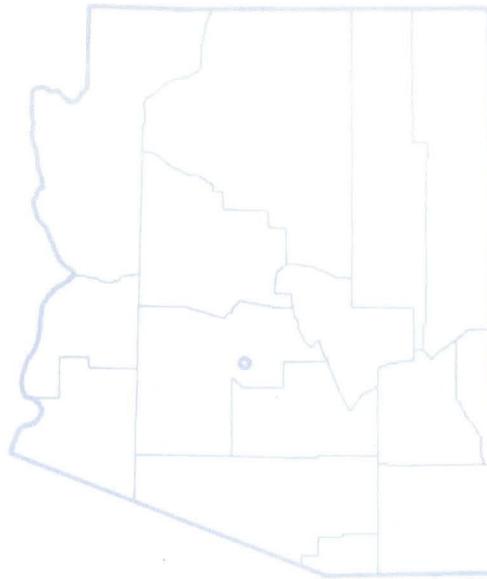


PRELIMINARY DRAINAGE REPORT
FOR
LITCHFIELD RIDGE



FLOOD CONTROL DISTRICT
RECEIVED
JAN 29 '83

CH ENG	7 & PR
DEF	HYDR
RRKIR	ASST
FINANCE	FILE
C & D	
ENGR	
REMARKS	

RECEIVED

JAN 20 1988

MARICOPA COUNTY
DEPARTMENT OF PLANNING & DEVELOPMENT
BY [Signature]

588-3



WOOD & ASSOCIATES, INC.

CONSULTING CIVIL ENGINEERS

A042.304

PRELIMINARY DRAINAGE REPORT
FOR
LITCHFIELD RIDGE

PREPARED FOR: American Continental Real Estate Division
2735 East Camelback Road
Phoenix, Arizona 85016
(602) 957-7170

SUBMITTED TO: Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009
(602) 262-1501

SUBMITTED BY: Wood & Associates, Inc.
4105 North 20th Street, Suite 130
Phoenix, Arizona 85016
(602) 957-3149



January 28, 1988
WA Job No. 87384

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1.0 EXECUTIVE SUMMARY

This report was prepared for use in construction of Phase I improvements, as well as, to set guidelines for future development of individual parcels. All design parameters are based on the assumption that Litchfield Park Dam could potentially breach at any given location and the total peak discharge of 2950 cfs will concentrate in the wash on the east side of Parcel 2, or in the wash on the west side of Parcel 2. Once the Litchfield Park Dam is removed or repaired, the drainage channel on the east side of Parcel 2 will be required to carry a maximum flowrate of 1525 cfs, and the drainage channel on the west side of Parcel 2 will be required to carry a maximum of 1425 cfs. Based on our understanding, ADWR requires the Litchfield Park Dam be removed or repaired. Repair of the dam to ADWR specifications requires the dam to detain the 1/2 PMF (Probable Maximum Flood), having the effect of potentially reducing peak discharges in the established floodplain.

In order to reclaim valuable land, an efficient drainage path will be graded according to the results of the HEC-2 analysis for the site. Consideration has been given to minimize earthwork activity. In addition, this report was prepared in conjunction with water, sewer and paving considerations.

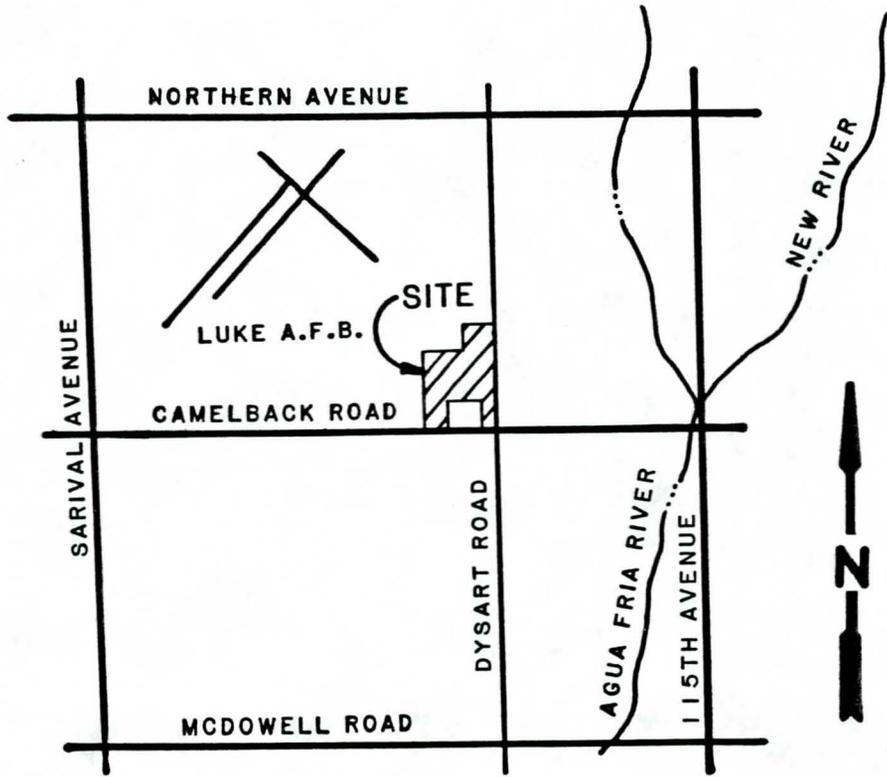
No increase has been made to the water surfaces and velocities along the downstream property boundary in the post-developed 100-year floodplain analysis as compared to the pre-developed 100-year floodplain analysis.

Development of adjacent undeveloped property prior to the site's improvements could reduce the size of the culverts proposed at dry crossings and could alter the geometrics of the drainage channels.

2.0 INTRODUCTION

The proposed site is located at the northwest corner of Camelback Road and Dysart Road in unincorporated Maricopa County, Arizona (see Plate 1). The north half of Camelback Road adjacent to the south property line has been strip annexed by the City of Glendale. The proposed site is approximately 340 acres in size and contained entirely within section 15, Township 2 North, Range 1 West, Gila and Salt River Base and Meridian.

The property was previously referred to as Camelback and Dysart, and has now been named Litchfield Ridge. Previous drainage reports and related materials have been entitled, "Camelback and Dysart".



VICINITY MAP

N.T.S.

3.0 FLOOD INSURANCE STUDY

The entire site is located in a Zone B designation, according to the Flood Insurance Rate Map, community panel no. 040037 1205 A for unincorporated Maricopa County, Arizona, dated July 2, 1979. Zone B designations are defined as:

Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100 year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

Flood Control District of Maricopa County (FCDMC) representatives indicated that Litchfield Park Dam located north of the project has been classified unsafe by the Arizona Department of Water Resources (ADWR). Therefore, the District required a 100-year floodplain delineation downstream of Litchfield Park Dam (see Reference No. 10).

4.0 OFF-SITE DRAINAGE CONSIDERATIONS

4.1 EXISTING WATERSHED CONDITIONS

The upper watershed is approximately ten square miles in size with the majority of the land used for agricultural purposes and approximately 1.5 square miles designated as Luke Air Force Base. North of Luke Air Force Base, a channel known as the Dysart Drain diverts some of the stormwater runoff easterly towards the Aqua Fria River. The remaining stormwater runoff continues southerly to a detention structure located north of the property boundary, known as the Litchfield Park Dam. Since the structure presently has a potential to breach at any given location, no benefits were analyzed in determination of peak discharges entering the project site.

Along the west property line a drainage area of approximately 0.3 square miles is characterized by shallow concentrated flow and traverses through the subject site in a southeasterly direction. Along the northeast area, shallow concentrated flow enters the proposed site and travels southerly in scattered sheet flow. The contributing watershed is approximately 1.4 square miles. Stormwater runoff backwaters at the intersection of Camelback & Dysart Roads until it eventually drains easterly through a series of ditches and culverts to the Agua Fria River.

4.2 FUTURE WATERSHED CONDITIONS

Two drainage structures influence the flood hazard associated with off-site stormwater runoff with respect to the subject site.

Drainage Structure No. 1 - Litchfield Park Dam

It is our understanding that the owners of Litchfield Park Dam have been notified by the Arizona Department of Water Resources (ADWR) to either remove or repair the dam. They have retained Boyle Engineering Corporation to make recommendations by April, 1988. Peak discharges entering the north property boundaries have been analyzed and estimated to be 1525 cfs in the west wash and 1425 cfs in the east wash (see Reference No. 9).

4.2 FUTURE WATERSHED CONDITIONS (Cont'd.)

Should the Dam be removed or repaired, the maximum flowrate permitted down each wash cannot exceed the present condition as established in Reference No. 9.

Drainage Structure No. 2 - Dysart Drain

As we understand, Luke Air Force Base would like to have 4.5 million dollars worth of improvements done to upgrade the Dysart Drain. Every year they request Washington D.C. to schedule these improvements for the annual budget. At report time, the annual budgets through 1992 have been determined and funds for improvements to the Dysart drain have not been allocated.

4.3 HYDRAULIC CONVEYANCE

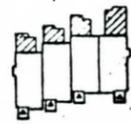
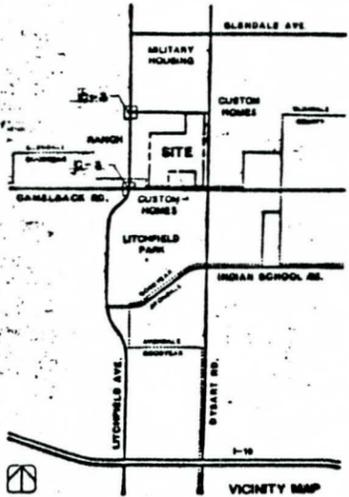
The United States Army Corps of Engineers HEC-2 backwater program was used to document pre-developed and post-developed conditions. This method allows reclamation of valuable land and integrates a drainage path concept with a grading scheme (see Reference No. 10).

A. PRE-DEVELOPED FLOODPLAIN

A pre-developed 100 year floodplain was delineated using topographic mapping at a scale of 1" = 200' with 1 foot contour intervals (see Exhibit I). The results of the study show shallow concentrated flows within the project site. It should be noted that the delineation for the east and west split flow along the north border was based on a broad-crested weir analysis and a field survey on the Litchfield Park Dam (see Reference No. 9).

B. POST-DEVELOPED FLOODPLAIN

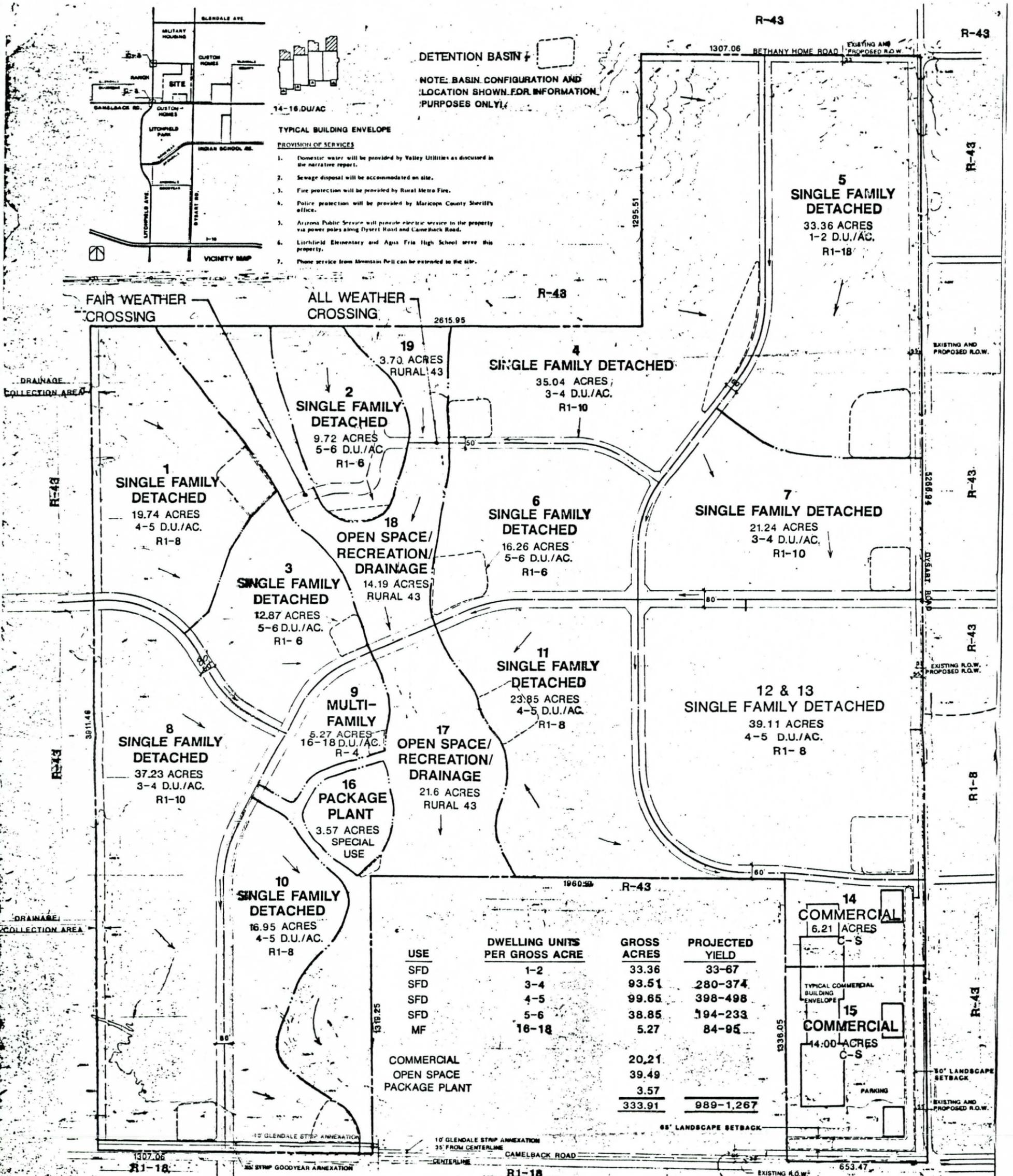
A post-developed 100 year floodplain was delineated using topographic mapping and a Concept Land Use Plan with approved zoning (see Plate 2 and Exhibit I). The plan shows an open space area which is used for efficient hydraulic conveyance of the 100 year, 24 hour rainfall-runoff event. The delineation for the east and west washes was based on the total peak discharge which reaches the Litchfield Park Dam being carried in both washes independently.



14-16 D.U./AC
TYPICAL BUILDING ENVELOPE

- PROVISION OF SERVICES
- Domestic water will be provided by Valley Utilities as discussed in the narrative report.
 - Sewage disposal will be accommodated on site.
 - Fire protection will be provided by Rural Metro Fire.
 - Police protection will be provided by Maricopa County Sheriff's office.
 - Arizona Public Service will provide electric service to the property via power poles along Dyster Road and Camelback Road.
 - Litchfield Elementary and Agua Fria High School serve this property.
 - Phone service from Mountain Bell can be extended to the site.

DETENTION BASIN # []
NOTE: BASIN CONFIGURATION AND LOCATION SHOWN FOR INFORMATION PURPOSES ONLY.



USE	DWELLING UNITS PER GROSS ACRE	GROSS ACRES	PROJECTED YIELD
SFD	1-2	33.36	33-67
SFD	3-4	93.51	280-374
SFD	4-5	99.65	398-498
SFD	5-6	38.85	194-233
MF	16-18	5.27	84-95
COMMERCIAL		20.21	
OPEN SPACE		39.49	
PACKAGE PLANT		3.57	
		333.91	989-1,267

PRELIMINARY TITLE RESERVATION

Reserve No. 1: []

Reserve No. 2: []

Reserve No. 3: []

Reserve No. 4: []

Reserve No. 5: []

Reserve No. 6: []

Reserve No. 7: []

Reserve No. 8: []

Reserve No. 9: []

Reserve No. 10: []

EXHIBIT SECTION 15, T2N, R1W, G4SR84M.

1"=200'

0 100 200 300 400 500

RECEIVED JUN 30 1987

OWNER/APPLICANT: AMCOR Investments Corporation, 2735 East Camelback Rd., Phoenix, AZ 85018, (602) 957-7170

Prepared By: []

REVISED 3/11/87 SEPTEMBER 19, 1986

REVISED 3/17/88 REVISED 1/8/87

REVISED 4/8/87 REVISED 1/25/87

CONCEPT PLAN CAMELBACK AND DYSART PROPERTY

AMCOR INVESTMENTS CORPORATION

B. POST-DEVELOPED FLOODPLAIN (Cont'd.)

This will ensure a safe design should the dam breach at any given location. The removal or repair of Litchfield Park Dam will not change the channel geometry but will lower the water surface on the wash on each side of Parcel 2 by one-half foot. Road crossings were modeled and specific requirements will be discussed later under a separate heading. Particular attention was given to insure entering and exiting characteristics are not exceeding pre-developed conditions. The open space/drainage channel will be owned and maintained by the developer of the property until a homeowner's association is formulated.

4.4 WEST PROPERTY LINE DRAINAGE EASEMENT

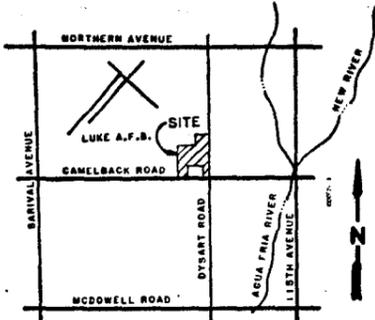
A drainage channel will be constructed along the west property line of the site, as a part of the Phase I improvements, to collect and convey easterly off-site stormwater runoff coming from the west (see Sheet 1 of Appendix A and Exhibit II). The east-west portion of the drainage channel will have a dry culvert crossing provided at its intersection with 135th Avenue. There were no adverse backwater influences resulting from the analysis of six - 3' x 10' concrete box culverts. In addition, a backwater analysis was performed on the entire drainage channel, and there were no adverse affects to adjacent property owners (see Reference No. 10 for both backwater analyses). Additional analysis of the dry crossing will be performed at construction drawing preparation time to determine the necessary sizes and types of culverts to be used.

4.5 NORTHEAST AREA DRAINAGE CHANNEL

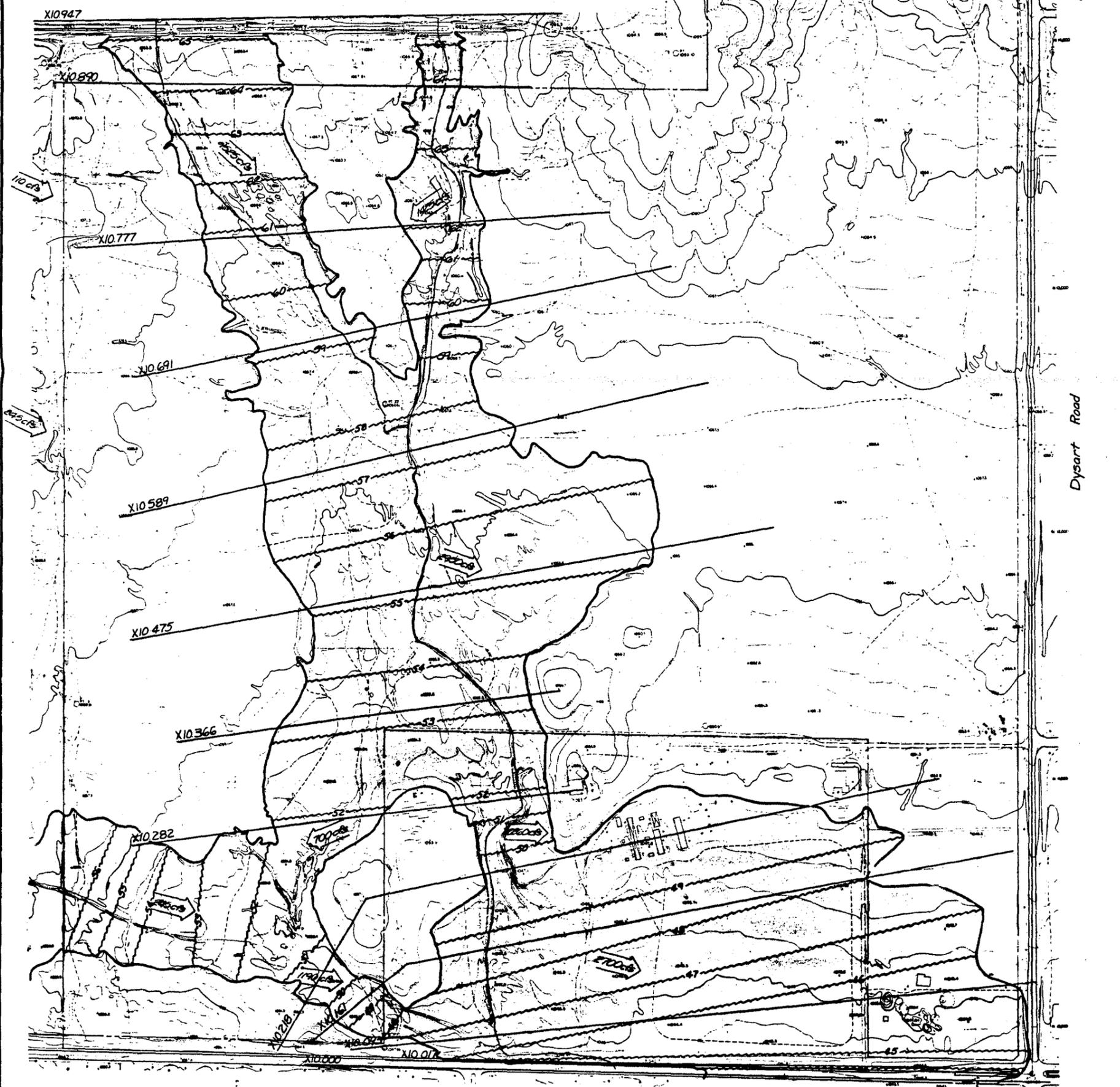
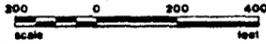
A drainage channel along the west side of Dysart Road is proposed for Phase I improvements, and will convey off-site stormwater runoff generated west of Dysart Road and north of Bethany Home Road southerly to the intersection of Camelback and Dysart Roads. At the intersection, the channel will either tie into the storm drain proposed along Camelback Road, or tie into the existing pipes located in the center of Camelback Road.

4.5 NORTHEAST AREA DRAINAGE CHANNEL (Cont'd.)

Manning's Equation was used to calculate the drainage channel capacity (see Sheet 1 of Appendix A). A dry culvert crossing will be constructed to pass the stormwater under Missouri Avenue at Dysart Road. Preliminary calculations indicate no problems are anticipated in using one 3' x 10' box culvert at this location (see Sheet 2 of Appendix A). In the event the property north of Bethany Home Road is developed prior to Litchfield Ridge, the dry crossing and associated drainage channel may be reduced in size.



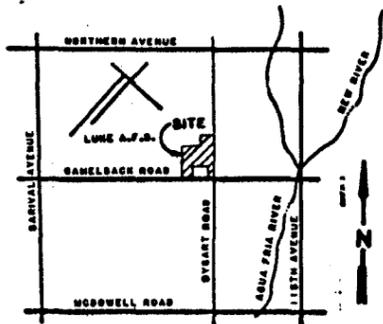
VICINITY MAP
N.T.S.



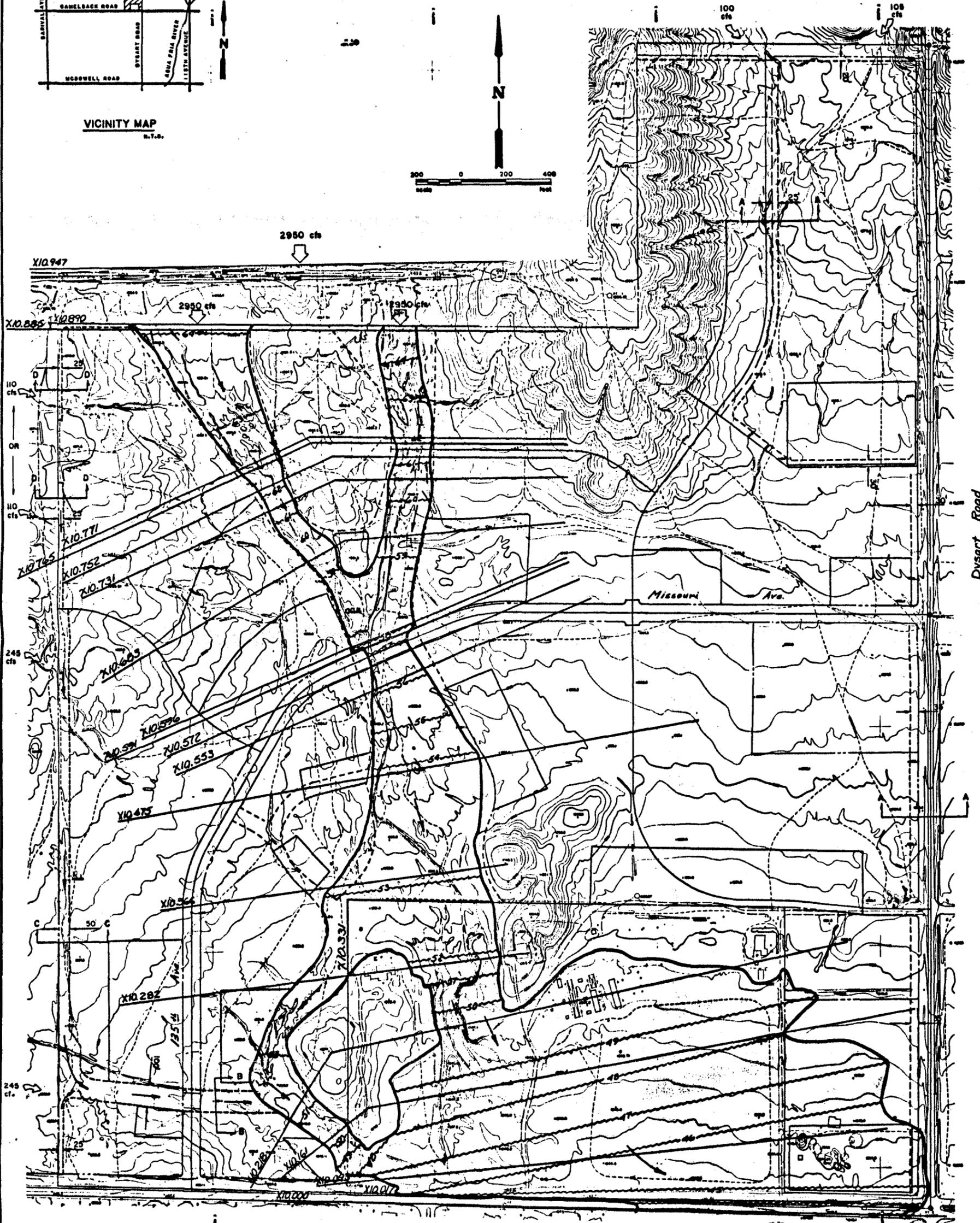
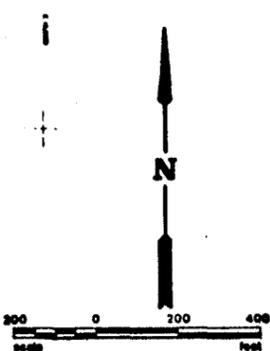
Legend
 ~~~~~ 100 Yr Highwater Elevation  
 - - - - - Flowline  
 X1097 Hydraulic Cross Section  
 - - - - - 100 Yr Floodplain Boundary

Camelback Road

|                                                                           |          |         |         |        |
|---------------------------------------------------------------------------|----------|---------|---------|--------|
| Pre Development<br>100 Year Floodplain<br>NW Corner of Camelback & Dysart |          |         |         |        |
| DESIGN L.M.T.                                                             | DATE     | JOB NO. | SCALE   | SHEET  |
| DRAWN H.S.                                                                | Nov 1987 | 87384   | 1"=200' | 1 OF 1 |
| CHECK P.E.M.                                                              |          |         |         |        |
| <b>WOOD &amp; ASSOCIATES, INC.</b><br>CONSULTING CIVIL ENGINEERS          |          |         |         |        |



VICINITY MAP  
N.T.S.



**LEGEND**

- 100 yr Highwater Elevation
- Flooding
- NSC-2 Hydraulic Cross Section
- 100 yr Floodplain Boundary
- Drainage Easement/Open Space
- Cross Section A-A (See Appendix A)
- Retention Basin (See Plate 3)
- Temporary

Camelback Road

Dysart Road

|                                                                                |           |         |           |
|--------------------------------------------------------------------------------|-----------|---------|-----------|
| <b>POST DEVELOPMENT<br/>100 YEAR FLOODPLAIN<br/>LITCHFIELD RIDGE - PHASE 1</b> |           |         |           |
| DESIGNED BY                                                                    | DATE      | JOB NO. | SCALE     |
| WOOD & ASSOCIATES, INC.                                                        | NOV. 1987 | 87384   | 1" = 200' |
| SHEET                                                                          |           | 1 OF 1  |           |
| <b>WOOD &amp; ASSOCIATES, INC.</b><br>CONSULTING CIVIL ENGINEERS               |           |         |           |

## 5.0 ON-SITE DRAINAGE CONSIDERATIONS

### 5.1 STREET DESIGN AND FINISHED FLOORS

- A. The proposed project will be developed in phases. Phase I will include mass grading and construction of the main collector street with associated infrastructure. At the location where the main collector street crosses the floodplain, a cross-section was modeled in HEC-2 (see Reference No. 10). The results showed a majority of stormwater will overtop the road and nuisance water will pass under the road through two - 24" x 35" corrugated metal pipes.
- B. Access to Parcel 2 (see Concept Plan) was modeled in HEC-2 using a dry road crossing over the east wash and a wet road crossing over the west wash (see Reference No. 10). The east crossing was modeled using 18 - 3' x 10' reinforced concrete box culverts. This will allow the total peak discharge of 2950 cfs to cross under the road. Once the Litchfield Park Dam is removed or repaired, the drainage channel on the east side of Parcel 2 will be required to carry a maximum flowrate of 1525 cfs (see Reference No. 9). Thus, the number of box culverts will be reduced. In addition, the west drainage channel will be required to carry a maximum flowrate of 1425 cfs. It should be noted that both access road crossings to Parcel 2 are not a part of the Phase I improvements.
- C. Finished floor elevations adjacent to the floodplain shall be set a minimum of one foot above the anticipated 100-year highwater elevation. In addition, the developer of Tract G (see Preliminary Plat) shall integrate a design which accounts for the shallow backwater affect at the intersection of Camelback and Dysart Roads.

## 5.2 RETENTION REQUIREMENTS

On-site retention for runoff generated by the 100-year, 2 hour storm event will be provided for each tract in accordance with soon to be adopted Flood Control, District of Maricopa County and current City of Glendale criteria (see Plate 3). Basin configurations shown on Exhibit II are approximate and were based on a depth of one foot. The basins are temporary and will be located within temporary retention easements. As each tract is developed, the retention basins will be modified to a final configuration and depth.

Retention is also required for stormwater falling within the right of way. The Preliminary Plat shows the approximate size and locations for temporary retention basins within temporary retention easements. As tracts are developed, retention of runoff generated from rights-of-way will be the responsibility of the tract fronting the said right-of-way.

## 5.3 BANK PROTECTION

Bank protection of the north property line downstream of the Litchfield Park Dam is under investigation, and will be provided if necessary.

PLATE 3

RETENTION REQUIREMENTS/TRACTS

| TRACT NO. | ZONING      | GROSS ACREAGE | RUNOFF COEFFICIENT (C) | VOLUME ** PROVIDED (A.C. FT.) | BASIN SURFACE AREA (S.F.) W/BASIN DEPTH 1' |
|-----------|-------------|---------------|------------------------|-------------------------------|--------------------------------------------|
| A         | R1-10       | 37.2          | .70                    | 5.88                          | 256,160                                    |
| B         | R1-8        | 19.7          | .70                    | 5.15                          | 224,490                                    |
|           | R1-6        | 12.9          |                        |                               |                                            |
| C         | R1-6        | 9.7           | .70                    | 1.53                          | 22,270                                     |
|           | R-43        | 17.9          | .40                    |                               | (3' Deep)                                  |
| D         | R1-10       | 35.0          | .70                    | 8.11                          | 353,260                                    |
|           | R1-6        | 16.3          |                        |                               |                                            |
| E         | R1-18       | 33.4          | .70                    | 8.63                          | 375,980                                    |
|           | R1-10       | 21.2          |                        |                               |                                            |
| F         | R1-8        | 63.0          | .70                    | 9.96                          | 433,825                                    |
| G         | C-5         | 20.2          | .9                     | 4.11                          | 178,850                                    |
| H         | R-43        | 21.6          | .4                     | --                            | --                                         |
| J         | R-4         | 5.3           | .8                     | .96                           | 41,710                                     |
| K         | Special Use | 3.6           | .9                     | .73                           | 31,870                                     |
| L         | R1-8        | 17.0          | .7                     | 2.7                           | 117,080                                    |

RETENTION REQUIREMENTS/RIGHT-OF-WAY

| RETENTION BASIN | TRIBUTARY AREA (S.F.) | RUNOFF COEFFICIENT (C) | VOLUME ** REQUIRED (C.F.) | BASIN SURFACE AREA = (S.F.) W/BASIN DEPTH 1' |
|-----------------|-----------------------|------------------------|---------------------------|----------------------------------------------|
| 1               | 12,000                | .95                    | 2575                      |                                              |
| 2               | 26,000                | .95                    | 5600                      |                                              |
| 3               | 24,000                | .95                    | 5200                      |                                              |
| 4               | 38,000                | .95                    | 8150                      |                                              |
| 5               | 39,200                | .95                    | 8400                      |                                              |
| 6               | 22,000                | .95                    | 4700                      |                                              |
| 7               | 36,000                | .95                    | 7700                      |                                              |
| 8               | 24,000                | .95                    | 5200                      |                                              |

\*NOTE: SEE PRELIMINARY PLAT FOR TRACT AND BASIN LOCATIONS.

\*\*NOTE: VOLUME PROVIDED =  $\frac{d}{12}$  CA WHERE: d = 2.71 INCHES.

## 6.0 REFERENCES

1. Chow, Ven Te, Open Channel Hydraulics, New York, 1959.
2. Construction Inspection and Testing Co., Camelback Dysart Property, Phase I, Phoenix, Arizona, October, 1987.
3. PRC Engineering, Camelback and Dysart Property Narrative Report, Orange, California, September, 1986.
4. United States Army Corps of Engineers, Water Resource Support Center, HEC-2 Water Surface Profiles, Davis, California, 1982.
5. United States Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Project Formulation - Hydrology, Washington, D.C., 1982.
6. United States Department of Commerce, Bureau of Public Roads, Hydraulic Engineering Circular No. 5, Washington, D.C., 1964.
7. Wood & Associates, Inc., Conceptual Master Drainage Plan for Northwest Corner of Camelback & Dysart Roads, Phoenix, Arizona, August, 1986.
8. Wood & Associates, Inc., Addendum No. 1 to Conceptual Drainage Plan for Northwest Corner of Camelback & Dysart Roads, Phoenix, Arizona, February, 1987.
9. Wood & Associates, Inc., Addendum No. 2 to Conceptual Drainage Plan for Northwest Corner of Camelback & Dysart Roads, Phoenix, Arizona, February, 1987.
10. Wood & Associates, Inc., 100 Year Floodplain Report for Northwest Corner Camelback & Dysart, Phoenix, Arizona, December, 1987.

Appendix A

MISCELLANEOUS CALCULATIONS



**WOOD & ASSOCIATES, INC.**

CONSULTING CIVIL ENGINEERS

4105 North 20th Street

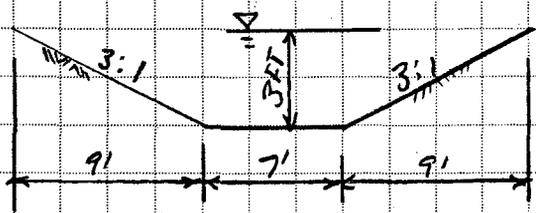
Suite 130

Phoenix, Arizona 85016

(602) 957-3149

JOB LITCHFIELD RIDGE

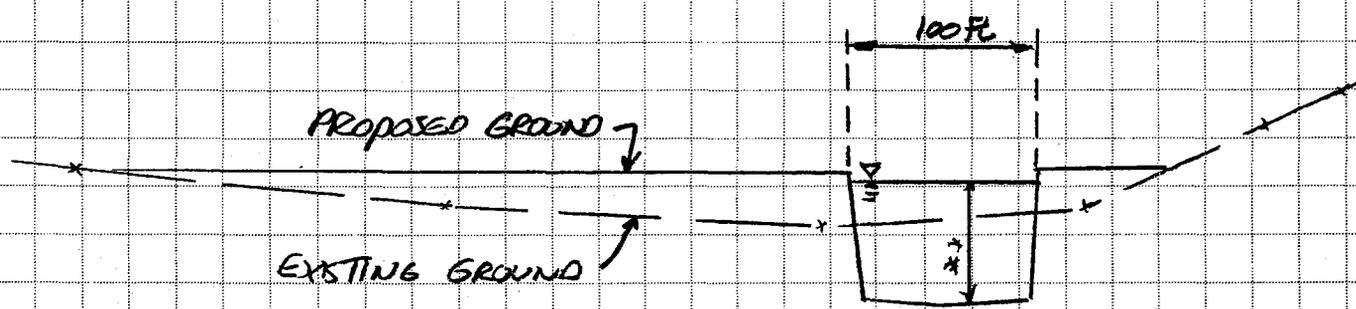
SHEET NO. 1 OF 2



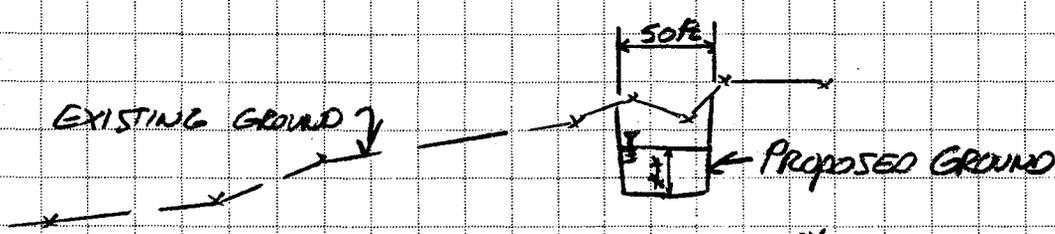
$n = .035$   
 $V = 68.16 \text{ } S^{.5} \text{ (Fps) MANNING EQN}$   
 $Q = 4293.45 \text{ } S^{.5} \text{ (CFS)}$

$S = .46\%$      $V = 4.34 \text{ Fps}$      $Q = 208 \text{ CFS} > Q_{100} = 205 \text{ CFS}$   
 $\therefore$  ACCEPTABLE

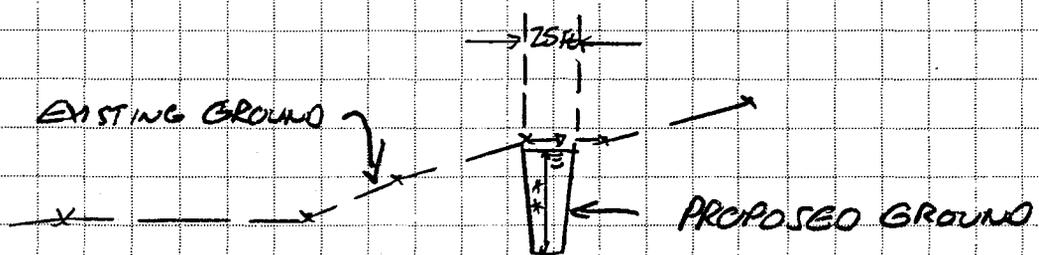
SECTION A-A\*



SECTION B-B\*



SECTION C-C\*



SECTION D-D\*

\* See EXHIBIT II FOR CROSS SECTION LOCATION  
 \*\* SEE REFERENCE NO. 10 FOR HEC-2 ANALYSIS OF CHANNEL.

PROJECT: LICKFIELD RIDGE

DESIGNER: J.C.

DATE: 1/26/88

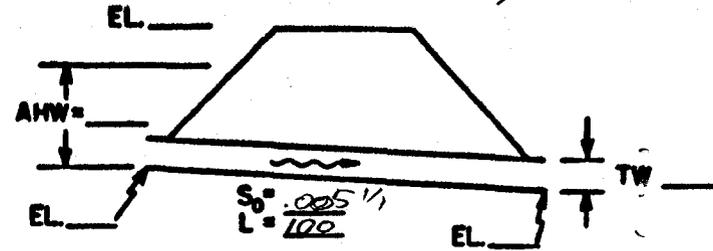
HYDROLOGIC AND CHANNEL INFORMATION

SKETCH MISSOURI &  
STATION: DYSART

$Q_1 =$  \_\_\_\_\_  
 $Q_2 =$  205

$TW_1 =$  \_\_\_\_\_  
 $TW_2 =$  \_\_\_\_\_

(  $Q_1$  = DESIGN DISCHARGE, SAY  $Q_{25}$   
 $Q_2$  = CHECK DISCHARGE, SAY  $Q_{50}$  OR  $Q_{100}$  )



MEAN STREAM VELOCITY = \_\_\_\_\_  
MAX. STREAM VELOCITY = \_\_\_\_\_

| CULVERT DESCRIPTION<br>(ENTRANCE TYPE) | Q   | SIZE  | HEADWATER COMPUTATION |      |                                                          |      |                |                     |    |                |                 |      | CONTROLLING HW | OUTLET VELOCITY | COMMENTS |  |
|----------------------------------------|-----|-------|-----------------------|------|----------------------------------------------------------|------|----------------|---------------------|----|----------------|-----------------|------|----------------|-----------------|----------|--|
|                                        |     |       | INLET CONT.           |      | OUTLET CONTROL HW = H + h <sub>0</sub> - LS <sub>0</sub> |      |                |                     |    |                |                 |      |                |                 |          |  |
|                                        |     |       | HW/D                  | HW   | K <sub>0</sub>                                           | H    | d <sub>c</sub> | $\frac{d_c + D}{2}$ | TW | h <sub>0</sub> | LS <sub>0</sub> | HW   |                |                 |          |  |
| BOX CULVERT<br>WINGWALL TS             | 100 | 3x10' | .75                   | 2.25 |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |
| "                                      | 205 | 3x10' | 1.28                  | 3.84 | .4                                                       | 1.25 | 2.3            | 2.65                | 3  | 3              | .5              | 3.75 | 3.94           | 6.8             |          |  |
|                                        |     |       |                       |      |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |
|                                        |     |       |                       |      |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |
|                                        |     |       |                       |      |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |
|                                        |     |       |                       |      |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |
|                                        |     |       |                       |      |                                                          |      |                |                     |    |                |                 |      |                |                 |          |  |

SUMMARY & RECOMMENDATIONS:

FIGURE 3-42

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