DRAINAGE REPORT

FOR

PARADISE GREENS, UNIT #1
SUBDIVISION (MAP #B-12)

PREPARED FOR

ARGUS DEVELOPMENT COMPANY

6501 AMERICAS PARKWAY, ALBUQUERQUE, NM 87110

PREPARED BY

COMMUNITY SCIENCES CORPORATION
P. O. BOX 1328
CORRALES, NEW MEXICO 87048

Richard 12/21/93
There is AMAFCA flood Zone on this property. Outlet to Calabacillas needs to be addressed. Unit #2 may have problems with Golf Course pond overflow. City Hydrology is reviewing on-site drainage.
See AMAFCA's Dec. comments.
AMAFCA

NOVEMBER, 1993

JAMES D. HUGHES
12-1-93

JAMES D. HUGHES 11674 NEW MEXICO REGISTERED PROFESSIONAL ENGINEER

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

community sciences corporation

MASTER DRAINAGE REPORT

FOR

38 ACRE AND 45 ACRE TRACTS ALONG IRVING BLVD.

PREPARED FOR

ARGUS DEVELOPMENT COMPANY

PREPARED BY

COMMUNITY SCIENCES CORPORATION
P. O. BOX 1328
CORRALES, NEW MEXICO 87048

12/21/93
Richard
This area will drain directly to the Calabacillas Arroyo. They need a Qualitative update of Pueblo line. Also inlets must convey water to bed of Arroyo by permanent facility. The grade control design in Calabacillas by RTI can provide stable outlet where available. Multiple outlets will be expensive. See AHAFCA's EPC comments.

NOVEMBER, 1993

STEPHEN L. CRAWFORD

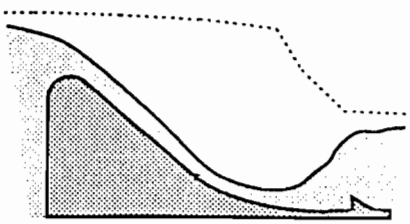
STEPHEN L. CRAWFORD
NEW MEXICO
10274
REGISTERED PROFESSIONAL ENGINEER

11-15-93

P.O. Box 1328
Corrales, New Mexico 87048
(505) 897-0000

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

Richard J. Heggen
PE, PH, PhD
Water Resources Engineering
620 Ridgecrest SE
Albuquerque, NM 87108



January 6, 1994

Cliff Anderson, PE
AMAFCA
2600 Prospect NE
Albuquerque, NM 87107

Dear Cliff:

Attached are my hydraulic/hydrologic reviews the several drainage reports you provided me on December 23.

Please let me know if additional reviews are needed.

Yours truly,

Richard Heggen
cc: Wilson & Co.

(505) 277-5737, 277-2722 FAX (505) 277-1988 e-mail rheggen@bootes.unm.edu

**Master Drainage Report for 38 Acre and 45 Acre Tracts
along Irving Blvd.
prepared for Argus Development
by Community Sciences Corp. (CSC)
November, 1993.**

The report develops a general drainage management plan for subsequent developments in two large tracts. The drainage report reviewed next in this set (*Drainage Report for Paradise Greens, Unit #1 Subdivision*) is for the first development in the 38 acre tract.

Coordination with other plans

The drainage-path map from the 1975 Leverton-Denny study is needed. Does the golf course and westward development drain as anticipated in the Leverton-Denny plan?

The AHYMO subbasin map has SLA Calabacillas cross-sections marked. See my remarks regarding sediment transport.

The Master Drainage Plan lacks specific discussion of the drainage of surrounding tracts. Four cases are:

a) Irving Blvd. may not protect the 45 acre site from current off site flow (sec. V-1-a). "Excess flow overtops the berm on the north side of Irving Blvd. and proceeds to the Calabacillas Arroyo at random locations in undefined gullies." These paths need to be identified and maintained until the Irving storm sewer relieves the issue.

b) Is the 38-acre tract protected from the golf course? The AHYMO run leaves basin 115 hanging at ID 10. Is the golf course pond retention or detention? Can it overtop? Where does this go?

   Item 4 of the 8/3/93 memo fails to acknowledge an easement from the golf course to Irving. Plate 2 shows direct grade into the tract, but no provision for conveyance. Does the easement serve an historic or potential purpose or has the golf course eliminated the need?

c) Two tracts not under review lie between the 38-acre tract and the Calabacillas. The Master Drainage Plan should report on how those tracts are likely to be drained. I foresee no problem, but master planning should look beyond client property lines.

d) The open channel storm drain along Golf Course appears to be a temporary facility and is wearing out. Can it sustain more flow?

community sciences corporation

MASTER DRAINAGE REPORT

FOR

38 ACRE AND 45 ACRE TRACTS ALONG IRVING BLVD.

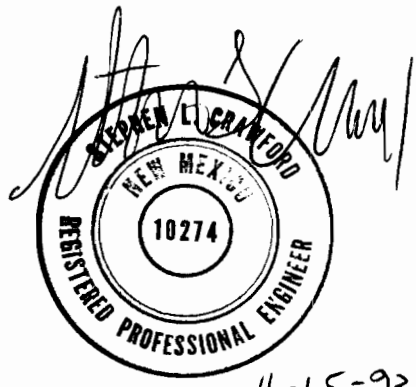
PREPARED FOR

ARGUS DEVELOPMENT COMPANY

PREPARED BY

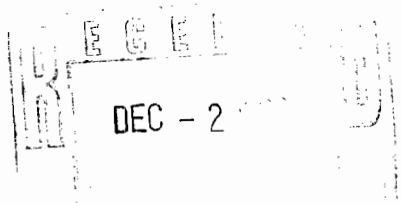
COMMUNITY SCIENCES CORPORATION
P. O. BOX 1328
CORRALES, NEW MEXICO 87048

NOVEMBER, 1993



11-15-93

STEPHEN L. CRAWFORD



P.O. Box 1328
Corrales, New Mexico 87048
(505) 897-0000

SURVEYING
LAND PLANNING
CIVIL ENGINEERING
DEVELOPMENT CONSULTANTS

TABLE OF CONTENTS

I. PURPOSE AND SCOPE

Argus Development is planning to plat and develop two parcels of land near the intersection of Irving Blvd. and Golf Course Road. The parcels are a 38 acre tract known as Tract A Paradise North and a 45 acre tract composed of Tracts 28A, 29A, and 30A Paradise North.

This report analyzes the current drainage situation for a major portion of Paradise Hills. About half of the existing developed area that makes up Paradise Hills drains north to Irving Blvd. and then east in the Irving right-of-way before ultimately discharging to the Calabacillas Arroyo.

The purpose of this report is to use the quantified flows from the contributing area to formulate a phasing approach for development of the aforementioned parcels. This phasing will include a chronological order for development of the parcels as well as storm drain to divert flows to the Calabacillas.

II. SITE LOCATION AND TOPOGRAPHY

The area studied is essentially the north half of Paradise Hills (See Plate #1). A study of the entire Paradise Hills area was done by Leverton-Denny in 1975. The land generally slopes to the northeast at about 2-4%. The soils are typically fine, silty sands. The area consists of single family detached residences at a density of about 4 dwellings per acre.

According to the US FEMA Map (Community No. 350002, Panels 1 and 2) prepared in 1983, a 100 year floodway passes through the north side of the 38 acre parcel just south of Irving Blvd.

III. DESIGN CRITERIA

A. Flood Control Regulations

The drainage plan presented in this report has been designed to comply with AMAFCA resolution 80-15, which requires that proposed land development projects be designed such that no flooding of private properties will occur during any storm up to and including the 100-year frequency event. The existing drainage situation is such that the street capacity of Irving Blvd. is violated. The proposed conditions will improve the drainage so it will also conform with current "City of Albuquerque Drainage Ordinance". Chapter 22 of the Development Process Manual (DPM) and subsequently adopted general policies of the City of Albuquerque.

1. 100-year storm

    a. Stormwater flow depth not to exceed the top of curb in any street.

    b. Jump depth to be contained within right-of-way.

2. 10-year storm:

    a. Local street - velocity times depth less than 6.5

b. Arterial streets:

i. Flow not to exceed a depth of 0.50
ii. Velocity times depth less than 6.5
iii. One driving lane in each direction free of stormwater

B. Engineering Parameters

In accordance with AMAFCA criteria, all hydrological analysis is based on the 100-year frequency, 6-hour duration storm, as represented in Section 22.2, Hydrology, of the "Development Process Manual, Volume 2, Design Criteria for the City of Albuquerque, New Mexico, January 1993".

Ten-year, 6-hour values were also used for sub attachments, in accordance with City drainage policies regarding street flow.

The four rainfalls pertinent to the study are as follows:

	10-Year	100-Year
One-Hour	1.27"	1.90"
Six-Hour	1.47"	2.20"

IV. COMPUTATIONAL PROCEDURES

The analysis approach follows standard engineering practice. Key points of confluence were selected and the associated individual and aggregate contributing basins were subsequently defined.

Hydrological computations were accomplished by means of the March 1992 version of AHYMO Computer Program as developed by AMAFCA. The input parameters and resulting flows for the basins are summarized on Table 1. Summary and detailed AHYMO printouts are contained in Appendix A.

Times of concentration were estimated using the Upland Method and then converted to times to peak (Lg), in accordance with the above referenced Section 22.2 which also establishes the minimum time of concentration as 12 minutes.

Flow characteristics for conveyance swales, channels, and streets were analyzed based on the Manning equation for uniform flow. Streets are assumed to have a 2% cross slope from lip of gutter to crown and a curb and gutter per City of Albuquerque Standard details unless found to be otherwise. Finished grade at the right-of-way is 0.33' above top of curb.

V. DRAINAGE SCENARIOS

The total area ultimately draining to Irving is about 0.360 mi^2, of this total, approximately 0.26 mi^2 is developed with single family residential homes. This report contains hydrologic modeling for a two-step drainage solution.

1. a) Existing condition - This run models the drainage situation for Irving Blvd. as it exists now with no improvements. Cross sections were surveyed every 200' along the length of Irving from Swinborne Dam to

Golf Course Rd. Critical sections were used to model the flow for this reach. As can be seen from the AHYMO run, the modeled capacity of Irving Blvd. is exceeded. We believe that excess flow overtops the berm on the north side of Irving Blvd. and proceeds to the Calabacillas Arroyo at random locations in undefined gullies.

The actual street capacity of Irving Blvd. is exceeded very early on. For the purpose of this study, the upstream reach of Irving (from La Paz Rd. to Lyons Rd.) was given the full right-of-way as the flow cross section.

b) Phase I of 38 acre Development - This run models the drainage situation after Phase I of the 38 acre parcel is developed. (See plates II , III). Phase I includes a storm drain that drains on-site developed flows. The storm drain is sufficiently sized to also take developed flows from the 45 acre tract. This storm drain does not take any flow from Irving Blvd., Unit 1 development of the 45 ac. tract takes place and therefore does not modify the 100 year flood plain.

2. Phase II of 38 acre Development - The second scenario models the drainage after Phase II of the 38 acre tract is developed. This phase includes completion of the 72" storm drain at Swinborne Dam to take all of the flow from Irving west of the dam. Also part of this step is completing the Phase II of the 45 acre storm drain from Irving Blvd. to the Calabacillas. These storm drains will remove the flood plain and allow the area to be developed. On-site developed flows from Phase II of the 38 acre will be directed east to the intersection of Golf Course and Irving. A structure will be placed under Irving to convey flows to an existing open channel and finally to the Calabacillas.

Phases I and II of the 45 acre parcel could be developed at any time between scenarios 1 and 2 because the line thru Phase I is adequately sized to handle developed flows.

Are these det flows?

TABLE I

SCENARIO #1 DEVELOPMENT

					LAND TREATMENT				INCREMENTAL		EXISTING TOTAL	
Basin I.D.	Area (Sq.Mi.)	Contr. Basin	Sum Area (Sq.Mi.)	T_c (Min.)	A	B	C	D	Q_{100} (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_{10} (cfs)
100	0.0119	100	0.0119	12	100	0	0	0	31.4	0	31.4	0
103	0.0116	103	0.0116	12	0	29	29	42	24.5	13.9	24.5	13.9
101a	0.0360	103	0.0476	12	0	29	29	42	76.0	43.1	100.4	56.9
101b	0.0450	101a	0.0926	12	0	29	29	42	95.0	53.9	188.4	110.0
102	0.0149	100, 101b	0.1194	12	0	29	29	42	31.5	17.8	227.4	126.7
105	0.0057	105	0.0057	12	0	29	29	42	12.1	6.9	12.1	6.9
104	0.0179	102, 105	0.1430	12	0	29	29	42	37.8	21.4	261.6	142.1
107	0.0405	107	0.0405	12	0	29	29	42	85.5	48.5	85.5	48.5
106	0.0269	104, 107	0.2104	12	0	29	29	42	56.8	32.2	386.3	211.0
108	0.0171	106	0.2275	12	0	29	29	42	36.1	20.5	418.5	230.8
109	0.0212	108	0.2487	12	0	29	29	42	44.8	25.4	456.2	252.1
110	0.0201	109	0.2688	12	0	29	29	42	42.4	24.1	484.0	260.8
111	0.0194	111	0.0194	12	0	29	29	42	41.0	23.2	41.0	23.2
112	0.034	111	0.0534	12	0	29	29	42	71.7	40.7	112.7	63.9
113	0.0174	112	0.0708	12	0	29	29	42	36.7	20.8	149.4	84.8
114	0.0224	113	0.0932	12	0	29	29	42	47.3	26.8	196.7	111.6
115	0.1260	114	0.2192	12	0	29	29	42	196.4	86.3	393.1	196.8
38 ac P1	0.0190	38 ac P1	0.0190	12	0	32.5	32.5	35	38.4	21.2	38.4	21.2
45 ac P1	0.0360	38 ac P1	0.0550	12	0	32.5	32.5	35	72.8	40.1	111.2	61.3
45 ac P2	0.0343	45 ac P1	0.08930	12	0	32.5	32.5	35	69.4	38.2	180.6	99.6

Dev flows ?

TABLE II

SCENARIO #2 DEVELOPMENT
*Flows up to Lyons and Irving intersection remain the same

					LAND TREATMENT				INCREMENTAL		FUTURE TOTAL	
Basin I.D.	Area (Sq.Mi.)	Contr. Basin	Sum Area (Sq.Mi.)	T_c (Min.)	A	B	C	D	Q_{100} (cfs)	Q_{10} (cfs)	Q_{100} (cfs)	Q_{10} (cfs)
108	0.0171		0.2275	12	0	29	29	42	36.1	20.5	418.5	230.8
*72" SD from Lyons/Irving to Swinborne Dam intercepts all of the upstream flow.												
109	0.0212	109	0.0212	12	0	29	29	42	44.8		44.8	
110	0.0201	109	0.0413	12	0	29	29	42	42.4		83.0	
*36" SD at west edge of 45 ac property intercepts all of the upstream flow.												
*Golf Course basins do not change from Scenario #1.												
38 ac P1	0.0190	38 ac P1	0.0190	12	0	32.5	32.5	35	38.4	21.2	38.4	21.2
45 ac P1	0.0360	38 ac P1	0.0550	12	0	32.5	32.5	35	72.8	40.1	111.2	61.3
45 ac P2	0.0343	45 ac P1	0.0893	12	0	32.5	32.5	35	69.4	38.2	180.6	99.6
38 ac P2	0.0404	38 ac P2	0.0404	12	0	32.5	32.5	35	81.7	45.0	81.7	45.0

252-05-610	JL	11-2-93

Capacity calcs on proposed storm drains.

① 72" @ Lyons & Irving to Swinborne Dam.

$Q = 1.49/n\, AR^{2/3} S^{1/2}$ $n = 0.013$ $A = 28.27\ ft^2$ $WP = 18.85'$

$R = 28.27/18.85 = 1.50'$

* Assume $S = 0.02$

$Q = 1.49/0.013\,(28.27)(1.50)^{2/3}(0.02)^{1/2} =$ (600 cfs)

② 36" @ west side of 45 ac parcel =

$n = 0.013$ $A = 7.07\ ft^2$ $WP = 9.42'$

$R = 7.07/9.42 = 0.75$

* Assume $S = 0.02$

$Q = 1.49/0.013\,(7.07)(0.75)^{2/3}(0.02)^{1/2} =$ (95 cfs)

③ 38 ac Phase I storm drain.

a) Reach #1 ⇒ Capacity of 24" SD. $A = 3.14\ ft^2$ $WP = 6.28'$

$Q = 1.49/0.013\,(3.14)(0.5)^{2/3}(0.03)^{1/2}$ * Assume $S = 0.03$

= (40 cfs)

b) Reach #2 ⇒ Capacity of 36" SD. $A = 7.07\ ft^2$ $WP = 9.42'$

$Q = 1.49/0.013\,(7.07)(0.75)^{2/3}(0.03)^{1/2}$ * Assume $S = 0.03$

= (116 cfs)

c) Reach #3 ⇒ Capacity of 48" SD. $A = 12.57\ ft^2$ $WP = 12.57'$

$Q = 1.49/0.013\,(12.57)(1)^{2/3}(0.02)^{1/2}$ * Assume $S = 0.02$

= (204 cfs)

Open Channel Capacity Calcs

slope = 5%

bottom width = 8'

side slope = 3:1

Depth = 2.5'

capacity =

$A = \frac{1}{2}(8+23)(2.5) = 38.8\ ft^2$

$WP = 7.91 + 7.91 + 8 = 23.8\ ft$

$R = 38.8/23.8 = 1.63'$

$Q = 1.49/0.02\,(38.8)(1.63)^{2/3}(0.05)^{1/2} =$ **895 cfs**

w/ 1' free board =>

$A = \frac{1}{2}(8+17)(1.5) = 18.8\ ft^2$

$WP = 4.74 + 4.74 + 8 = 17.5\ ft$

$R = 18.8/17.5 = 1.07'$

$Q = 1.49/0.02\,(18.8)(1.07)^{2/3}(0.05)^{1/2} =$ **330 cfs**