PLANS/PLATS ON FILE

FILE DESC: _____

D-20 / D002

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PLANS/PLATS 2

March 23, 1977

RECEIVED
MAR 24 1977
CITY ENGINEERS

Mr. V.M. Kimmick
City Engineer
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

REFERENCE: Heritage Hills, Units 2, 3, and 4

Dear Mr. Kimmick:

Transmitted is one copy of the Master Drainage Report for Heritage Hills, Units 2, 3, and 4. We request your review and if acceptable, approval of this report.

Very truly yours,

Thomas O. Isaacson
Senior Vice President

TOI:dd

Encl.

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects, engineers, planners, 3500 indian school road, n.e. albuquerque, new mexico 87106, 505-266-5521

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

April 19, 1977

Chambers,Campbell,Isaacson & Chaplin Inc.
3500 Indian School Rd. N.E.
Albuquerque, New Mexico 87106

Gentlemen:

Today a meeting was held in this office to review the drainage plans for Units 2,3 and 4 of Heritage Hills. The meeting was attended by Mr. Jim Smith for A.M.A.F.C.A., Mr. V. M. Kimmick and the undersigned for the City of Albuquerque. The drainage report was not considered acceptable by either authority on the basis of the following considerations:

1. The interception of the off-site flows G,H,I through a temporary channel constructed within the R.O.W. of Ventura Rd. is not satisfactory. Either a fully improved channel (concrete lined) running along the backside of the lots within the subdivision is provided, or an interceptor channel to the east of Ventura Rd. is constructed within a separate and independent drainage easement.

2. In a similar fashion the flows from the east across Ventura Rd. would convey sediment loads onto the roadway causing unacceptable traffic hazards and severe maintenance problems. Either sedimentation ponds must be provided with sufficient residence time to remove the fines from the surface runoff or a diversion is constructed to the appropriate natural watercourse.

3. Mr. Smith strongly stressed the point that no encroachment can be allowed in the flood plain and it is his request that either the tier of lots bordering the easement for the Domingo Baca are removed from the plat or the channel improvements outlined in the Drainage Master Plan are executed in such manner as to confine the flood plain to the Arroyo R.O.W. boundaries.

The drainage plan for this area will be approved when the points described above are resolved in a satisfactory manner.

Cordially yours,

Bruno Conegliano

Bruno Conegliano
Assistant City Engineer-Hydrology

BC/fs

cc: Jim Smith, AMAFCA
Mr. Hensch
V. M. Kimmick

April 26, 1977

RECEIVED
APR 28 1977
CITY ENGINEERS

City of Albuquerque
Bruno Conegliano
Assistant City Engineer-Hydrology
P.O. Box 1293
Albuquerque, NM 87103

REFERENCE: Heritage Hills, Units 2, 3, and 4

Dear Mr. Conegliano:

This is in response to your letter of April 19, 1977, and the meeting of April 25, between our firm and the City, where we discussed your rejection of the drainage study for Heritage Hills, Units 2, 3, and 4.

Reference is made to Item 1 of your letter. As we stated at the meeting, the concept of intercepting offsite flows from Areas G, H and I, with a temporary drainage channel within the east half of Ventura Road, was approved in preliminary discussion with Mr. Robert, AMAFCA, and Mr. Kimmick, City Engineer. Because of these preliminary approvals, the design of Unit 2 was based on Ventura-temporary drainage channel concept. For reasons that are still not completely clear to us, you have rejected this concept. In its place, you have suggested alternate methods - ie., a concrete channel running along the backside of lots within the subdivision, or an interceptor channel east of Ventura Road within a separate and independent drainage easement. After discussion with the Bellamah Corporation, we find these alternates completely unacceptable to us and our client. In regard to the concrete lined channel, first you must realize that we had already completed the improvement plans for Unit 2 several weeks ago, and a change of this magnitude would create an unreasonable expense and time delay for our client. Secondly, while our present Ventura-temporary drainage channel concept is an economical approach, a concrete lined channel would be prohibitively expensive for the use derived from it. As stated in the drainage report, the magnitude of these offsite flows will be drastically reduced when development of the area east of Ventura occurs, which experts predict will happen within 3 to 4 years. Therefore, if the channel was constructed for present use, four years from now a concrete lined channel, capable of carrying several hundred cfs, would be used to convey a total of 20% to 30% of the present 100 year storm flows. Lastly, it must be remembered that the people who would ultimately pay the bill for the channel would be the home buyer, for all these development costs are passed directly to them. This would

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505-266-5521

put an unnecessary and unreasonable burden on the future home buyer at a time when he is already hard pressed to make ends meet.

We find the second suggestion of putting the channel east of Ventura Road impracticable, because of the following: the area east of Ventura is owned by several different parties. Trying to get a common easement from one party, let alone several parties, would be a time consuming adventure that is destined to frustration, and ultimate disappointment. It is one thing for the City to obtain an easement - it is another thing altogether for a private firm to obtain such an easement.

Therefore, in the spirit of cooperation and compromise, we are willing to submit the following change to the drainage study, even though we firmly believe the existing concept is a safe, more practical solution.

Offsite flows from Areas G, H, and I will now pass through the Heritage Hills Unit 2 before emptying into the North Arroyo de Pino. Area G, with its peak flow rate of 78 cfs, can be accommodated by Gettysburg Road, which has a minimum grade of 1.0%.

Area H, with a peak runoff rate of 135 cfs, will be handled as follows: A temporary diversion channel will be constructed within the R/W of Eubank Boulevard to the east of the site to intercept the majority of flows from Area H; the drainage from the rest of Area H will pass through the site via Bunker Hill Road into the Pino. This concept was approved by Mr. Kimmick during our meeting on the 25th. Area I, with a peak discharge of 32 cfs, will pass through the site via Valley Forge Road. The channel location, size, adjusted flow rates, etc., are shown in red on Figure V. Corrected flow rates, pertaining to Item 1, are shown on Figure VI.

Reference is made to Item 2 of your letter. We recognize the problem of sediment deposits on roadways, and the maintenance problems which must occur. However, the requirement of sediment ponds is a policy change not covered by the AMAFCA resolution. After discussing this item with the Bellamah Corporation, it was decided to provide a stilling basin at the outflow point of each offsite drainage area, but to confine the limits of each basin within the unpaved east half of the Ventura R/W. A typical section of each basin would be 30' wide x 100' long x 3' deep, with 2:1 S.S. Because Ventura Road is designed with a median, a cut in the median and curb should correspond to each overflow point. We also recommend a cut-off wall to protect the lip of the asphalt adjacent to the downstream edge of each stilling basin overflow area. Because of the possibility of someone driving into one of the stilling basins, it is also recommended that 4" x 4" barricade posts be installed at 5'-0" centers, with reflectors, along the median curb cut.

We feel that this approach would provide the safest form of control for sedimentation control. We are definitely against any form of stilling basin which would be formed with the use of a berm, or dike. This situation would create

an ever-present danger of a breach of the structure. If a breach occured at any point other than the designed low points on Ventura Road, substantial flows, sediment, etc., could be directed at one of the houses bordering Ventura Road. Our proposal eliminates this danger because the cut-off wall and street serve as checks against erosion. A further point to consider with a berm-type stilling basin is, if the basin behind a berm filled up with sediment, the flood plain at that particular point in the arroyo would be much wider than the historical flood plain. This would cause the runoff to outflow at points not intended to accept these flows. Our proposal simply digs a hole below the existing flow line of the arroyo. If this fills up, the arroyo simply returns to its original flood plain limits. It will, of course, be up to the City to keep the basins cleaned and to keep their operation effective.

Item #3 was discussed with Bellamah Corporation, and they are doing a feasibility study on the cost of constructing the Domingo Baca Arroyo adjacent to Units 3 and 4.

You will find the changes referred to marked in red on the enclosed plats. When the City and AMAFCA approves these changes, we will then revise the originals and send you revised copies of the drainage study. Design for these improvements will be incorporated in the improvement plans for Units 2, 3, and 4.

Sincerely,

Christopher L. Weiss

Christopher L. Weiss, for

CHAMBERS, CAMPBELL, ISAACSON & CHAPLIN, INC.

CLW:dd
Enclosures

cc: Mr. Kimmick - City
Mr. Shipley - Bellamah
AMAFCA

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

May 3, 1977

D20.D2

Mr. Chris Weiss
Chambers,Campbell,Isaacson & Chaplin
3500 Indian School Road N.E.
Albuquerque, New Mexico 87106

Dear Mr. Weiss:

In reply to your letter dated April 28, 1977 my comments are as follows: The main objection to the construction of a temporary interceptor channel within the right-of-way of Ventura Road resides in the observation that such construction would remove the developer's responsibility for the permanent on-site management of the upstream surface runoff and transfer this responsibility to the public authorities.

The AMAFCA Resolution clearly indicates that the developer is fully responsible for the management of the runoff waters crossing his property (Sect. 3, Par. A). In addition, Sect. 21B of the Subdivision Ordinance requires silt and erosion control where necessary. The sediment load carried by surface waters cannot be separated nor disregarded but is an essential constituent of the runoff. As such it cannot be claimed that the requirement detailed in Paragraph 2 of my letter dated April 19, 1977 is in any way a change in policy or an addition to the AMAFCA Resolution or the Subdivision Ordinance.

An acceptable drainage plan must fully comply with the concepts above and provide satisfactory engineering solutions which will not result in inconvenience to the public nor in the expenditure of public funds.

Because of the above considerations, I am not in favor of a diversion channel located within the R.O.W. of Eubank Road and the stilling basins proposed to be constructed within the R.O.W. of Ventura Road do not seem to have any relation to the flow quantities anticipated nor to the corresponding sediment loads.

If, as you indicate in your letter, the development of the upstream land is three to four years away, the sedimentation basins should be designed accordingly including the appropriate safety factors. By this I mean that the basins should have a life expectancy of at least six years. I would like to point out that the assumption that further development to the east will reduce the surface runoff to a total of 20 to 30% of the presently estimated values is highly speculative and not acceptable as a design criterion.

Since in your proposal you suggest the use of the roadways as runoff channels, I want to point out that the experience of the Street Maintenance Division indicates the following: The standard asphaltic concrete roadways deteriorate quickly and fail when the roadways must carry frequent and substantial flows (in excess of 50 c.f.s.) Therefore, for those streets which according to your calculations will have to convey flows in excess of 50 c.f.s., consideration should be given to a design with reinforced concrete movement, 5" thick if dedicated to local traffic or 8" thick if major collectors.

Those solutions to drainage problems which result in high maintenance costs,be it for silt removal or for frequent pavement resurfacing, are not in the best public interest and are therefore unacceptable.

I look forward to receiving a more comprehensive and satisfactory solution to the drainage problem in the Heritage Hills Subdivision.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Assist. City Engineer-Hydrology

BC/fs

cc - V. M. Kimmick
Jim Smith

DALE BELLAMAH CORPORATION

POST OFFICE BOX 3325
6400 UPTOWN BOULEVARD, N.E.
EAST TOWER, SUITE 600

ALBUQUERQUE, NEW MEXICO 87110
TELEPHONE (505) 299-7631

May 12, 1977

Bruce —

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico
87103

RE: SETTLEMENT BASINS FOR
HERITAGE HILLS UNIT #2

Dear Mr. Kimmick:

This letter is to guarantee that the Dale Bellamah Corporation will maintain any and all settlement basins which will be constructed in the eastern half of the Ventura Avenue right-of-way adjacent to Heritage Hills Unit #2 in accordance with the proposed drainage plan prepared by Chambers, Campbell, Isaacson and Chaplin. The Dale Bellamah Corporation will clean and maintain these ponds of all sediment until such time as the western half of Ventura Avenue is improved or for a period of ten years from date of acceptance of the improvements by the City of Albuquerque.

Very truly yours,
DALE BELLAMAH LAND CO., INC.

Terrance L Connors

Terrance L. Connors
Construction Engineer

/kc

BUILDERS—DEVELOPERS—REALTORS

Builders Owners and Managers of Residential Homes Apartment Properties Shopping Centers Motels
Mobile Home Parks, Free-Standing Commercial Properties
MEMBERS
National Association of Home Builders, International Council of Shopping Centers, National Association of Realtors

THIS MICROIMAGE IS THE BEST POSSIBLE REPRODUCTION DUE TO THE POOR QUALITY OF THE ORIGINAL DOCUMENT.

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

May 17, 1977

Chambers, Campbell, Isaacson, Chaplin, Inc.
3500 Indian School Rd., N.E.
Albuquerque, NM 87106

Re: Approval for Heritage Hills, Section 2, 3, and 4

Gentlemen:

An item of serious concern that needs to be resolved at the earliest time between the Dale Bellamah Corporation and the City Engineer's Office regards the imorovements of the Domingo Baca Arroyo as it crosses Barstow Street. At this time, a 12' difference is indicated between the grade on Barstow and the flow line of the Domingo Baca. As a consequence, both with existing flood flows and with the reduced flows after construction of the flood retention dam, Barstow and Loma del Norte, Unit 9, would become subject to flooding. This question has not been addressed to in the drainage report, and a solution must be furnished.

As it regards the internal drainage of the subdivision Heritage Hills Section 2, 3, and 4, the drainage report submitted and amended is approved subject to the following:

1. The requirement that no increase in runoff from before development conditions will be satisfied with on site runoff retention.

2. The effectiveness of the trap efficiency of the stilling basins will be maintained at all times as agreed in the letter from Dale Bellamah Corporation dated May 12, 1977.

3. Since it has been established that the northern most tier of lots ajacent to the Domingo Baca Arroyo needs to be removed from the plat of

THIS MICROIMAGE IS THE BEST POSSIBLE REPRODUCTION DUE TO THE POOR QUALITY OF THE ORIGINAL DOCUMENT.

Heritage Hills, Section 3 and 4, due to flood plain encroachment, an easement for the two runoff rundowns discharging in the Domingo Baca must be retained.

4. With regard to Heritage Hills, Section 2, an easement needs to be dedicated for drainage along the Arroyo Pino to protect the channel and must correspond to the flood plain boundaries. Those lots marginally affected by the flood plain will need to be regraded so that the drainage easement boundaries will correspond to the lots boundaries.

5. The construction plans must include details for the runoff rundowns from the cul-de-sacs to the channel of the arroyo together with the appropriate erosion control facilities necessary to prevent the degradation of the channel and for protection of the rundowns.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Assist. City Engineer-Hydrology

BC/kr

cc-Jim Smith AMAFCA
V. M. Kimmick
Dwayne Sheppard
George Paul
Bob Klielich
Drainage File
Rip Orr

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

June 5, 1978

D20-D2

Sheilah L. Sweenhart
Development Engineer
Dale Bellamah Corporation
P. O. Box 3325
Albuquerque, N.M. 87110

SUBJECT: HERITAGE HILLS UNIT IV-A
TEST TURNKEY PROJECT WORK AUTHORIZATION #T-4

Dear Sheilah:

Under the provisions of the Test Turnkey Project procedures, this letter is the Work Authorization to begin field work on the project.

Sincerely,

V. M. Kimrick
City Engineer

VMK/fs

cc - H. R. Orr
Contractor
Ray Dawson
Water Resources
Dwayne Sheppard
Bob Kielich
LaMonte Urban
Bruno Conegliano
Bill Mueller

Kw JUL 17 1978

July 13, 1978

D 26' D2

Public Works Department
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

ATTENTION: Mr. H.R. Orr

REFERENCE: Heritage Hills 4A Turnkey Inspection

Gentlemen:

We have been selected by the Dale Bellamah Land Corp. to administer the Turnkey Inspections program for the Heritage Hills 4-A Subdivision.

During the inspection process, we propose to take all the field density tests for earthfill compaction, with the City's approval. We have hired Sergent, Hauskins & Beckwith to take the Proctor tests, asphalt density tests and concrete cylinder tests. Our firm has been actively engaged in soil testing for the past 10 years. We have the necessary field test equipment and personnel trained in its proper use. A Professional Engineer will supervise the test procedures and verify all reports sent to the City.

If you approve of CCIC taking the field density tests for earthwork compaction, please sign in the space indicated below and return one copy to us. Thank you.

Very truly yours,

Christopher L. Weiss

Christopher L. Weiss, P.E., for

CHAMBERS, CAMPBELL, ISAACSON & CHAPLIN, INC.

CLW:dd

7-20-78

H.R. Orr, Jr., Director
Public Works Department

Chambers, Campbell, Isaacson, Chaplin, Inc.
architects engineers planners 3500 indian school road ne albuquerque new mexico 87106 505 266 5521

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

HYDROLOGY SECTION PROJ. NO. D20 D2 DATE: 10/12/83

PLANNING DIVISION NO.

CONFERENCE RECAP

SUBJECT: Tract A-A, Unit 6 Loma Del Norte Addn (D20) + Tract C, Unit 3, Heritage Hills Add Subd.

ATTENDANCE:	WHO	REPRESENTING
	Tom Mann	
	Fred J. Aguirre	

FINDINGS:

1. Drainage Report per the DPM appropriate
2. Bank protection required
3. Financial guarantee required for drainage, utilities and street improvements prior to final sign-off
4. Free discharge appropriate if downstream conditions are adequate.

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: Fred Aguirre SIGNED: T. Mann

TITLE: TITLE:

DATE: 10/12/83 DATE: 10/12/83

D20-D2

MASTER DRAINAGE REPORT

FOR

HERITAGE HILLS

UNITS 2, 3 & 4

MARCH 1977
REVISED MAY 1977
ADDENDUM NO. 1

CHAMBERS-CAMPBELL-ISAACSON-CHAPLIN, INC.
5500 INDIAN SCHOOL RD. NE • ALBUQUERQUE, NEW MEXICO 87108 • TELEPHONE (AREA 505) 266-5521

BIBLIOGRAPHY OF REFERENCES

Butler, Stanley S., Engineering Hydrology.
New Jersey: Printice-Hall, Inc. 1959

Herkenhoff, Gordon & Associates, "Master Plan of Drainage, City of Albuquerque, New Mexico and Environs, 1963", Albuquerque; Gordon Herkenhoff & Associates, Consulting Engineers.

King, H.W., and Brater, E.F., Handbook of Hydraulics.
New York: McGraw-Hill Book Company, 1963.

Lunsley Jr., R.K. Kohler, M.A., Parelhus, J.L.H., Hydrology for Engineers. New York: McGraw-Hill Book Company, 1975.

Schulz, E.F., "Problems in Applied Hydrology", Fort Collins, Colorado, Water Resources Publications.

U.S. Department of Commerce, "Precipitation - Frequency Atlas of the Western U.S., Vol. IV, New Mexico" Washington, D.C., U.S. Government Printing Office, 1973.

U.S. Department of the Interior, Bureau of Reclamation, "Metric Supplement to Water Measurement Manual", Denver, Colorado, Engineer and Research Center, 1971.

Wright-McLaughlin Engineers, "Urban Storm Drainage Criteria Manual, Vol. I.", Denver, Colorado: Wright-McLaughlin Engineers, 1969.

MASTER DRAINAGE REPORT

FOR

HERITAGE HILLS

UNITS 2, 3 & 4

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
NO. 3908
NEW MEXICO
THOMAS O. ISAACSON

PREPARED BY

CHAMBERS, CAMPBELL, ISAACSON & CHAPLIN, INC.

March 1977
REVISED MAY 1977
ADDENDUM NO. 1

City of Albuquerque

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinheinz

April 19, 1977

Chambers,Campbell,Isaacson & Chaplin Inc.
3500 Indian School Rd. N.E.
Albuquerque, New Mexico 87106

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The drainage plan for this area will be approved when the points described above are resolved in a satisfactory manner.

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Bruno Conegliano
Assistant City Engineer-Hydrology

BC/fs

cc: Jim Smith, AMAFCA
Mr. Hensch
V. M. Kimmick

April 26, 1977

City of Albuquerque
Bruno Conegliano
Assistant City Engineer-Hydrology
P.O. Box 1293
Albuquerque, NM 87103

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Sincerely,

Christopher L. Weiss, for

CHAMBERS, CAMPBELL, ISAACSON & CHAPLIN, INC.

CLW:dd
Enclosures

cc: Mr. Kimmick - City
Mr. Shipley - Bellamah
AMAFCA

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

May 3, 1977

Mr. Chris Weiss
Chambers,Campbell,Isaacson & Chaplin
3500 Indian School Road N.E.
Albuquerque, New Mexico 87106

Dear Mr. Weiss:

In reply to your letter dated April 28, 1977 my comments are as follows: The main objection to the construction of a temporary interceptor channel within the right-of-way of Ventura Road resides in the observation that such construction would remove the developer's responsibility for the permanent on-site management of the upstream surface runoff and transfer this responsibility to the public authorities.

The AMAFCA Resolution clearly indicates that the developer is fully responsible for the management of the runoff waters crossing his property (Sect. 3, Par. A). In addition, Sect. 21B of the Subdivision Ordinance requires silt and erosion control where necessary. The sediment load carried by surface waters cannot be separated nor disregarded but is an essential constituent of the runoff. As such it cannot be claimed that the requirement detailed in Paragraph 2 of my letter dated April 19, 1977 is in any way a change in policy or an addition to the AMAFCA Resolution or the Subdivision Ordinance.

An acceptable drainage plan must fully comply with the concepts above and provide satisfactory engineering solutions which will not result in inconvenience to the public nor in the expenditure of public funds.

Because of the above considerations, I am not in favor of a diversion channel located within the R.O.W. of Eubank Road and the stilling basins proposed to be constructed within the R.O.W. of Ventura Road do not seem to have any relation to the flow quantities anticipated nor to the corresponding sediment loads.

If, as you indicate in your letter, the development of the upstream land is three to four years away, the sedimentation basins should be designed accordingly including the appropriate safety factors. By this I mean that the basins should have a life expectancy of at least six years. I would like to point out that the assumption that further development to the east will reduce the surface runoff to a total of 20 to 30% of the presently estimated values is highly speculative and not acceptable as a design criterion.

Since in your proposal you suggest the use of the roadways as runoff channels, I want to point out that the experience of the Street Maintenance Division indicates the following: The standard asphaltic concrete roadways deteriorate quickly and fail when the roadways must carry frequent and substantial flows (in excess of 50 c.f.s.) Therefore, for those streets which according to your calculations will have to convey flows in excess of 50 c.f.s., consideration should be given to a design with reinforced concrete pavement, 5" thick if dedicated to local traffic or 8" thick if major collectors.

Those solutions to drainage problems which result in high maintenance costs,be it for silt removal or for frequent pavement resurfacing, are not in the best public interest and are therefore unacceptable.

I look forward to receiving a more comprehensive and satisfactory solution to the drainage problem in the Heritage Hills Subdivision.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Assist. City Engineer-Hydrology

BC/fs

cc - V. M. Kimmick
Jim Smith

ADDENDUM NO. 1

DRAINAGE STUDY FOR

HERITAGE HILLS, UNITS 2, 3, and 4

May 10, 1977

This addendum is in reference to a meeting on May 9, 1977, held at the AMAFCA Office. Representatives from the City, AMAFCA, Bellamah Corporation and our office were present.

A summary of the conclusions arrived at, and agreed upon by all present, are as follows: Heritage Hills Units 2, 3, and 4, have been well designed in that the primary consideration was drainage. The direct effect of this layout is to reduce the offsite flow burden on Barstow Road and the subdivisions to the west. It was generally agreed that this same pattern of reduction of flows will continue as the area east of Heritage Hills develops. At present rate of expansion, the area east of Ventura could be developed in 3 to 4 years. Therefore, it was recognized that the flow rates shown intercepting Ventura Road represent a temporary 100 year storm runoff rate. Subsequently, it was agreed to route these temporary, potential flows through the respective subdivisions for direct discharge into either the North Arroyo del Pino, or the Domingo Baca Arroyo.

In more detail, the following requirements were agreed to by the developer. Bunker Hill Road, which intercepts the largest of all the offsite flows, will be a standard 32' FF asphalt street section with 1/2 crown (2"); the sidewalks adjacent to this street will be constructed against the curb to prevent scouring from the overflow. The City Ordinance allows for a 0.2' overflow in the design capacity of streets. This particular street will overflow 0.13' at a 1% minimum

grade for a design Q of 140 cfs. The sidewalk X-slope will account for 0.06' elevation difference, with the remaining 0.07' being taken up by 3-1/2' of parkway. The velocity of the flow in the street at the 1% slope will be 6'/sec. The velocity of the flow in the parkway would be minimal.

All of the remaining streets which intercept offsite flows have the capacity to handle these flows with no overflow of the curb.

The last point raised concerned the sediment deposits on the roadways, and the maintenance problems which occur. It was agreed that large flows will carry their deposits to the points of outfall, as shown by the velocity in the above situation. Smaller storms will not have these velocities, and thus sediment deposits on the streets will occur. To offset this probelm until development to the east of Ventura Road occurs, Bellamah agreed to the conditions set forth by the City. Bellamah will construct temporary sediment ponds at the outflow point of each offsite drainage area. These ponds will be confined to the limit of the unpaved east-half of the Ventura Right-of-Way. A typical section of each basin would be 30' wide x 100' long x 3' deep, with 2:1 s:s. Because Ventura Road is designed with a median, a cut in the median and curb should correspond to each overflow point. We recommend a cut-off wall to protect the lip of the asphalt adjacent to the downstream edge of each stilling basin overflow area. Because of the possibility of someone driving into one of the stilling basins, it is also recommended that 4" x 4" barricade posts be installed at 5'-0" centers, with reflectors along the median cut.

The Bellamah Corporation has also agreed to maintain these sediment basins until the east half of Ventura Road is paved. A copy of this agreement accompanies this Addendum.

This completes changes covered by Addendum No. 1.

DALE BELLAMAH CORPORATION

POST OFFICE BOX 3325
6400 UPTOWN BOULEVARD, N.E.
EAST TOWER, SUITE 600

ALBUQUERQUE, NEW MEXICO 87110
TELEPHONE (505) 299-7631

May 12, 1977

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P. O. Box 1293
Albuquerque, New Mexico
87103

RE: SETTLEMENT BASINS FOR
HERITAGE HILLS UNIT #2

Dear Mr. Kimmick:

This letter is to guarantee that the Dale Bellamah Corporation will maintain any and all settlement basins which will be constructed in the eastern half of the Ventura Avenue right-of-way adjacent to Heritage Hills Unit #2 in accordance with the proposed drainage plan prepared by Chambers, Campbell, Isaacson and Chaplin. The Dale Bellamah Corporation will clean and maintain these ponds of all sediment until such time as the western half of Ventura Avenue is improved or for a period of ten years from date of acceptance of the improvements by the City of Albuquerque.

Very truly yours,
DALE BELLAMAH LAND CO., INC.

Terrance L Connors

Terrance L. Connors
Construction Engineer

/kc

BUILDERS—DEVELOPERS—REALTORS

Builders Owners and Managers of Residential Homes Apartment Properties Shopping Centers Motels
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City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

RECEIVED
MAY 19 1977

May 17, 1977

Chambers, Campbell, Isaacson, Chaplin, Inc.
3500 Indian School Rd., N.E.
Albuquerque, NM 87106

Re: Approval for Heritage Hills, Section 2, 3, and 4

Gentlemen:

An item of serious concern that needs to be resolved at the earliest time between the Dale Bellamah Corporation and the City Engineer's Office regards the improvements of the Domingo Baca Arroyo as it crosses Barstow Street. At this time, a 12' difference is indicated between the grade on Barstow and the flow line of the Domingo Baca. As a consequence, both with existing flood flows and with the reduced flows after construction of the flood retention dam, Barstow and Loma del Norte, Unit 9, would become subject to flooding. This question has not been addressed to in the drainage report, and a solution must be furnished.

As it regards the internal drainage of the subdivision Heritage Hills Section 2, 3, and 4, the drainage report submitted and amended is approved subject to the following:

1. The requirement that no increase in runoff from before development conditions will be satisfied with on site runoff retention.

2. The effectiveness of the trap efficiency of the stilling basins will be maintained at all times as agreed in the letter from Dale Bellamah Corporation dated May 12, 1977.

3. Since it has been established that the northern most tier of lots ajacent to the Domingo Baca Arroyo needs to be removed from the plats of

Heritage Hills, Section 3 and 4, due to flood plain encroachment, an easement for the two runoff rundowns discharging in the Domingo Baca must be retained.

4. With regard to Heritage Hills, Section 2, an easement needs to be dedicated for drainage along the Arroyo Pino to protect the channel and must correspond to the flood plain boundaries. Those lots marginally affected by the flood plain will need to be regraded so that the drainage easement boundaries will correspond to the lots boundaries.

5. The construction plans must include details for the runoff rundowns from the cul-de-sacs to the channel of the arroyo together with the appropriate erosion control facilities necessary to prevent the degradation of the channel and for protection of the rundowns.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Assist. City Engineer-Hydrology

BC/kr

cc-Jim Smith AMAFCA
V. M. Kimmick
Dwayne Sheppard
George Paul
Bob Klielich
Drainage File
Rip Orr

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INTRODUCTION

This drainage report will analyze the drainage characteristics of three proposed R-1 developments, Heritage Hills Units 2, 3 and 4.[1]

The three sites all have common boundaries to each other and are located in the Northeast Heights of Albuquerque. The entire land area is surrounded by Barstow Road and Ventura Road, the North Arroyo del Pino, and the Domingo Baca Arroyo. (See Figure I)

SUMMARY OF RESULTS

Figure V - Reference to this plat shows the offsite drainage areas affecting the site. These areas are labeled A thru I. Flow rates are shown at Ventura Road, which forms the east border of Sites 2 and 4. Further reference to the plat shows the on-site undeveloped drainage areas. The on-site drainage areas are labeled J thru O. Flow rates are shown at their respective departure points on the west side of Units 2, 3 and 4.

Figure VI and VII - Reference to these two plats shows the developed flow rates for the respective drainage areas of Units 2, 3, and 4.

Unit 2 (Figure VI) - Offsite flows up to almost the northeast corner of the site will be intercepted by a temporary drainage channel constructed within the east half of the dedicated Ventura R/w. This channel will drain

[1] Heritage Hills Unit #1 is also located on the same land area. A drainage study for this area was prepared by this firm on January 1977.

these flows south to the North Arroyo del Pino.[2]

On site flows are all channeled directly into the North Arroyo del Pino, with the exception of Area 2-1 and Area 2-3, which empty onto San Francisco and Unit I, respectively.

Unit 3 and 4 (Figure VII) - These units are treated as one because of interlaced sub-drainage areas.

Approximately 20% of the area drains directly onto San Francisco Drive.[3] Another 20% of the area, along with the school site, drains onto Barstow Road for exit into the Domingo Baca Arroyo. The remaining area is divided evenly into two sub-drainage basins which empty directly into the Domingo Baca.

Offsite flows from the east of Ventura Road are passed thru the site at two different points. Flows from Areas A, B and C pass directly thru to the Domingo Baca. Flows from Areas D, E and F pass thru to San Francisco Drive.

---

2 This channel will be temporary until the area east of Ventura begins development. Then the east half of Ventura will be paved to match the west lanes. It is recognized that Ventura Road, even paved full width, couldn't carry the existing flows from the east. In most likelihood, future development to the east will divert flows directly into the North Arroyo del Pino and the Domingo Baca, as Units 2, 3 and 4 have done. This is in line with the policies set forth by AMAFCA. However, if an east-west grid pattern is built east of Ventura, it is beyond the responsibilities of this report to accept the consequences of such action. The City Engineer and AMAFCA should therefore be alert to approving only those plans which reduce the total flows before the runoff reaches Ventura Road.

3 These flows cross Barstow Road before being diverted north to the Domingo Baca thru Loma Del Norte Subdivision. The drainage study for Loma Del Norte Unit 10, by Murray McCormick, Inc., has accounted for 169 cfs at Barstow and San Francisco vs 171 cfs from this report. It should be noted that this should be a temporary maximum rate. Here again, development east of Ventura will reduce this flow rate if flows are diverted north and/or south as per AMAFCA policies.

Summation of Flows - A comparision of flow rates before development vs after development is as follows:

Pre-development Units 2, 3, 4	After Development Units 2, 3, 4
342 cfs	338 cfs
(9,684 Lit/Sec)	(9,571 Lit/Sec)
This is a reduction of 4 cfs	(113 Lit/Sec)

RECOMMENDATIONS

Unit 2

1. The temporary drainage channel on the east half of Ventura Road will intercept flows from Areas G, H and I. A typical section would have a 10' wide base; 3:1 s.s. on the upstream side, where in cut, level when in fill; 4:1 s.s. on the downstream side; depth of flow plus freeboard of 3'; a slope of 0.5%.
2. No individual street is required to handle a large flow rate, but the minimum grade should be 0.5% for a capacity of 63 cfs (1784 Lit/Sec).
3. Where the flows leave Unit 2 and empty into the North Arroyo del Pino, erosion protection, in the form of concrete rundowns, rock rip-rap, or other suitable protection, should be constructed to prevent the undermining of the pavement at the outflow points.
4. Certain lots, situated along the south perimeter of the site, lie within the 100 year flood hazard boundary. These lots should be raised up a minimum of 3 feet (0.91 meters) above the existing chan-

nel bottom.[4] If walls are constructed around these lots, erosion protection should be provided around any and all parts of the walls that enter the flood hazard area.

5. Rear yard ponding will require a minimum of 15% of the area drained to the pond. This will allow a maximum depth of 0.5' (0.15 meter). The limits of the ponded waters should be kept a minimum distance of 5' (1.52 meter) away from any walls and 15' (4.57 meters) away from any house foundations.[5]

Units 3 and 4

1. Offsite drainage passes thru this area at two different points. Where Areas A, B, and C enter Area 4-1, the street carrying these flows to outlet at Pt. III should have a minimum slope of 1.0%.

   Where Areas D, E and F enter Area 4-3, the street carrying these flows to outlet at San Francisco Drive should have a minimum slope of 2.0%. San Francisco Drive should have a minimum slope of 3.0%. It should be noted that the flows make a 90° turn onto San Francisco. To help change the flow direction onto San Francisco, the street emptying onto San Francisco should have a grade break approximately 75' (22.9 meters) back from the curb return. This will help reduce

---

4 It should be noted that the channel area is part of a dedicated park. Future plans are unknown at this time, but it would be logical to assume that some improvements in the channel area will occur. Improvements could take the form of deepening, providing a straight grade and grass lining of the channel.

5 These general recommendations are only intended to call the developer's attention to potential settlement problems in the area. A qualified soils engineer should prepare specific guidelines for ponding waters around structures. (This recommendation also applies to Units 3 and 4.)

the velocity before entering the intersection.

The grade of San Francisco is presently designed at a 3% grade across the intersection. This will help increase the velocity while leaving the intersection.[6]

With the exception of the above mentioned streets, the remaining streets can be designed to a minimum grade of 0.5% for a capacity of 63 cfs (1784 Lit/Sec).

2. The lots bordering the Domingo Baca Arroyo should all be removed from development at this time. The flood hazard limit line overlaps almost all of these lots. Present 100 year flow rates of 3827 cfs (108,369 Lit/Sec) will be reduced to 1142 cfs (32,338 Lit/Sec) when the Domingo Baca Dam is built in the near future. After such construction, it would become economically feasible to develop these lots.

3. The proposed channel outlets at Points II and III will require a 10' (3.1 meters) and 20' (6.1 meters) wide R/W, respectively. Because the Domingo Baca is going to be improved after the dam is built, it would be a waste of money to construct these channels at this time.[7] Rather, an erosion blanket at the outlet from the streets should be constructed at each point. The channels will be unlined, guide channels cut thru the embankment to outlet flows into the Domingo Baca Arroyo. The street elevation at the collection points should be a

---

6 It should be noted that the lots south of this intersection have been raised a minimum of 2' (0.61 meter) above top of curb. See Grading Plan - Unit 1.

7 When the channels are constructed, conform to City Standard Drawings No. P-17-1.

minimum of 3' (0.91 meter) above the existing arroyo bottom.[8]

This concludes the recommendations for Heritage Hills, Units 2, 3 and 4. The following section, the Appendix, contains all the design criteria, calculations, graphs and plats used in arriving at the conclusions presented here.

---

8 Depth of flow in the Domingo Baca for present conditions = 2' (0.61 meter).

APPENDIX

DESIGN CRITERIA

In analyzing the storm runoff to determine the runoff basis of the undeveloped and developed site, the Rational formula, Q=CIA, was used.

Where:

Q = Runoff quantity in cubic feet/second (Liters/Sec)

A = Contributing area in acres (hectares)

I = Intensity in inches/hour (cm/hr)

For a duration equal to the time of accumulation (duration) measured in minutes and obtained from Figure IV - Intensity Duration Frequency Curves (Albuquerque Area - 1961). (Note: where a Time of Concentration [Tc] is less than 10 minutes, the intensity value equal to 10 minutes was used as shown on the curve for a 100 year storm in Figure IV).

C = Runoff coefficient (no unit). This coefficient represents the integrated effects of infiltration, detention storage, evaporation, retention, flow routing, and interception which all affect the time distribution and peak rate of runoff.

For the proposed developed areas, it was desirable to develop a composite runoff coefficient based on the percentage of different types of surface in each sub-drainage area. Different coefficients with respect to surface type are given on the following page.[1]

---

[1] Table 3-2, Urban Storm Drainage Criteria Manual Vol. I, Denver Regional Council of Governments.

Streets, walls and drives	C = 0.90
Roofs	C = 0.90
Lawns, Sandy Soils, Avg. 2 to 7% slope	C = 0.20

COMPOSITE "C" CALCULATIONS

Refer to Area 3-3 as an example.

Step #1. Determine Area subject to runoff = 15.1 Acres (6.1 ha)

Step #2. Determine Hard Surfaced Area

a) Streets and Walks (32' BB, 4' Sidewalks)

Length = 3000' (914.4 meters)

Width = 40' (12.19 meters)

Area = (3000')(40') = 120,000 $ft.^2$

(914.4) (12.19 m) = 11,146 m^2

b) Driveway

Length = 25' (7.62 meters)

Width = 18' (5.49 meters)

Area = (25')(18') = 450 $ft.^2$ x No. of Units

= 450 $ft.^2$ x 68 = 30,600 $ft.^2$

(7.62 m)(5.49 m) = 41.83 m^2 x 68 = 2,844 m^2

c) Roofs - Typical Roof = 40' (12.19 m) x 50' (15.24 m)

Ponded Lots - 1/2 roof drains to street

1) Area of Roof x No. of Units

(20') (50') = 1000 $ft.^2$ x 19 ponded lots = 19,000 $ft.^2$

(6.10 m)(15.24 m) = 92.96 m^2 x 19 = 1,766 m^2

Unponded Lots - entire roof drains to street

1) Area of Roof x No. of Units

(40')(50') = 2000 ft.^{2} x 49 in ponded lots = 98,000 ft.^{2}

(12.19 m)(15.24 m) = 185.78 m^2 x 49 = 9,103 m^2

Total Hard Surfaced Area =	a)	120,000 ft.^{2}	11,146 m^2
	b)	30,600 ft.^{2}	2,844 m^2
	c)	19,000 ft.^{2}	1,766 m^2
		98,000 ft.^{2}	9,103 m^2
		267,600 ft.^{2}	24,859 m^2
	=	6.1 Ac	2.5 ha

Step #3. Determine unsurfaced area which drains to the street

15.1 Ac	6.1 ha
- 6.1 AC	- 2.5 ha
9.0 AC	3.6 ha = Unsurfaced Area

Step #4. Calculate Composite "C"

$0.90\ (\frac{6.1}{15.1}) = 0.36$ $\quad$ $0.90\ (\frac{2.5}{6.1}) = 0.37$

$0.20\ (\frac{9.0}{15.1}) = 0.12$ $\quad$ $0.20\ (\frac{3.6}{6.1}) = 0.11$

$\overline{0.48}$ $\quad$ $\overline{0.48}$

The following table (Table I) is a summary of the Composite "C" values for the individual areas of the developed units of Heritage Hills #2, 3 and 4. In addition, following the above summary, the calculations are shown in table form, for the Composite "C" values for the flows at Points I, II, III and IV. These point numbers represent exit points for runoff where several small areas have combined to form a single drainage basin.

TABLE I

HERITAGE HILLS #2, 3, 4

DRAINAGE MASTERPLAN

Subdivision & Drainage Section	Area Acres (Hectares)	By Area C=0.20 Acres (Hectares)	By Area C=0.90 Acres (Hectares)	Composite "C" Factor (No Unit)
2-1	3.3 (1.3)	0.9 (0.3)	2.4 (1.0)	0.71
2-2	7.9 (3.2)	4.0 (1.6)	3.9 (1.6)	0.55
2-3	1.1 (0.5)	0.4 (0.2)	0.7 (0.3)	0.65
2-4	12.1 (4.9)	6.7 (2.7)	5.4 (2.2)	0.51
2-5	3.3 (1.3)	1.6 (0.6)	1.7 (0.7)	0.56
2-6	6.1 (2.5)	3.1 (1.3)	3.0 (1.2)	0.54
2-7	8.1 (3.3)	4.5 (1.8)	3.6 (1.5)	0.51
2-8	0.5 (0.2)	0 (0)	0.5 (0.2)	0.90
3-1	8.7 (3.5)	4.7 (1.9)	4.0 (1.6)	0.52
3-2	1.1 (0.5)	0.2 (0.1)	0.9 (0.4)	0.77
3-3	15.1 (6.1)	9.0 (3.6)	6.1 (2.5)	0.48
3-4	6.6 (2.7)	3.6 (1.5)	3.0 (1.2)	0.52
3-5	5.5 (2.2)	3.4 (1.4)	2.1 (0.8)	0.47
3-6	4.2 (1.7)	2.1 (0.9)	2.1 (0.8)	0.55

TABLE I (CONTINUED)

Subdivision & Drainage Section	Area Acres (Hectares)	By Area C=0.20 Acres (Hectares)	By Area C=0.90 Acres (Hectares)	Composite "C" Factor (No Units)
4-1	15.1 (6.1)	8.0 (3.2)	7.1 (2.9)	0.53
4-2	6.4 (2.6)	3.4 (1.4)	3.0 (1.2)	0.53
4-3	8.7 (3.5)	3.6 (1.5)	5.1 (2.0)	0.61
4-4	4.1 (1.7)	1.9 (0.8)	2.2 (0.9)	0.58
4-5	3.9 (1.6)	2.0 (0.8)	1.9 (0.8)	0.54

Pt. #	Area	% Total Area		Ind. Composite "C"		Overall Composite "C"
Pt. #I	3-1	8.7/22.4 = 0.39	x	0.52	=	0.20
	3-2	1.1/22.4 = 0.05	x	0.77	=	0.04
	Sch. Site	12.6/22.4 = 0.56	x	0.35	=	0.20
						0.44
Pt. #II	3-3	15.1/27.2 = 0.56	x	0.48	=	0.27
	3-4	6.6/27.2 = 0.24	x	0.52	=	0.13
	3-5	5.5/27.2 = 0.20	x	0.47	=	0.10
						0.49
Pt. #III	4-1	15.1/46.4 = 0.32	x	0.53	=	0.17
	4-2	6.4/46.4 = 0.14	x	0.53	=	0.07
	A	5.8/46.4 = 0.13	x	0.35	=	0.05
	B	16.2/46.4 = 0.35	x	0.35	=	0.12
	C	2.9/46.4 = 0.06	x	0.35	=	0.02
						0.43
Pt. #IV	3-6	4.2/78.1 = 0.05	x	0.55	=	0.03
	4-3	8.7/78.1 = 0.11	x	0.61	=	0.07
	4-4	4.1/78.1 = 0.05	x	0.58	=	0.03
	4-5	3.9/78.1 = 0.05	x	0.54	=	0.03
	2-1	3.3/78.1 = 0.04	x	0.71	=	0.03
	1-1	3.5/78.1 = 0.04	x	0.62	=	0.03
	D	36.2/78.1 = 0.46	x	0.35	=	0.16
	E	4.6/78.1 = 0.06	x	0.35	=	0.02
	F	9.6/78.1 = 0.12	x	0.35	=	0.04
						0.44

RUNOFF RATES

The following tables summarize the flow rates from their respective areas. The first table (Table II) shows offsite flow rates at their respective exit points at Ventura Road.

The next table (Table III) summarizes flow rates from the existing, undeveloped area which encompasses Units 2, 3, and 4. Only flows originating within this area are shown in this table.

The final table (Table IV) shows the flow rates from their respective developed areas for Units 2, 3, and 4. Flow rates shown at Points I thru IV represent flows originating within Units 2, 3, and 4, plus the flows from offsite areas lying to the east of the site. This table is a summary of the calculations presented in Sheets A-11 thru A-29 Runoff Computations. For a graphical picture of the flow rates and their respective departure points, refer to Figures VI and VII.

TABLE II

HERITAGE HILLS #2, 3, 4

DRAINAGE MASTERPLAN

OFFSITE FLOWS

Drainage Basin	Flow Length Feet (Meters)	Elev. Dif. Feet (Meters)	Tc Min.	I "/Hr. (cm/hr)	C No Unit	Area Acres (Hectares)	Q Ft3/Sec. (Lit/Sec)
A	900 (274)	40 (12)	5	5.4 (13.7)	0.35	5.8 (2.3)	11 (311)
B	1920 (585)	77 (23)	9	5.4 (13.7)	0.35	16.2 (6.6)	31 (878)
C	840 (256)	37 (11)	5	5.4 (13.7)	0.35	2.9 (1.2)	6 (170)
D	2720 (829)	93 (28)	13	4.97 (12.6)	0.35	36.2 (14.7)	63 (1784)
E	1040 (317)	50 (15)	6	5.4 (13.7)	0.35	4.6 (1.9)	9 (255)
F	1300 (396)	56 (17)	6	5.4 (13.7)	0.35	9.6 (3.9)	18 (510)
G	3960 (1207)	122 (37)	18	4.4 (11.2)	0.35	50.5 (20.4)	78 (2209)
H	6900 (2103)	227 (69)	25	3.78 (9.6)	0.35	101.9 (41.2)	135 (3823)
I	2000 (610)	66 (20)	10	5.4 (13.7)	0.35	17.0 (6.9)	32 (906)

Metric Conversion Units

1 Foot = 0.3048 meters, 1 inch = 2.54 cm
1 Acre = 4047 m^2 = 0.4047 Hectares
1 cfs = 28.317 Lit/Sec.

TABLE III

HERITAGE HILLS #2, 3, 4

DRAINAGE MASTERPLAN

ESTIMATED FLOWS - UNDEVELOPED STATE

Drainage Area #	Flow Length Feet (Meters)	Elev. Dif. Feet (Meters)	Tc Min.	I "/Hr. (cm/hr)	C No Unit	Area Acres (Hectares)	Q Ft3/Sec. (Lit/Sec)
J	2800 (853)	90 (27)	13	4.97 (12.62)	0.35	66.3 (26.8)	115 (3256)
K	2700 (823)	90 (27)	12	5.11 (12.99)	0.35	26.6 (10.8)	48 (1359)
L	1880 (573)	58 (18)	10	5.40 (13.72)	0.35	16.6 (6.7)	31 (878)
M	2000 (610)	56 (17)	11	5.25 (13.34)	0.35	19.9 (8.1)	37 (1048)
N	1600 (488)	44 (13)	10	5.40 (13.72)	0.35	19.5 (7.9)	37 (1048)
O	2200 (671)	62 (19)	11	5.25 (13.34)	0.35	40.4 (16.4)	74 (2095)

$\Sigma Q =$ 342 cfs

(9684)

TABLE IV

HERITAGE HILLS #2, 3, 4

DRAINAGE MASTERPLAN

ESTIMATED FLOWS - DEVELOPED STATE

Subdivision & Drainage Sub-Area	Tc Min.	I "/hr. (cm/hr)	C No. Unit	Area Acres (Hectares)	Q cfs (Lit/Sec)	Discharge Pt.
2-1	15	4.73 (12.01)	0.71	3.3 (1.3)	11 (311)	San Francisco
2-2	18	4.40 (11.18)	0.55	7.9 (3.2)	19 (538)	North Arroyo del Pino
2-3	10	5.40 (13.72)	0.65	1.1 (0.4)	4 (113)	Heritage Hills #1
2-4	11	5.25 (13.34)	0.51	12.1 (4.9)	32 (906)	North Arroyo del Pino
2-5	15	4.73 (12.01)	0.56	3.3 (1.3)	9 (255)	North Arroyo del Pino
2-6	17	4.50 (11.43)	0.54	6.1 (2.5)	15 (425)	North Arroyo del Pino
2-7	13	4.97 (12.62)	0.51	8.1 (3.3)	21 (595	North Arroyo del Pino
2-8	10	5.40 (13.72)	0.90	0.5 (0.2)	2 (57)	North Arroyo del Pino
3-1	16	4.61 (11.71)	0.52	8.7 (3.5)	21 (595)	Barstow Road
3-2	10	5.40 (13.72)	0.77	1.1 (0.5)	5 (142)	Barstow Road
3-3	17	4.50 (11.43)	0.48	15.1 (6.1)	33 (924)	Area 3-4
3-4	16	4.61 (11.71)	0.52	6.6 (2.7)	16 (453)	D. Baca
3-5	13	4.97 (12.60)	0.47	5.5 (2.2)	13 (368)	Area 3-4
3-6	14	4.85 (12.32)	0.55	4.2 (1.7)	11 (311)	San Francisco

TABLE IV (CONTINUED)

Subdivision & Drainage Sub-Area	Tc Min.	I "/hr. (cm/hr)	C No. Unit	Area Acres (Hectares)	Q cfs (Lit/Sec)	Discharge Pt.
4-1	15	4.73 (12.01)	0.53	15.1 (6.1)	38 (1076)	- D. Baca
4-2	11	5.25 (13.34)	0.53	6.4 (2.6)	18 (510)	- Area 4-1
4-3	16	4.61 (11.71)	0.61	8.7 (3.5)	24 (680)	- San Francisco
4-4	14	4.85 (12.32)	0.58	4.1 (1.7)	12 (340)	- Area 4-3
4-5	14	4.85 (12.32)	0.54	3.9 (1.6)	10 (283)	- San Francisco [Σ = 338 Developed Flow
School Site	10	5.40 (13.72)	0.35	12.6 (5.1)	24 (674)	- Barstow Road
Pt. I	13	4.97 (12.62)	0.44	22.4 (9.1)	42 (1189)	- D. Baca @ Barstow Road
Pt. II	16	4.61 (11.71)	0.49	27.2 (11.0)	61 (1727)	- Arroyo Domingo Baca
Pt. III	12	5.11 (12.97)	0.43	46.4 (18.8)	102 (2888)	- Arroyo Domingo Baca
Pt. IV	13	4.97 (12.62)	0.44	78.1 (31.6)	171 (4842)	- San Francisco @ Barstow Rd.

RUNOFF COMPUTATIONS

Sheet No. A-1L

Heritage Hills #2
PROJECT

Drainage Area No. 2-1

Area = 3.3 Acres

1.3 Hectares

C = 0.71

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.02

H = 3 feet

= 0.9 meters

Maximum Channel Flow: L = 1300 feet

= 396 meters

S = 0.03

H = 38 feet

= 12 meters

Accumulation time

Overland Flow: (Figure 2) = 13 min.

Channel Flow:

Velocity = 10.2 ft/sec Time = $\frac{1300 \text{ feet}}{10.2 \text{ feet/sec} \times 60}$ = 2 min.

= 3.1 m/sec. = $\frac{396 \text{ meters}}{3.1 \text{ m/sec} \times 60}$

Total Accumulated Time = 15 min.

$I = \frac{189}{t+25} = \frac{189}{40} = 4.73$ "/hr.

= 12.01 cm/hr.

Q = CIA = (0.71)(4.73)(3.3) = 11 cfs

= 311 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TDI

RUNOFF COMPUTATIONS

Sheet No. A-12

Heritage Hills #2
PROJECT

Drainage Area No. 2-2

Area = 7.9 Acres

3.2 Hectares

C = 0.55

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.02

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 1900 feet

= 579 meters

S = 0.02

H = 46 feet

= 14 meters

Accumulation Time

Overland Flow: (Figure 2) = 14 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{1900 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 4 min.

= 2.5 m/sec. = $\frac{579 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 18 min.

$I = \frac{189}{t+25} = \frac{189}{43} = 4.40$ "/hr.

= 11.18 cm/hr.

Q = CIA = (0.55)(4.40)(7.9) = 19 cfs

= 538 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-13

Heritage Hills #2
PROJECT

Drainage Area No. 2-3

Area = 1.1 Acres

0.4 Hectares

C = 0.65

Maximum Overland Flow: L = 45 feet S = 0.04

= 14 meters

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 350 feet S = 0.01

= 107 meters

H = 2 feet

= 0.6 meters

Accumulation Time

Overland Flow: (Figure 2) = 6 min.

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{350 \text{ feet}}{6.9 \text{ feet/sec} \times 60}$ = 1 min.

= 1.8 m/sec. = $\frac{107 \text{ meters}}{1.8 \text{ m/sec} \times 60}$

Total Accumulated Time = 7 min.
use 10

$I = \frac{189}{t+25} = \frac{189}{35} = 5.4$ "/hr.

= 13.72 cm/hr.

Q = CIA = (0.65)(5.4)(1.1) = 4 cfs

= 113 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-14

Heritage Hills #2
PROJECT

Drainage Area No. 2-4

Area = 12.1 Acres

4.9 Hectares

C = 0.51

Maximum Overland Flow: L = 45 feet

= 14 meters

S = 0.04

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 2500 feet

= 762 meters

S = 0.02

H = 48 feet

= 15 meters

Accumulation Time

Overland Flow: (Figure 2) = 6 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{2500 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 5 min.

= 2.5 m/sec. = $\frac{762 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 11 min.

$I = \frac{189}{t+25} = \frac{189}{36} = 5.25$ "/hr.

= 13.34 cm/hr.

Q = CIA = (0.51)(5.25)(12.1) = 32 cfs

= 906 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-15

Heritage Hills #2

PROJECT

Drainage Area No. 2-5

Area = 3.3 Acres

1.3 Hectares

C = 0.56

Maximum Overland Flow: L = 120 feet S = 0.03

= 37 meters

H = 3 feet

= 0.9 meters

Maximum Channel Flow: L = 800 feet S = 0.01

= 244 meters

H = 10 feet

= 3 meters

Accumulation Time

Overland Flow: (Figure 2) = 13 min.

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{800 \text{ feet}}{5.9 \text{ feet/sec} \times 60}$ = 2 min.

= 1.8 m/sec. = $\frac{244 \text{ meters}}{1.8 \text{ m/sec} \times 60}$

Total Accumulated Time = 15 min.

$I = \frac{189}{t+25} = \frac{189}{40} = 4.73$ "/hr.

= 12.01 cm/hr.

Q = CIA = (0.56)(4.73)(3.3) = 9 cfs

= 255 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-16

Heritage Hills #2
PROJECT

Drainage Area No. 2-6

Area = 6.1 Acres

2.5 Hectares

C = 0.54

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.02

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 1400 feet

= 427 meters

S = 0.02

H = 31 feet

= 9 meters

Accumulation Time

Overland Flow: (Figure 2) = 14 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{1400 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 3 min.

= 2.5 m/sec. = $\frac{427 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 17 min.

$I = \frac{189}{t+25} = \frac{189}{42} = 4.50$ "/hr.

= 11.40 cm/hr.

Q = CIA = (0.54)(4.50)(6.1) = 15 cfs

= 425 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-17

Heritage Hills #2
PROJECT

Drainage Area No. 2-7

Area = 8.1 Acres

3.3 Hectares

C = 0.51

Maximum Overland Flow: L = 90 feet S = 0.03

= 27 meters

H = 3 feet

= 0.9 meters

Maximum Channel Flow: L = 900 feet S = 0.02

= 274 meters

H = 20 feet

= 6 meters

Accumulation Time

Overland Flow: (Figure 2) = 11 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{900 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 2 min.

= 2.5 m/sec. = $\frac{274 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 13 min.

$I = \frac{189}{t+25} = \frac{189}{38} = 4.97$ "/hr.

= 12.62 cm/hr.

Q = CIA = (0.51)(4.97)(8.1) = 21 cfs

= 595 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-18

Heritage Hills #2
PROJECT

Drainage Area No. 2-B

Area = 0.5 Acres

0.2 Hectares

C = 0.90

Maximum Overland Flow: L = - feet S = -

= - meters

H = - feet

= - meters

Maximum Channel Flow: L = 400 feet S = 0.01

= 122 meters

H = 4 feet

= 1.2 meters

Accumulation Time

Overland Flow: (Figure 2) = - min.

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{400 \text{ feet}}{5.9 \text{ feet/sec} \times 60}$ = 1 min.

= 1.8 m/sec. = $\frac{122 \text{ meters}}{1.8 \text{ m/sec} \times 60}$

Total Accumulated Time = 1 min.
use 10

I = $\frac{189}{t+25}$ = $\frac{189}{35}$ = 5.4 "/hr.

= 13.72 cm/hr.

Q = CIA = (0.90)(5.40)(0.5) = 2 cfs

= 57 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-19

Heritage Hills #3
PROJECT

Drainage Area No. 3-1

Area = 8.7 Acres

3.5 Hectares

C = 0.52

Maximum Overland Flow: L = 115 feet S = 0.02

= 35 meters

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 1800 feet S = 0.02

= 549 meters

H = 40 feet

= 12 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{1800 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 4 min.

= 2.5 m/sec. = $\frac{549 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 16 min.

$I = \frac{189}{t+25} = \frac{189}{41} = 4.61$ "/hr.

= 11.71 cm/hr.

Q = CIA = (0.52)(4.61)(8.7) = 21 cfs

= 595 Liters/sec

Date 3-3-77

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RUNOFF COMPUTATIONS

Sheet No. A-20

Heritage Hills #3
PROJECT

Drainage Area No. 3-2

Area = 1.1 Acres

0.5 Hectares

C = 0.77

Maximum Overland Flow: L = 45 feet S = 0.04

= 14 meters

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 620 feet S = 0.05

= 189 meters

H = 28 feet

= 9 meters

Accumulation Time

Overland Flow: (Figure 2) = 6 min.

Channel Flow:

Velocity = 13.1 ft/sec Time = $\frac{620 \text{ feet}}{13.1 \text{ feet/sec} \times 60}$ = 1 min.

= 4.0 m/sec. = $\frac{189 \text{ meters}}{4.0 \text{ m/sec} \times 60}$

Total Accumulated Time = 7 min.
use 10

I = $\frac{189}{t+25}$ = $\frac{189}{35}$ = 5.4 "/hr.

= 13.72 cm/hr.

Q = CIA = (0.77)(5.4)(1.1) = 5 cfs

= 142 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-21

Heritage Hills #3
PROJECT

Drainage Area No. 3-3

Area = 15.1 Acres

6.1 Hectares

C = 0.48

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.02

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 2600 feet

= 792 meters

S = 0.02

H = 56 feet

= 17 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{2600 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 5 min.

= 2.5 m/sec.

= $\frac{792 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 17 min.

$I = \frac{189}{t+25} = \frac{189}{42} = 4.50$ "/hr.

= 11.43 cm/hr.

Q = CIA = (0.48)(4.50)(15.1) = 33 cfs

= 924 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A - 22

Heritage Hills #3
PROJECT

Drainage Area No. 3-4

Area = 6.6 Acres

2.7 Hectares

C = 0.52

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.03

H = 3 feet

= 0.9 meters

Maximum Channel Flow: L = 1450 feet

= 442 meters

S = 0.01

H = 17 feet

= 5 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 5.9 ft/sec Time = $\frac{1450 \text{ feet}}{5.9 \text{ feet/sec} \times 60}$ = 4 min.

= 1.8 m/sec. = $\frac{442 \text{ meters}}{1.8 \text{ m/sec} \times 60}$

Total Accumulated Time = 16 min.

$I = \frac{189}{t+25} = \frac{189}{41} = 4.61$ "/hr.

= 11.71 cm/hr.

Q = CIA = (0.52)(4.61)(6.6) = 16 cfs

= 453 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-23

Heritage Hills #3
PROJECT

Drainage Area No. 3-5

Area = 5.5 Acres

2.2 Hectares

C = 0.47

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.03

H = 4 feet

= 1 meters

Maximum Channel Flow: L = 800 feet

= 244 meters

S = 0.04

H = 28 feet

= 9 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 11.7 ft/sec Time = $\frac{800 \text{ feet}}{11.7 \text{ feet/sec} \times 60}$ = 1 min.

= 3.6 m/sec. = $\frac{244 \text{ meters}}{3.6 \text{ m/sec} \times 60}$

Total Accumulated Time = 13 min.

$I = \frac{189}{t+25} = \frac{189}{38} = 4.97$ "/hr.

= 12.6 cm/hr.

Q = CIA = (0.47)(4.97)(5.5) = 13 cfs

= 368 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-24

Heritage Hills #3
PROJECT

Drainage Area No. 3-6

Area = 4.2 Acres

1.7 Hectares

C = 0.55

Maximum Overland Flow: L = 115 feet S = 0.02

= 35 meters

H = 4 feet

= 1 meters

Maximum Channel Flow: L = 1400 feet S = 0.03

= 427 meters

H = 42 feet

= 13 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 10.2 ft/sec Time = $\frac{1400 \text{ feet}}{10.2 \text{ feet/sec} \times 60}$ = 2 min.

= 3.1 m/sec. = $\frac{427 \text{ meters}}{3.1 \text{ m/sec} \times 60}$

Total Accumulated Time = 14 min.

$I = \frac{189}{t+25} = \frac{189}{39} = 4.85$ "/hr.

= 12.32 cm/hr.

Q = CIA = (0.55)(4.85)(4.2) = 11 cfs

= 311 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-25

Heritage Hills # 4
PROJECT

Drainage Area No. 4-1

Area = 15.1 Acres

6.1 Hectares

C = 0.53

Maximum Overland Flow: L = 110 feet

= 34 meters

S = 0.04

H = 4 feet

= 1 meters

Maximum Channel Flow: L = 2100 feet

= 640 meters

S = 0.02

H = 42 feet

= 12.8 meters

Accumulation Time

Overland Flow: (Figure 2) = 11 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{2100 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 4 min.

= 2.5 m/sec. = $\frac{640 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 15 min.

$I = \frac{189}{t+25} = \frac{189}{40} = 4.73$ "/hr.

= 12.01 cm/hr.

Q = CIA = (0.53)(4.73)(15.1) = 38 cfs

= 1076 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-26

Heritage Hills #4
PROJECT

Drainage Area No. 4-2

Area = 6.4 Acres

2.6 Hectares

C = 0.53

Maximum Overland Flow: L = 85 feet S = 0.04

= 26 meters

H = 3 feet

= 0.9 meters

Maximum Channel Flow: L = 1000 feet S = 0.04

= 305 meters

H = 36 feet

= 11 meters

Accumulation Time

Overland Flow: (Figure 2) = 10 min.

Channel Flow:

Velocity = 11.7 ft/sec Time = $\frac{1000 \text{ feet}}{11.7 \text{ feet/sec} \times 60}$ = 1 min.

= 3.6 m/sec. = $\frac{305 \text{ meters}}{3.6 \text{ m/sec} \times 60}$

Total Accumulated Time = 11 min.

$I = \frac{189}{t+25} = \frac{189}{36} = 5.25$ "/hr.

= 13.34 cm/hr.

Q = CIA = (0.53)(5.25)(6.4) = 18 cfs

= 510 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-27

Heritage Hills #4
PROJECT

Drainage Area No. 4-3

Area = 8.7 Acres

3.5 Hectares

C = 0.61

Maximum Overland Flow: L = 115 feet S = 0.02

= 35 meters

H = 2 feet

= 0.6 meters

Maximum Channel Flow: L = 1850 feet S = 0.02

= 564 meters

H = 43 feet

= 13 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{1850 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 4 min.

= 2.5 m/sec. = $\frac{564 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 16 min.

$I = \frac{189}{t+25} = \frac{189}{41} = 4.61$ "/hr.

= 11.71 cm/hr.

Q = CIA = (0.61)(4.61)(8.7) = 24 cfs

= 680 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-28

Heritage Hills #4
PROJECT

Drainage Area No. 4-4

Area = 4.1 Acres

1.7 Hectares

C = 0.58

Maximum Overland Flow: L = 115 feet

= 35 meters

H = 3 feet

= 0.9 meters

S = 0.02

Maximum Channel Flow: L = 1100 feet

= 335 meters

H = 26 feet

= 8 meters

S = 0.02

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{1100 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 2 min.

= 2.5 m/sec. = $\frac{335 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 14 min.

$I = \frac{189}{t+25} = \frac{189}{39} = 4.85$ "/hr.

= 12.32 cm/hr.

Q = CIA = (0.58)(4.85)(4.1) = 12 cfs

= 340 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

RUNOFF COMPUTATIONS

Sheet No. A-29

Heritage Hills # 4
PROJECT

Drainage Area No. A-5

Area = 3.9 Acres

1.6 Hectares

C = 0.54

Maximum Overland Flow: L = 115 feet

= 35 meters

S = 0.03

H = 4 feet

= 1 meters

Maximum Channel Flow: L = 850 feet

= 259 meters

S = 0.02

H = 14 feet

= 4 meters

Accumulation Time

Overland Flow: (Figure 2) = 12 min.

Channel Flow:

Velocity = 8.3 ft/sec Time = $\frac{850 \text{ feet}}{8.3 \text{ feet/sec} \times 60}$ = 2 min.

= 2.5 m/sec. = $\frac{259 \text{ meters}}{2.5 \text{ m/sec} \times 60}$

Total Accumulated Time = 14 min.

$I = \frac{189}{t+25} = \frac{189}{39} = 4.85$ "/hr.

= 12.32 cm/hr.

Q = CIA = (0.54)(4.85)(3.9) = 10 cfs

= 283 Liters/sec

Date 3-3-77

Com. by CLW Ck. by TOI

REAR YARD PONDS

Development of an R-1 area increases runoff rates by approximately 1.33 times the undeveloped flow rate. In most cases where downstream streets have to assume the burden of these flows, it is important that developed runoff rates equal the undeveloped flow rates. In this case, however, the site is bordered on the south by the North Arroyo del Pino and the north by the Domingo Baca Arroyo. Where it is possible, due to street layout, off-site and on-site flows are channeled directly into either one of these arroyos. In cases such as this one, developed flow rates do not have to be restricted because of the immediate availability of major storm drain channels. However, some runoff rate restrictions were incorporated into this design in different areas as explained by the following text.

Looking at Unit #2, 87% of the flows are channeled directly into the North Arroyo del Pino. The developed flow rate from Unit 2 is less than or equals the undeveloped rate by the extensive use of backyard ponding. This concept was used because the Pino, while not a major arroyo, has substantial flows passing thru several "bottlenecks" downstream from the site. Therefore, it was felt best not to increase the burden on the North Arroyo del Pino system with unrestricted flow rates from Unit 2.

In analyzing Unit #3, some backyard ponding was used, where it was best adaptable to the grading. This moderate amount of flow rate restriction was used because of flat grades on Barstow Road and the major interior streets, which carry runoff to the Domingo Baca. Unrestricted runoff would have pushed the capacity of these streets to the limit. This was

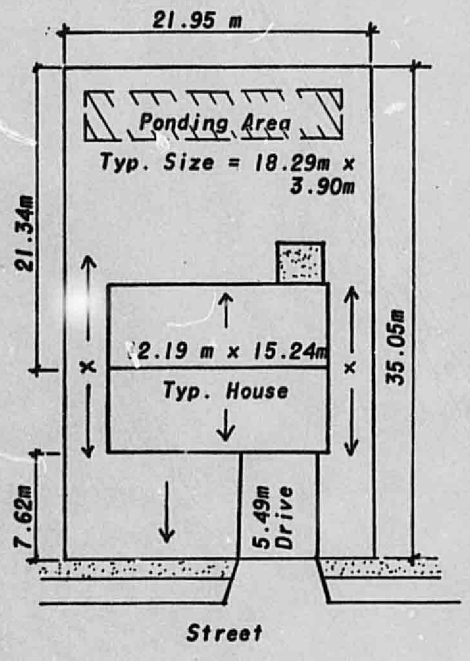
undesirable because of all of the flow direction changes created by the street pattern of Unit 3.

Unit #4 had extensive and moderate backyard ponding depending on where the flows departed the site. Where the runoff flows leave Unit #4 onto San Francisco Street, extensive backyard ponding was used to keep these flow rates as low as possible. Moderate backyard ponding was used in the remaining area of Unit 4 which drained to the Domingo Baca. Hence, backyard ponding was used mainly to serve as an advantage in the site grading. In areas with steep slope from the front to back of the lot, backyard ponding can hold down the fill requirements of the individual lots.

For the individual lot with backyard ponding, the only area within each lot to contribute flow to the streets would be the front yard, one-half of the roof (assuming a pitched roof), and one-half of the side yards. The area required for backyard ponds, 0.5' (0.15 m) deep, averages around 15% of the total area draining to the pond. This area includes the rear one-half of the roof, one-half of the side yards, and all of the rear yard. The following sketch shows these relationships.

Rear Yard Pond Calculations

Typical Lot Size = 21.95 m x 35.05 m



Area Draining to Rear Yard =

21.95 m x 21.34 m = 468.33 m^2

Roof Area = 6.10 m x 15.24 m

= 92.96 m^2

Patio (typ) = $(3.05)^2$ = 9.29 m^2

Composite "C"

$0.9\ (\frac{102.19}{468.33}) = 0.20$

$0.2\ (\frac{366.04}{468.33}) = \underline{0.16}$

0.36

Volume of Runoff*

(Area) (0.0635 m) (c) =

(468.33 m) (0.0635 m) (0.36) = 10.71 m^3

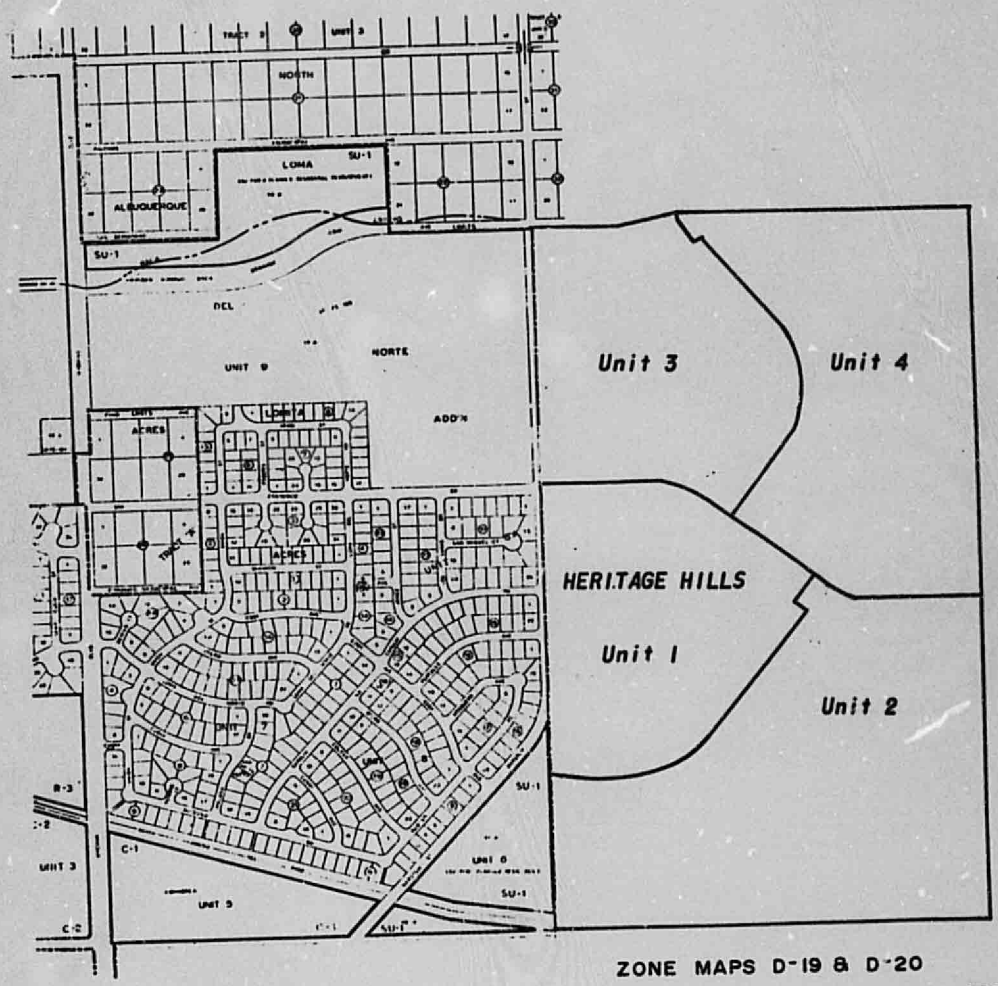
at 0.15 in depth in Pond Surface,

Area Required = 71.37 m^2

Typical Pond Size = 18.29 m x 3.90 m

% of Area = $\frac{71.37}{468.33}$ = 0.15%

* Precipitation for 100 Year - 6 Hr. Storm = 0.0635 m.



N

T11N, R4E

Section 20

ZONE MAPS D-19 & D-20

FIGURE I

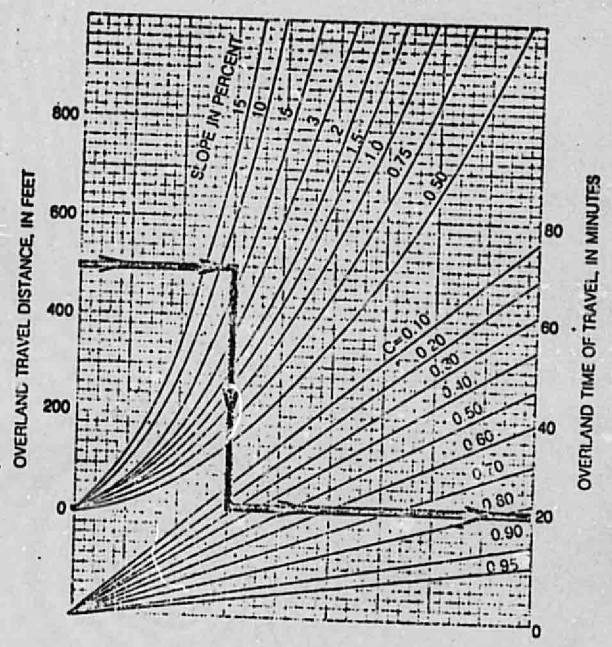
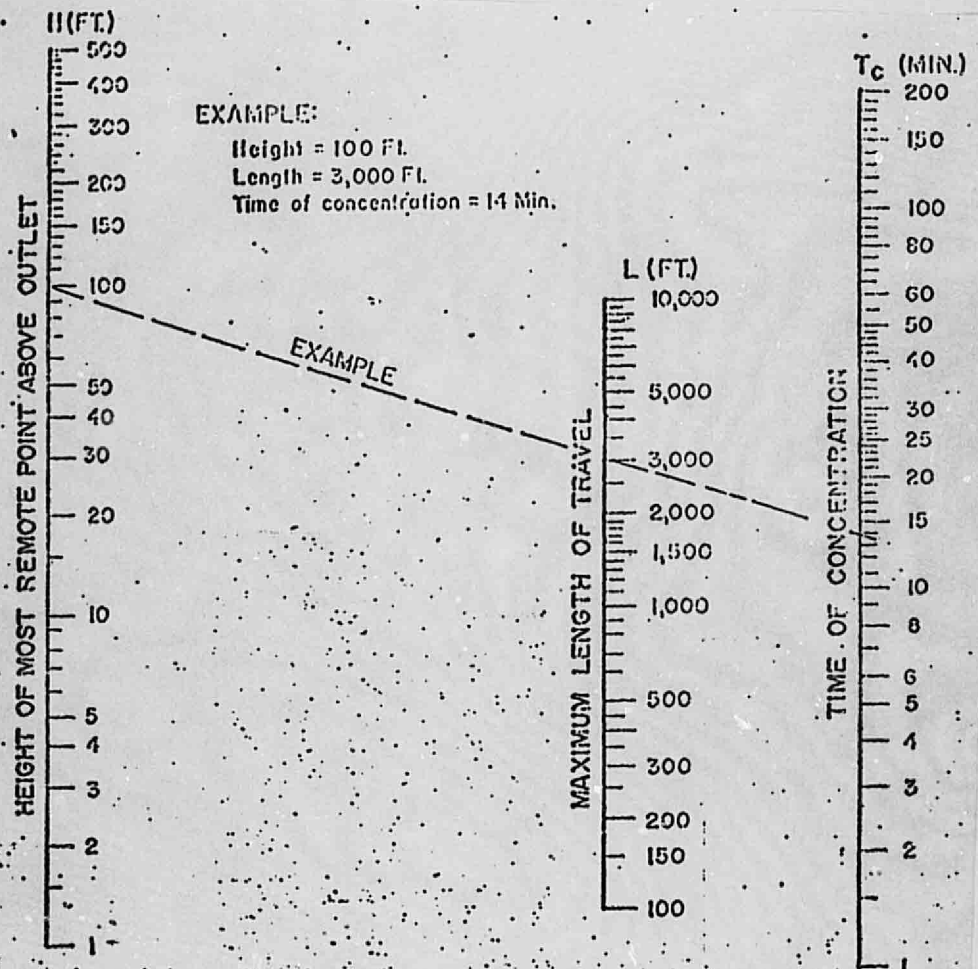


Figure 2
Relation of overland time of travel to overland travel distance, average overland slope, and coefficient C —for use in Rational Method.

Source:
Wright-McLaughlin Engineers/
"Airport Drainage,"
Federal Aviation Administration
Washington, DC 1965.

FIGURE II

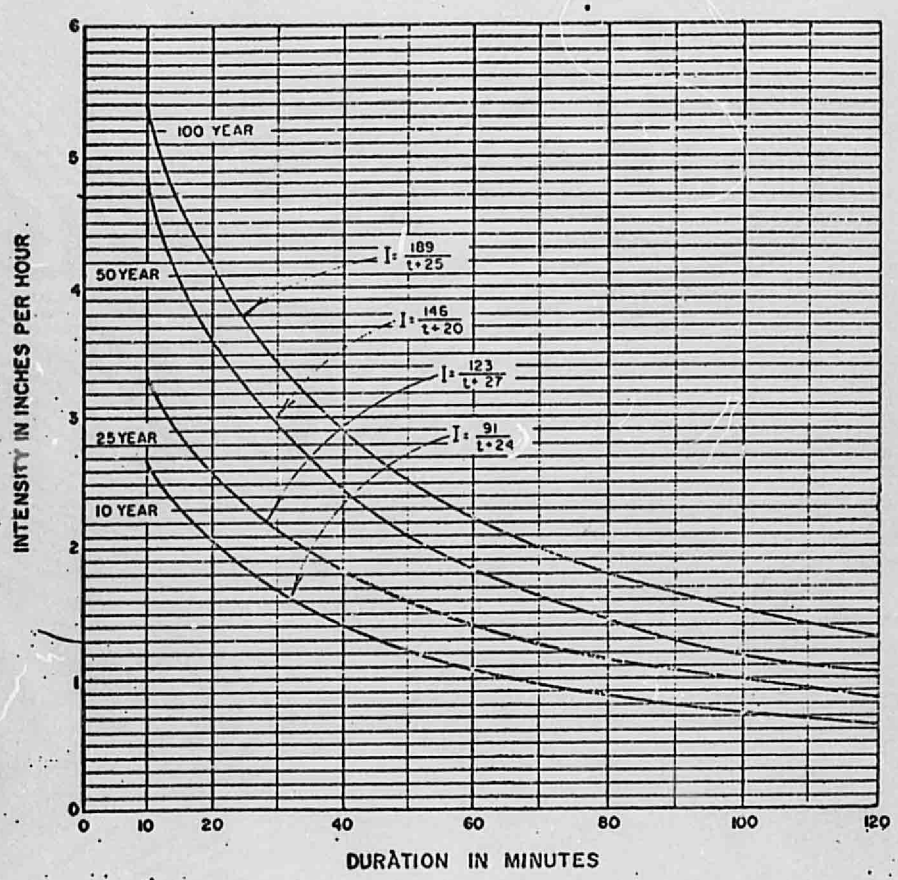


Based on study by P. Z. Kirpich,
Civil Engineering, Vol. 10, No. 6, June 1940, p. 332

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

Reprinted from "Design of Roadside Drainage Channels - Hydraulic Engineering Circular No. 6", April 1962, U. S. Dept.

FIGURE III



MASTER PLAN OF DRAINAGE
CITY OF ALBUQUERQUE - NEW MEXICO
AND ENVIRONS

INTENSITY DURATION
FREQUENCY CURVES

(ALBUQUERQUE AREA - 1961)

FIGURE IV

ADDENDUM NO. 1

DRAINAGE STUDY FOR

HERITAGE HILLS, UNITS 2, 3, and 4

May 10, 1977

This addendum is in reference to a meeting on May 9, 1977, held at the AMAFCA Office. Representatives from the City, AMAFCA, Bellamah Corporation and our office were present.

A summary of the conclusions arrived at, and agreed upon by all present, are as follows: Heritage Hills Units 2, 3, and 4, have been well designed in that the primary consideration was drainage. The direct effect of this layout is to reduce the offsite flow burden on Barstow Road and the subdivisions to the west. It was generally agreed that this same pattern of reduction of flows will continue as the area east of Heritage Hills develops. At present rate of expansion, the area east of Ventura could be developed in 3 to 4 years. Therefore, it was recognized that the flow rates shown intercepting Ventura Road represent a temporary 100 year storm runoff rate. Subsequently, it was agreed to route these temporary, potential flows through the respective subdivisions for direct discharge into either the North Arroyo del Pino, or the Domingo Baca Arroyo.

In more detail, the following requirements were agreed to by the developer. Bunker Hill Road, which intercepts the largest of all the offsite flows, will be a standard 32' FF asphalt street section with 1/2 crown (2"); the sidewalks adjacent to this street will be constructed against the curb to prevent scouring from the overflow. The City Ordinance allows for a 0.2' overflow in the design capacity of streets. This particular street will overflow 0.13' at a 1% minimum

grade for a design Q of 140 cfs. The sidewalk X-slope will account for 0.06' elevation difference, with the remaining 0.07' being taken up by 3-1/2' of parkway. The velocity of the flow in the street at the 1% slope will be 6'/sec. The velocity of the flow in the parkway would be minimal.

All of the remaining streets which intercept offsite flows have the capacity to handle these flows with no overflow of the curb.

The last point raised concerned the sediment deposits on the roadways, and the maintenance problems which occur. It was agreed that large flows will carry their deposits to the points of outfall, as shown by the velocity in the above situation. Smaller storms will not have these velocities, and thus sediment deposits on the streets will occur. To offset this probelm until development to the east of Ventura Road occurs, Bellamah agreed to the conditions set forth by the City. Bellamah will construct temporary sediment ponds at the outflow point of each offsite drainage area. These ponds will be confined to the limit of the unpaved east-half of the Ventura Right-of-Way. A typical section of each basin would be 30' wide x 100' long x 3' deep, with 2:1 s:s. Because Ventura Road is designed with a median, a cut in the median and curb should correspond to each overflow point. We recommend a cut-off wall to protect the lip of the asphalt adjacent to the downstream edge of each stilling basin overflow area. Because of the possibility of someone driving into one of the stilling basins, it is also recommended that 4" x 4" barricade posts be installed at 5'-0" centers, with reflectors along the median cut.

The Bellamah Corporation has also agreed to maintain these sediment basins until the east half of Ventura Road is paved. A copy of this agreement accompanies this Addendum.

This completes changes covered by Addendum No. 1.

PLAN/PLATS

ON

FILE