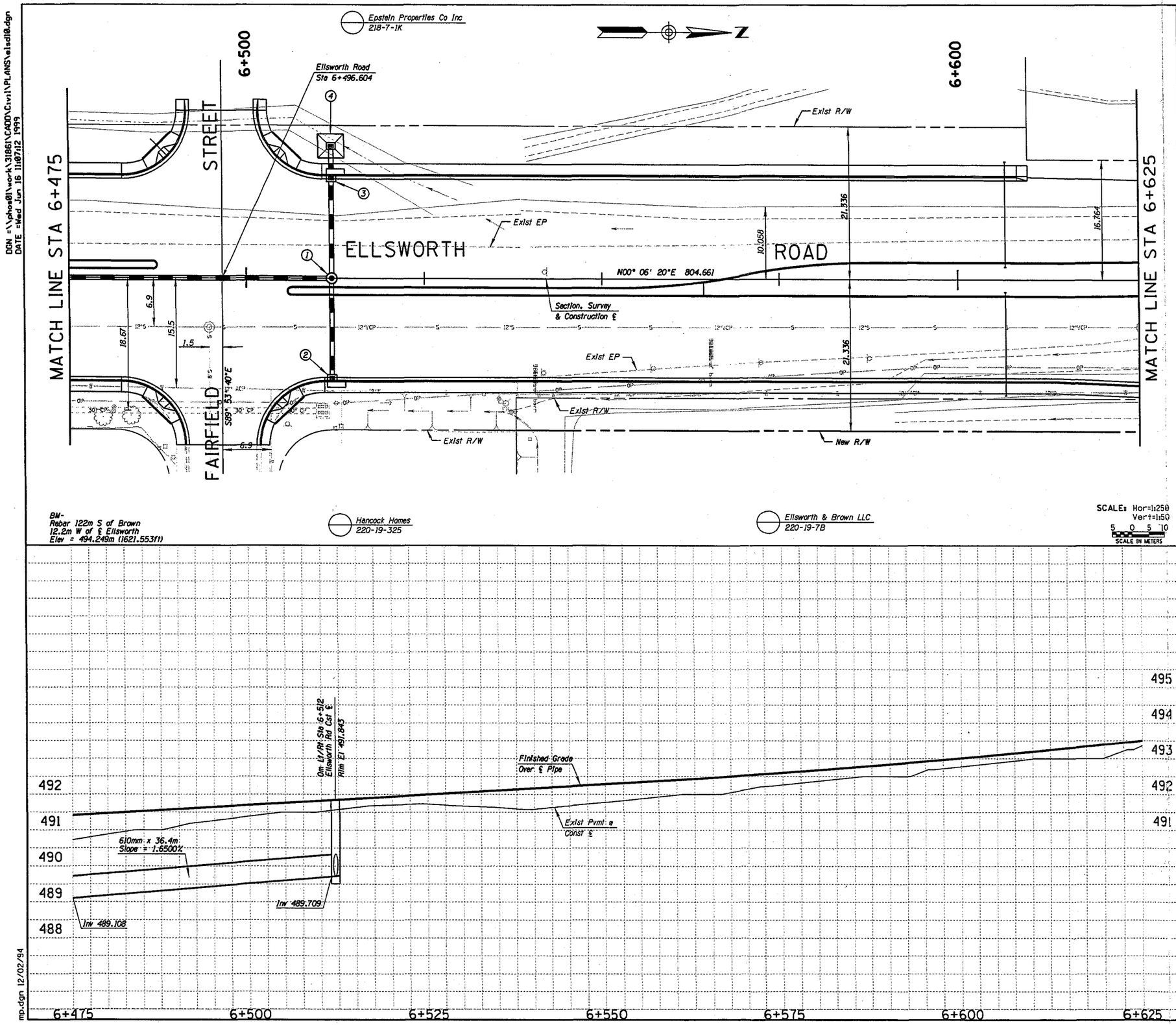

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

○ CONSTRUCTION ○

1. Sta 6+512, Om Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+512 14.33m Rt, Install New CB per Mesa Std Det 533-1
3. Sta 6+512 14.33m Lt, Install New CB per Mesa Std Det 533-1
4. Sta 6+512, 18m Lt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 6+475.000 TO STA 6+625.000

SHEET OF 11

TRACS NO.

mp.dgn 12/02/94

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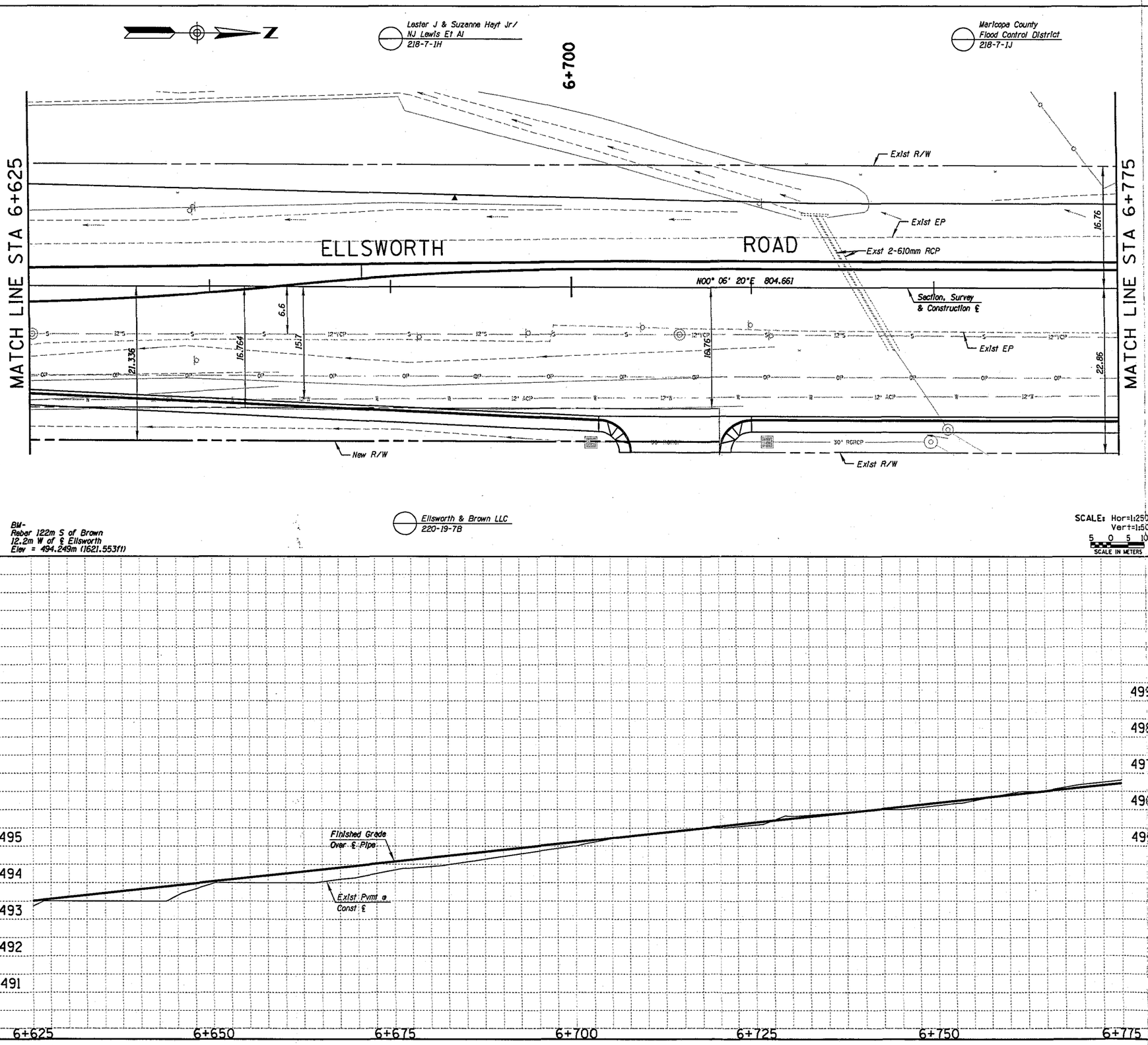

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 6+625.000 TO STA 6+775.000

SHEET OF
12

TRACS NO.

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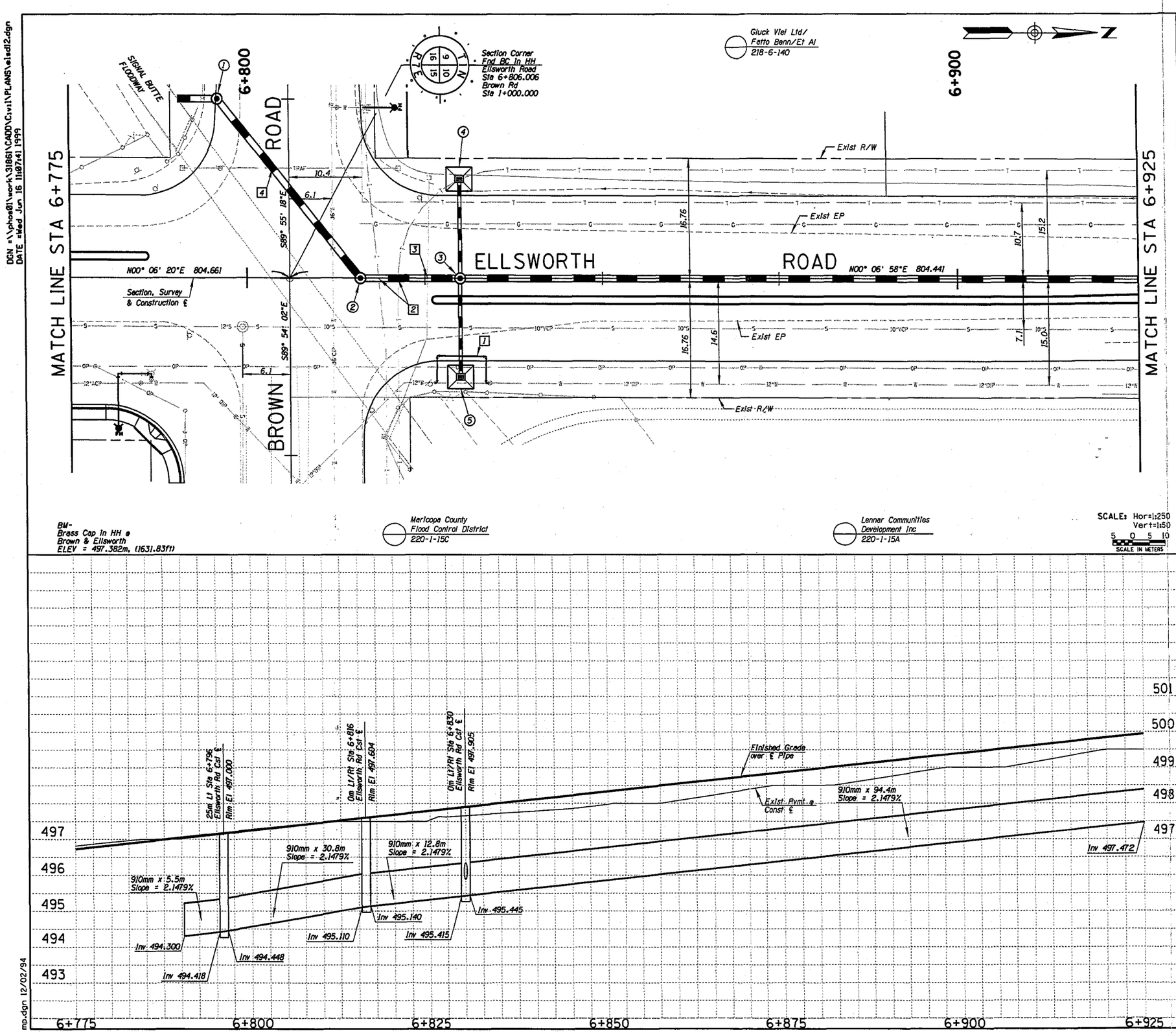

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

1. Relocate 12" DIP Water
2. Relocate Telephone (By Others)
3. Relocate TV (By Others)
4. Remove Traf Conduit per Signal Plans

◯ CONSTRUCTION ◯

1. Sta 6+796, 25m Lt New MH per MAG Det 520 & 522
2. Sta 6+816, 0m Lt/Rt New MH per MAG Det 520 & 522
3. Sta 6+830, 0m Lt/Rt New MH per MAG Det 520 & 522
4. Sta 6+830, 14.33 m Lt, Install New CB per ADOT C-15.80
5. Sta 6+830, 14.33 m Rt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 6+775.000 TO STA 6+925.000

SHEET OF 13

TRACS NO.

mp.dgn 12/02/94

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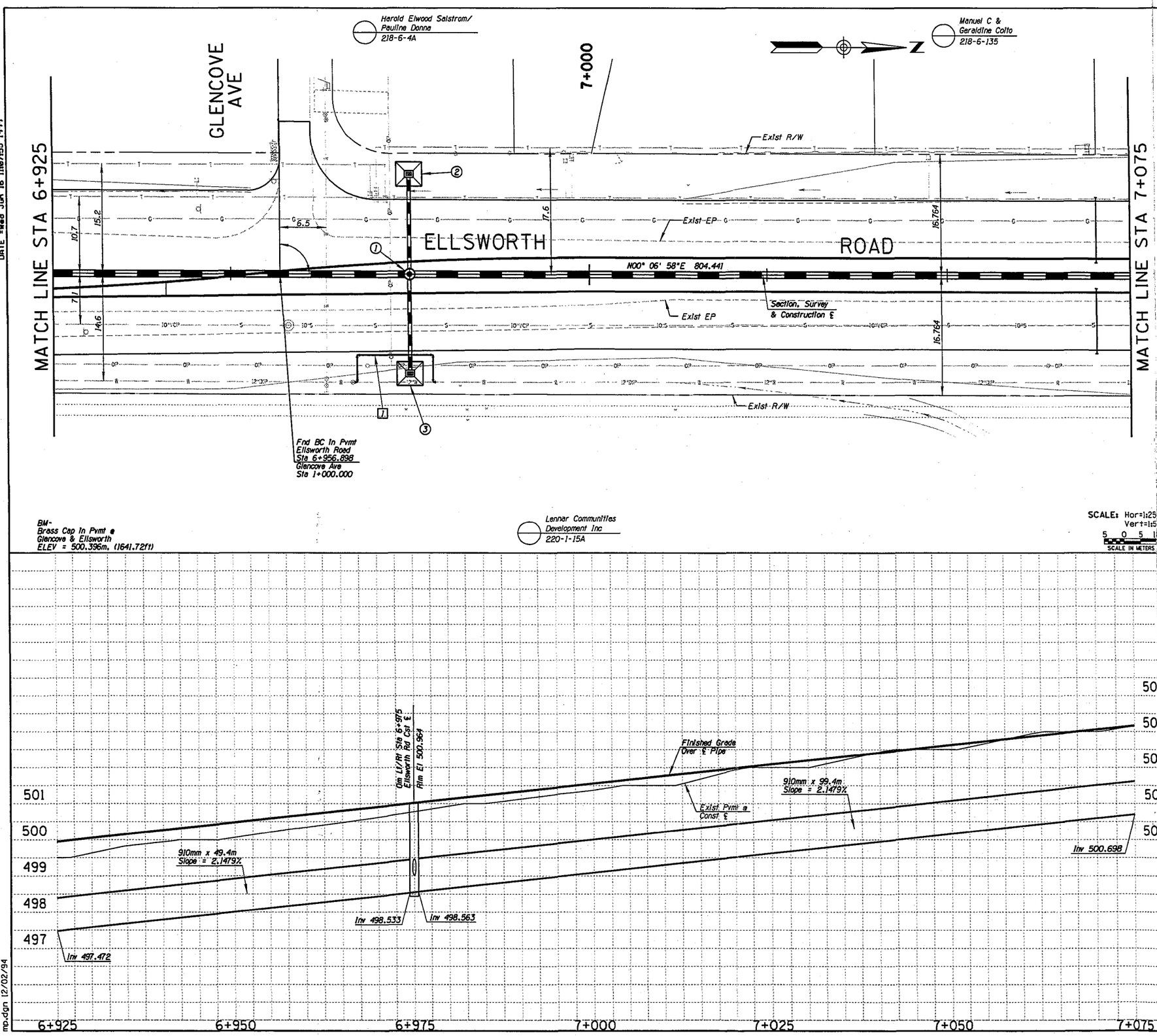

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

7 Relocate 12" DIP Water

◯ CONSTRUCTION ◯

1. Sta 6+975, 0m Lt/Rt New MH per MAG Det 520 & 522
2. Sta 6+830, 14.33 m Lt, Install New CB per ADOT C-15.80
3. Sta 6+830, 14.33 m Rt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 6+925.000 TO STA 7+075.000

SHEET OF 14

TRACS NO.

mp.dgn 12/02/94

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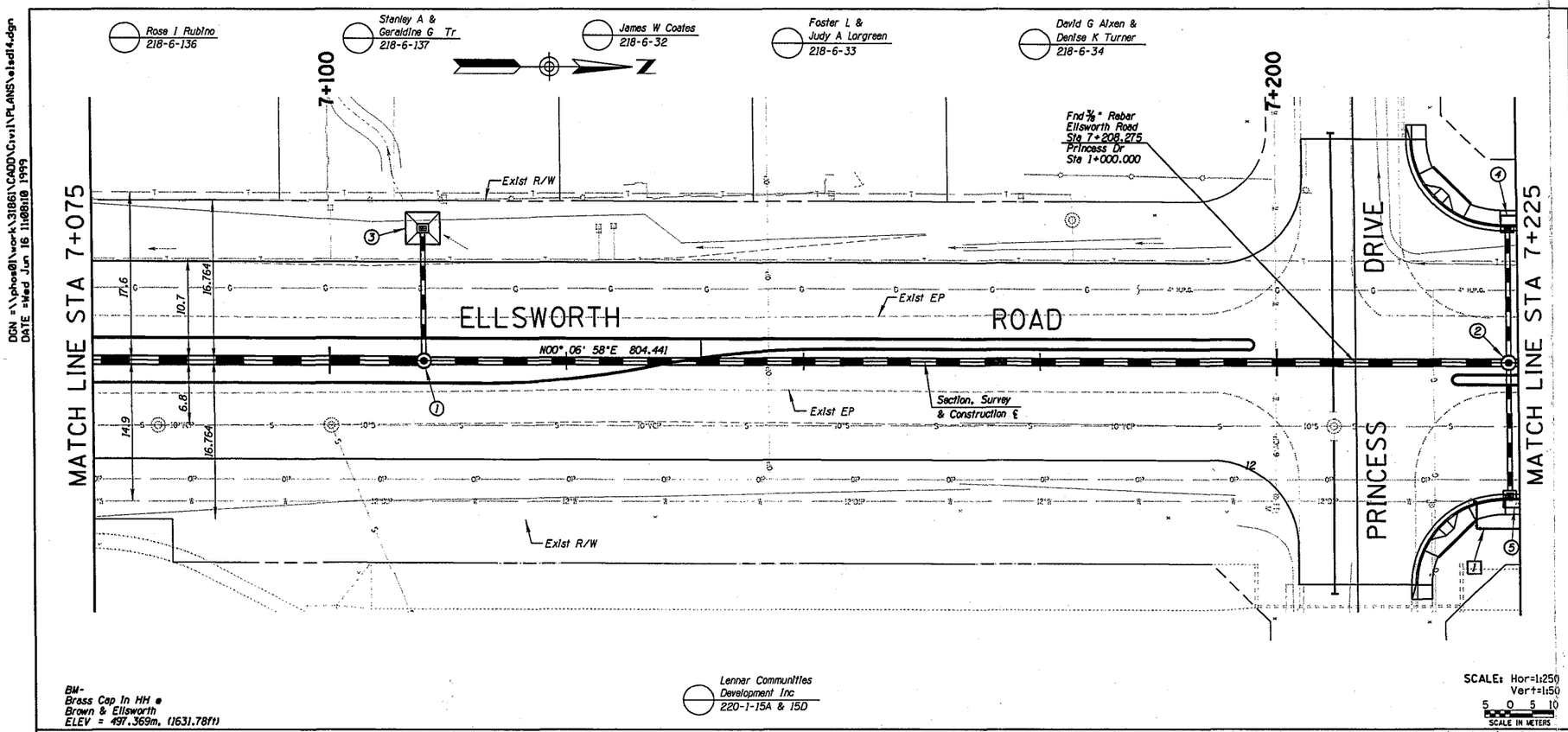

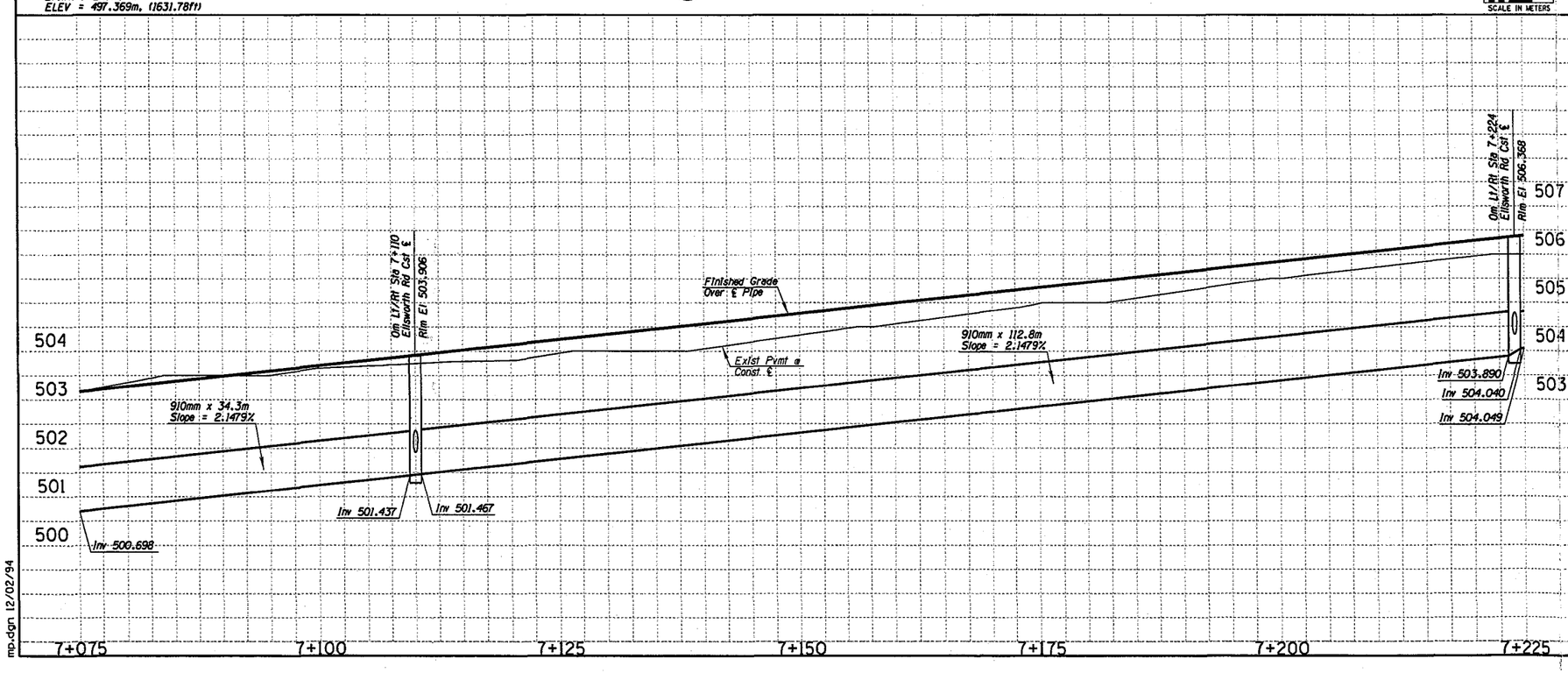

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

[7] Relocate 12" DIP Water

◯ CONSTRUCTION ◯

1. Sta 7+110, 0m Lt/Rt New MH per MAG Det 520 & 522
2. Sta 7+224, 0m Lt/Rt New MH per MAG Det 520 & 522
3. Sta 7+110, 14.33m Lt, Install New CB per ADOT C-15.80
4. Sta 7+224, 14.33m Lt, Install New CB per Mesa Std Det 533-1
5. Sta 7+224, 14.33m Rt, Install New CB per Mesa Std Det 533-1

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 7+075.000 TO STA 7+225.000

SHEET OF 15

TRACS NO.

mp.dgn 12/02/94

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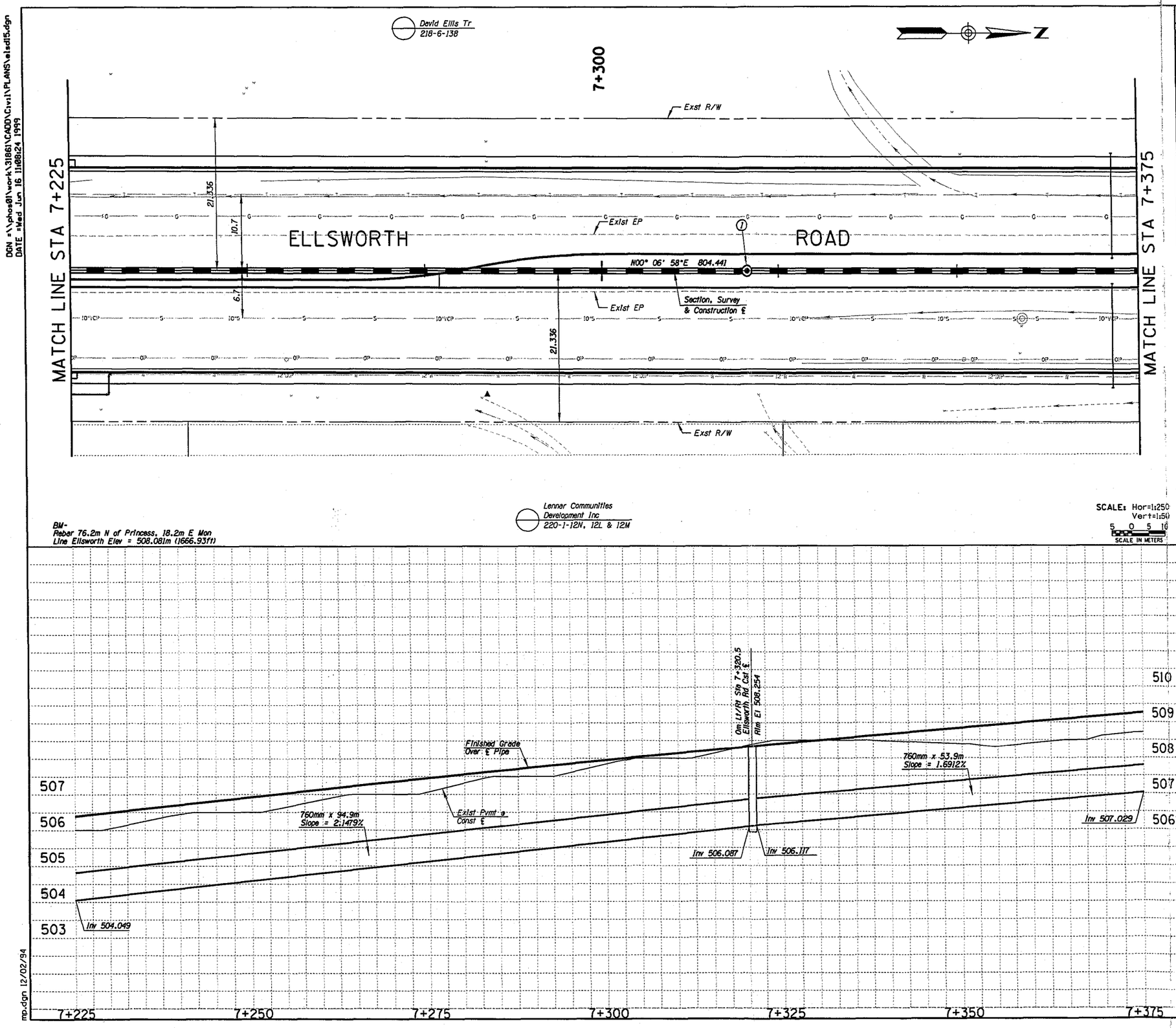

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

(1) Sta 7+320.5, 0m Lt/Rt New MH per MAG Det 520 & 522

NO.	REVISION	BY	DATE
3			
2			
1			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

E A R T H T E C H

ELLSWORTH ROAD STORM DRAIN
STA. 7+225.000 TO STA 7+375.000

SHEET OF
16

TRACS NO.

mp.dgn 12/02/94

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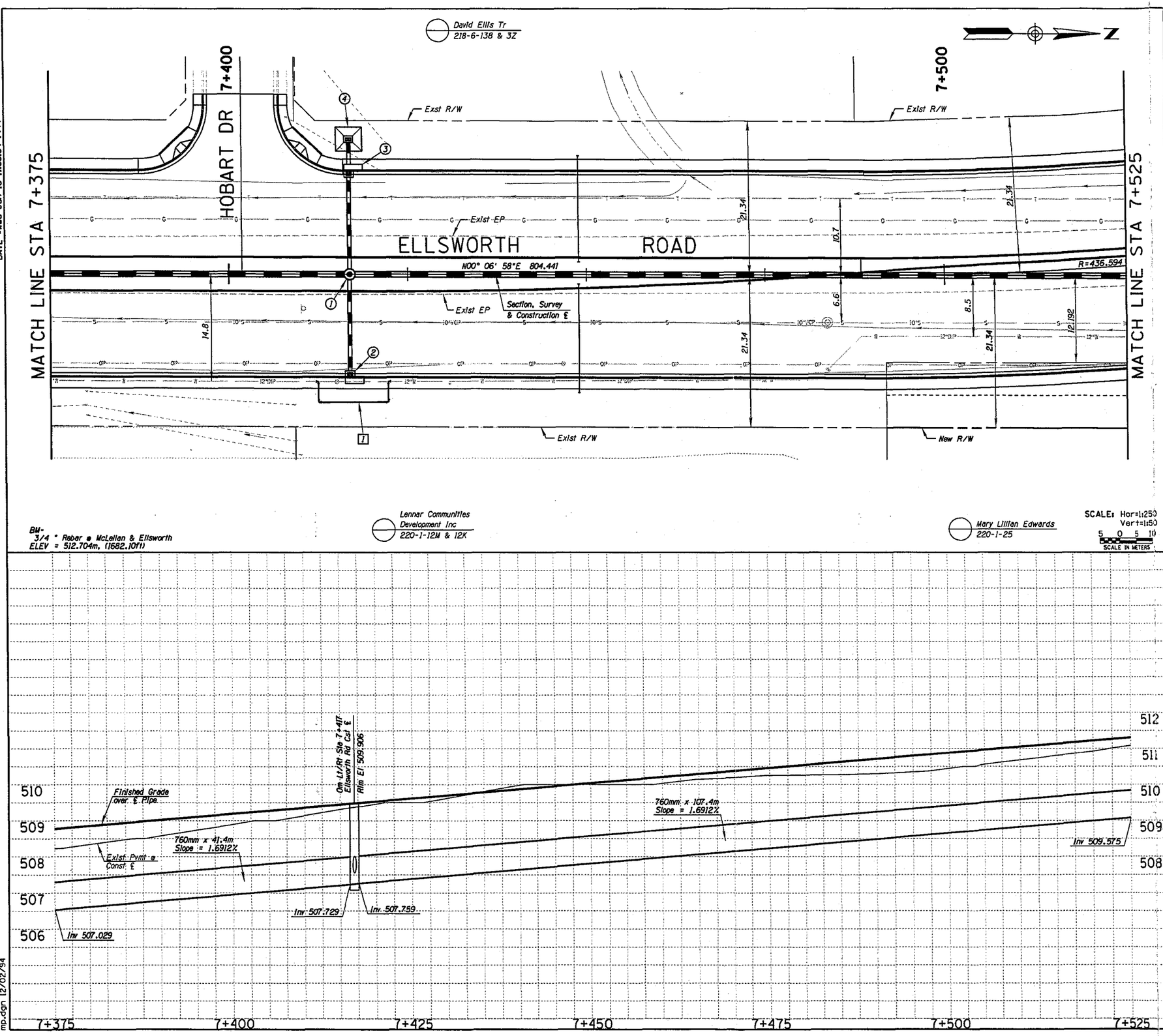

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

1 Relocate 12" DIP Water

◯ CONSTRUCTION ◯

1. Sta 7+417, Om Lt/Rt New MH per MAG Det 520 & 522
2. Sta 7+417 14.33m Rt, Install New CB per Mesa Std Det 533-1
3. Sta 7+417 14.33m Lt, Install New CB per Mesa Std Det 533-1
4. Sta 7+417, 18.31 Lt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 7+375.000 TO STA 7+525.000

SHEET OF 17

TRACS NO.

mp.dgn 12/02/94

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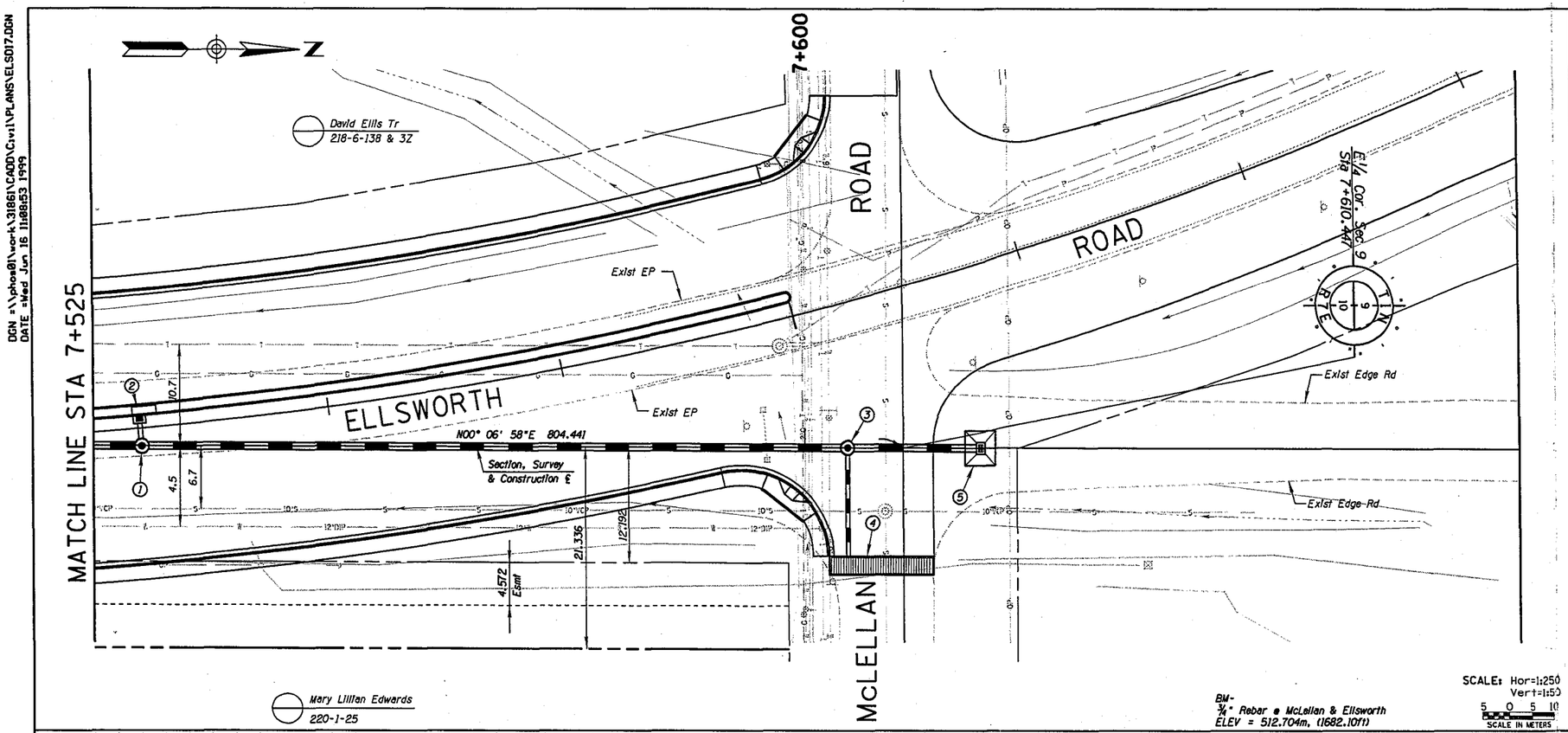

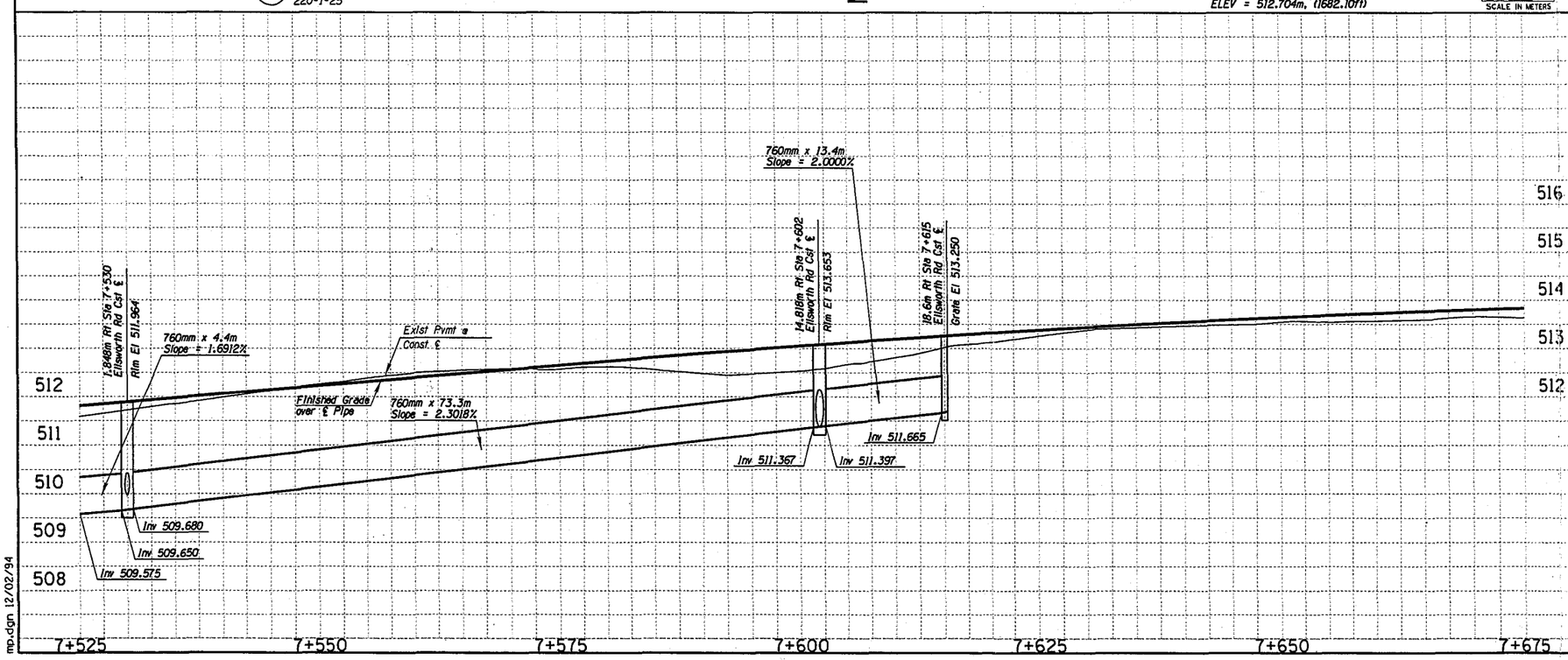

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

1. Relocate 12" Water
2. Relocate Telephone
3. Relocate TV

◯ CONSTRUCTION ◯

1. Sta 7+530, 1.848m Rt New MH per MAG Det 520 & 522
2. Sta 7+530, 1.3m Lt, Install New CB per Mesa Std Det 533-1
3. Sta 7+602, 14.818m Rt New MH per MAG Det 520 & 522
4. Sta 7+599.25, 25.9m Rt, Install New Drop Inlet Structure per Special Det D1
5. Sta 7+615, 18.6m Rt, Install New CB per ADOT C-15.80

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ELLSWORTH ROAD STORM DRAIN
STA. 7+525.000 TO STA 7+675.000

SHEET OF 18

TRACS NO.

mp.dgn 12/02/94

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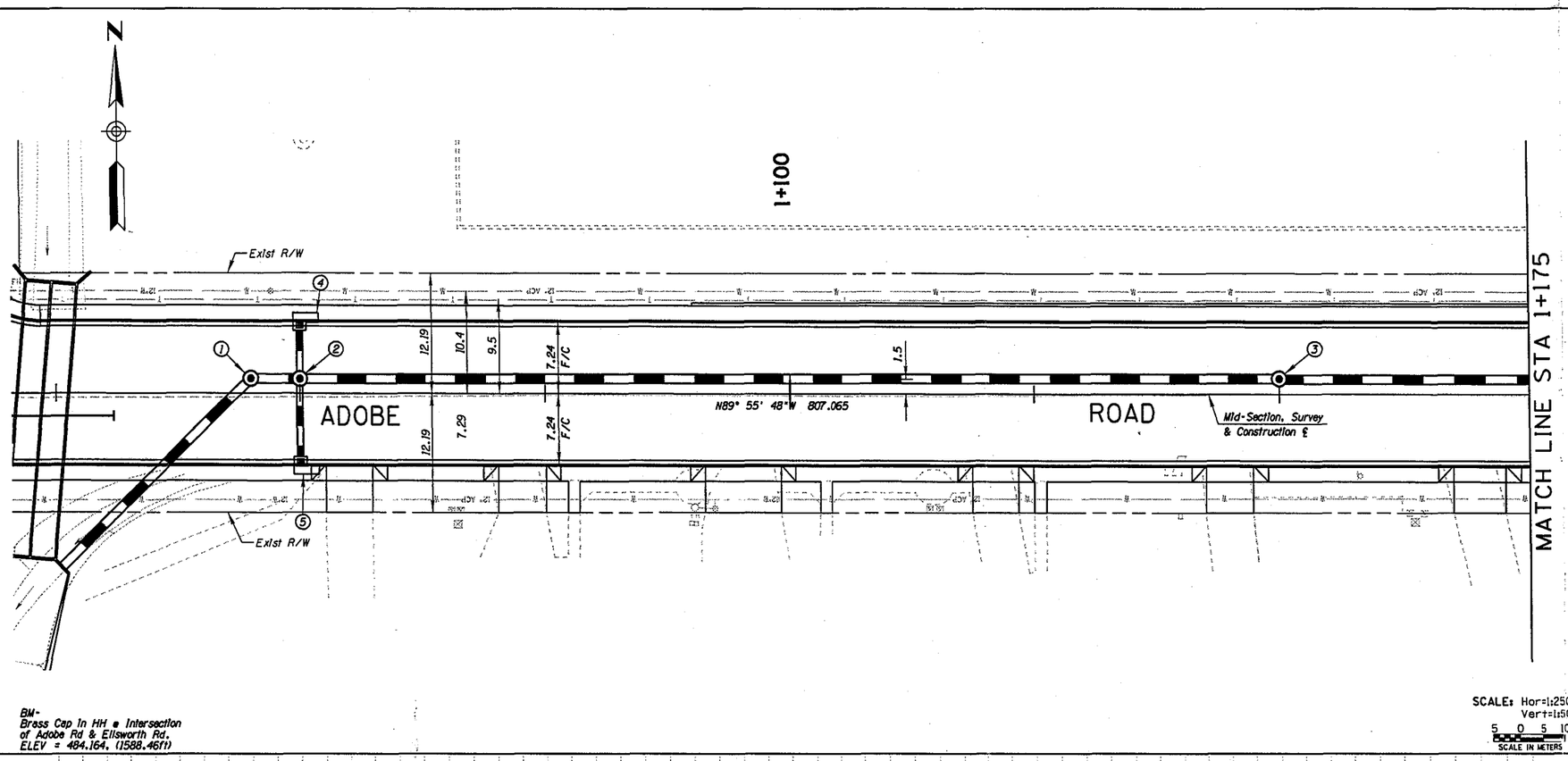

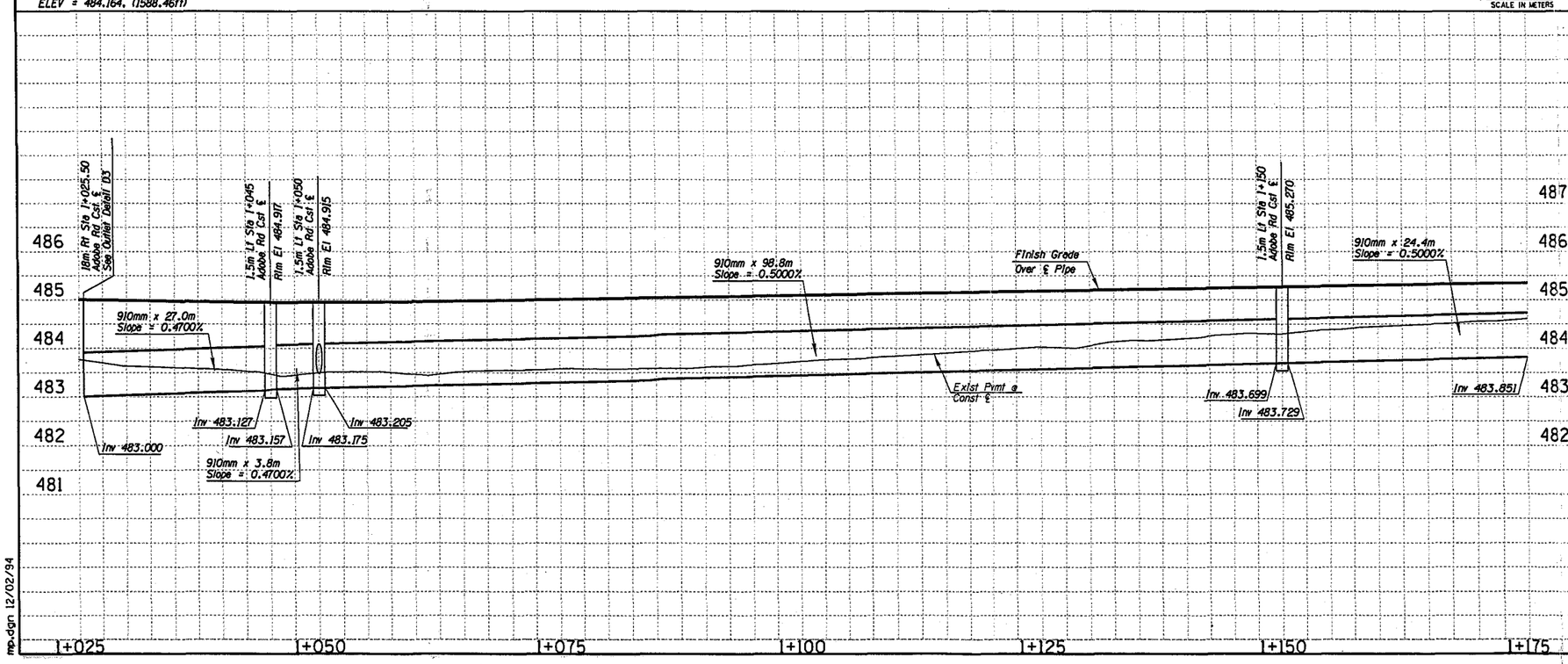

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

1. Sta 1+045, 1.5m Lt New MH per MAG Det 520 & 522 — 1 Ea
2. Sta 1+050, 1.5m Lt New MH per MAG Det 520 & 522 — 1 Ea
3. Sta 1+150, 1.5m Lt New MH per MAG Det 520 & 522 — 1 Ea
4. Sta 1+050, 7.24m Lt, Install New CB per Mesa Std Det 533-1 — 1 Ea
5. Sta 1+050, 7.24m Rt, Install New CB per Mesa Std Det 533-1 — 1 Ea

NO.	REVISION	BY	DATE
1			
2			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ADOBE ROAD STORM DRAIN
STA. 1+025.000 TO STA 1+175.000

SHEET OF 23

TRACS NO.

mp.dgn 12/02/94

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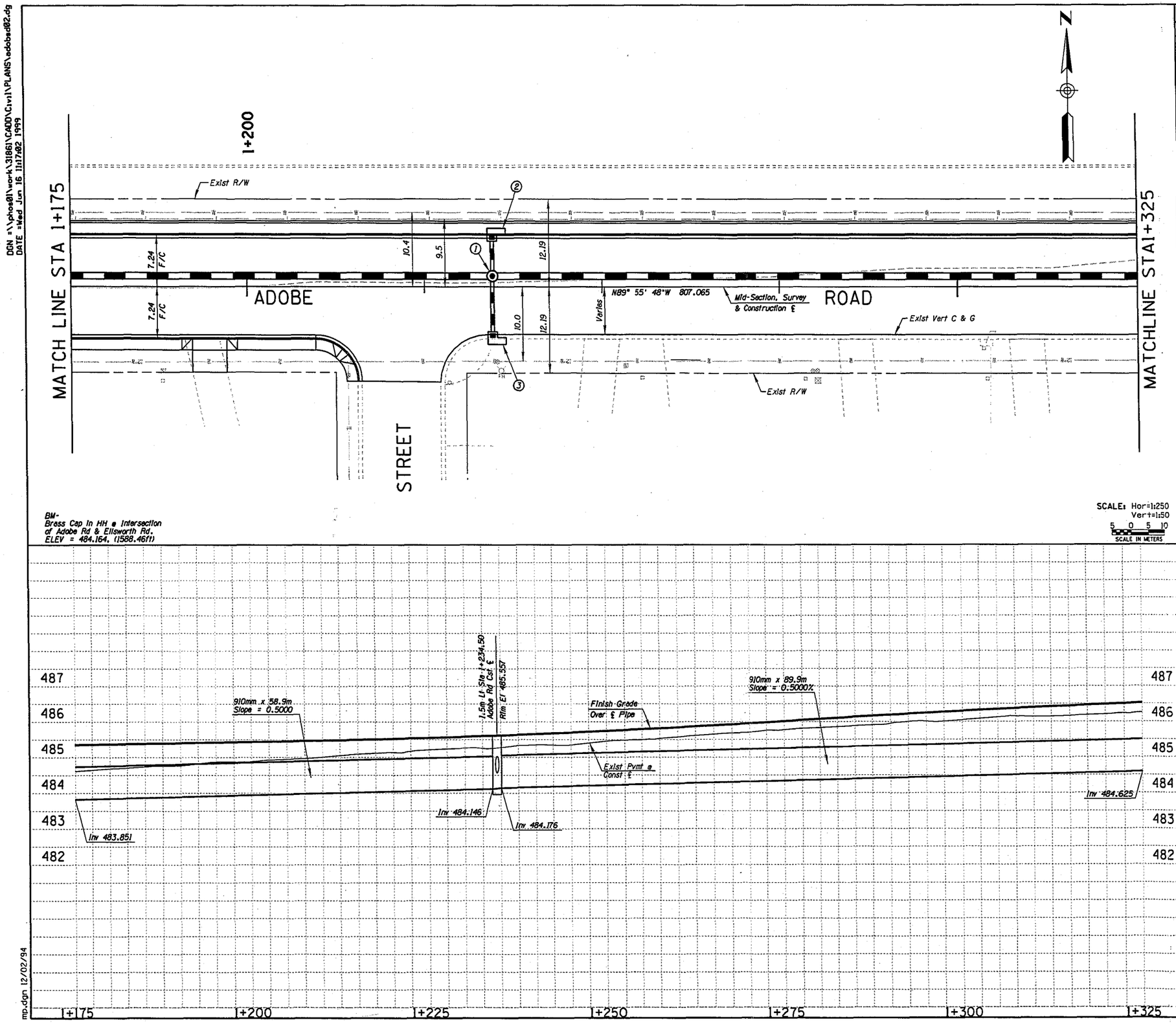

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

1. Sta 1+234.5, 1.5m Lt, New MH per MAG Det 520 & 522 — 1 Ea
2. Sta 1+234.5, 7.24m Lt, Install New CB per Mesa Std Det 533-1 — 1 Ea
3. Sta 1+234.5, 7.24m Rt, Install New CB per Mesa Std Det 533-1 — 1 Ea

NO.	REVISION	BY	DATE
1			
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ADOBE ROAD STORM DRAIN
STA. 1+175.000 TO STA 1+325.000

SHEET OF 24

TRACS NO.

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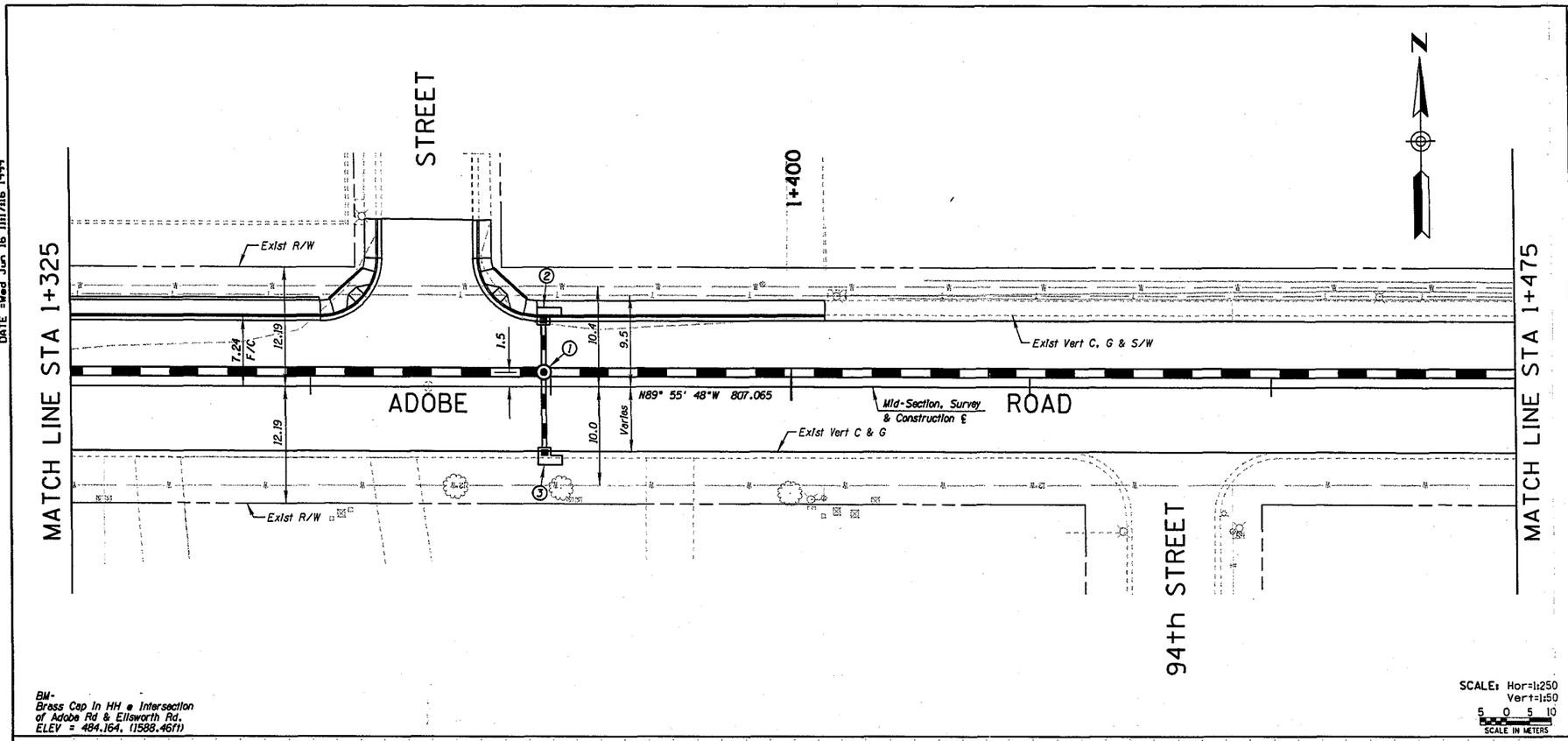

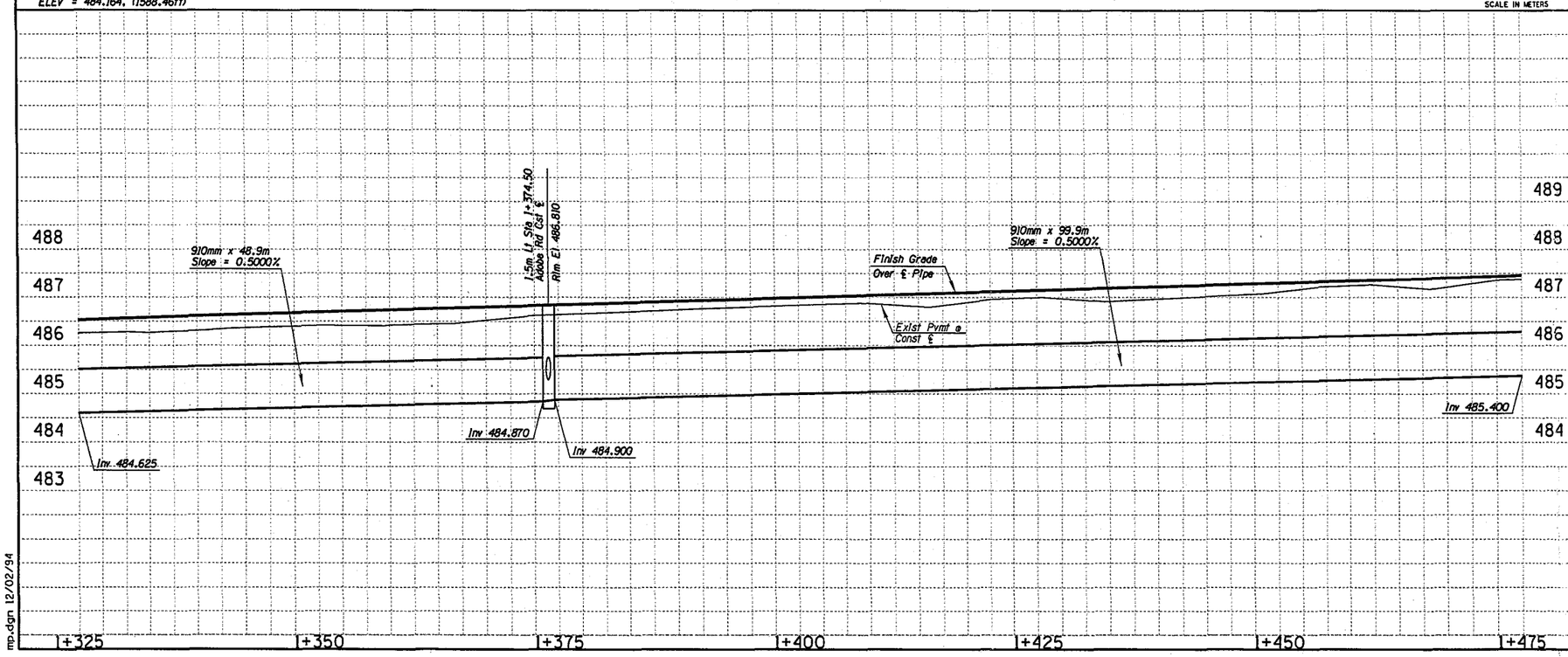

mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

1. Sta 1+374.50 1.5m Lt, New MH per MAG Det 520 & 522 — 1 Ea
2. Sta 1+374.50, 7.24m Lt, Install New CB per Mesa Std Det 533-1 — 1 Ea
3. Sta 1+374.50, 7.24m Rt, Install New CB per Mesa Std Det 533-1 — 1 Ea

NO.	REVISION	BY	DATE
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MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ADOBE ROAD STORM DRAIN
STA. 1+325.000 TO STA 1+475.000

SHEET OF 25

TRACS NO.

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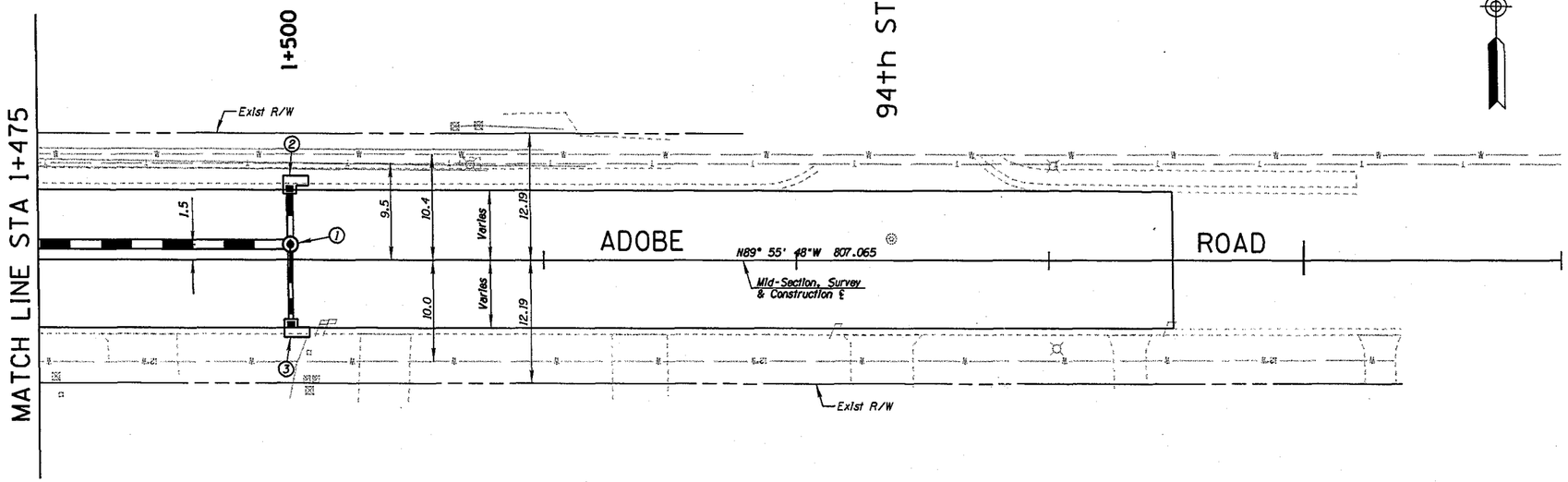
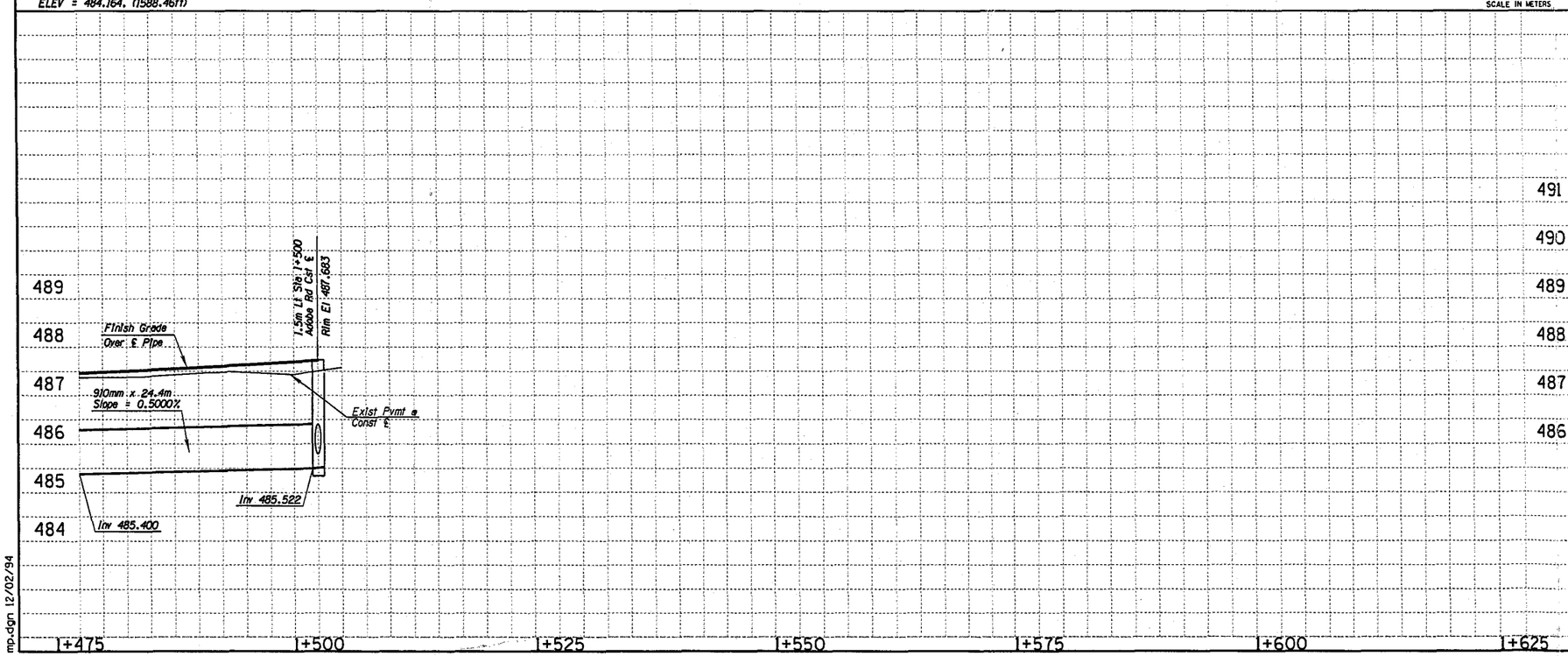


BM-
Brass Cap in HH @ Intersection
of Adobe Rd & Ellsworth Rd.
ELEV = 484.164. (1588.46ft)

SCALE: Hor=1:250
Vert=1:50
5 0 5 10
SCALE IN METERS



mp.dgn 12/02/94

F.W.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ.				

☐ REMOVAL/RELOCATE ☐

◯ CONSTRUCTION ◯

1. Sta 1+500, 1.5m Lt, New MH per MAG Det 520 & 522 — 1 Ea
2. Sta 1+500, 7.24m Lt, Install New CB per Mesa Std Det 533-1 — 1 Ea
3. Sta 1+500, 7.24m Rt, Install New CB per Mesa Std Det 533-1 — 1 Ea

NO.	REVISION	BY	DATE
1			
2			
3			

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION

ELLSWORTH ROAD
UNIVERSITY DR TO McLELLAN DR
PROJECT NO. 65902

40%
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	E. WATKINS	06/11/99
DRAWN	J. WAHL	06/11/99
CHECKED	R. WEYRAUCH	06/11/99

EARTH TECH

ADOBE ROAD STORM DRAIN
STA. 1+475.000 TO STA 1+625.000

SHEET OF 26

TRACS NO.