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CITY OF LITCHFIELD PARK

MASTER DRAINAGE STUDY

REPORT

PREPARED BY:

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MARCH 1989

City of Litchfield Park
Master Drainage Study
Report

Prepared by:

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March 1989

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CITY OF LITCHFIELD PARK
MASTER DRAINAGE STUDY

INTRODUCTION

This report has been prepared for the City of Litchfield Park by Willdan Associates in the capacity as City Engineer. The purpose of the report is to present their results of the analysis of the existing drainage system within the developed area and propose potential solutions to correct recurring drainage and flooding problems.

The City of Litchfield Park was incorporated in 1987. Prior to that date Litchfield Park was a privately developed residential and resort community within the unincorporated area of Maricopa County. Development of the residential subdivisions, resort, golf course and related streets and infrastructure began in the 1940's and progressed through several stages of development to the current level.

On August 21, 1988, a localized, severe "monsoon-type" rain storm produced heavy runoff through the area and caused the flooding of a number of homes. This event initiated the following:

(1) A considerable amount of investigation of the existing drainage system,

(2) Implementation of some remedial construction projects to prevent or control future flooding,

(3) Discussions with the Flood Control District of Maricopa County to initiate a project to provide flood control upstream of the City, and;

(4) Preparation of this master drainage study for the developed area of the City.

The boundaries of the study are shown on Exhibit 1 and are based on an important assumption. This assumption is that a permanent drainage channel will be constructed along Camelback Road from Litchfield Road to Dysart Road in the near future with sufficient capacity to convey the 100-year storm event around Litchfield Park. This channel will therefore prevent any off-site stormwater from entering the developed area and, thereby, sets the upstream limits of the drainage basins to be analyzed.

METHODOLOGY

This study has been carried out using generally accepted methods for this area. The following is a summary:

- Aerial photo maps at a scale of 1 inch = 200 feet with a contour interval of 4 feet was used to define the drainage basins. The maps were prepared in 1987.

- The aerial maps were supplemented by additional spot elevations extracted from the aerial models with an accuracy of plus or minus one foot, field survey spot elevations, visual inspections of the area, and "as-built" plans of various existing features.

- Runoff analysis and routings were done using the Corps of Engineers computer model HEC-I.

- Parameters used in the model for storm intensity, runoff coefficients, and hydrograph increments have been correlated with the Boyle Engineering Study north of Camelback Road in order to ensure compatibility of combining the two studies as part of the design criteria for the proposed Dysart Channel.

The quantitative results of the analysis is presented in the next section and is followed by a number of potential approaches to the solution of the existing drainage problems.

DISCUSSION AND RESULTS

As previously stated, the basic methodology incorporated the HEC-I program with available maps and field inspections. The basins' boundaries and routings reflect the conditions during a 100-year event, and may differ from conditions witnessed during low flows when the

stormwater will basically follow streets and other defined drainageways. When high rates of flow occur as during a 100-year event, the drainage pattern will begin to change. The runoff will overtop curbs and begin to flow overland, following the general topography of the area. The Air Line Canal will overtop and divert a major part of its flow overland. The existing catchbasins and storm drainage pipes become overloaded and largely ineffective. Consequently, most of the stormwater will flow from north to south and attempt to exit the area along the Indian School Bypass. At this point, the combination of roadway grades, lot grades, and perimeter walls causes the stormwater to pond until the water levels are high enough to overtop the obstructions and continue downstream.

During the process of ponding a number of homes and other property were flooded. Residents reported that this type of flooding had occurred on a number of previous occasions.

Therefore the objective of the study was to analyze the routing and quantities of this type of storm runoff in order to have a basis for recommendations to correct the situation.

The results of the analysis are presented in the following parts of the report.

- Exhibit I outlines the drainage basin boundaries and is enclosed in the pocket at the back of the report.

- A summary of the HEC-I output is shown with comments in Table I, and appears on the following page.

- In addition to the general outline of basin boundaries shown on Exhibit I, larger scale maps of the outlet areas have been prepared to show the existing drainage patterns in more detail. These maps are identified as Exhibits II, II and IV and are enclosed in the map pocket at the back of the report.

- The HEC-I input parameters are listed in Table II and is contained in the Appendix.

- The flow routing diagrams and the HEC-I computer printouts are included in the Appendix.

TABLE I

HEC-I ANALYSIS, SUMMARY OF OUTPUT DATA

BASIN	PEAK FLOW (cfs)	COMMENTS
A	49	Exits Basin through culverts under Indian School Bypass. Some minor flow exits through catchbasins to Bypass stormdrain.
B	96	Exits Basin through fence opening into Bypass right-of-way. B-3 has a catchbasin system to Bypass stormdrain.
C	234	This flow includes a diversion from H-I due to overtopping of Air Line Canal. (110 cfs). The 234 cfs. splits with approximately 134 cfs exiting through a channel into the Bypass right-of-way and the balance is retained in an area of ponding south of the lake.
D	<10	Minor flow exits through catchbasins to Bypass stormdrain and subsequently meters flow received from basin "C".
E	47	This flow is metered out through catch basins to Bypass stormdrain.
F	105	It is estimated that 25 cfs exits at the intersection of Litchfield Road into the Bypass right of way. The balance ponds in the Desert Avenue area and is eventually metered out through catchbasins into the Bypass stormdrain.
G	49	Routed directly into the Air Line Canal.

BASIN	PEAK FLOW (cfs)	COMMENTS
H	130	Approximately 20 cfs is routed through the Air Line Canal underground pipe flowing west. This is the capacity of the pipe and therefore the balance of 110 cfs overtops the canal and flows south through basin C-5.
I	48	Exits the basin through catchbasins and street flow to a ditch flowing south along the Litchfield Road Bypass.
J	18	Exits into Airline Canal.
K	10	Exits into Airline Canal.
L	19	Exits into Airline Canal for a total combined flow of 61 cfs for J, K, and L and the upstream pipe flow from H-I.

POTENTIAL SOLUTIONS AND COST ESTIMATES

The natural topography and the development of Litchfield Park have created a basin effect with respect to storm runoff, which provides virtually no means for runoff to exit the area before ponding. Also, because the area is almost completely developed, there are limited options for controlling the run-off by means of on-site retention facilities. This leaves the general approach of intercepting the runoff at critical locations and conveying it downstream, away from the developed area to a point where it will not do any damage and can be managed adequately.

Recognizing that the potential outlet locations will involve other municipal jurisdictions and the land holdings of private developers, the proposed solutions can only be tentative and will require negotiations and agreements before final choices can be made and implemented. Consequently, the potential solutions shown here may evolve through several alternatives and combinations, depending upon these negotiations. Therefore, the solutions are presented in general terms until the negotiations are further developed and the alternatives have been refined.

Two approaches for the storm drain system have been developed. The first approach assumes that the Dysart Channel will be constructed and will service the internal system. The second approach assumes that the Dysart Channel will not be constructed and a major new outlet must be developed to cross the R.I.D. and flow south.

These approaches and related cost summaries are presented below. The locations are illustrated on Exhibits V and VI. The costs associated with each approach have been developed with the following understanding:

1) The costs as presented represent the order of magnitude of the potential work and are directional only.

2) They serve as a means of comparing the alternatives presented.

3. They are subject to change as the alternatives evolve and are further defined based on more detailed design.

With the Dysart Channel

1. West to East Interceptor: Construct an interceptor along the southern boundary of the golf course. The interceptor could be a landscaped low berm and swale incorporated into the golf course landscape and would detain flow from the north and route it to the southeast at a reduced rate. The outlet from the berm would flow into an underground pipe. In order to further reduce the peak flows and related cost of the outlet pipe, it is proposed that the park at the intersection of Indian School ~~Road~~ LANE and the Bypass be developed as a detention basin. If the Dysart Channel is not constructed, the need for a detention or retention basin in this area will be very important.

   The interceptor will handle approximately 50 percent of the runoff that would otherwise arrive at the south boundary of Litchfield Park. The construction of this part of the system will require approval of the golf course owner.

2. Alternative Interceptor: As an alternative to the interceptor along the golf course, an underground storm drain could be constructed from west to east along Indian School Road starting at Litchfield Road and to the detention basin. This could be done within the City's own jurisdiction, however it would be very costly.

3. Indian School Storm Drain: The third element is an underground storm drain along Indian School Road, starting at Litchfield Road and draining to the west under Litchfield Bypass to an open channel on the west side of the right-of-way. This would provide drainage for an existing low area at the Litchfield/Indian School intersection and intercept the balance of the runoff from the north. This interceptor would be within the City's jurisdiction except for the Litchfield Bypass right-of-way portion.

4. Litchfield Road Bypass Channel: In order to ensure that future runoff does not enter the Park at the north entrance to Litchfield Road and its intersection with the Bypass, improvements should be made along the west side of Litchfield Road Bypass from Camelback Road to south of Litchfield Greens entrance. This channel then needs to be extended to the south side of Indian School to avoid any additional problems along the Litchfield Bypass. This work can be done with open channels and culverts, and for the most part, would be the responsibility of the developer.

5. Southern Area Drainage System: The next major element for managing the runoff is to provide a positive drainage system south of the proposed east/west interceptor as described in items 1 and 2. The most important components are to develop the lake and park at the south end of Litchfield Road to a detention basin system and to

provide improvements to route local runoff south along Litchfield Road and Neolin Avenue into the basins. The basins would also receive runoff from Villa Nueva and the Desert Avenue area. The costs associated with this element will be depend upon what happens with the other proposed elements, and the amount of detention capacity incorporated into the lake and park area.

The use of the lake has a significant benefit to reduce peak flows and thereby simplify and reduce the cost of other parts of the system such as the downstream outlet channels or pipes. There are however other related factors which could be viewed as a disadvantage to using the lake and which should be carefully considered. They include:

(1) The water surface of the lake will need to be lowered, thereby reducing its surface area and requiring a new shore line to be established.

(2) During storm runoff it is possible that the water will be discolored due to mud or silt from the runoff.

(3) The accumulation of mud and silt could in turn require future expenditures to clean the lake. There is also a possibility that future maintenance would have to include algae control due to the decreased water depth and increased nutrients from the runoff.

Cost Summary of Proposed Storm Drainage Improvements

With Dysart Channel

		Cost Estimate
PHASE 1		
1.	Interceptor berm/swale along south side of golf course.	$180,000
2.	Pipeline along Villa Nueva to Indian School Lane, into detention basin.	70,000
3.	Construct new detention basin (Turtle Park).	150,000
4.	Outlet pipe under Indian School Bypass and pipe or open channel to Dysart Channel.	100,000
PHASE II		
5.	Storm drainage on Neolin Avenue and Cart Path from Fairway Drive to Lake.	150,000
6.	Storm drainage on Litchfield Road from Indian School to new detention basin.	60,000
7.	Storm drainage on Indian School from Litchfield Road intersection to Litchfield Bypass.	80,000
8.	Storm drainage on Dorado Circle to new detention basin.	25,000
9.	Construct new detention basin in park and connect to lake.	100,000
10.	Construct new pump outlet from lake and connect to existing storm drain.	30,000
PHASE III		
11.	Drainage ditch and culvert improvements at various locations along Litchfield Bypass from Indian School Bypass north to Camelback Road.	50,000
	Total Estimated Construction Cost	$995,000

Alternatives

		Cost Estimate
PHASE I		
1.	Construct a pipeline interceptor along Indian School Road from west to east starting at Litchfield Road connect to detention basin at Turtle Park. Delete interceptor along golfcourse and pipelines along Villa Nueva.	$220,000
PHASE II		
2.	Connect storm drain along Neolin north of Indian School to interceptor and reduce pipe size along Neolin south of Indian School.	(40,000)
3.	Delete storm drain on Indian School from Litchfield Road west to Litchfield Bypass. Extend storm drain on Litchfield east and west of Indian School intersection and increase its capacity.	(30,000)
	Net Cost of Alternatives	$150,000
	Total Estimated Construction Cost with Alternatives	$1,145,000

Without the Dysart Channel

1. RID Outlet: If the construction of the Dysart Channel does not proceed within a reasonable period, it is recommended that a second outlet crossing under the R.I.D. Canal be constructed with culvert crossings of the Indian School Bypass. This would also require negotiations with the County and/or private landowners for a drainage easement south of the R.I.D. Canal to allow the runoff to reach the I-10 retention basins.

   Suncor has begun to develop a master drainage plan for their land in this area and the possibility of this requirement should be incorporated into their study.

2. Neolin Avenue System: In addition to the R.I.D. crossing, the capacity of drainage system along Neolin Avenue would have to be increased to convey runoff from the west side of the golf course in addition to the previously planned flows.

3. Indian School Bypass Channel: The runoff which is now routed to the south will be conveyed across Indian School Bypass in culverts. From there an existing channel along the south side of the Bypass will need to be improved and extended to direct the runoff to the new R.I.D. crossing.

Cost Summary of Proposed Storm Drainage Improvements

Without Dysart Channel

		Cost Estimate
PHASE I		
1.	Interceptor berm/swale along south side of golf course.	$180,000
2.	Pipeline along Villa Nueva to Indian School Lane, into detention basin.	70,000
3.	Construct new detention basin (Turtle Park).	150,000
4.	Outlet pipe under Indian School Bypass and an open channel along south side of Indian School Bypass flowing southwest to a new crossing under the R.I.D. canal in the vicinity of the old Litchfield Road alignment.	330,000
PHASE II		
5.	Storm drainage on Neolin Avenue and Cart Path from Golf Course to Lake.	150,000
6.	Storm drainage on Litchfield Road from Indian School to new detention basin.	60,000
7.	Storm drainage on Indian School from Litchfield Road intersection to Litchfield Bypass.	80,000
8.	Storm drainage on Dorado Circle to new detention basin.	25,000
9.	Construct new detention basin in park and connect to lake.	100,000
10.	Construct gravity outlet from lake and connect to new channel on south side of Indian School Bypass.	40,000
PHASE III		
11.	Drainage ditch and culvert improvements at various locations along Litchfield Bypass from Indian School Bypass north to Camelback Road.	50,000
	Total Estimated Construction Cost	$1,235,000

Alternatives

	Cost Estimate
PHASE I	
1. Construct a pipeline interceptor along Indian School Road starting at Neolin Avenue and connect to detention basin at Turtle Park second pipeline from Wigwam Resort and connect to pipeline in Neolin Avenue. Delete interceptor along golfcourse and pipelines along Villa Nueva.	$220,000
PHASE II	
2. Delete storm drain on Indian School from Litchfield Road west to Litchfield Bypass. Extend stormdrain on Litchfield east and west of Indian School intersection and increase its capacity.	(30,000)
Net Cost of Alternatives	190,000
Total Estimated Construction Cost with Alternatives	$1,425,000

SUMMARY

In summary, two alternative approaches have been presented for review and comment to improve the Litchfield Park storm drainage system. The final selection, order of development, and costs are highly dependent upon several factors still to be determined. These factors include:

(1) The decision to build and the timing of the Dysart Channel construction.

(2) Development plans and jurisdiction over land between Indian School Bypass and the R.I.D. Canal and from the R.I.D. south to I-10.

(3) Approval to construct drainage controls along the existing golf course.

(4) Approval to use park land within Litchfield Park for detention basins.

(5) The financing ability of the City.

Depending upon the final configuration, the estimated construction costs would be $995,000 for the first approach or $1,235,000 for the second approach.

APPENDIX

TABLE II

HEC-I INPUT DATA SUMMARY

BASIN	AREA (SQ. MI.)	CURVE NUMBER	SCS LAG (HR)
A	0.113	72	0.86
B-1	0.012	72	0.82
B-2	0.288	70	1.13
B-3	0.007	72	0.53
C-1	0.162	72	1.26
C-2	0.067	72	1.08
C-3	0.006	72	0.50
C-4	0.019	72	0.61
C-5	0.106	72	0.67
D	0.011	72	0.49
E-1	0.032	72	0.21
E-2	0.020	72	0.61
F-1	0.124	72	0.84
F-2	0.102	72	0.68
G	0.106	72	0.79
H-1	0.019	68	0.66
H-2	0.178	70	0.74
I	0.039	75	0.23
J	0.031	72	0.57
K	0.017	72	0.57
L	0.033	72	0.58

HEC-I Printout

Routing Diagrams

CLIENT LITCHFIELD PARK		JOB NO. 39052/ESS-13	
PROJECT MASTER DRAINAGE STUDY		SHEET 1 OF 5	
DESIGN FOR RUNOFF ROUTING		DESIGNER DWG	DATE 2/89
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

LEGEND

BASIN HYDROGRAPH LABEL — B-1

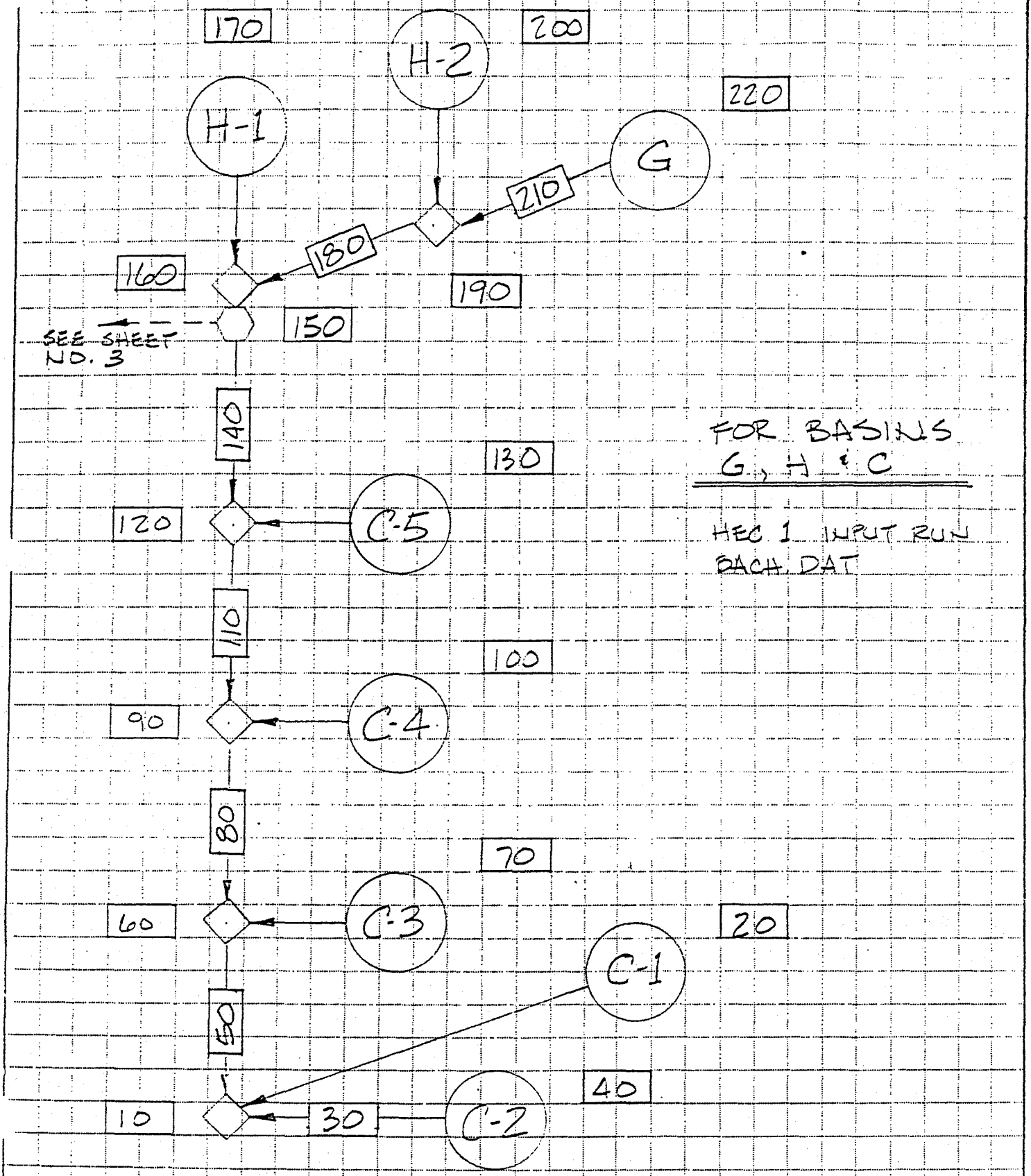
HYDROGRAPH ROUTING W/ STATION I.D. NUMBER — 41

COMBINE HYDROGRAPHS

DIVERT FLOW

STATION I.D. NUMBER — 100

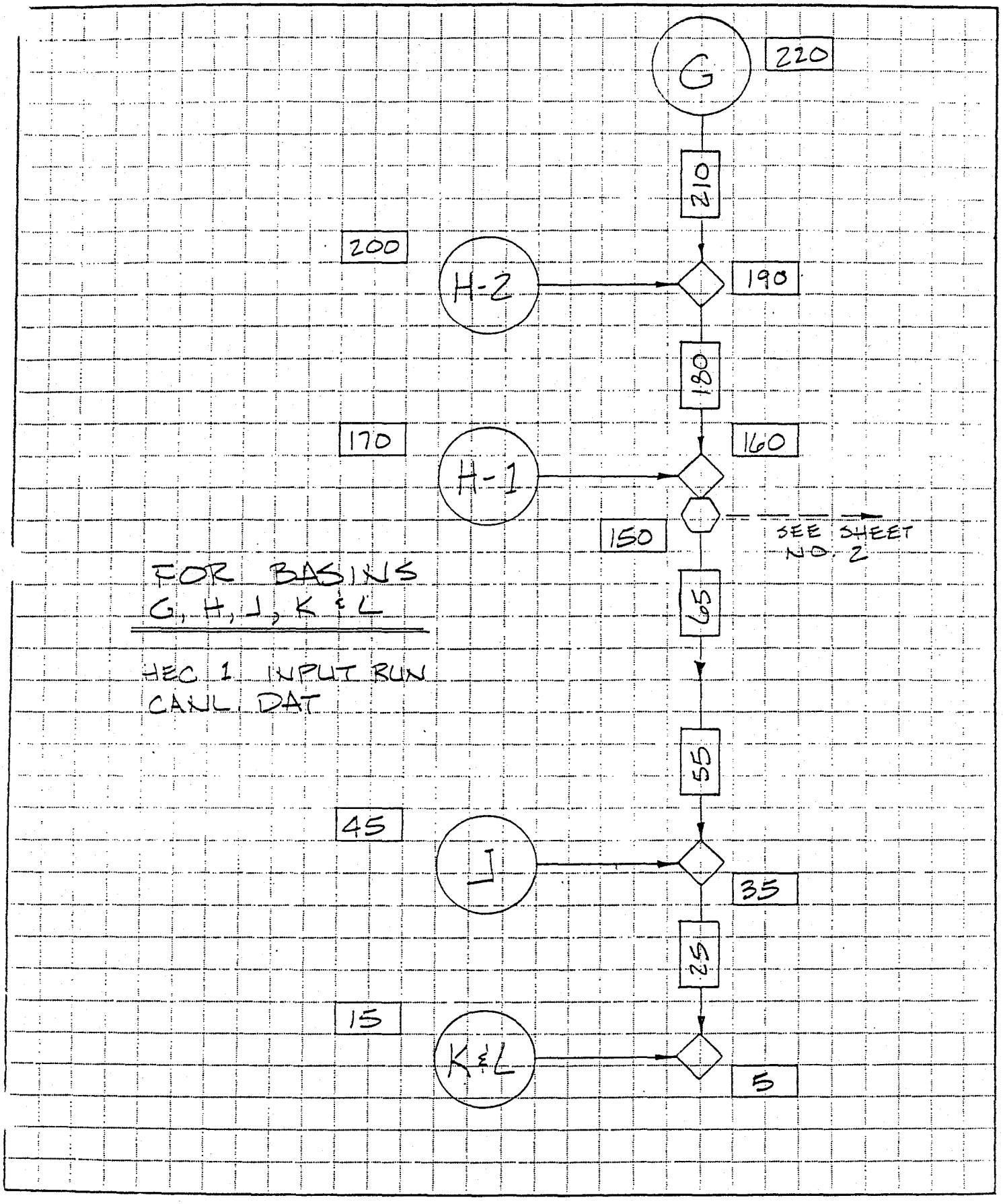
CLIENT LITCHFIELD PARK	JOB NO. 39052/E88-13	
PROJECT MASTER DRAINAGE STUDY	SHEET 2 OF 4	
DESIGN FOR RUNOFF ROUTING	DESIGNER DWG	DATE 2/89
WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE



FOR BASINS G, H & C

HEC 1 INPUT RUN BACH.DAT

CLIENT LITCHFIELD PARK	JOB NO. 39052/E88-13	
PROJECT MASTER DRAINAGE STUDY	SHEET 3 OF 6	
DESIGN FOR RUNOFF ROUTING	DESIGNER DWG	DATE 2/89
WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE



FOR BASINS G, H, J, K & L

HEC 1 INPUT RUN CANL.DAT

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	PROJECT MASTER DRAINAGE STUDY	SHEET 6 OF 6	
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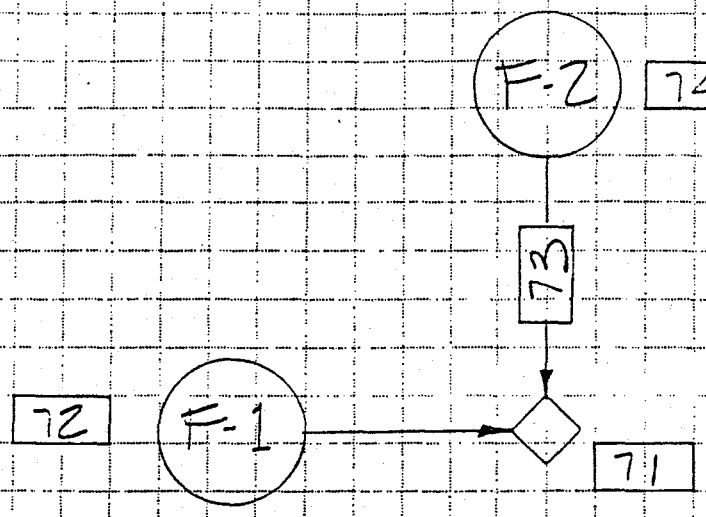
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE



FOR BASIN F

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BAFR.DAT

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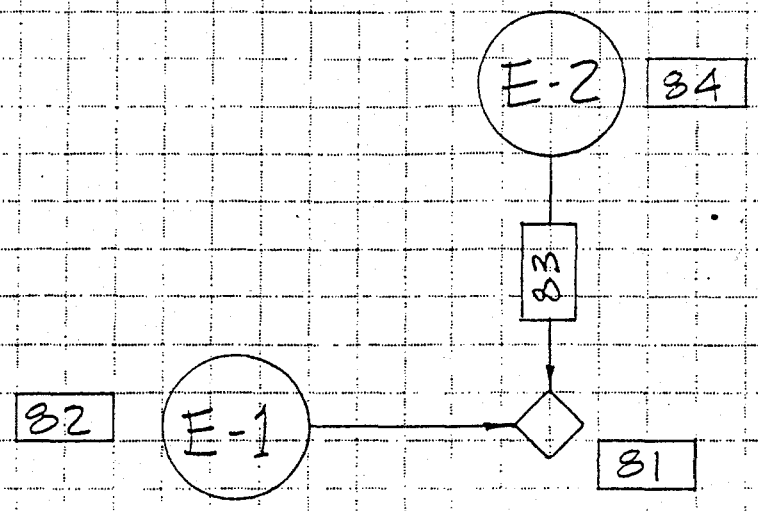
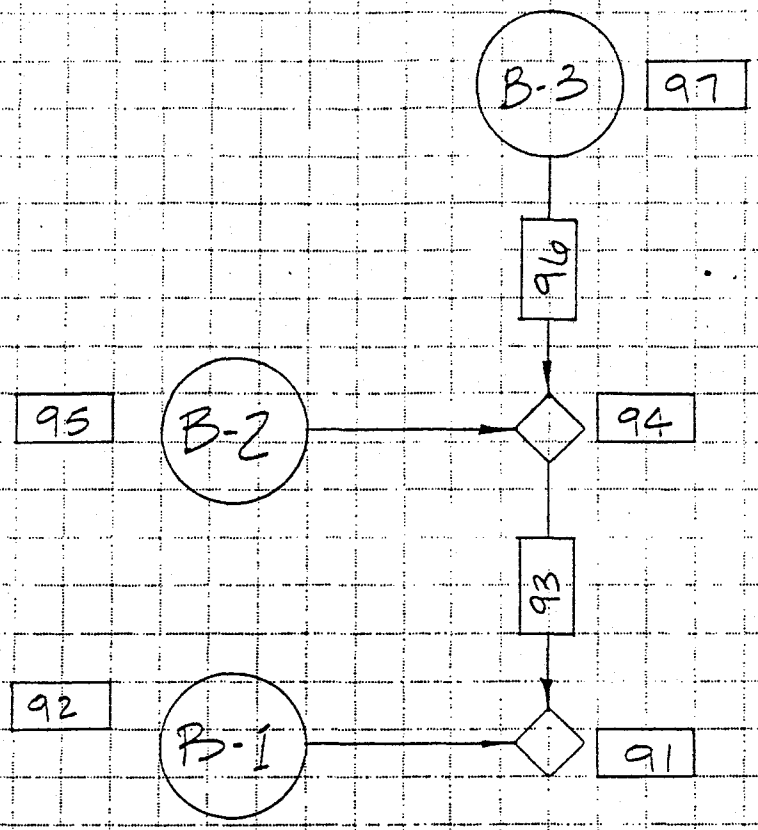
	PROJECT MASTER DRAINAGE STUDY	SHEET 5 OF 6	
	DESIGN FOR RUNOFF ROUTING	DESIGNER DWG	DATE 2/89
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE



FOR BASIN E

HEC 1 INPUT RUN
BASE.DAT

CLIENT LITCHFIELD PARK		JOB NO. 39052/E32-3	
PROJECT WATER DRAINAGE STUDY		SHEET 6 OF 6	
DESIGN FOR RUNOFF ROUTING		DESIGNER DWG	DATE 2/80
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE



FOR BASIN B

HEC 1 INPUT RUN
BASB.DAT

HEC-I Printout

Printouts

HEC-I Printout

Basin A routed to south end.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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  4           ID        JOB NO. 39052/E88-13
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 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
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 15           IN      5.
 16           IO      5.

 17           KK    1000        BASIN A RUNOFF
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 30           LS      0      72.       0
 31           UD    .86
 32           ZZ
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THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: BASA.DAT
OUTPUT FILE: BASA.OUT

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*************************************  *************************************
STANDARD SCS 24-HOUR, TYPE II . STRIBUTION
100 YEAR
TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
*************************************************************************

16 IO        OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                 NMIN          5  MINUTES IN COMPUTATION INTERVAL
                IDATE     1    0  STARTING DATE
                ITIME       0000  STARTING TIME
                   NQ        300  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE     2    0  ENDING DATE
               NDTIME       0055  ENDING TIME

            COMPUTATION INTERVAL      .08 HOURS
                 TOTAL TIME BASE   24.92 HOURS

      ENGLISH UNITS

                                  HYDROGRAPH MULTIPLIED BY  1.00

                                        RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                 TIME IN HOURS,  AREA IN SQUARE MILES

                                PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
      OPERATION       STATION   FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                  6-HOUR     24-HOUR     72-HOUR

      HYDROGRAPH AT
+                      1000     49.    4.92         16.         4.          4.        .11

*** NORMAL END OF HEC-1 ***
```

HEC-I Printout

Basins B-3, B-2 and B-1 routed to south end.

FLOOD HYDROGRAPH PACKAGE HEC .BM XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC L JINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
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 14           IT      5.                    300.
 15           IN      5.
 16           IO      5.

 17           KK     97        BASIN B-3 RUNOFF
 18           BA    .007              1.
 19           PB    3.77
 20           PC     0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC   .0290   .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC   .0640   .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC   .1100   .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC   .1810   .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC   .7350   .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC   .8560   .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC   .9130   .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC   .9530   .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC   .9830   .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS      0     72.       0
 31           UD    .53

 32           KK     96        ROUTE FLOWS IN REACH 96
 33           RK    270.    .002    .100                    10.     10.

 34           KK     95        BASIN B-2 RUNOFF
 35           BA    .288              1.
 36           LS      0     70.       0
 37           UD   1.13

 38           KK     94        COMBINE FLOWS AT 94
 39           HC      2.

 40           KK     93        ROUTE FLOWS IN REACH 93
```

+	ROGR AT	97	4.	4.58		0.	0.	.01
	ROUTED TO							
+		96	4.	4.67	1.	0.	0.	.01
	HYDROGRAPH AT							
+		95	90.	5.25	36.	9.	9.	.29
	2 COMBINED AT							
+		94	92.	5.25	37.	9.	9.	.29
	ROUTED TO							
+		93	92.	5.25	37.	9.	9.	.29
	HYDROGRAPH AT							
+		92	5.	4.92	2.	0.	0.	.01
	2 COMBINED AT							
+		91	96.	5.25	39.	10.	9.	.31

*** NORMAL END OF HEC-1 ***

```
          43          BA     .012                1.
          44          LS        0     72.        0
          45          UD      .82
1                                                HEC-1 INPUT                                                    PAGE  2

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

          46          KK       91       COMBINE FLOWS AT 91
          47          HC       2.
          48          ZZ
1                                                                  ****
                    FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                                   ****

                         THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
                         FOR THE CITY OF LITCHFIELD PARK
                         BY WILLDAN ASSOCIATES
                         JOB NO. 39052/E88-13

                         INPUT FILE: BASB.DAT
                         OUTPUT FILE: BASB,OUT
                      ******************************************************************************
                         STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
                         100 YEAR
                         TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
                         FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
                      ******************************************************************************

   16 IO          OUTPUT CONTROL VARIABLES
                        IPRNT          5  PRINT CONTROL
                        IPLOT          0  PLOT CONTROL
                        QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1   0  STARTING DATE
                        ITIME       0000  STARTING TIME
                           NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      2   0  ENDING DATE
                       NDTIME       0055  ENDING TIME

                  COMPUTATION INTERVAL      .08 HOURS
                       TOTAL TIME BASE    24.92 HOURS

          ENGLISH UNITS

                                          HYDROGRAPH MULTIPLIED BY  1.00

                                          HYDROGRAPH MULTIPLIED BY  1.00

                                          HYDROGRAPH MULTIPLIED BY  1.00
1
                                                   RUNOFF SUMMARY
                                             FLOW IN CUBIC FEET PER SECOND
                                           TIME IN HOURS,  AREA IN SQUARE MILES

                                   PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION      STATION   FLOW    PEAK                                            AREA      STAGE     MAX STAGE
```

HEC-I Printout

Basin D routed to stormdrain.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: BASD.DAT
  7           ID        OUTPUT FILE: BASD.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT     5.                    300.
 15           IN     5.
 16           IO     5.

 17           KK    51        BASIN D
 18           BA   .011              1.
 19           PB  3.77
 20           PC    0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290  .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640  .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100  .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810  .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350  .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560  .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130  .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530  .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830  .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS     0    72.       0
 31           UD   .49
 32           ZZ
```


THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

```
                    INPUT FILE: BASO.DAT
                    OUTPUT FILE: BASO.OUT
                    ************************************  ************************************
                          STANDARD SCS 24-HOUR, TYPE II .  TRIBUTION
                          100 YEAR
                          TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
                          FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
                    ************************************************************************

  16 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME

                 COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE    24.92 HOURS

          ENGLISH UNITS

                                    HYDROGRAPH MULTIPLIED BY  1.00


                                  TIME IN HOURS,  AREA IN SQUARE MILES

                                  PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
          OPERATION       STATION  FLOW    PEAK                                          AREA     STAGE    MAX STAGE
 +                                                   6-HOUR     24-HOUR     72-HOUR

          HYDROGRAPH AT
 +                         51       7.    4.50         2.          0.          0.        .01

 *** NORMAL END OF HEC-1 ***
```

HEC-I Printout

Basins E-I and E-2 combined and routed to Indian School Bypass Stormdrain.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: BASE.DAT
  7           ID        OUTPUT FILE: BASE.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT      5.                    300.
 15           IN      5.
 16           IO      5.

 17           KK     84       BASIN E-2 RUNOFF
 18           BA   .020              1.
 19           PB   3.77
 20           PC     -0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC   .0290   .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC   .0640   .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC   .1100   .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC   .1810   .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC   .7350   .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC   .8560   .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC   .9130   .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC   .9530   .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC   .9830   .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS      0     72.       0
 31           UD    .61

 32           KK     83       ROUTE FLOW IN REACH 83
 33           RK   400.    .015    .020            CIRC    1.25

 34           KK     82       BASIN E-1 RUNOFF
 35           BA   .032              1.
 36           LS      0     72.       0
 37           UD    .21

 38           KK     81       COMBINE FLOWS AT 81
 39           HC      2
 40           ZZ
```

THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: BASE.DAT
OUTPUT FILE: BASE.OUT

****
STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
100 YEAR
TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
****

16 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

HYDROGRAPH MULTIPLIED BY 1.00

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	84	11.	4.67	3.	1.	1.	.02		
+	ROUTED TO	83	11.	4.67	3.	1.	1.	.02		
+	HYDROGRAPH AT	82	36.	4.17	4.	1.	1.	.03		
+	2 COMBINED AT	81	39.	4.17	7.	2.	2.	.05		

*** NORMAL END OF DEC-1 ***

HEC-I Printout

Basins F-2 and F-1 routed to south end.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: BAFR.DAT
  7           ID        OUTPUT FILE: BAFR.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT      5.                      300.
 15           IN      5.
 16           IO      5.

 17           KK     74        BASIN F-2 RUNOFF
 18           BA   .102              1.
 19           PB   3.77
 20           PC    -0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290   .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640   .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100   .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810   .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350   .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560   .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130   .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530   .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830   .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS      0     72.       0
 31           UD    .68

 32           KK     73        ROUTE FLOW IN REACH 73
 33           RK  3000.   .0027    .015                    20.     10.

 34           KK     72        BASIN F-1 RUNOFF
 35           BA   .124              1.
 36           LS      0     72.       0
 37           UD    .84

 38           KK     71        COMBINE FLOWS AT 71
 39           HC      2
 40           ZZ
```

THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: BAFR.DAT
OUTPUT FILE: BAFR.OUT

****
STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
100 YEAR
TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
****

16 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	74	52.	4.75	14.	4.	3.	.10		
+	ROUTED TO	73	52.	4.83	14.	4.	3.	.10		
+	HYDROGRAPH AT	72	54.	4.92	17.	4.	4.	.12		
+	2 COMBINED AT	71	105.	4.92	31.	8.	8.	.23		

*** NORMAL END OF HEC-1 ***

HEC-I Printout

Basins G, H-2, H-1, C, J, K, and L routed to Air Line Canal at Litchfield Bypass.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: CANL.DAT
  7           ID        OUTPUT FILE: CANL.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT      5.                    300.
 15           IN      5.
 16           IO      5.

 17           KK    220       BASIN G RUNOFF
 18           BA   .106              1.
 19           PB   3.77
 20           PC    0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290  .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640  .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100  .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810  .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350  .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560  .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130  .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530  .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830  .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS     0    72.       0
 31           UD   .79

 32           KK    210       ROUTE FLOW IN REACH 210
 33           RK  3400.   .002    .011                    4.0    1.25

 34           KK    200       BASIN H-2 RUNOFF
 35           BA   .178              1.
 36           LS     0    70.       0
 37           UD   .74

 38           KK    190       COMBINE FLOWS AT 190
 39           HC      2.

 40           KK    180       ROUTE FLOW IN REACH 180
```

```
                                                SIN      RUN
        43          BA     .019                 1.
        44          LS        0      68.        0
        45          UD      .66
1                                                  HEC-1 INPUT                                                    PAGE  2

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


        46          KK      160        COMBINE FLOWS AT 160
        47          HC       2.

        48          KK      150        DIVERT FLOW TO BASIN C
        49          DT    BAS-C
        50          DI        0     100.     130.     150.
        51          DQ        0      85.     110.     127.

        52          KK       65        ROUTE FLOW IN REACH 65
        53          RK    1000.     .002     .020            CIRC      3.0

        54          KK       55        ROUTE FLOW IN REACH 55
        55          RK     200.     .002     .020                      4.0     1.25

        56          KK       45        BASIN J RUNOFF
        57          BA     .031                 1.
        58          LS        0      72.        0
        59          UD      .57

        60          KK       35        COMBINE FLOWS AT 35
        61          HC       2.

        62          KK       25        ROUTE FLOW IN REACH 25
        63          RK     650.     .002     .015                      4.0     1.25

        64          KK       15        BASINS K&L RUNOFF
        65          BA     .050                 1.
        66          LS        0      72.        0
        67          UD      .58

        68          KK        5        COMBINE FLOWS AT 5
        69          HC       2.
        70          ZZ
1                                                                  ****
                          FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
              U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                                  ****



                          THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
                          FOR THE CITY OF LITCHFIELD PARK
                          BY WILLDAN ASSOCIATES
                          JOB NO. 39052/E88-13

                          INPUT FILE: CANL.DAT
                          OUTPUT FILE: CANL.OUT
                    ***************************************************************************
                          STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
                          100 YEAR
                          TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
                          FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
                    ***************************************************************************
```

IPRNT 5 PRINT CONTROL
IPLOT [illegible] PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	220	49.	4.83	15.	4.	4.	.11		
+	ROUTED TO	210	48.	4.92	15.	4.	4.	.11		
+	HYDROGRAPH AT	200	76.	4.83	23.	6.	5.	.18		
+	2 COMBINED AT	190	123.	4.83	37.	9.	9.	.28		
+	ROUTED TO	180	123.	4.92	37.	9.	9.	.28		
+	HYDROGRAPH AT	170	8.	4.75	2.	1.	1.	.02		
+	2 COMBINED AT	160	130.	4.92	39.	10.	10.	.30		
+	DIVERSION TO	BAS-C	110.	4.92	33.	8.	8.	.30		
+	HYDROGRAPH AT	150	20.	4.92	6.	1.	1.	.30		
+	ROUTED TO	65	20.	4.92	6.	1.	1.	.30		

+		55	20.	5.00	6.	1.	1.	.30
+	HYDROGRAPH AT	45	18.	4.58	4	1.	1.	.03
+	2 COMBINED AT	35	35.	4.83	10.	3.	2.	.33
+	ROUTED TO	25	34.	4.83	10.	3.	2.	.33
+	HYDROGRAPH AT	15	28.	4.58	7.	2.	2.	.05
+	2 COMBINED AT	5	61.	4.75	17.	4.	4.	.38

*** NORMAL END OF HEC-1 ***

HEC-I Printout

Basin I routed to Litchfield Road Bypass.

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: BAIR.DAT
  7           ID        OUTPUT FILE: BAIR.OUT
  8           ID  ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID  ******************************************************************************
 14           IT      5.                    300.
 15           IN      5.
 16           IO      5.

 17           KK     31        BASIN I RUNOFF
 18           BA   .039              1.
 19           PB   3.77
 20           PC     0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290   .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640   .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100   .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810   .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350   .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560   .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130   .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530   .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830   .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS      0     75.       0
 31           UD    .23
 32           ZZ
```


THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: BAIR.DAT

[redacted]UT [redacted] B[redacted]UT [redacted]

********** **********

STANDARD SCS 24-HOUR, TYPE II L .RIBUTION

100 YEAR

TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD

FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD

****

16	IO	OUTPUT CONTROL VARIABLES		
		IPRNT	5	PRINT CONTROL
		IPLOT	0	PLOT CONTROL
		QSCAL	0.	HYDROGRAPH PLOT SCALE
	IT	HYDROGRAPH TIME DATA		
		NMIN	5	MINUTES IN COMPUTATION INTERVAL
		IDATE 1	0	STARTING DATE
		ITIME	0000	STARTING TIME
		NQ	300	NUMBER OF HYDROGRAPH ORDINATES
		NDDATE 2	0	ENDING DATE
		NDTIME	0055	ENDING TIME

COMPUTATION INTERVAL .08 HOURS

TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	31.	48.	4.17	6.	2.	2.	.04		

*** NORMAL END OF HEC-1 ***

HEC-I Printout

Basins G, H, and C routed to south end.

FLOOD HYDROGRAPH PACKAGE HEC-1 (M XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC EN EERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: BACH.DAT
  7           ID        OUTPUT FILE: BACH.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT     5.                    300.
 15           IN     5.
 16           IO     5.

 17           KK    220        BASIN G RUNOFF
 18           BA   .106              1.
 19           PB   3.77
 20           PC     0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290   .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640   .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100   .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810   .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350   .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560   .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130   .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530   .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830   .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS     0     72.       0
 31           UD   .79

 32           KK    210        ROUTE FLOWS IN REACH 210
 33           RK  3400.    .002    .011                    4.0    1.25

 34           KK    200        BASIN H-2 RUNOFF
 35           BA   .178              1.
 36           LS     0     70.       0
 37           UD   .74

 38           KK    190        COMBINE FLOWS AT 190
 39           HC      2

 40           KK    180        ROUTE FLOW IN REACH 180
```

```
                                    SIN      RUN
   43          BA     .019                1.
   44          LS        0       68        0
   45          UD      .66
```



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

   46          KK      160        COMBINED FLOWS AT 160
   47          HC        2.

   48          KK      150        DIVERT FLOW TO AIRLINE CANAL
   49          DT    CANAL
   50          DI        0     100.     130.     150.
   51          DQ        0      15.      20.      23.

   52          KK      140        ROUTE FLOW IN REACH 140
   53          RK    2200.     .006     .030                  20.      10.

   54          KK      130        BASIN C-5 RUNOFF
   55          BA     .106                1.
   56          LS        0      72.        0
   57          UD      .67

   58          KK      120        COMBINED FLOWS AT 120
   59          HC        2

   60          KK      110        ROUTE FLOW IN REACH 110
   61          RK     700.    .0034     .020                  20.      10.

   62          KK      100        BASIN C-4 RUNOFF
   63          BA     .019                1.
   64          LS        0      72.        0
   65          UD      .61

   66          KK       90        COMBINE FLOWS AT 90
   67          HC        2

   68          KK       80        ROUTE FLOW IN REACH 80
   69          RK     350.    .0071     .020                  20.      10.

   70          KK       70        BASIN C-3 RUNOFF
   71          BA     .006                1.
   72          LS        0      72.        0
   73          UD      .50

   74          KK       60        COMBINED FLOWS AT 60
   75          HC        2

   76          KK       50        ROUTE FLOW IN REACH 50
   77          RK     700.    .0037     .030                  20.      10.

   78          KK       40        BASIN C-2 RUNOFF
   79          BA     .067                1.
   80          LS        0      72.        0
   81          UD     1.08
```



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

   82          KK       30        ROUTE FLOW IN REACH 30
   83          RK    1600.    .0029     .020                  25.      10.
```

```
84          KK      20        BASIN C-1 RUNOFF
85
86          LS       0     72.        0
87          UD    1.26

88          KK      10        COMBINE FLOWS AT 10
89          HC       3
90          ZZ
1                                                    ****
                    FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ****


                    THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
                    FOR THE CITY OF LITCHFIELD PARK
                    BY WILLDAN ASSOCIATES
                    JOB NO. 39052/E88-13

                    INPUT FILE: BACH.DAT
                    OUTPUT FILE: BACH.OUT
                ***************************************************************************
                    STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
                    100 YEAR
                    TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
                    FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
                ***************************************************************************

  16 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                   NMIN          5  MINUTES IN COMPUTATION INTERVAL
                  IDATE     1    0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     2    0  ENDING DATE
                 NDTIME       0055  ENDING TIME

              COMPUTATION INTERVAL      .08 HOURS
                  TOTAL TIME BASE    24.92 HOURS

        ENGLISH UNITS

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00
1
                                              RUNOFF SUMMARY
```

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME MAX STAGE
HYDROGRAPH AT	220	49.	4.83	15.	4.	4.	.11		
ROUTED TO	210	48.	4.92	15.	4.	4.	.11		
HYDROGRAPH AT	200	76.	4.83	23.	6.	5.	.18		
2 COMBINED AT	190	123.	4.83	37.	9.	9.	.28		
ROUTED TO	180	123.	4.92	37.	9.	9.	.28		
HYDROGRAPH AT	170	8.	4.75	2.	1.	1.	.02		
2 COMBINED AT	160	130.	4.92	39.	10.	10.	.30		
DIVERSION TO	CANAL	20.	4.92	6.	1.	1.	.30		
HYDROGRAPH AT	150	110.	4.92	33.	8.	8.	.30		
ROUTED TO	140	109.	5.00	34.	8.	8.	.30		
HYDROGRAPH AT	130	54.	4.75	15.	4.	4.	.11		
2 COMBINED AT	120	157.	4.92	48.	12.	12.	.41		
ROUTED TO	110	157.	5.00	48.	12.	12.	.41		
HYDROGRAPH AT	100	10.	4.67	3.	1.	1.	.02		
2 COMBINED AT	90	164.	5.00	51.	13.	12.	.43		
ROUTED TO	80	164.	5.00	51.	13.	12.	.43		
HYDROGRAPH AT	70	4.	4.50	1.	0.	0.	.01		
2 COMBINED AT	60	166.	5.00	52.	13.	13.	.43		
ROUTED TO	50	166.	5.00	52.	13.	13.	.43		
HYDROGRAPH AT	40	24.	5.17	9.	2.	2.	.07		

[redacted] + [redacted] [redacted] [redacted] 3[redacted] [redacted] [redacted] [redacted] [redacted] [redacted] 2. [redacted] 2. [redacted] .07 [redacted]

HYDROGRAPH AT

+ 20 52. 5.42 22. 6. 5. .16

3 COMBINED AT

+ 10 234. 5.08 84. 21. 20. .66

*** NORMAL END OF HEC-1 ***

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: C1C2.DAT
  7           ID        OUTPUT FILE: C1C2.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CANELBACK ROAD
 13           ID   ******************************************************************************
 14           IT      5.                    300.
 15           IN      5.
 16           IO      5.

 17           KK     63        BASIN C-2 RUNOFF
 18           BA    .067              1.
 19           PB    3.77
 20           PC      0.    .0020    .0050    .0080    .0110    .0140    .0170    .0200    .0230    .0260
 21           PC   .0290    .0320    .0350    .0380    .0410    .0440    .0480    .0520    .0560    .0600
 22           PC   .0640    .0680    .0720    .0760    .0800    .0850    .0900    .0950    .1000    .1050
 23           PC   .1100    .1150    .1200    .1260    .1330    .1400    .1470    .1550    .1630    .1720
 24           PC   .1810    .1910    .2030    .2180    .2360    .2570    .2830    .3870    .6630    .7070
 25           PC   .7350    .7580    .7760    .7910    .8040    .8150    .8250    .8340    .8420    .8490
 26           PC   .8560    .8630    .8690    .8750    .8810    .8870    .8930    .8980    .9030    .9080
 27           PC   .9130    .9180    .9220    .9260    .9300    .9340    .9380    .9420    .9460    .9500
 28           PC   .9530    .9560    .9590    .9620    .9650    .9680    .9710    .9740    .9770    .9800
 29           PC   .9830    .9860    .9890    .9920    .9950    .9980   1.0000   1.0000   1.0000   1.0000
 30           LS      0     72.       0
 31           UD   1.08

 32           KK     62        ROUTE FLOWS IN REACH 62
 33           RK  1600.    .0029     .020                      25.      10.

 34           KK     61        BASIN C-1 RUNOFF
 35           BA   .162              1.
 36           LS      0     72.       0
 37           UD   1.26

 38           KK     60        COMBINE FLOWS AT 60
 39           HC      2
 40           ZZ
```

THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: C1C2.DAT
OUTPUT FILE: C1C2.OUT

****
STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
100 YEAR
TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
****

16 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		299	NUMBER OF HYDROGRAPH ORDINATES

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	63	24.	5.17	9.	2.	2.	.07		
+	ROUTED TO	62	24.	5.33	9.	2.	2.	.07		
+	HYDROGRAPH AT	61	52.	5.42	22.	6.	5.	.16		
+	2 COMBINED AT	60	77.	5.42	32.	8.	8.	.23		

*** NORMAL END OF HEC-1 ***

HEC-I Printout

Basins G, H-2, H-1, partial C-5, partial B-2, routed along a berm on south side of golf course.

FLOOD HYDROGRAPH PACKAGE HEC- 3M XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC E NEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
****

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: STM1.DAT
  7           ID        OUTPUT FILE: STM1.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
 13           ID   ******************************************************************************
 14           IT     5.                    300.
 15           IN     5.
 16           IO     5.

 17           KK   220        BASIN G RUNOFF
 18           BA   .106              1.
 19           PB   3.77
 20           PC   -0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290  .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640  .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100  .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810  .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350  .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560  .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130  .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530  .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830  .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS     0    72.       0
 31           UD   .79

 32           KK   210        ROUTE FLOW IN REACH 210
 33           RK  3400.   .002    .011                    4.0    1.25

 34           KK   200        BASIN H-2 RUNOFF
 35           BA   .178              1.
 36           LS     0    70.       0
 37           UD   .74

 38           KK   190        COMBINE FLOWS AT 190
 39           HC     2.

 40           KK   180        ROUTE FLOW IN REACH 180
```

```
 2                    ASIN  RU
 43          BA     .019              1.
 44          LS        0      68.       0
 45          UD      .66
```



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

 46          KK      160       COMBINE FLOWS AT 160
 47          HC        2.

 48          KK      150       DIVERT FLOW TO CANAL
 49          DT    CANAL
 50          DI        0     130.
 51          DQ        0      20.

 52          KK      159       ROUTE FLOW IN REACH 159
 53          RK    1000.     .004     .020                      20.      10.

 54          KK      158       DIVERT FLOW TO BASIN C
 55          DT    BAS-C
 56          DI        0      80.     110.     130.
 57          DQ        0      29.      40.      47.

 58          KK      157       ROUTE FLOW IN REACH 157
 59          RK     350.     .004     .020                      20.      10.

 60          KK      156       BASIN C-5 RUNOFF/PARCIAL
 61          BA     .027              1.
 62          LS        0      72.       0
 63          UD      .50

 64          KK      155       COMBINE FLOWS AT 155
 65          HC        2.

 66          KK      154       ROUTE FLOW IN REACH 154
 67          RK     700.     .004     .020                      20.      10.

 68          KK      153       BASIN C-1 RUNOFF/PARCIAL
 69          BA     .049              1.
 70          LS        0      72.       0
 71          UD      .74

 72          KK      152       COMBINE FLOWS AT 152
 73          HC        2.

 74          KK      151       ROUTE FLOW IN REACH 151
 75          RK    1900.     .004     .020                      20.      10.

 76          KK      149       BASIN B-2 RUNOFF/PARCIAL
 77          BA     .280              1.
 78          LS        0      70.       0
 79          UD     1.05

 80          KK      148       COMBINE FLOWS AT 148
 81          HC        2
```



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

 82          KK      147       ROUTE FLOW IN REACH 147
 83          RK    1200.     .005     .013            CIRC     2.25
```

FLOOD HYDROGRAPH PACKAGE HEC- 4 XT 512K VERSION) -FEB 1,1985
U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC E ..ERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
***

THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
FOR THE CITY OF LITCHFIELD PARK
BY WILLDAN ASSOCIATES
JOB NO. 39052/E88-13

INPUT FILE: STM1.DAT
OUTPUT FILE: STM1.OUT

****
STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
100 YEAR
TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
****

16 IO OUTPUT CONTROL VARIABLES

IPRNT		5	PRINT CONTROL
IPLOT		0	PLOT CONTROL
QSCAL		0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN		5	MINUTES IN COMPUTATION INTERVAL
IDATE	1	0	STARTING DATE
ITIME		0000	STARTING TIME
NQ		300	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	2	0	ENDING DATE
NDTIME		0055	ENDING TIME

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

1 RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

+	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	220	49.	4.83	15.	4.	4.	.11		
+	ROUTED TO	210	48.	4.92	15.	4.	4.	.11		

+	HYDROGRAPH AT	200	76.	4.83	23	6.	5.	.18
+	2 COMBINED AT	190	123.	4.83	37.	9.	9.	.28
+	ROUTED TO	180	123.	4.92	37.	9.	9.	.28
+	HYDROGRAPH AT	170	8.	4.75	2.	1.	1.	.02
+	2 COMBINED AT	160	130.	4.92	39.	10.	10.	.30
+	DIVERSION TO	CANAL	20.	4.92	6.	2.	1.	.30
+	HYDROGRAPH AT	150	110.	4.92	33.	8.	8.	.30
+	ROUTED TO	159	110.	4.92	33.	8.	8.	.30
+	DIVERSION TO	BAS-C	40.	4.92	12.	3.	3.	.30
+	HYDROGRAPH AT	158	70.	4.92	21.	5.	5.	.30
+	ROUTED TO	157	69.	5.00	21.	5.	5.	.30
+	HYDROGRAPH AT	156	17.	4.50	4.	1.	1.	.03
+	2 COMBINED AT	155	80.	4.92	25.	6.	6.	.33
+	ROUTED TO	154	80.	4.92	25.	6.	6.	.33
+	HYDROGRAPH AT	153	23.	4.83	7.	2.	2.	.05
	2 COMBINED AT							

THIS HEC-1 VERSION CONTAINS ALL OPTIONS EXCEPT ECONOMICS, AND THE NUMBER OF PLANS ARE REDUCED TO 3

1 HEC-1 INPUT PAGE 1

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

  1           ID        THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
  2           ID        FOR THE CITY OF LITCHFIELD PARK
  3           ID        BY WILLDAN ASSOCIATES
  4           ID        JOB NO. 39052/E88-13
  5           ID
  6           ID        INPUT FILE: STRM.DAT
  7           ID        OUTPUT FILE: STRM.OUT
  8           ID   ******************************************************************************
  9           ID        STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
 10           ID        100 YEAR
 11           ID        TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
 12           ID        FROM LITCHFIELD ROAD BYPASS AND CANDLEWOOD ROAD
 13           ID   ******************************************************************************
 14           IT     5.                    300.
 15           IN     5.
 16           ID     5.

 17           KK    30        BASIN F-2 RUNOFF
 18           BA   .102              1.
 19           PB  3.77
 20           PC    0.   .0020   .0050   .0080   .0110   .0140   .0170   .0200   .0230   .0260
 21           PC  .0290  .0320   .0350   .0380   .0410   .0440   .0480   .0520   .0560   .0600
 22           PC  .0640  .0680   .0720   .0760   .0800   .0850   .0900   .0950   .1000   .1050
 23           PC  .1100  .1150   .1200   .1260   .1330   .1400   .1470   .1550   .1630   .1720
 24           PC  .1810  .1910   .2030   .2180   .2360   .2570   .2830   .3870   .6630   .7070
 25           PC  .7350  .7580   .7760   .7910   .8040   .8150   .8250   .8340   .8420   .8490
 26           PC  .8560  .8630   .8690   .8750   .8810   .8870   .8930   .8980   .9030   .9080
 27           PC  .9130  .9180   .9220   .9260   .9300   .9340   .9380   .9420   .9460   .9500
 28           PC  .9530  .9560   .9590   .9620   .9650   .9680   .9710   .9740   .9770   .9800
 29           PC  .9830  .9860   .9890   .9920   .9950   .9980  1.0000  1.0000  1.0000  1.0000
 30           LS     0    72.       0
 31           UD   .68

 32           KK    50        ROUTE FLOWS IN REACH 50
 33           RK  1400.  .0015    .011             CIRC     3.5

 34           KK   220        BASIN G RUNOFF
 35           BA   .106              1.
 36           LS     0    72.       0
 37           UD   .79

 38           KK   210        ROUTE FLOW IN REACH 210
 39           RK  3400.   .002    .011                      4.0    1.25

 40           KK   200        BASIN H-2 RUNOFF
```

```
   42        LS       0     70.       0
   43
   44        KK     190       COMBINE FLOWS AT 190
   45        HC      2.
```



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

   46        KK     180       ROUTE FLOW IN REACH 180
   47        RK    800.    .002    .011                      4.0    1.25

   48        KK     170       BASIN H-1 RUNOFF
   49        BA    .019              1.
   50        LS       0     68.       0
   51        UD     .66

   52        KK     160       COMBINE FLOWS AT 160
   53        HC      2.

   54        KK     150       DIVERT FLOW TO AIRLINE CANAL
   55        DT   CANAL
   56        DI       0    100.    130.    150.
   57        DQ       0     15.     20.     23.

   58        KK     140       ROUTE FLOW IN REACH 140
   59        RK   2200.    .006    .030                      20.     10.

   60        KK     130       BASIN C-5 RUNOFF
   61        BA    .106              1.
   62        LS       0     72.       0
   63        UD     .67

   64        KK     121       COMBINE FLOWS AT 121
   65        HC      3.

   66        KK     119       ROUTE FLOW IN REACH 119
   67        RK    800.   .0015    .011            CIRC     4.0

   68        KK     118       BASIN C-1 RUNOFF
   69        BA    .089              1.
   70        LS       0     72.       0
   71        UD     .90

   72        KK     117       COMBINE FLOWS AT 117
   73        HC       2

   74        KK     116       ROUTE FLOW IN REACH 116
   75        RK   1000.   .0015    .011            CIRC     4.0

   76        KK     115       BASIN C-2 RUNOFF
   77        BA    .049              1.
   78        LS       0     72.       0
   79        UD     .94

   80        KK     114       COMBINE FLOWS AT 114
   81        HC       2
```



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

   82        KK     113       ROUTE FLOW IN REACH 113
   83        RK    600.   .0015    .011            CIRC     4.5
```

```
 84          KK      112        BASIN B RUNOFF
 85
 86          LS        0     72.        0
 87          UD     1.15

 88          KK      111        COMBINE FLOWS AT 111
 89          HC        2

 90          KK      109        ROUTE FLOW IN REACH 109
 91          RK    1400.    .0015     .011            CIRC      4.5

 92          KK      108        BASIN A RUNOFF
 93          BA     .113                1.
 94          LS        0     72.        0
 95          UD      .86

 96          KK      107        COMBINE FLOWS AT 107
 97          HC        2
 98          ZZ
1                                                    ****
                    FLOOD HYDROGRAPH PACKAGE HEC-1 (IBM XT 512K VERSION) -FEB 1,1985
          U.S. ARMY CORPS OF ENGINEERS, THE HYDROLOGIC ENGINEERING CENTER, 609 SECOND STREET, DAVIS, CA. 95616
                                                    ****


                    THE CITY OF LITCHFIELD PARK MASTER DRAINAGE STUDY
                    FOR THE CITY OF LITCHFIELD PARK
                    BY WILLDAN ASSOCIATES
                    JOB NO. 39052/E88-13

                    [illegible]: STRM.DAT
                    OUTPUT FILE: STRM.OUT
                ***************************************************************************
                    STANDARD SCS 24-HOUR, TYPE II DISTRIBUTION
                    100 YEAR
                    TO INDIAN SCHOOL ROAD BYPASS AND DYSART ROAD
                    FROM LITCHFIELD ROAD BYPASS AND CAMELBACK ROAD
                ***************************************************************************

  16 IO        OUTPUT CONTROL VARIABLES
                  IPRNT            5  PRINT CONTROL
                  IPLOT            0  PLOT CONTROL
                  QSCAL           0.  HYDROGRAPH PLOT SCALE

     IT        HYDROGRAPH TIME DATA
                   NMIN            5  MINUTES IN COMPUTATION INTERVAL
                  IDATE      1     0  STARTING DATE
                  ITIME         0000  STARTING TIME
                     NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      2     0  ENDING DATE
                 NDTIME         0055  ENDING TIME

              COMPUTATION INTERVAL      .08 HOURS
                   TOTAL TIME BASE    24.92 HOURS

        ENGLISH UNITS

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00

                                        HYDROGRAPH MULTIPLIED BY  1.00
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HY[redacted]AP[redacted] IP[redacted]BY[redacted]

HYDROGRAPH [illegible]LTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

HYDROGRAPH MULTIPLIED BY 1.00

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	30	52.	4.75	14.	4.	3.	.10		
+	ROUTED TO	50	52.	4.83	14.	4.	3.	.10		
+	HYDROGRAPH AT	220	49.	4.83	15.	4.	4.	.11		
+	ROUTED TO	210	48.	4.92	15.	4.	4.	.11		
+	HYDROGRAPH AT	200	76.	4.83	23.	6.	5.	.18		
+	2 COMBINED AT	190	123.	4.83	37.	9.	9.	.28		
+	ROUTED TO	180	123.	4.92	37.	9.	9.	.28		
+	HYDROGRAPH AT	170	8.	4.75	2.	1.	1.	.02		
+	2 COMBINED AT	160	130.	4.92	39.	10.	10.	.30		
+	DIVERSION TO	CANAL	20.	4.92	6.	1.	1.	.30		
+	HYDROGRAPH AT	150	110.	4.92	33.	8.	8.	.30		
+	ROUTED TO	140	109.	5.00	34.	8.	8.	.30		
+	HYDROGRAPH AT	130	54.	4.75	15.	4.	4.	.11		
+	3 COMBINED AT	121	207.	4.92	63.	16.	15.	.51		
+	ROUTED TO	119	207.	4.92	63.	16.	15.	.51		
	HYDROGRAPH AT									

+	COMBINED AT	117	243.	4.92	7[illegible]	19.	18.	.60
	ROUTED TO							
+		116	242.	5.00	75.	19.	18.	.60
	HYDROGRAPH AT							
+		115	20.	5.00	7.	2.	2.	.05
	2 COMBINED AT							
+		114	262.	5.00	82.	21.	20.	.65
	ROUTED TO							
+		113	262.	5.00	82.	21.	20.	.65
	HYDROGRAPH AT							
+		112	106.	5.25	42.	11.	10.	.31
	2 COMBINED AT							
+		111	359.	5.00	124.	31.	30.	.96
	ROUTED TO							
+		109	359.	5.08	124.	31.	30.	.96
	HYDROGRAPH AT							
+		108	49.	4.92	16.	4.	4.	.11
	2 COMBINED AT							

*** NORMAL END OF HEC-1 ***

Neolin Avenue Drainage Analysis

In October 1988, Willdan Associates analyzed the drainage along Neolin Avenue and developed a concept to improve the drainage in this area. The following is a summary of this analysis.

The general approach was to improve the drainage capacity within the Neolin Avenue right-of-way and the pathway which continues south of Neolin Avenue. From there, the stormwater would be routed into the lake which in turn would be modified to function as a retention basin. The purpose of these improvements would be to reduce flooding along Neolin Avenue and the area south of the lake.

The analysis showed that such a drainage system could be developed and the results are presented in Table A-I.

Neolin Avenue Drainage

Cost-Benefit Summary

Assume 2400 L.F. of roadway and 600 L.F. of pathway need to be changed.

ITEM	STORM RUNOFF (ONE HOUR DURATION)			
	10 Year	25 Year	50 Year	100 Year
1) Peak Flow Rate	33.4 CFS	50.1 CFS	87.2 CFS	111.3 CFS
2) Street	$81,600	$82,560	$83,280	$84,000
2) Pathway	17,040	17,160	17,340	17,520
3) Dredging Lake	6,800	10,000	18,200	25,600
5) Total Cost	$105,440	$109,720	$118,820	$127,120
6) Cost per CFS	$3,157	$2,190	$1,363	$1,142

TABLE A-I

Since this analysis was completed, a more detailed area drainage study has been completed. The results of this study shows a higher runoff to the area of the lake than previously calculated. The difference accounts for overtopping of the Air Line Canal and subsequent diversion of runoff south along Neolin Avenue. This is in addition to the previously calculated runoff from the golf course area. The increased flow is now in the order of 170 cfs which is approximately 50% greater than originally calculated.

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT SUBDIVISION NO 15-B		SHEET 1 OF 1	
DESIGN FOR UNIT ONE		DESIGNER DWG	DATE 10-5-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

LAKE

RADIUS	AREA	DEPTH	VOL AVG	VOL TOTAL
276'	239,314 FT²	0		0
			236,727 FT³	
273'	234,140 FT²	1'		236,727
			231,581 FT³	
270'	229,022 FT²	2'		468,308
			226,491 FT³	
267'	223,960 FT²	3'		694,799
			221,458 FT³	
264'	218,956 FT²	4'		916,257
			216,478 FT³	
261'	214,000 FT²	5'		1,132,735

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 1 OF 2	
	DESIGN FOR	DESIGNER DWG	DATE 10-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

FROM CONTOUR MAPS SUPPLIED BY KENNEY AERIAL MAPPING AN AVERAGE SLOPE OF 0.005 FT/FT WAS EST.

ASSUMING A MAX. STORAGE DEPTH OF 2 FT FOR THE LAKE, USE A TOTAL VOLUME STORED OF 468,000 FT^3

FROM SHT 2 OF 2 OF PATHWAY-Q ASSUME Q_p = 80 CFS

USING THE SCS HYDROGRAPH METHOD DETERMINE THE TIME TO PEAK (T_p) VALUE

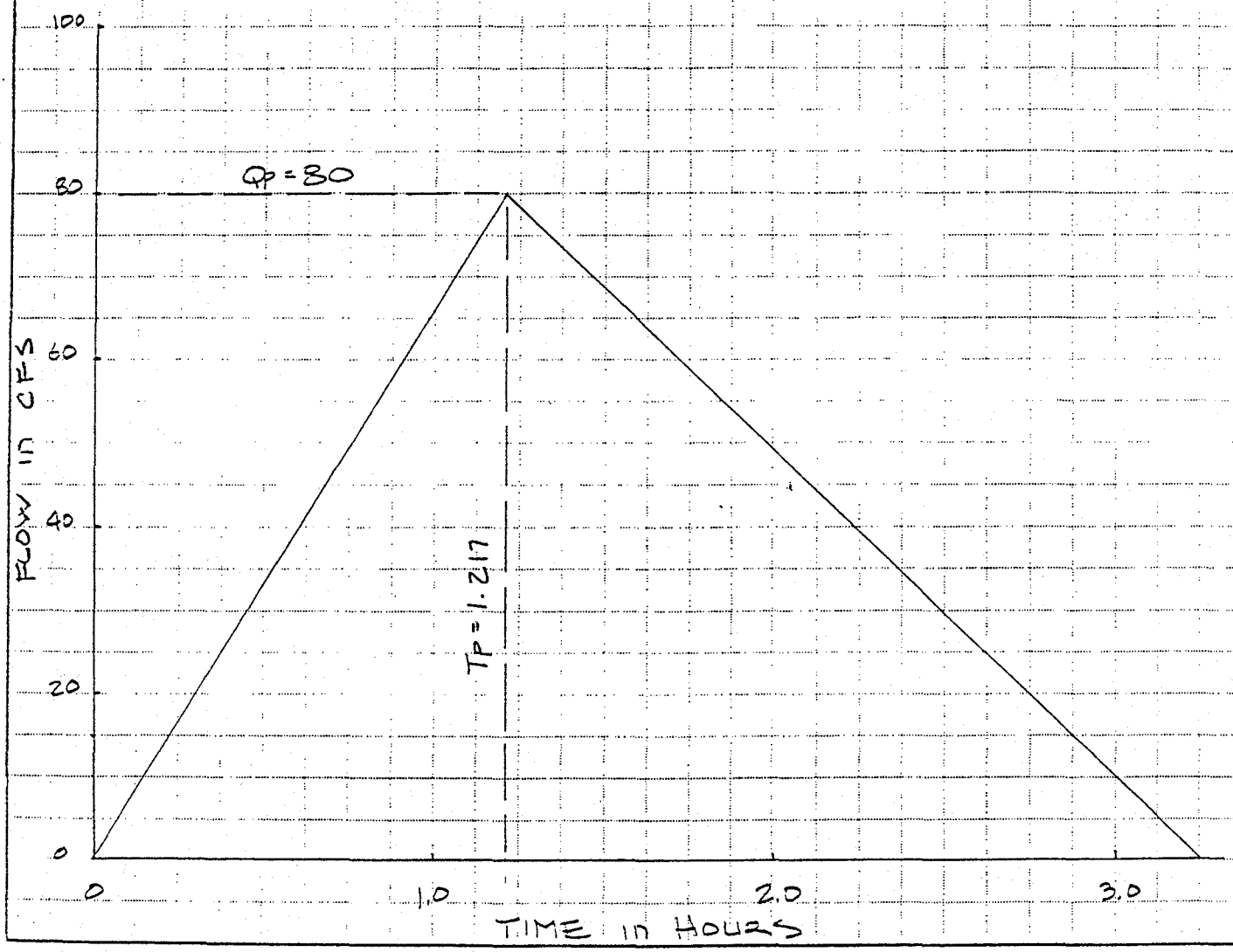
CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 2 OF 2	
DESIGN FOR		DESIGNER DWG	DATE 10-82
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

PEAK RUNOFF FLOW = 80 CFS

TOTAL VOLUME STORED = 468,000 FT^3

TOTAL TIME = 468,000 FT^3 ÷ 80 FT^3/SEC X2 = 11,700 SEC
OR 3.25 HR

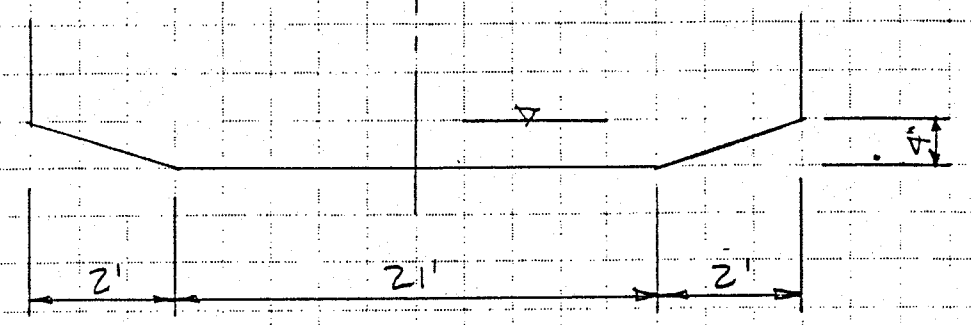
T_P = 3.25 ÷ 2.67 = 1.217 HR



CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT SUBDIVISION NO 15-B		SHEET 1 OF 2	
DESIGN FOR UNIT ONE		DESIGNER DXG	DATE 10-5-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

FOR PATHWAY (Q)

AREA = 7.658 FT^2
W.P. = 25.051 FT
H.R. = 0.3057 FT



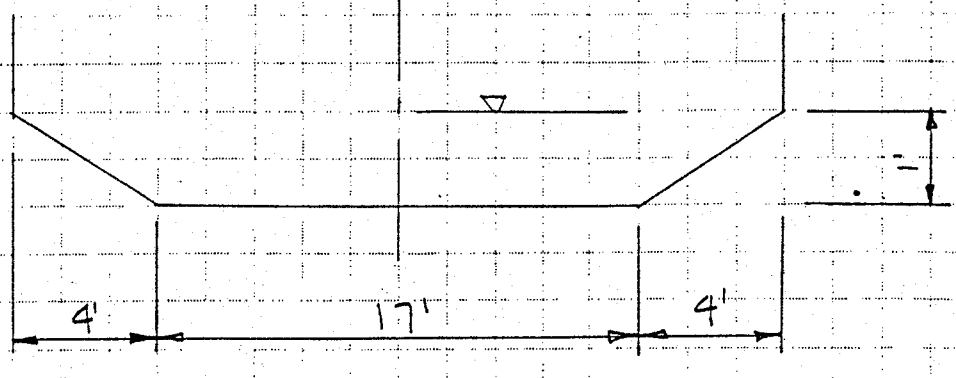
DETERMINE FLOW (Q) FROM MANNINGS EQ.

	SLOPE = 0.005 1/1			SLOPE = 0.0075 1/1			SLOPE = 0.010 1/1		
n	0.020	0.025	0.030	0.020	0.025	0.030	0.020	0.025	0.030
V	2.38	1.91	1.59	2.92	2.34	1.95	3.37	2.70	2.25
Q	18.3	14.6	12.2	22.4	17.9	14.9	25.8	20.7	17.2

CLIENT LITCHFIELD PARK	JOB NO. 39052	
PROJECT SUBDIVISION NO 15-B	SHEET 2 OF 2	
DESIGN FOR UNIT ONE	DESIGNER DWG	DATE 10-5-88
WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

FOR PATHWAY (Q)

AREA = 21 FT²
W.P. = 25.25 FT
H.R. = 0.3318 FT



DETERMINE FLOW (Q) FROM MANNINGS EQ.

	SLOPE = 0.005 1/1			SLOPE = 0.0075 1/1			SLOPE = 0.010 1/1		
n	0.020	0.025	0.030	0.020	0.025	0.030	0.020	0.025	0.030
V	4.65	3.72	3.10	5.69	4.55	3.79	6.57	5.26	4.38
Q	97.6	78.1	65.1	119.5	95.6	79.7	138.0	110.4	92.0

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 1 OF 2	
DESIGN FOR		DESIGNER DWG	DATE 10-12-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

DRAINAGE AREA THROUGH PATHWAY EAST OF LAKE, SUBDIVISION NO 15-B UNIT ONE

AREA = 11,792,000 FT^2 = 270.7 AC = 0.423 MI^2

CALCULATE STORM RUNOFF IN INCHES (Q)

USING $Q_P = 484 \times A \times Q / T_P$

WHERE:

Q_P = 80 CFS
A = 0.423 MI^2
T_P = 1.217 HR

$Q = Q_P \times T_P / (484 \times A)$
$= 80 \times 1.217 / (484 \times 0.423)$
$= 0.476$ IN

DETERMINE HYDROLOGIC SOIL GROUP

FROM "SOIL SURVEY OF MARICOPA COUNTY, ARIZONA CENTRAL PART" SEPTEMBER 1977, SOIL CONSERVATION SERVICE

MAPS 46 & 47 & TABLE 5

MAP SYMBOLS	HYDROLOGIC SOIL GROUP
AbA	B
RpE	B
LcA	B
LcB	B
Lb	B
Es	B

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 2 OF 2	
	DESIGN FOR	DESIGNER DWG	DATE 10-12-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

MAP SYMBOLS	HYDROLOGIC SOIL GROUP
Gr	B
Gt	B
Mr	B
Va	B
Pa	B
GgA	B

ESTIMATE RUNOFF CURVE NUMBER (CN)

FROM "URBAN HYDROLOGY FOR SMALL WATERSHEDS", JUNE 1986, SOILS CONSERVATION SERVICE

ASSUME ALL LAND USE IS RESIDENTIAL 1/3 ACRE IN SIZE

FROM TABLE 2-2a

CN = 72

ESTIMATED PRECIPITATION (P)

FROM "HYDROLOGIC DESIGN FOR HIGHWAY DRAINAGE IN ARIZONA", MARCH 1969

FIGURE 2-4

P = 2.4 IN

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 1 OF 2	
DESIGN FOR		DESIGNER DWG	DATE 10-12-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

LITCHFIELD PARK PRECIPITATION

- FROM "HYDROLOGIC DESIGN FOR HIGHWAY DRAINAGE IN ARIZONA", MARCH 1969, ARIZONA HIGHWAY DEPT. BRIDGE DIVISION

PRECIPITATION MAP A-D 1-8

2 YR, 6 HR	1.2"
2 YR, 24 HR	1.4"
5 YR, 6 HR	1.7"
5 YR, 24 HR	2.0"
10 YR, 6 HR	2.0"
10 YR, 24 HR	2.3"
25 YR, 6 HR	2.4"
25 YR, 24 HR	2.8"
50 YR, 6 HR	2.8"
50 YR, 24 HR	3.2"
100 YR, 6 HR	3.2"
100 YR, 24 HR	3.8"

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 2 OF 2	
	DESIGN FOR	DESIGNER DWG	DATE 6-12-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

CALCULATE THE ONE HOUR PRECIP. VALUES

USING $P_{1\,HOUR} = 2 \times P_6 - P_{24}$

2-YEAR = 2x 1.2 - 1.4 = 1.0 in

5-YEAR = 2x 1.7 - 2.0 = 1.4 in

10-YEAR = 2x 2.0 - 2.3 = 1.7 in

25-YEAR = 2x 2.4 - 2.8 = 2.0 in

50-YEAR = 2x 2.8 - 3.2 = 2.4 in

100-YEAR = 2x 3.2 - 3.8 = 2.6 in

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 1 OF 2	
DESIGN FOR		DESIGNER DWG	DATE 10-17-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

HYDROLOGICAL SUMMARY SHEET

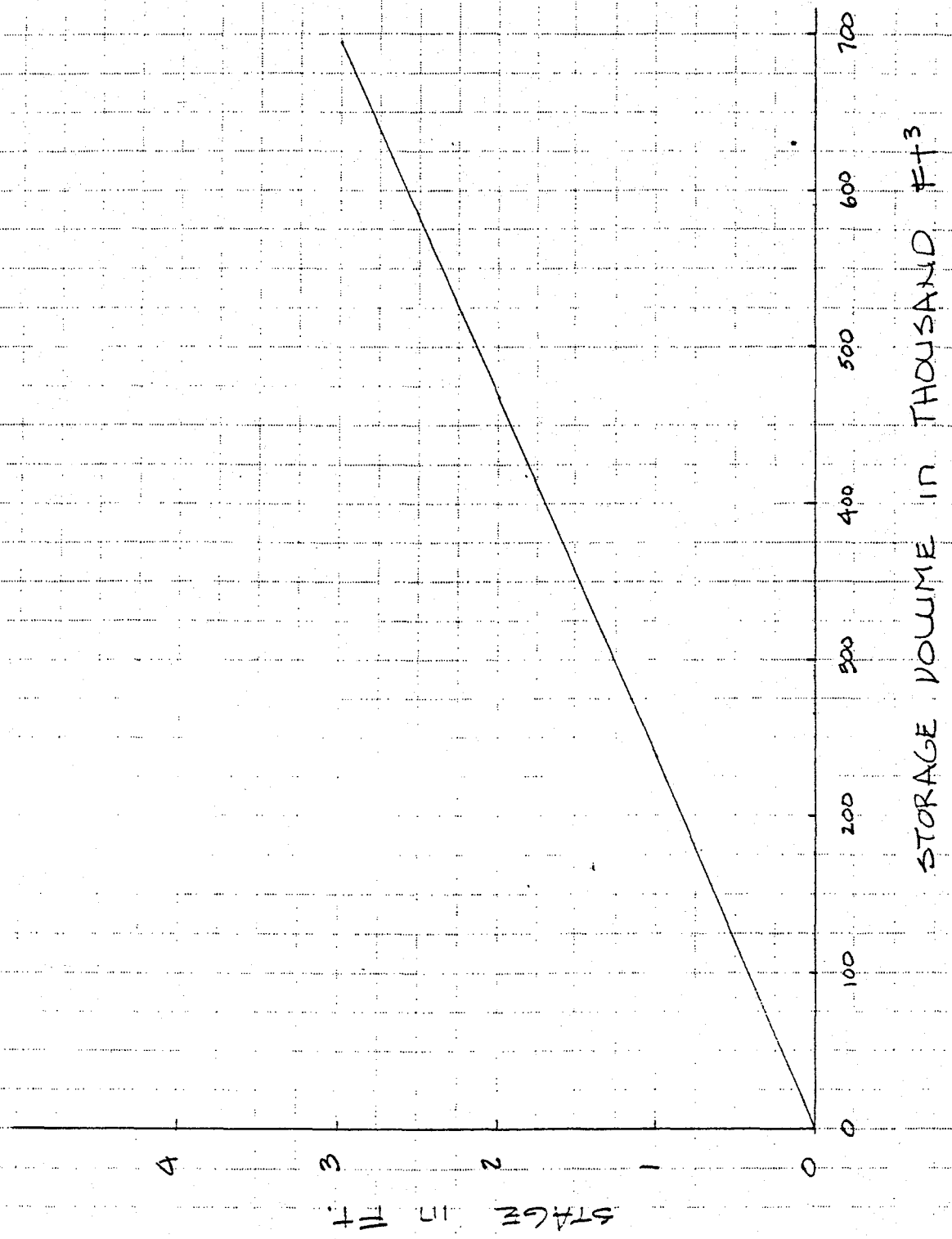
HYDROLOGIC DATA	ONE HOUR STORM			
	10 YR	25 YR	50 YR	100 YR
PEAK RUNOFF (Q_p)	33.4 CFS	50.1 CFS	87.2 CFS	111.3 CFS
VOLUME	177,150 FT^3	265,700 FT^3	462,500 FT^3	590,300 FT^3
PRECIPITATION	1.7 IN	2.0 IN	2.4 IN	2.6 IN
DIRECT RUNOFF	0.18 IN	0.27 IN	0.47 IN	0.6 IN
DEPTH OF STOR.	0.75 FT	1.1 FT	2.0 FT	2.6 FT

BASIC HYDROLOGIC DATA

WATERSHED AREA = 11,792,000 FT^2 = 0.423 MI^2
DRAINAGE LENGTH = 3,870 FT
AVG AREA WIDTH = 3,050 FT
WIDTH FACTOR (W_F) = 0.89
AVG SLOPE = 0.012 FT/FT
TIME OF CONCENTRATION (T_C) = 1.24 HR
TIME TO PEAK (T_P) = 1.1036 HR
CURVE NUMBER = 72

CLIENT LITCHFIELD PARK	JOB NO. 39052	
PROJECT SUBDIVISION NO 15-B	SHEET 2 OF 2	
DESIGN FOR UNIT ONE	DESIGNER DWG	DATE 10-17-88
WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

PRELIMINARY STAGE - STORAGE GRAPH



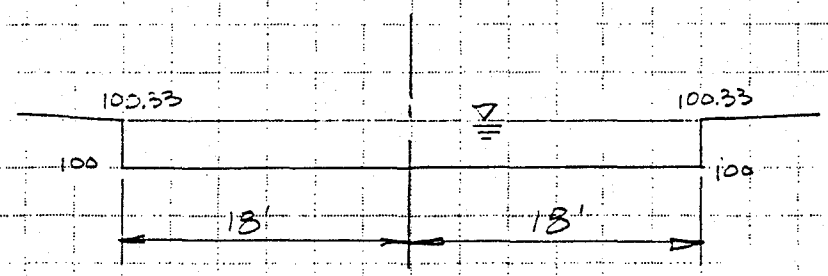
CLIENT LITCHFIELD PARD		JOB NO. 39052	
PROJECT		SHEET 1 OF	
DESIGN FOR		DESIGNER DWG	DATE 6-11-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

HYDRAULIC SECTIONS

A) 10 YEAR STORM

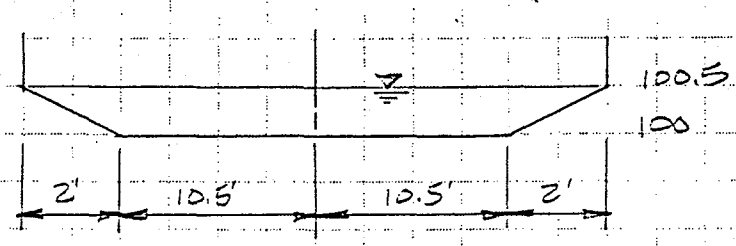
Q_P = 33.4 CFS
AVG SLOPE = 0.005 FT/FT
MANNINGS n = 0.016 FOR STREET
= 0.020 FOR PATHWAY

STREET SECTION



AREA = 11.88 FT²
WETTED PER = 36.66 FT
HYDRAULIC RADIUS = 0.32406 FT
VELOCITY = 3.1 FT/SEC
FLOW = 36.8 CFS

PATHWAY SECTION



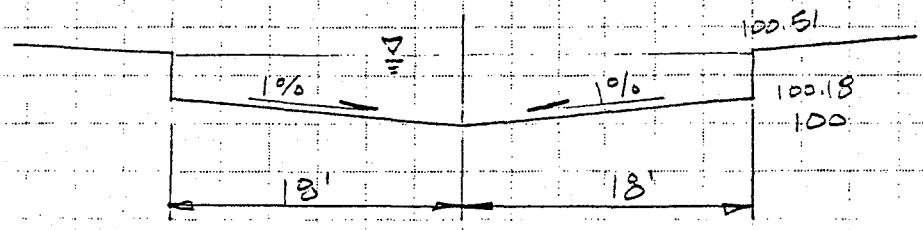
AREA = 11.5 FT²
WETTED PER = 25.12 FT
HYDRAULIC RADIUS = 0.457746 FT
VELOCITY = 3.1 FT/SEC
FLOW = 35.9 CFS

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 2 OF	
DESIGN FOR		DESIGNER DWG	DATE 10-17-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

B) 25 YEAR STORM

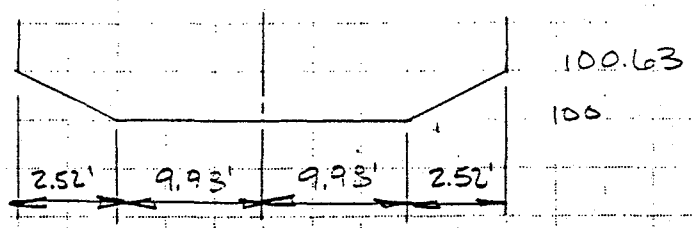
Q_P = 50.1 CFS
AVG SLOPE = 0.005 FT/FT
MANNINGS n = 0.016 FOR STREET
0.020 FOR PATHWAY

STREET SECTION



AREA = 15.12 FT^2
W.P. = 36.6613 FT
HYDRAULIC RADIUS = 0.41242 FT
VELOCITY = 3.64 FT/SEC
FLOW = 55.0 CFS

PATHWAY SECTION



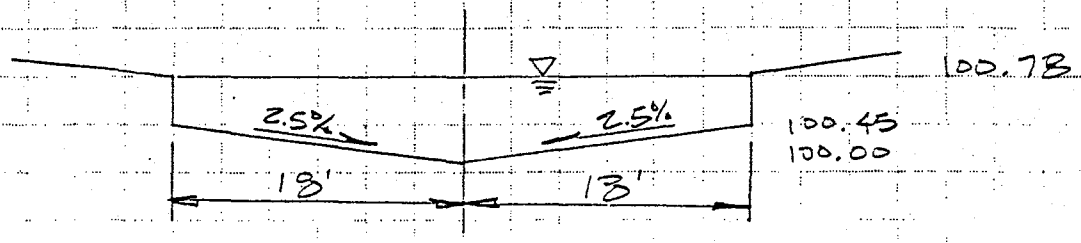
AREA = 14.1624 FT^2
W.P. = 25.1551 FT
HYDRAULIC RADIUS = 0.563 FT
VELOCITY = 3.53 FT/SEC
FLOW = 50.73 CFS

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 3 OF	
	DESIGN FOR	DESIGNER DWG	DATE 10-17-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

C) 50 YEAR STORM

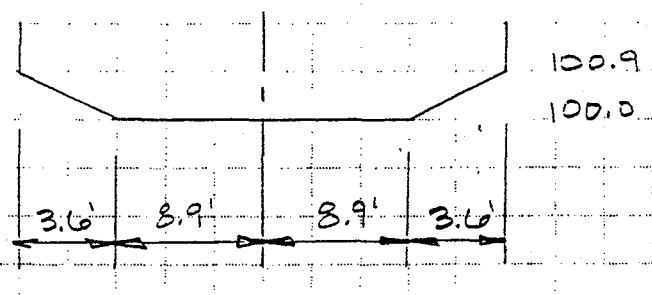
Q_P = 87.2 CFS
AVG SLOPE = 0.005 FT/FT
MANNINGS n = 0.016 FOR STREET
0.020 FOR PATHWAY

STREET SECTION



AREA = 19.93 FT^2
W.P. = 36.6712 FT
HYDRAULIC RADIUS = 0.54484 FT
VELOCITY = 4.38 FT/SEC
FLOW = 87.5 CFS

PATHWAY SECTION



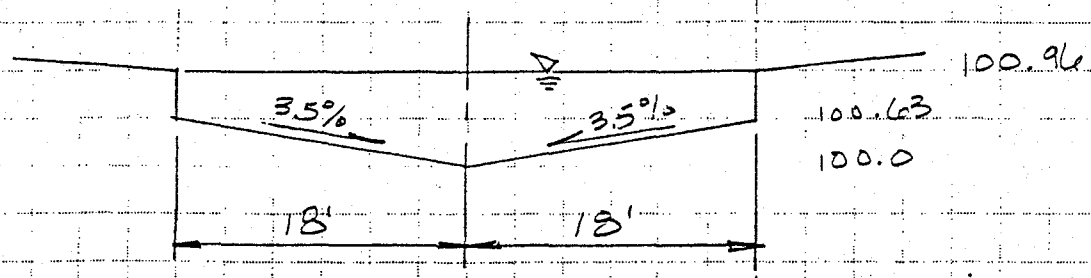
AREA = 19.26 FT^2
W.P. = 25.2216 FT
HYDRAULIC RADIUS = 0.76363 FT
VELOCITY = 4.39 FT/SEC
FLOW = 84.5 CFS

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 4 OF	
DESIGN FOR		DESIGNER DWG	DATE 10-17-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

D) 100 YEAR STORM

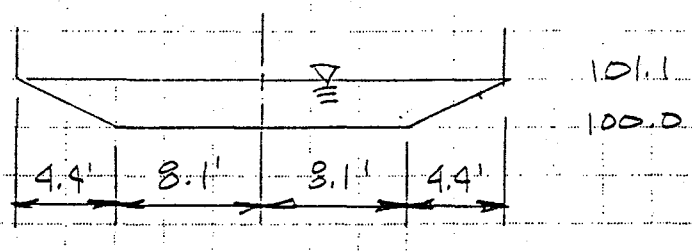
Q_P = 111.3 CFS
AVG SLOPE = 0.005 FT/FT
MANNINGS n = 0.016 FOR STREET
0.020 FOR PATHWAY

STREET SECTION



AREA = 23.22 FT^2
W.P. = 36.6820 FT
HYDRAULIC RADIUS = 0.63301 FT
VELOCITY = 4.84 FT/SEC
FLOW = 112.4 CFS

PATHWAY SECTION



AREA = 22.66 FT^2
W.P. = 25.27033 FT
HYDRAULIC RADIUS = 0.8967 FT
VELOCITY = 4.89 FT/SEC
FLOW = 110.7 CFS

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 5 OF	
	DESIGN FOR	DESIGNER DVG	DATE 10-17-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

COST ESTIMATE

A) 10 YEAR STORM

1) STREET (COST PER LF)

a) PAVEMENT REMOVAL	12.00
b) EXCAVATION	2.00
c) BASE COURSE (6")	9.00
d) A.C. PAVEMENT (3")	11.00
TOTAL	$34.00

2) PATHWAY (COST PER LF)

a) SIDEWALK REMOVAL	5.50
b) EXCAVATION	0.90
c) SIDEWALK CONST.	20.00
d) FINISH GRADING	2.00
TOTAL	$28.40

3) DREDGING LAKE $6,800.00

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 6 OF	
	DESIGN FOR	DESIGNER DWB	DATE 10-17-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

B) 25 YEAR STORM

1) STREET (COST PER LF)

a) PAVEMENT REMOVAL	12.00
b) EXCAVATION	2.40
c) BASE COURSE (6")	9.00
d) A.C. PAVEMENT (3")	11.00
TOTAL	$34.40

2) PATHWAY (COST PER LF)

a) SIDEWALK REMOVAL	5.50
b) EXCAVATION	1.10
c) SIDEWALK CONST.	20.00
d) FINISH GRADING	2.00
TOTAL	$28.60

3) DREDGING LAKE $10,000.00

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 7 OF	
DESIGN FOR		DESIGNER DWG	DATE 10-17-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

c) 50 YEAR STORM

1) STREET (COST PER LF)

a) PAVEMENT REMOVAL	12.00
b) EXCAVATION	2.70
c) BASE COURSE (6")	9.00
d) A.C. PAVEMENT (3")	11.00
TOTAL	$ 34.70

2) PATHWAY (COST PER LF)

a) SIDEWALK REMOVAL	5.50
b) EXCAVATION	1.40
c) SIDEWALK CONST.	20.00
d) FINISH GRADING	2.00
TOTAL	$ 28.90

3) DREDGING LAKE $ 19,200.00

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT	SHEET 8 OF	
	DESIGN FOR	DESIGNER DWG	DATE 10-13-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

D) 100 YEAR STORM

1) STREET (COST PER LF)

a) PAVEMENT REMOVAL	12.00
b) EXCAVATION	3.00
c) BASE COURSE (6")	9.00
d) A.C. PAVEMENT (3")	11.00
TOTAL	$35.00

2) PATHWAY (COST PER LF)

a) SIDEWALK REMOVAL	5.50
b) EXCAVATION	1.70
c) SIDEWALK CONST.	20.00
d) FINISH GRADING	2.00
TOTAL	$29.20

3) DREDGING LAKE $25,600.00

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 9 OF	
DESIGN FOR		DESIGNER DXB	DATE 10-18-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

COST ESTIMATE SUMMARY

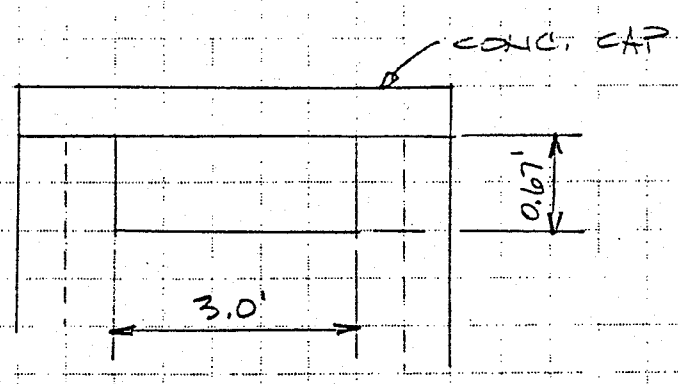
ITEM	ONE HR. STORM			
	10 YR	25 YR	50 YR	100 YR
1) STREET (COST PER LF)	34.00	34.40	34.70	35.00
2) PATHWAY (COST PER LF)	28.40	28.60	28.90	29.20
3) DREDGING LAKE (TOTAL COST)	6800.00	10,000.00	18,200.00	25,600.00

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT SUBDIVISION NO 15-B		SHEET 1 OF	
DESIGN FOR UNIT ONE TRACK "A"		DESIGNER DWG	DATE 10-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

LAKE OUTLET STRUCTURE

- EXIST. STRUC. IS CONC. BOX W/ WEIR OPNG ON SIDE.
- NO AS-BUILT DATA PROVIDED
- ASSUME FROM FIELD OBSERVATIONS

1. WEIR OPNG. IS AS FOLLOWS:



THICKNESS OF ALL WALL IS 0.5 FT

2. PIPE OUTLET OUT OF BOX STRUC.
   a. 18" DIA
   b. RCP
   c. TIES TO 18" LINE @ PATHWAY

COMPUTE WEIR CAPACITY

$$Q = CLH^{3/2}$$

WHERE:

$L = 3.0$ FT
$H = 0.67'$
$C = 3.3$

$$Q = 3.3 \times 3 \times 0.67^{1.5} = \underline{\underline{5.4 \text{ CFS}}}$$

E88-10

CLIENT LITCHFIELD PARK	JOB NO. 39052	
PROJECT DRAINAGE STUDY	SHEET 1 OF	
DESIGN FOR LAKE AREA	DESIGNER DWG	DATE 10/88
WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

STUDY OF LAKE NORTH OF VILLA NUEVA & NEOLIN RD DRAINAGE AREAS

WISH LIST

1. TOPO OF AREA W/ ENOUGH DETAIL & AREA TO BE ABLE TO DEFINE THE WATERSHED AREA.

2. AERIAL PHOTO OF AREA

3. AS-BUILT CONSTRUCTION PLANS FOR THE LAKE, ROADWAYS, STORM DRAIN SYSTEMS AND GOLF COURSE

39052
E88-10

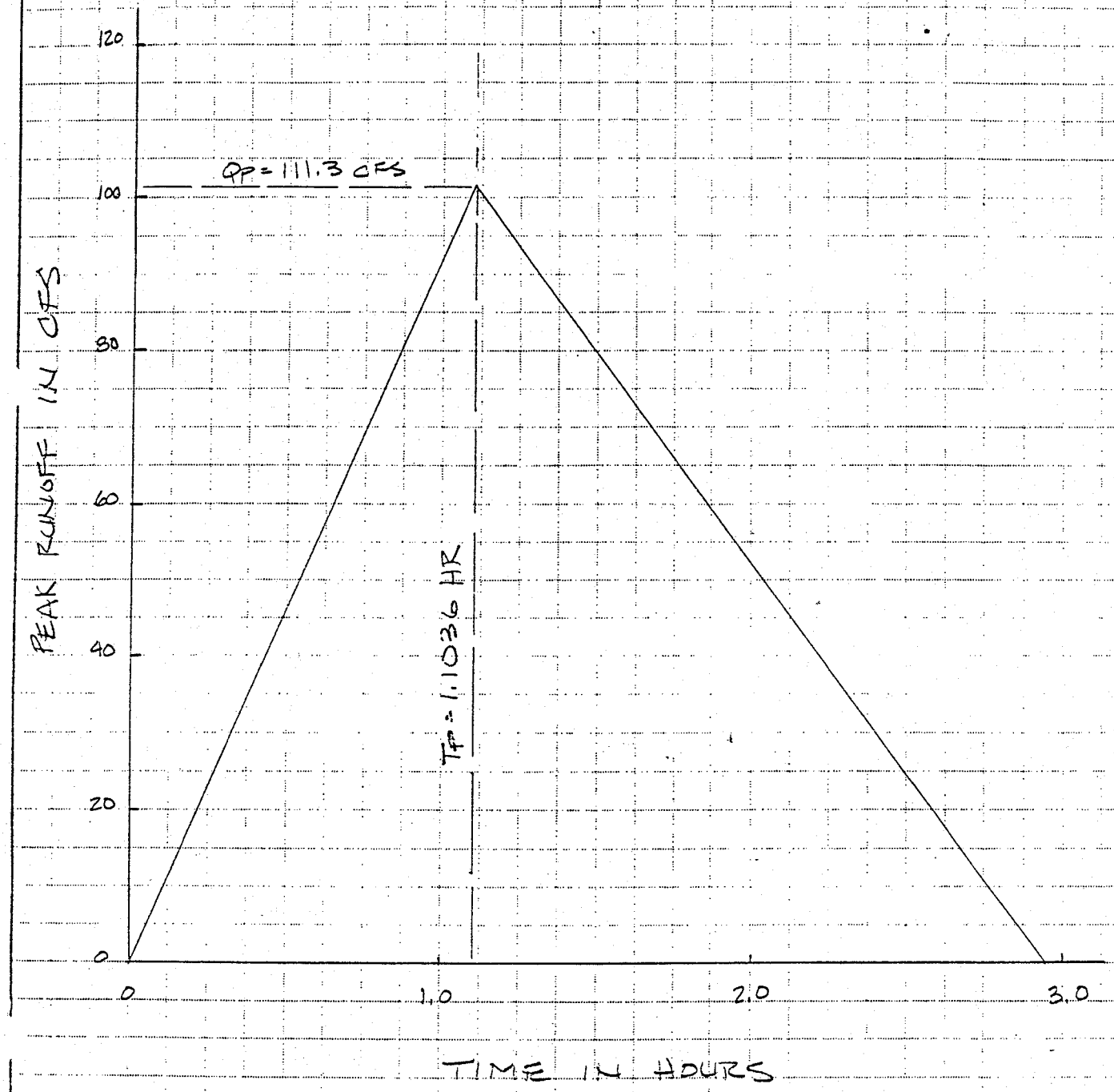
LAKE AREA 240,000 FT^2

LICHFIELD PARK
SURVEYOR
JAMES WARKOMSKI
935-5522

- CAPACITY OF PATHWAY SOUTH OF INTER. OF NEOLIN & CASCADA
- CAPACITY OF LAKE W/ MAX SIDE SLOPE & DEPTH
- CAPACITY OF OUTLET STRUCTURE
  1. WEIR INLET 3.0' X 0.67
  2. PIPE OUTLET 18"

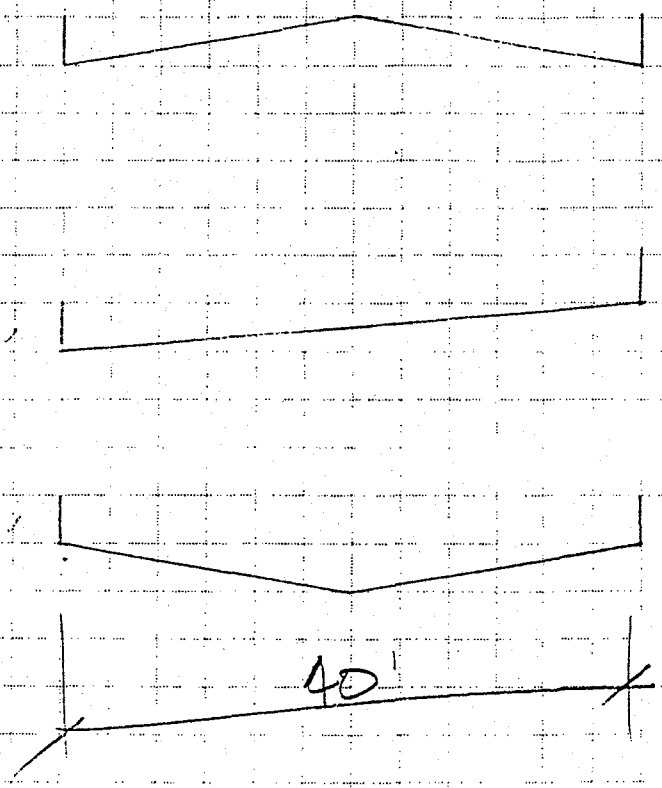
	CLIENT	JOB NO.	
	PROJECT	SHEET OF	
	DESIGN FOR	DESIGNER	DATE
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

VOLUME = 111.3 × 3600 × 2.9466 ÷ 2
= 590,320 FT^3



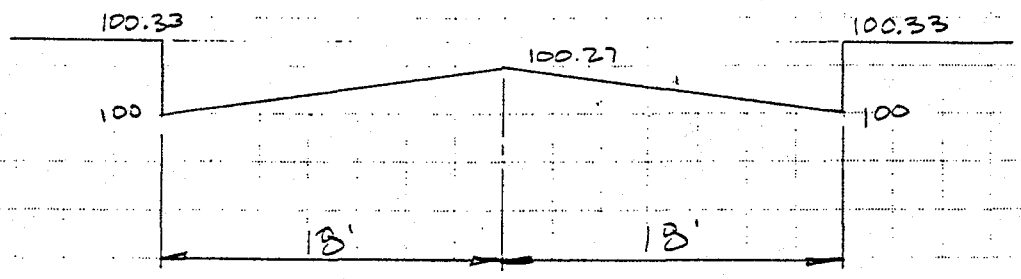
E88-10

	CLIENT	JOB NO.	
	PROJECT	SHEET OF	
	DESIGN FOR	DESIGNER	DATE
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE



R=100
I=45
L=78.53978326

n=0.015



S=0.005
V=2.33
Q=16.3

S=0.0075
V=2.85
Q=20.0

AREA = 7.02 FT²
W.P. = 36.674 FT
R = 0.191416 FT

Desert Avenue Drainage Analysis

In October 1988, Willdan Associates analyzed the drainage in the area of Desert Avenue/Ancora Drive in order to develop recommendations to reduce future flooding in this area. The following is a summary of the analysis.

Because the existing topography runoff approaches this area from several directions and is almost sheet flow because of the very flat slopes. The runoff then ponds in a relatively shallow basin area. There are some catchbasins in this area, but like most of the existing underground storm drainage, it is ineffective during major storms. The total runoff into this area during a 100-year event is estimated at approximately 80 cfs. Three alternatives were considered to provide improved drainage from this area.

1. Convert the park area to the north into a retention basin and install new drain pipes to the basin. Although the park area could provide sufficient volume, it would have to be relatively deep in order to drain the pipes to it. The cost and final depth of the grade (± 4′) would not make this a very desirable solution.

2. Install a system of drywells. This would be very expensive and require ongoing maintenance.

3. Develop the area along Indian School Bypass (known as Kiwanis Park) into a retention basin and provide an outlet from the Desert Avenue area into the basin. With a basin three feet deep it could store about 260,000 cubic feet of water, which represents the runoff volume of a 50 year event or about 70% of a 100 year event.

	CLIENT LITCHFIELD PARK	JOB NO. 39052	
	PROJECT DESERT AV AREA	SHEET 1 OF 1	
	DESIGN FOR	DESIGNER DWG	DATE 10-21-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

CONCEPT DRAINAGE PLAN

PLAN 1

USE PARK AS RETENTION BASIN AND CONVEY RUNOFF FROM DESERT AV TO BASIN THROUGH PIPES. THE PROBLEM W/ THIS IS IN BEING ABLE TO PROVIDE A LARGE ENOUGH CONVEYENCE WITH OUT CREATING TOO DEEP OF A HOLE AT THE PARK

PLAN 2

SURFACE DRAIN ANCORA DR BETWEEN EXIST. HOMES, THROUGH PROPERTY WALL IN TO BASIN ON NORTH OR SOUTH SIDE OF INDIAN SCHOOL RD BYPASS. PROBLEM W/ THIS IS EXIST. VEG AND/OR PROPERTY ACQUISION.

PLAN 3

PLACE DRY WELLS IN STREETS. PROBLEM W/ THIS IS EFF. OF DRY WELL W/ LITTLE PONDING OF WATER, NO OF DRY WELLS REQUIRED & G.W. CONTAMINATION.

CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 1 OF 4	
DESIGN FOR		DESIGNER DWG	DATE 10-26-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

PRELIMINARY CALC FOR BASIN IN KIWANIS PARK

AREA OF PARK = 2.258 AC = 98,358.5 FT²

- ASSUME TO BE FLAT TOPO IN PARK
- BASIN TO BE DEVELOPED OUTSIDE OF PUBLIC R/W
- SIDE SLOPES OF BASIN = 4 TO 1
- MAX DEPTH = 3.0'
- FREEBOARD = 1.0'

FRUSTRUM

CALC VOLUME BASED ON INVERTED CONE SHAPE.

AREA = πr^2

$\sqrt{(98{,}358.5 \div \pi)} = r$

$r = 177'$ @ SURFACE

1.0 FT DEPTH

$r = 173'$

$A = \pi\, 173^2 = 94{,}024.7\ FT^2$

2.0 FT DEPTH

$r = 169'$

$A = \pi\, 169^2 = 89{,}727.0\ FT^2$

3.0 FT DEPTH

$r = 165'$

$A = \pi\, 165^2 = 85{,}530\ FT^2$

4.0 FT DEPTH

$r = 161'$

$A = \pi\, 161^2 = 81{,}433\ FT^2$

	CLIENT	JOB NO. 39052	
	PROJECT	SHEET 2 OF 4	
	DESIGN FOR	DESIGNER DXG	DATE 10-26-88
	WILLDAN ASSOCIATES-PHOENIX	CHECKER	DATE

VOLUME @ WATER DEPTH OF 3.0' &
BASIN DEPTH OF 4.0'

$(94,025 + 81,433)/2 \times 3 = 263,187$ FT^3 OR

6.0 AC-FT

TR-55 GRAPHICAL DISCHARGE METHOD VERSION 1.11

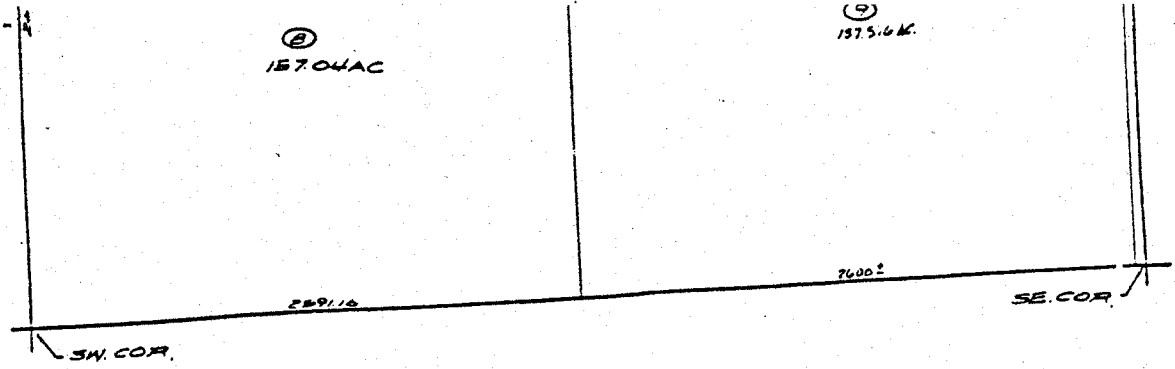
Project : LITCHFIELD PARK User: DWG Date: 10-26-88
County : MARICOPA State: AZ Checked: _____ Date: _____
Subtitle: DESERT AV DRAINAGE

Data: Drainage Area : 80 Acres
Runoff Curve Number : 78
Time of Concentration: 0.90 Hours = 3240 SEC
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1	2	3	4	5	6
Frequency (yrs)	2	5	10	25	50	100
24-Hr Rainfall (in)	1.4	2.0	2.3	2.8	3.2	3.8
Ia/P Ratio	0.40	0.28	0.25	0.20	0.18	0.15
Runoff (CFS)	6	19	27	43	56	79

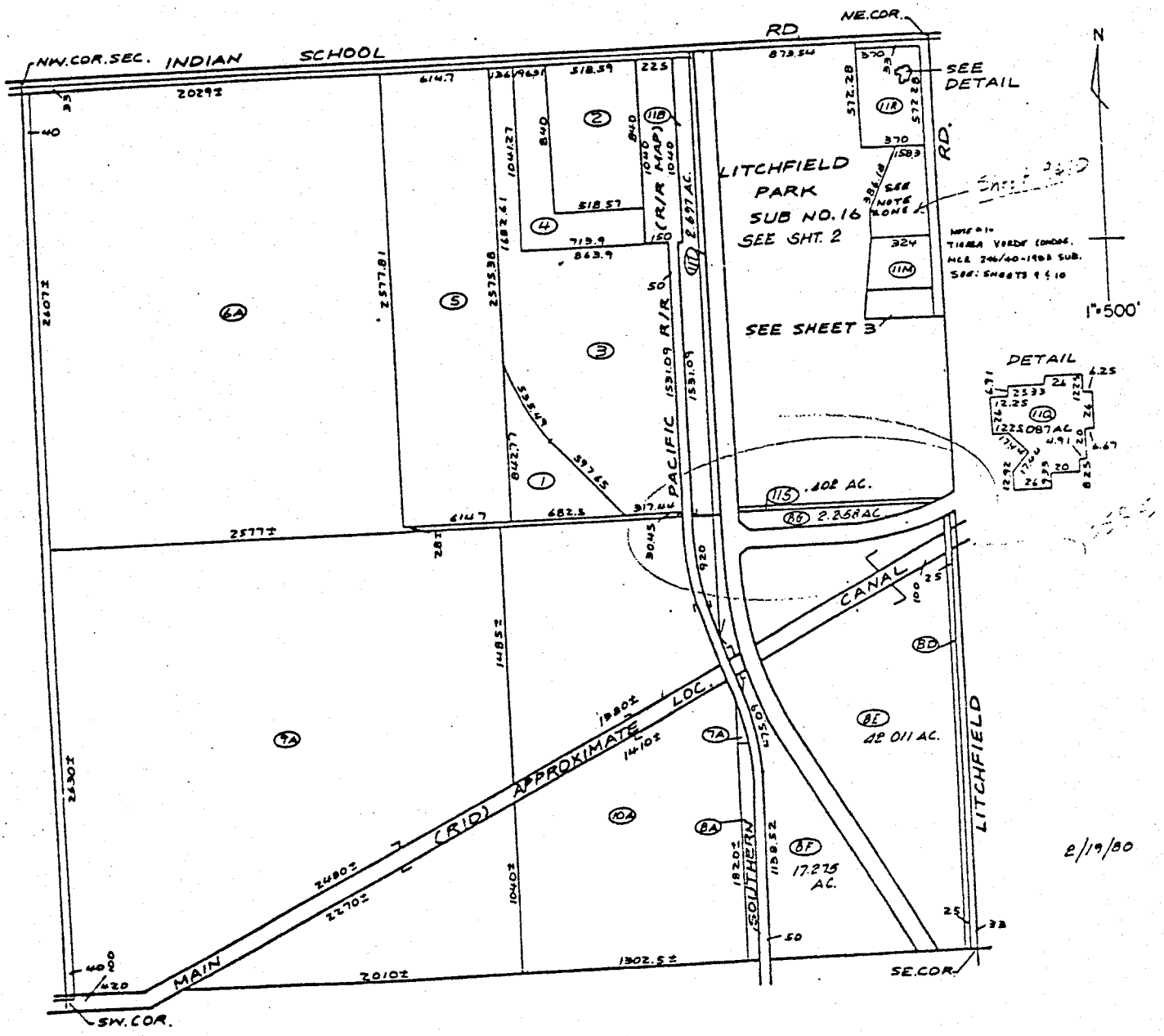
3240 x 2.67 = 8650.8 SEC

Runoff VOLUME (FT^3)	25,960	32,180	116,780	156,000	242,200	341,700



BOOK 501
MAP 70
SHEET 1

SEC. 28 T-2N R-IW



CLIENT LITCHFIELD PARK		JOB NO. 39052	
PROJECT		SHEET 1 OF 2	
DESIGN FOR		DESIGNER DWG	DATE 10-27-88
WILLDAN ASSOCIATES-PHOENIX		CHECKER	DATE

PLAN #2

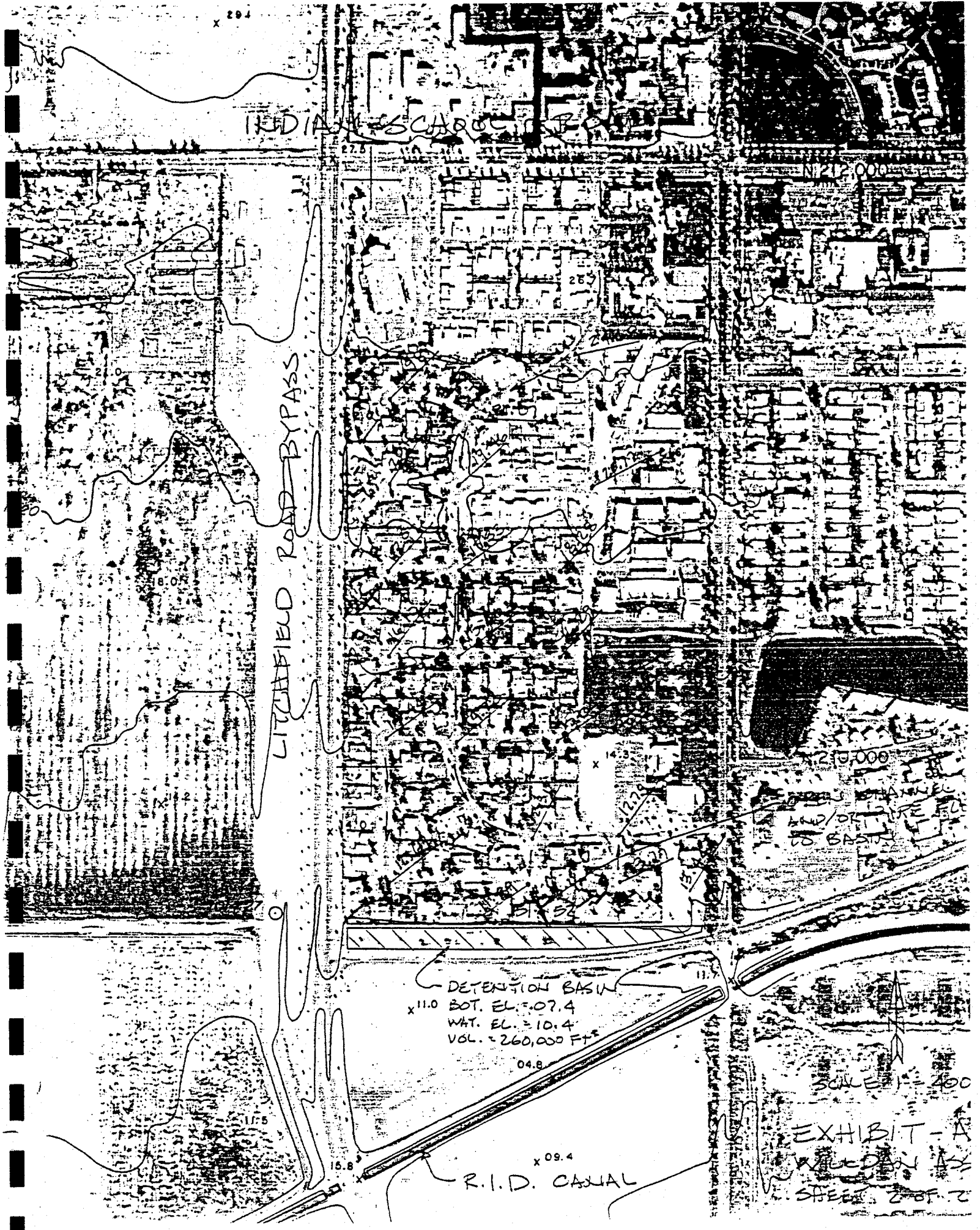
SUMMARY OF CONCEPT PLAN 2 FOR DESERT AV AREA DRAINAGE

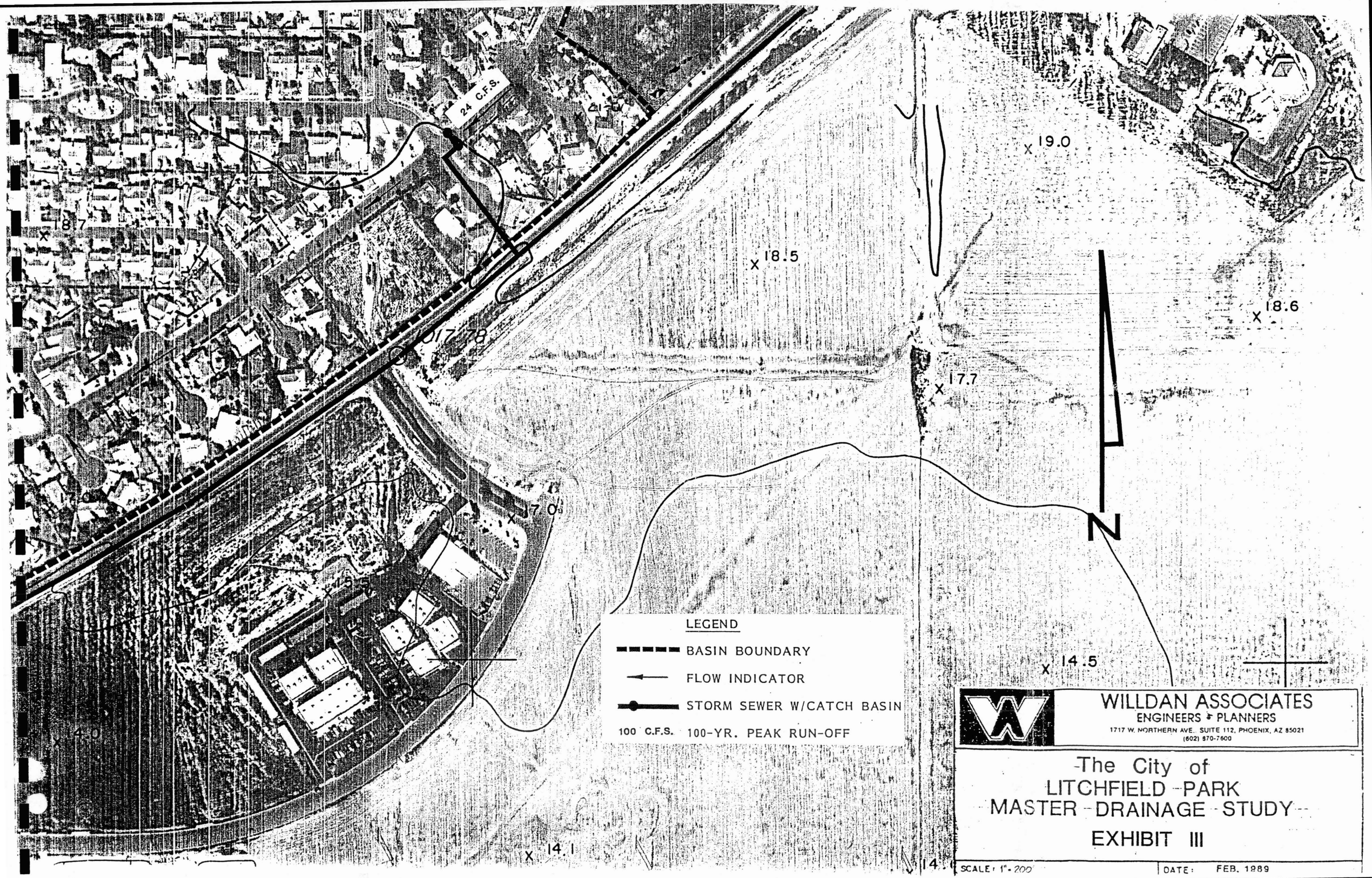
1. ALLOW AREA STREETS TO CONTINUE TO DRAIN TO THE ANCORA DRIVE CUL-DA-SAC

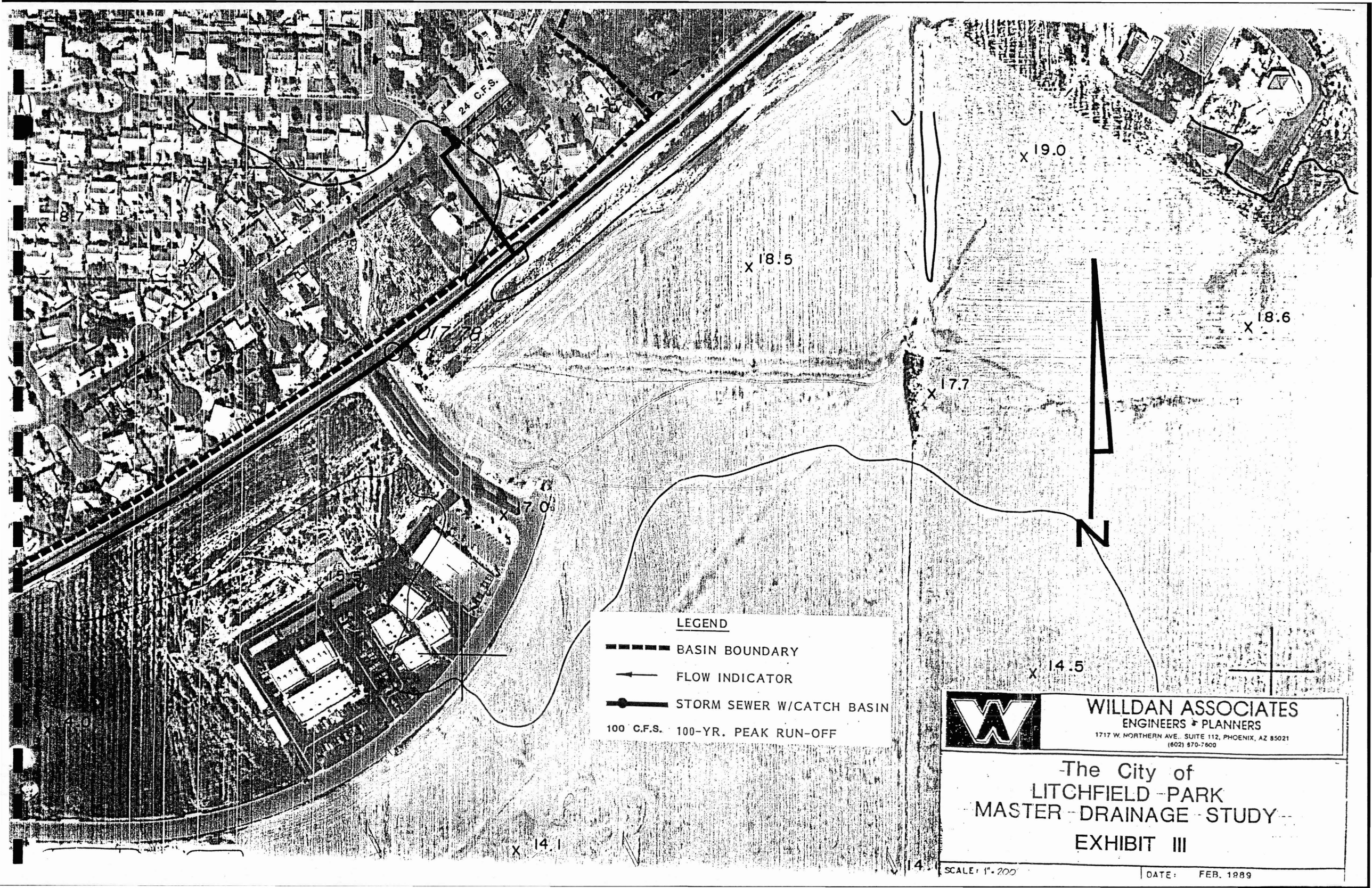
2. CONSTRUCT A OPEN CHANNEL AND/OR DRAINAGE PIPE BETWEEN LOTS 51 & 52 TO CARRY FLOW

3. CONSTRUCT DETENTION BASIN AT KIWANIS PARK LOCATION. MAX. WATER DEPTH TO BE 3.0'. APPROX. VOLUME TO BE 260,000 FT^3

4. DRAIN BASIN BY TAPPING INDIAN SCHOOL BYPASS STORM DRAIN SYS OR BY LOCATING DRY WELLS (3-5 WELLS) IN BOTTOM OF BASIN.


INDIANA SCHOOL
N212,000
LITCHFIELD ROAD BYPASS
N210,000
DETENTION BASIN
BOT. EL. = 07.4
WAT. EL. = 10.4
VOL. = 260,000 FT³
R.I.D. CANAL
SCALE 1" = 400'
EXHIBIT - A


24 C.F.S.
017 78
18.7
18.5
19.0
18.6
17.7
17.0
14.5
14.1
N
LEGEND
BASIN BOUNDARY
FLOW INDICATOR
STORM SEWER W/CATCH BASIN
100 C.F.S. 100-YR. PEAK RUN-OFF
WILLDAN ASSOCIATES
ENGINEERS & PLANNERS
1717 W. NORTHERN AVE., SUITE 112, PHOENIX, AZ 85021
(602) 870-7600
The City of
LITCHFIELD PARK
MASTER DRAINAGE STUDY
EXHIBIT III
SCALE: 1"=200'
DATE: FEB. 1989


24 C.F.S.
X 18.7
X 18.5
X 19.0
X 18.6
X 17.7
X 17.0
X 15.5
X 14.5
X 14.1
N
LEGEND
BASIN BOUNDARY
FLOW INDICATOR
STORM SEWER W/CATCH BASIN
100 C.F.S. 100-YR. PEAK RUN-OFF
WILLDAN ASSOCIATES
ENGINEERS & PLANNERS
1717 W. NORTHERN AVE., SUITE 112, PHOENIX, AZ 85021
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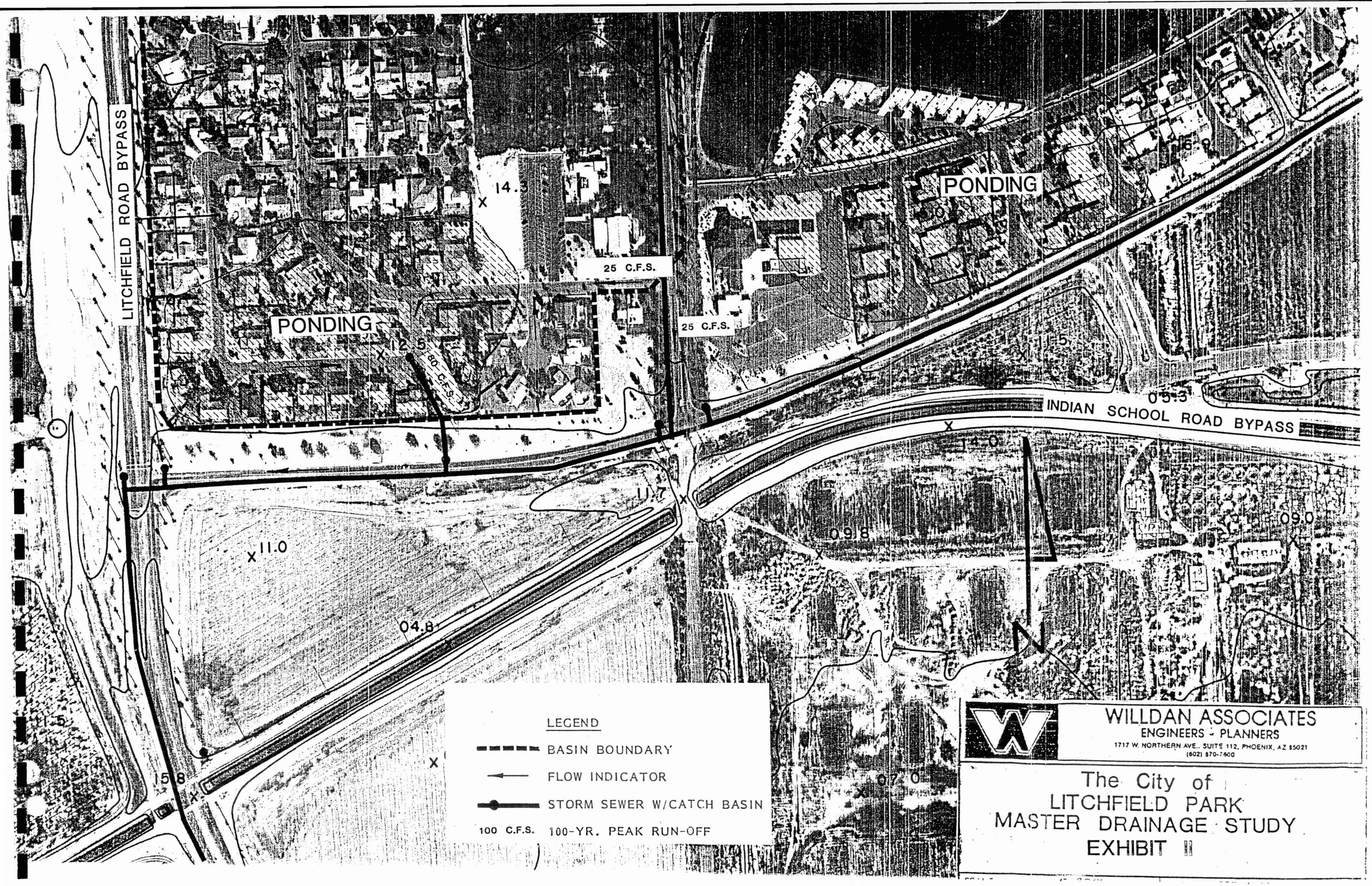
The City of
LITCHFIELD PARK
MASTER DRAINAGE STUDY
EXHIBIT III
SCALE: 1"=200'
DATE: FEB. 1989


LITCHFIELD ROAD BYPASS
INDIAN SCHOOL ROAD BYPASS
PONDING
PONDING
25 C.F.S.
25 C.F.S.
80 C.F.S.
14.3
12.5
11.5
05.3
14.0
11.7
09.0
09.8
11.0
04.8
11.5
15.8
07.0
N
LEGEND
BASIN BOUNDARY
FLOW INDICATOR
STORM SEWER W/CATCH BASIN
100 C.F.S. 100-YR. PEAK RUN-OFF
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The City of
LITCHFIELD PARK
MASTER DRAINAGE STUDY
EXHIBIT II

BASIN G
BASIN A
BASIN H-2
BASIN K
BASIN F-2
BASIN J
BASIN H-1
BASIN B-2
BASIN L
BASIN C-5
BASIN I
BASIN C-2
BASIN B-3
BASIN C-1
BASIN B-1
BASIN C-4
BASIN C-3
BASIN E-1
BASIN F-1
BASIN E-2
BASIN D
LEGEND
STUDY AREA LIMITS
BASIN BOUNDARY
AIRLINE CANAL
CONCENTRATION POINT WITH 100 YEAR PEAK FLOW IN CUBIC FEET PER SECOND
DIVERTED FLOW IN CUBIC FEET PER SECOND
STORM PIPE
NOTE:
SEE EXHIBITS II, III & IV FOR DETAILS ALONG SOUTH BOUNDARY OF DRAINAGE BASINS
N
SCALE 1"=400'
WILLDAN ASSOCIATES
ENGINEERS • PLANNERS
1737 W. NORTHERN AVE. SUITE 112, PHOENIX, AZ 85021
(602) 870-7600
The City of
LITCHFIELD PARK
MASTER DRAINAGE STUDY
EXHIBIT 1
SCALE: 1"=400'
DATE: FEB. 1989

MASTER DRAINAGE STUDY

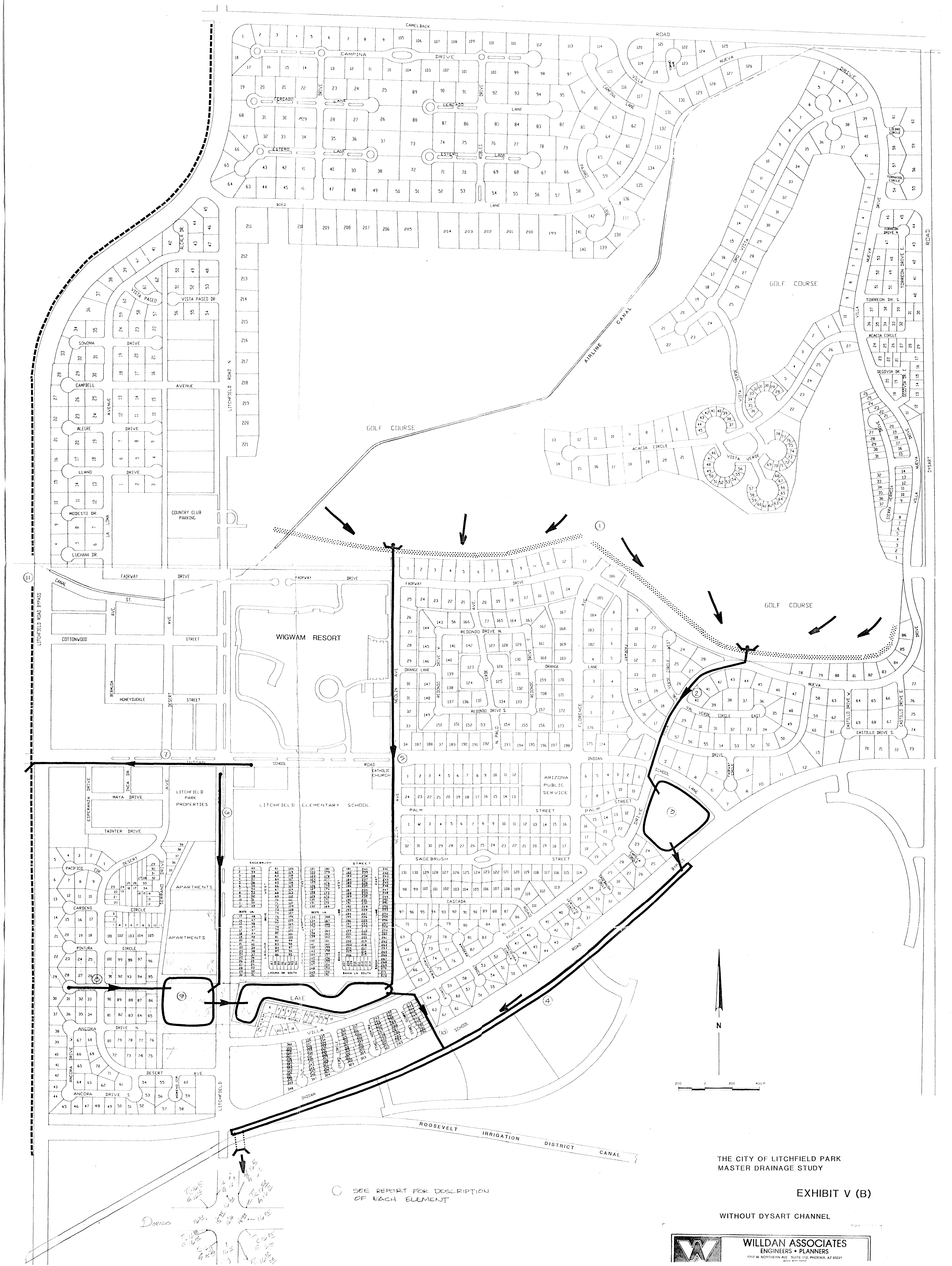
○ SEE REPORT FOR DESCRIPTION OF EACH ELEMENT

THE CITY OF LITCHFIELD PA
MASTER DRAINAGE STUDY

WITH DYSART CHANNEL

WILLD
ENG
1717 W. NORT

MASTER DRAINAGE STUDY



THE CITY OF LITCHFIELD PARK
MASTER DRAINAGE STUDY

EXHIBIT V (B)

WITHOUT DYSART CHANNEL

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