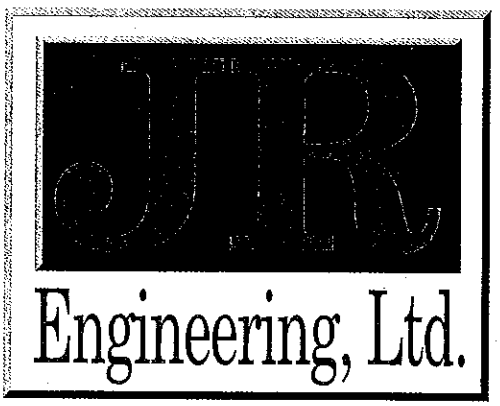
MASTER DEVELOPMENT DRAINAGE PLAN
FOR
UNIVERSITY PARK



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MASTER DEVELOPMENT DRAINAGE PLAN
FOR
UNIVERSITY PARK

November 1995

Prepared For:

ELITE PROPERTIES OF AMERICA
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DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

COLORADO REGISTERED KYLE R. CAMPBELL 29794 PROFESSIONAL ENGINEER

Kyle R. Campbell, Colorado P.E. #29794 — Date: 7/25/96
For and On Behalf of JR Engineering, Ltd.

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Elite Properties of America, Inc.

By: _____

Title: Vice Pres

Address: 888 Garden of the Gods Road, Suite 200

Colorado Springs, CO 80907

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

_____ — August 21, 1996
City Engineer — Date

Conditions:

Recycled

MASTER DEVELOPMENT DRAINAGE PLAN FOR UNIVERSITY PARK

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APPENDICES

MASTER DEVELOPMENT DRAINAGE PLAN FOR UNIVERSITY PARK

PURPOSE

This document is the Master Development Drainage Plan for University Park (formerly known as the northerly parcel of the Houck Estate). The purpose of this report is to identify major drainageways, culvert, storm sewer, and inlet locations, and areas tributary to this site. This report will analyze overall routing for developed flows based upon the conceptual master plan currently being reviewed and recommend outfall locations to transfer these flows to their respective discharge points. This report does not attempt to size or locate the minor storm facility system due to the unknown nature of the ultimate land use and street configuration.

GENERAL DESCRIPTION

University Park is located in a portion of Sections 17, 20, 21, and 28, Township 13 South, Range 66 West of the Sixth Principal Meridian in the City of Colorado Springs, County of El Paso. The site is bounded by land with various types of land uses. These uses include: Park area, unplatted land, single family residential and multi-family housing. More specifically, University Park is bounded to the north by The Valley at Erindale and Erindale Heights Filing No. 9, which are both existing single family residential subdivisions. To the east by the Berkshire Plaza Subdivision, a multi-family subdivision, Alamo Subdivision and Triple J Subdivision Filing No. 2 which are both commercial uses and Garden Ranch Estates, a single family residential area that borders the majority of the east side of this project. To the south there is unplatted land along with several multi-family subdivisions including Union Bluffs Filing No. 5 Phases 2, 3, 4, 5 & 6, and Campus Commons Filing No. 1. To the west, University Park is bordered by unplatted land, with the northerly portion bordering Pulpit Rock Park.

The entire site currently being submitted for master plan approval is approximately 675 acres (including the previously platted Triple J Subdivision). The site is currently zoned "R" single-family estate residential and will be rezoned in the future to the appropriate zone classification per the approved master plan. The proposed use is for a mix of single family residential, multi-family residential, and mixed use commercial with a school and park sites.

The average soil condition reflects Hydrologic Group "A" (Blakeland Loamy Sand), Group "B" (Bresser Sandy Loam, Blendon Sandy Loam, and Truckton Sandy Loam) and "D" (Travessilla Rock Outcrop Complex) as determined by the "Soil Survey of El Paso County Area," prepared by S.C.S. (see map in Appendix). The majority of the site (approx. 90%) is classified as the Travessilla Rock Outcrop Complex which is evident from the natural rock formations contained on the site. Two relatively small pockets of Group "B" soils exist in the very northeast and southeast portions of the project. Hydrologic Group "D" was assumed for calculations in this report.

Several utilities currently are located on the site. Overhead electric lines run predominantly in the center and most southerly portion of the project and several city water transmission and distribution mainlines run east-west through the tank site at the southerly boundary and northerly to Anglo Drive.

EXISTING DRAINAGE CONDITIONS

University Park is located within the Templeton Gap and Pulpit Rock Drainage Basins. The majority of the site (approximately 606 acres) is located within the Templeton Gap Drainage Basin which encompasses the southern portion of the project. This area was studied in the "Engineering Study and Revision of the North Shook's Run - Templeton Gap Drainage Basin" by Lincoln-Devore in 1977. The Templeton Gap Drainage Basin Planning Study generally notes various major outfall locations to the southeast and west and was based upon the land uses as detailed on the original Houck Estate Master Plan.

The remaining 69 acres along the northerly portion of the project was previously studied in the "Engineering Study of Pulpit Rock Drainage Basin System" by R. Keith Hooks and Associates, in 1968. The developed flows from this drainage basin outfall into Pulpit Rock Park.

The majority of the existing flows generated by this site travel in a westerly direction towards Nevada Avenue and the ultimate discharge into Fountain Creek. For discussion purposes, this report will start at the southerly boundary and discuss existing drainage conditions along the perimeter of the site in a counter-clockwise direction.

Existing flows from the water tank area and adjacent bluffs travel south to an existing rip-rap and 42-inch C.M.P. storm system located just northeast of the existing Palm Drive cul-de-sac. These storm facilities were analyzed in the "Final Drainage Report and Plan for Campus Commons No. 1", by JR Engineering, Ltd., October 1993. The storm system, per the JR report, accepts Q_5 = 78 cfs and Q_{100} = 135 cfs. The facilities that were recommended in this area per the DBPS (Basin E-8) are already in place to handle developed flows from the north.

Directly east of the Palm Drive outfall, a natural valley collects flows from the bluffs and directs them south towards an existing 42-inch storm pipe stub that ultimately discharges into the Templeton Gap floodway. The 42-inch storm pipe may be extended to the north depending upon future development per the "Final Drainage Study for Union Bluffs Filing No. 5 and Remainder Damon Drive North Townhomes", by Costin Engineering Co., December 1983. Per the Costin Analysis, approximately Q_5 = 109 cfs and Q_{100} = 192 cfs will ultimately be intercepted by the existing 42-inch pipe. This area was also restudied in the "Final Drainage Report for Campus Commons", by JR Engineering, Ltd., June 1993. This updated analysis reaffirmed the adequacy of the existing 42-inch C.M.P. and outfall system to handle the fully developed flows from the unplatted areas in the existing valley and discharge them into the Templeton Gap Floodway. This area lies within the previously studied DBPS Basin E-7. All outfall facilities as recommended in the DBPS are existing and the only remaining facilities to be installed are the previously mentioned northerly storm extension.

Portions of the existing Garden Ranch Estates drain in a southeasterly direction down Michael Drive and Brown Valley Lane and enter the University Park site. The Garden Ranch area was studied in the "Master Drainage Plan for Garden Ranch Estates", by Karcich and Weber, Inc., August 1972. These flows travel in a natural drainageway to a pair of existing 60-inch R.C.P. pipes that cross under Union Boulevard to the Templeton Gap floodway. Per the Templeton Gap DBPS, approximately Q_5 = 127 cfs and Q_{100} = 330 cfs will travel through the existing crossing at the time of ultimate upstream buildout. Also tributary to this outfall is a large internal area that includes two reservoirs previously used for irrigation purposes. Both reservoirs are currently empty and the outfall structures are in the open position so water will not be detained. This southeasterly portion of the site is contained within Basin E-5 of the DBPS. The DBPS recommended that a storm system be extended northwesterly up the valley to collect developed flows. The existing dual 60-inch storm system is in good condition and capable of handling the proposed developed flows generated by the proposed University Park development.

The ends of Saddle Drive and Montebello Drive West are existing high points in the roadway that keep the majority of existing University Parkway flows from entering the existing Garden Ranch Estates residential area. Currently some overland sheetflows travel in a northeasterly direction into several backyards of the homes between Brown Valley Lane and Montebello Drive West.

The previously platted Triple J Subdivision Filing No. 2 is included as a part of the master plan to facilitate a new major arterial entrance into University Park instead of previously designed Montebello Drive extension. Currently the Triple J site is undeveloped and the natural sheetflows travel southeasterly towards the Academy Boulevard right-of-way in a grass swale. The existing flows ultimately discharge into Academy Boulevard at the Saddle Drive intersection. This area was examined in the "Drainage Report and Plan for Triple J Subdivision Filing No. 2", by Leigh Whitehead and Associates, November 1984.

The existing southwest end of Anglo Drive is a highpoint that divides the Templeton Gap and Pulpit Rock Drainage Basins. This area was studied in the "Berkshire Plaza Subdivision Drainage Report", by H.J. Kraettli & Sons, Inc., August 1980. The Kraettli report examined the approximately 47 acre Berkshire Plaza Subdivision for commercial and high-density residential use. Out of this 47 acres, approximately 21 acres is directed towards an existing 5-year storm system along Saxon Lane that ultimately discharges from an existing 42-inch R.C.P. at the most northeasterly corner of University Park which is the southeast corner of Erindale Heights Filing No. 9. (See Exhibits 'B' and 'C')

Erindale Heights Filing No. 9 is an existing single family hillside development that was analyzed in the "Erindale Heights Filing No. 9 Drainage Report and Plan", by Abbott & Jacobson Engineering Services in 1976. Per the recorded plat and approved drainage report:

> "The Drainage swales adjacent to Lots 16 thru 36 in Block 3, Lots 7 thru 10 in Block 1, and Lots 11 and 12 in block 2 will be kept natural and maintained by the adjacent lot owners."

The existing natural swale runs along the rear lot line of the previously mentioned lots and then ultimately discharges into a 90-inch corrugated steel pipe as a part of the "Valley at Erindale Drainage Report and Plan", by Leigh Whitehead and Associates, December 1985. The ultimate outfall for these concentrated developed flows is at the easterly boundary of Pulpit Rock Park where a rip-rap stilling basin controls the discharge velocities.

The existing constructed outfall storm facilities in Erindale Heights and the Valley at Erindale are in generally good condition. The stilling basin outfall has experienced some rip-rap displacement, but the natural drainage channel past the outfall appears to have experienced little erosion or destablization. The only noticeable area of erosion or disturbance is located at the existing 42-inch R.C.P. outfall for the Berkshire Plaza Subdivision. The storm system constructed as a part of Berkshire Plaza is a public system maintained by the city. The actual outfall was designed to include a rip-rap energy dissipator, but site reconnaissance located no rip-rap at all in the area of the outfall.

For several hundred feet north and west of the outfall severe erosion has undercut side slopes and caused some property damage. Recent meetings with the residents of the affected area produced stories of continual replacements and shoring up of the walls, slopes, and trees. Although its clearly stated on the Erindale Heights plat that the drainage swale maintenance is the responsibility of the individual homeowners, it appears that main contributor to the erosion and flooding problems is the developed flows from the only partially built-out Berkshire Plaza Subdivision.

Per the Berkshire Plaza Drainage Report in regards to the 42-inch R.C.P. outfall:

> "The possible necessity for a detention structure in this area was also studied. It was determined that because of the relatively small amount of additional runoff generated because of this development, such a facility is not required. Additionally, a review of the Erindale No. 9 drainage report indicates that the downstream improvements have the capacity to handle any additional flows that may be generated."

It appears that the addition of only a portion of the developed flows from Berkshire Plaza is having a detrimental impact on the immediate downstream natural channel and that upon development of the remaining lots in the Berkshire Plaza Subdivision, the drainage situation should be reanalyzed to determine how onsite detention would benefit the situation.

The remaining internal flows within the Templeton Gap Drainage Basin head directly west in a natural drainage swale where they ultimately cross under Nevada Avenue and outfall into Fountain Creek. This area was included in Basin H-1, 2, 3, 4, and 5 of the DBPS. A major storm system is recommended to convey developed flows to Fountain Creek that is proposed to run along the extended Montebello Drive. This system was analyzed in more detail in the "Preliminary Drainage Report for Montebello Drive Sanitary Sewer Improvement District", by Drexel Barrell, January 12, 1989. This report recommended private temporary detention be used until a complete outfall system could be constructed.

PROPOSED DRAINAGE CHARACTERISTICS

Due to the hillside zoning designation of this property and the developers intent to preserve a large portion of the site (approximately 42 percent) as open space, the developed flow characteristics will remain relatively unchanged from their existing patterns and outfall locations. The proposed characteristics that follow are in the same order as the descriptions for existing conditions. Two existing reports, "Preliminary Master Drainage Report for the Northerly Parcel of the Houck Estate" and "Preliminary Drainage Report for Montebello Drive Sanitary Sewer Improvement District", by Drexel, Barrell & Co. analyzed this site based upon the previously approved Houck Estate master plan which included an extension of Montebello Drive west to the westerly boundary of the site.

The two major revisions on this project that are reflected on the University Park Master Plan are the overall reduction in density and the introduction of a new east-west road corridor to take the place of Montebello Drive. The new arterial, University Parkway, will tie directly into Academy Boulevard. The main portion of the alignment will be similar to the previous design corridor as it travels to the westerly boundary. The intent of this report is not to establish the exact design or location of storm inlets or facilities, but rather to identify major drainageways, ponding/detention areas, locations of culverts, bridges, open channels, and drainage areas which are tributary to the proposed development.

Basin V (Q_5 = 40 cfs and Q_{100} = 84 cfs) generates flows from the existing water tank facilities and proposed townhome area. The resultant flow is less than that originally anticipated in the Campus Commons No. 1 drainage report of Q_5 = 78 cfs and Q_{100} = 135 cfs. The existing 42-inch C.M.P. outfall system is adequate in size and grade to convey the developed flows to the Templeton Gap Floodway.

Basin W (Q_5 = 44 cfs and Q_{100} = 91 cfs) generates concentrated natural channel flows that travel southerly into the area studied as a part of Union Bluffs Filing No. 5. These flows are below the quantities as described in the previously mentioned drainage report. This same basin was also analyzed in the Final Drainage Report for Campus Commons that also resulted in the confirmation that the existing outfall facilities are adequate to handle all developed flows. An existing 42-inch

R.C.P. at the northerly right-of-way line of Damon Drive currently intercepts a majority of the undeveloped flows. This pipe is proposed to be extended to the north or an improved channel to collect flows from the townhome area proposed on the University Park Master Plan. Final storm system determination will be made based upon site layout and future road alignments. The only developed flows from University Park are those unconcentrated flows from proposed rear yard single-family homes. Therefore, the only system required will be what is needed at the valley floor.

Basin Z (Q_5 = 4 cfs and Q_{100} = 9 cfs) generates unconcentrated sheet flows that travel south into the Union Bluffs Filing No. 5 Development. No development is proposed for this basin and the "Final Drainage Study Union Bluffs Filing No. 5 and Remainder Damon Drive North Townhomes" included this area in the analysis of the townhome site.

Basin Y (Q_5 = 9 cfs and Q_{100} = 20 cfs) generates unconcentrated sheet flow from a small portion of proposed single-family residential and undevelopable hillside. These flows travel southeasterly where a portion enters Union Boulevard and the remainder follows a natural swale to an existing rip-rap channel that runs parallel to Union Boulevard. The flow is then intercepted into an existing 9.5- foot x 4-foot (9.5' x 4') Type "D" grated inlet that ultimately discharges into the Templeton Gap Floodway. This existing system was examined in the "Final Drainage Report for Union Bluffs Filing No. 5, Phase 8", by JR Engineering, Ltd., November 1993.

The existing upper reservoir in Basin S will be filled in as a part of the development of the mixed use commercial/residential site. As previously stated, the two reservoirs were initially used for private irrigation water storage and have no detention capabilities since the outfall gates are open. The drainage basins in the southeast corner of the project have been slightly expanded from their existing basin limits (see Basins R, S, T, U, and V for proposed basins). This increase in basin size is to reduce the amount of developed flows being discharged westerly down the existing bluffs. By diverting those flows east, it will be possible to take advantage of the existing lower reservoir as a private detention facility. The existing reservoir is very large and can easily restrict flows from basins R and S to reduced levels. The reduced discharge will then join with the remaining basins in a storm

system that discharges at the existing dual 60-inch R.C.P. crossing under Union Boulevard. The quantity of flows detained is based upon restricting the total flow at the existing dual 60-inch R.C.P.s to a quantity at or below that calculated in the DBPS. The total flow with detention is very similar to the quantities calculated in the Templeton Gap DBPS. Without detention, the Basin R outfall could not be diverted to the east since the total non-detained flows would exceed the design capacity of the dual 60-inch R.C.P. pipes under Union Boulevard. The proposed pond will require 5.6 acre-feet for a 100-year event and 3.2 acre-feet for a 5-year event (see Appendix for calculations). The private detention pond will be used for storage and conveyance of public water and a private maintenance agreement will be obtained prior to construction.

The utilization of the existing lower reservoir is beneficial in several aspects. A larger area is being diverted away from existing westerly bluffs in a piped system, therefore, minimizing the drainage outfall impacts on the westerly bluffs. The use of the lower reservoir as a detention facility also takes advantage of the existing natural features resulting in a discharge storm system that outfalls directly into the Templeton Gap floodway. The proposed storm system that discharges into the dual 60-inch R.C.P. system will be a 48-inch or 54-inch R.C.P. dependent upon the final street grades and will be designed to carry both 5-year and 100-year flows.

Basin T contains a proposed school and park site that currently drain towards existing rearyards of Garden Ranch Estates. At the time of development, consideration must be taken to not allow any increase from historic flows to negatively impact the existing homes. This can be accomplished by diversion swales or on-site detention.

The Triple J Subdivision is proposed to be an office/commercial use. The state has already expressed their concerns regarding not allowing developed flows to enter Academy Boulevard since there are no storm collection facilities available (see Appendix for drainage letter sent to State Department of Transportation.) The University Parkway extension to Academy is beneficial in helping to divert future developed flows from the proposed commercial/office site directly north of the proposed roadway. These flows will be collected in on-site and off-site inlets that direct the flows westerly in a proposed storm system. The only area remaining that is tributary to the existing grass swale on the

westerly side of Academy Blvd. is the proposed office/commercial site directly south of the roadway. On-site detention is proposed to restrict the total discharge into this grass swale to historic levels.

Basin P (Q_5 = 42 cfs and Q_{100} = 92 cfs) generates flows along the easterly boundary directly adjacent to Picket Drive. At the time of final design, no developed flows will be allowed to enter any of the existing rear yards along the easterly boundary. The majority of the flows from this basin travel westerly towards the proposed alignment of University Parkway where Basins K (Q_5 = 54 cfs and Q_{100} = 113 cfs), L (Q_5 = 54 cfs and Q_{100} = 107 cfs), M (Q_5 = 40 cfs and Q_{100} = 81 cfs) and O (Q_5 = 56 cfs and Q_{100} = 115 cfs) are proposed to be intercepted by a 100-year storm system that will run along with University Parkway. Various smaller storm systems will tie into the main University Parkway trunkline to generate a total developed flow at the easterly edge of the research and development parcel of Q_5 = 229 cfs and Q_{100} = 475 cfs. As the developed flows continue westerly, Basins J (Q_5 = 60 cfs and Q_{100} = 122 cfs) and N (Q_5 = 115 cfs and Q_{100} = 231 cfs) are added to the system for a resultant developed flow at the westerly University Park boundary of Q_5 = 393 cfs and Q_{100} = 805 cfs. The ultimate discharge for the developed flows generated by this site is into Fountain Creek. The Templeton Gap DBPS projected a Q_{100} of 1025 cfs at this point and the "Preliminary Drainage Report for Montebello Drive Sanitary Sewer Improvement District" calculated a Q_{100} of 1611 cfs based upon the old Master Plan. By creating more open space reducing the densities, and diverting a portion of the westerly tributary flows to the proposed privately maintained southeast detention pond, a proposed 84-inch R.C.P. could carry the projected developed flows of Q_{100} = 805 cfs to the westerly boundary. The DBPS and subsequent drainage studies recommended various outfall solutions to Fountain Creek including a open concrete lined channel, box culvert, and pipe system. Based upon the reduction in developed flows in the westerly direction, a pipe system appears to be the most feasible from a cost and aesthetic standpoint. At the time of final design, these various options will be analyzed to determine the most reasonable alternative.

Since an outfall storm system to Fountain Creek is not in place at this time, and no existing easements exist beyond the westerly boundary, a permanent public detention facility is proposed inside the research and development parcel. This pond would overdetain by approximately 10% of historic values and be constructed at the same time as development in contributing basins occurs. The

detention facility construction may take place in phases as upstream filings are processed and constructed. Nuisance flows generated from future upstream development will be examined in order to try to minimize the erosive effects the flows may have on downstream properties. The proposed public pond will be privately maintained until such time that the complete storm system is installed to the pond. At that time, the pond will be maintained by the City. Consideration will also be given to the ponds location with respect to the ultimate University Parkway alignment.

Basin Q (Q_5 = 68 cfs and Q_{100} = 143 cfs) consists of a large, predominately undevelopable, Basin (66.3 acres). Approximately 7.5 acres of the westerly portion of this basin is master planned for attached single family residential and the northeast corner of the basin is 3.5 acres of low density single family residential. Actual development of this basin will be hindered by the lack of access at this time. The DBPS recommends a storm outfall system that originates in this basin and outfalls directly into Fountain Creek. If access is acquired prior to the outfall storm facilities being constructed, developed flows from the attached single-family area will be restricted to historic levels. The impact of the 3.5 acres large single family lots is negligible for this basin. It is proposed to give this property to UCCS. If this gift occurs, the use of this property would probably remain unchanged form existing uses other than the small single family residential area.

PROPOSED NORTHERLY DRAINAGE CHARACTERISTICS

As previously mentioned in the Existing Conditions section of this report, the developed flows being discharged from the Berkshire Plaza Subdivision appear to be having a negative impact upon the natural privately maintained drainage swale in Erindale Heights Filing No. 9. Conversations with many adjacent property owners and the City of Colorado Springs have indicated a continual erosion problem in the area from the existing 42-inch R.C.P. public system outfall to the pipe entrance at the intersection of Spurwood Court and Vickers Drive (See Northerly Drainage Letter (Spurwood Court) from City of Colorado Springs in Appendix). Numerous examinations of this drainage corridor confirmed the accounts of sediment transfer and scouring. The existing situation is made worse when it is taken into account that only approximately 2/3 of the developed flows from Berkshire Plaza are present at the 42-inch R.C.P. outfall. Due to portions of the site being platted

but undeveloped, the following analysis details the existing flows present today and what the implications of full development may be.

An existing 5-year storm system installed as a part of the construction of Saxon Lane and Wales Drive (Berkshire Plaza) intercepts existing flows from Basin E-13 (Q_5 = 37 cfs and Q_{100} = 76 cfs) and Basin E-12 (Q_5 = 8 cfs and Q_{100} = 17 cfs). These flows travel as pipe and overland flow to the existing 42-inch R.C.P. outfall where Basin E-11 (Q_5 = 19 cfs and Q_{100} = 40 cfs) is added for a resultant existing flow of Q_5 = 51 cfs and Q_{100} = 101 cfs. Currently, a portion of the Basin E-13 100-year flows enter Bavaria Drive of the northerly apartment complex. Upon development of the vacant multi-family site no 100-year developed flows will be allowed to enter Bavaria Drive in order to direct the 100-year basin flows to their respective outfall points as approved in the Berkshire Plaza Drainage Report. The existing flows now reaching the natural swale appear to create erosion problems. With the additional development of the now vacant 14.7 acre multi-family site, additional erosion potential may be realized. In order to alleviate the northerly neighborhoods concern regarding possible increases in developed flows with the University Park development and Berkshire Plaza, a detention pond is proposed for the most northeasterly corner of the site. The use of a detention facility will benefit the existing northerly subdivisions in several ways. One, it is proposed to over detain developed flows (including ultimate buildout of Berkshire Townhomes) in the detention facility to a level 20% less than existing conditions. This will not only keep any additional developed flows from entering the sensitive natural swale area, but it will actually reduce the quantity of discharge to a level less than currently experienced. Secondly, it will allow for the diversion of a portion of the University Park developed flows into the proposed pond. This diversion will be discussed in greater detail in the next few paragraphs, but generally, it will allow the restriction of developed flows to existing or less than existing quantities. Thirdly, the proposed upstream detention will decrease the amount of developed flows tributary to the 90-inch C.S.P. storm outfall at Pulpit Rock Park to a quantity well below what was originally anticipated. Total developed flows that are directed to the proposed pond are Q_5 = 100 cfs and Q_{100} = 204 cfs. A 20 percent decrease in existing flows (Q_5 = 51 cfs and Q_{100} = 101 cfs) would result in an allowable discharge of Q_5 = 40 cfs and Q_{100} = 80 cfs (40% of fully developed flows). The required detention pond size would then be 1.2 acre feet for a 5-year and 2.6 acre-feet for a 100-year event (See attached calculations).

The majority of the developed flows tributary to the proposed pond are delivered through the existing public storm facilities located in the Berkshire Plaza Subdivision. It is, therefore, proposed to define the detention pond inlet, outlet, pipe and structures as public facilities to be maintained by the City of Colorado Springs. All surface maintenance of the detention facility (ie. mowing, weed control, debris cleanup, etc.) would be performed by the same development mechanism handling landscape maintenance. The proposed pond would be located on a portion of the University Park property and on a portion of the Berkshire Plaza Subdivision. Conversations with the adjacent property owners have been initiated and will be resolved prior to final drainage report preparation and approval. All downstream natural privately maintained channel will remain the responsibility of the individual lot owner.

Currently, Basins E-2 (Q_5 = 2 cfs and Q_{100} = 5 cfs), E-4 (Q_5 = 1 cfs and Q_{100} = 3 cfs), E-6 (Q_5 = 1 cfs and Q_{100} = 3 cfs), E-8 (Q_5 = 1 cfs and Q_{100} = 2 cfs), and Basin E-10 (Q_5 = 1 cfs and Q_{100} = 2 cfs) are unconcentrated sheet flows that travel northerly into Erindale Heights and the Valley at Erindale. With the proposed detention facility diversion and development as proposed on the Master Plan, the following flow quantities are realized:

Existing Basin	**Existing Flows**		**Proposed Basin**	**Proposed Flows**	
	5-Year	**100-Year**		**5-Year**	**100-Year**
E-2	2	5	P-2	2	5
E-4	1	3	P-4	1	2
E-6	1	3	P-6	1	3
E-8	1	2	P-8	1	2
E-10	1	2	P-10	1	3

The above proposed flows are relatively unchanged from the existing flows due to the decrease in the tributary areas due to the proposed detention facility diversion and the large amounts of open space proposed along the northerly boundary.

Existing flows from Basins E-1 (Q_5 = 14 cfs and Q_{100} = 30 cfs), E-3 (Q_5 = 18 cfs and Q_{100} = 39 cfs), E-5 (Q_5 = 7 cfs and Q_{100} = 14 cfs), E-7 (Q_5 = 4 cfs and Q_{100} = 8 cfs), and E-9 (Q_5 = 7 cfs and Q_{100} = 15 cfs), travel partially as unconcentrated sheet flow to the north where natural swales eventually carry the flows to existing facilities in Vickers Drive and Spurwood Drive. Once again, after development of the upstream basins and diversion of flows to the proposed detention facility, the following flow comparison is realized:

Existing Basin	**Existing Flows**		**Proposed Basin**	**Proposed Flows**	
	5-Year	**100-Year**		**5-Year**	**100-Year**
E-1	14	30	P-1	13	29
E-3	18	39	P-3	18	40
E-5	7	14	P-5	5	11
E-7	4	8	P-7	2	4
E-9	7	15	P-9	1	3

Due to the large open space areas, low densities, and detention facility diversion, the developed flows are approximately equal to or less than the existing flows currently traveling north. For example, the existing 24-inch C.M.P. crossing Vickers Drive was designed to accept Q_{100} developed flows of 34 cfs. The total developed flows proposed for this basin is only Q_{100} = 4 cfs. The existing 36-inch R.C.P. stub in Canyon Springs Place was designed to accept Q_{100} flows of 76 cfs from the area to the north per the Valley at Erindale Drainage Report. Proposed developed flows upon total build-out are approximately half of the original design flow anticipated and approximately equal to the existing flows realized at the current entrance.

Although the developed flows discharging to the north are approximately equal to or less than existing flows, great care will still need to be taken to protect existing outfalls from construction erosion and sediment transfer. At the time of final design each outfall will be re-examined again to ensure proper discharge of flows to their respective outfall locations. Erosion measures may include rip-rap at potential existing storm facility entrance locations and the possible use of check structures.

The design of the on-site street system will be critical in the transference and discharge of flows.

Per the "Valley at Erindale Drainage Plan", the projected 100-year discharge at the Pulpit Rock Outfall was 735 cfs. By examining the developed and existing basins tributary to this outfall, it was determined that the existing flows reaching the outfall are only approximately 660 cfs. This reduction is due to the undeveloped condition of the northerly University Park area and the undeveloped high density Berkshire Plaza Subdivision. If these areas were developed the outfall at Pulpit Rock Park would be close to the projected 735 cfs. With the proposed public detention proposed as a part of the University Park development, the total 100-year flow reaching Pulpit Rock Park will decrease to 640 cfs, a reduction of 3 percent from existing conditions. With the construction of the northerly portion of University Park and Berkshire Plaza, the majority of the basins tributary to the Pulpit Rock outfall will be constructed. The use of the proposed detention pond will result in a net decrease in anticipated developed flows by approximately 100 cfs or 13 percent.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence interval. All facilities calculated in this report are designed to accept both 5-year and 100-year flows.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by Flood Insurance Rate Map Community Panel Numbers 080060-0162B, effective December 18, 1986 and 08860-0164C, effective March 2, 1989. See the Appendix for a Floodplain Information Map which shows the location of the site of University Park.

DRAINAGE FEES (Pulpit Rock Drainage Basin)

Entire Site

A.	Drainage Fees		
	69 Acres x $2,989.00/Acre	=	$ 206,241.00
	(Sub-total Pulpit Rock)	=	**$206,241.00**

DRAINAGE AND BRIDGE FEES (Templeton Gap Drainage Basin)

Entire site (excluding Triple J Subdivision)

A.	Drainage Fees		
	606 Acres x $3,084.00/Acre	=	$1,868,904.00
B.	Bridge Fees		
	606 Acres x $34.00/Acre	=	$ 20,604.00
	(Sub-total Templeton Gap)	=	**$1,889,508.00**
	TOTAL	=	**$ 2,095,749.00**

SUMMARY

Based upon the preliminary analysis of the overall University Park master plan area, it appears that the developed flows generated by this site can be handled with the facilities as detailed in the Templeton Gap DBPS and as outlined within this report. The developed basin configuration as defined in the DBPS remain generally intact in this new analysis. Upon final drainage analysis of this site, extreme detail must be taken to direct flows to proper collection facilities and to minimize this development's impact upon the adjacent existing subdivisions. This should include keeping discharge

velocities to non-erosive levels and meeting current city street capacity criteria. Due to the schematic nature of this analysis, the facilities recommended in this master development drainage plan are only approximations and are subject to revisions upon final drainage analysis. At the time of Development Plan and Final Plat submittal, a Preliminary and/or Final Drainage Report will be submitted that details all required storm facilities and outfalls.

Based upon the analysis in this report, the northerly portion of the development will remain relatively unchanged from existing conditions experienced today. The proposed detention pond will restrict outfall flows to levels equal to or less than existing conditions. This results in net decreases of developed flows at the Pulpit Rock outfall.

PREPARED BY:

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Designer
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REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual, dated November, 1991.

2. Soils Survey of El Paso County Area, Colorado Soil Conservation Service.

3. "Engineering Study and Revision of the North Shook's Run-Templeton Gap Drainage Basin", Lincoln DeVore, September 1977.

4. "Engineering Study of Pulpit Rock Drainage Basin System", R. Keith Hooks & Associates, Inc., March 1968.

5. "Erindale Heights Filing No. 9 Drainage Plan", Abbott and Jacobson Engineering Services, Inc. July, 1980.

6. "Drainage Report for Berkshire Plaza Subdivision", H.J. Kraettli & Sons, Inc., July 1980.

7. "Drainage Report and Plan The Valley at Erindale", Leigh Whitehead & Associates, November 1985.

8. "Drainage Report and Plan Triple-J Subdivision Filing No. 2", Leigh Whitehead & Associates, November 1984.

9. Master Drainage Plan for Garden Ranch Estates", Karcich & Weber, Inc., August 1972.

10. "Final Drainage Study Union Bluffs Filing No. 5 and Remainder Damon Drive North Townhomes", Costin Engineering Company, December 1983.

11. "Final Drainage Report for Campus Commons No. 1, a Replat of Union Bluffs Filing No. 3, Phases 9, 10, and 11", JR Engineering, Ltd., September 1993.

12. "Final Drainage Report for Campus Commons", JR Engineering, Ltd., June 1993.

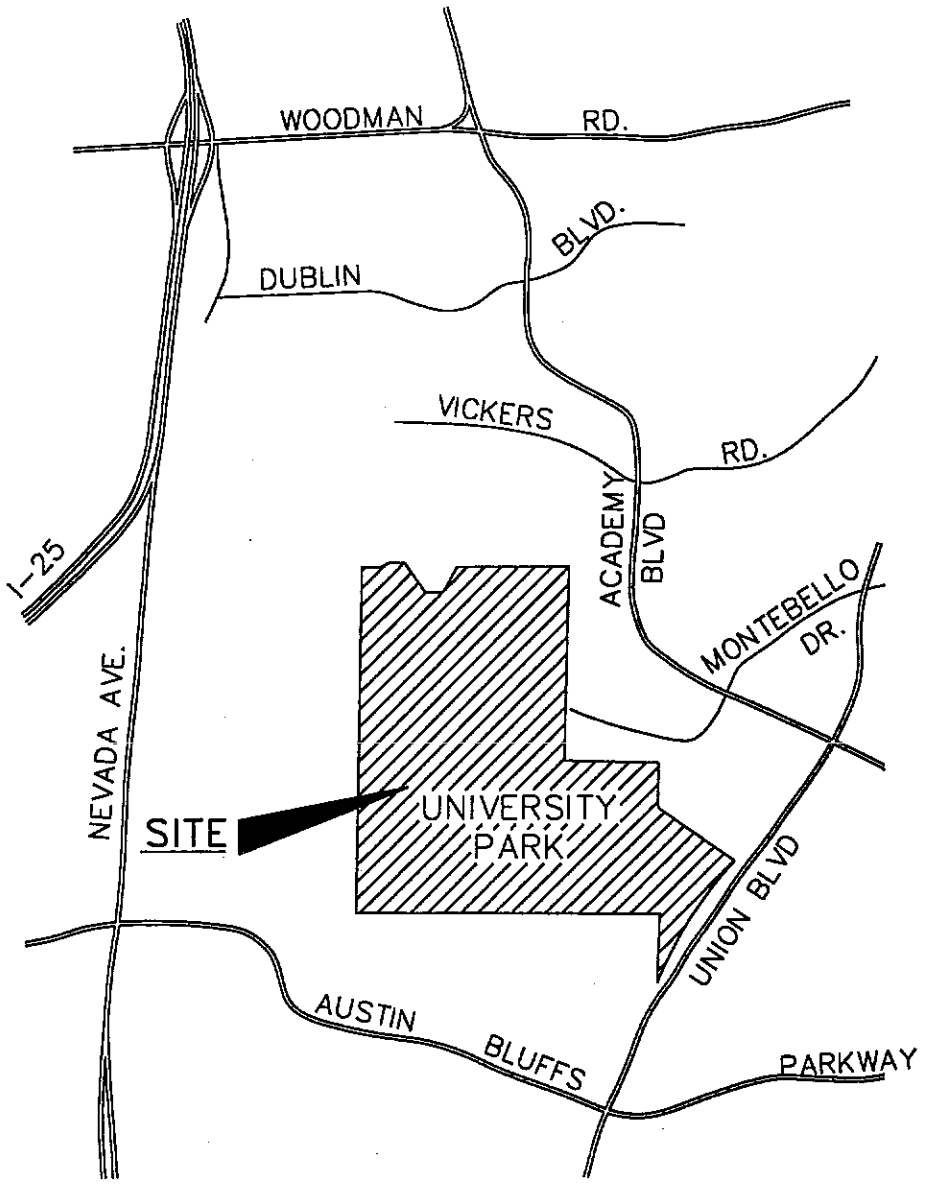
13. "Preliminary Master Drainage Report for the Northerly Parcel of the Houck Estate", Drexel Barrel & Co., October 1983.

14. Preliminary Drainage Report for Montebello Drive Sanitary Sewer Improvement District", Drexel Barrell & Co., January 12, 1989.

15. "Final Drainage Report for Union Bluffs Filing No. 5 - Phase 8", JR Engineering, Ltd., November 1993.

APPENDICES

VICINITY MAP



VICINITY MAP

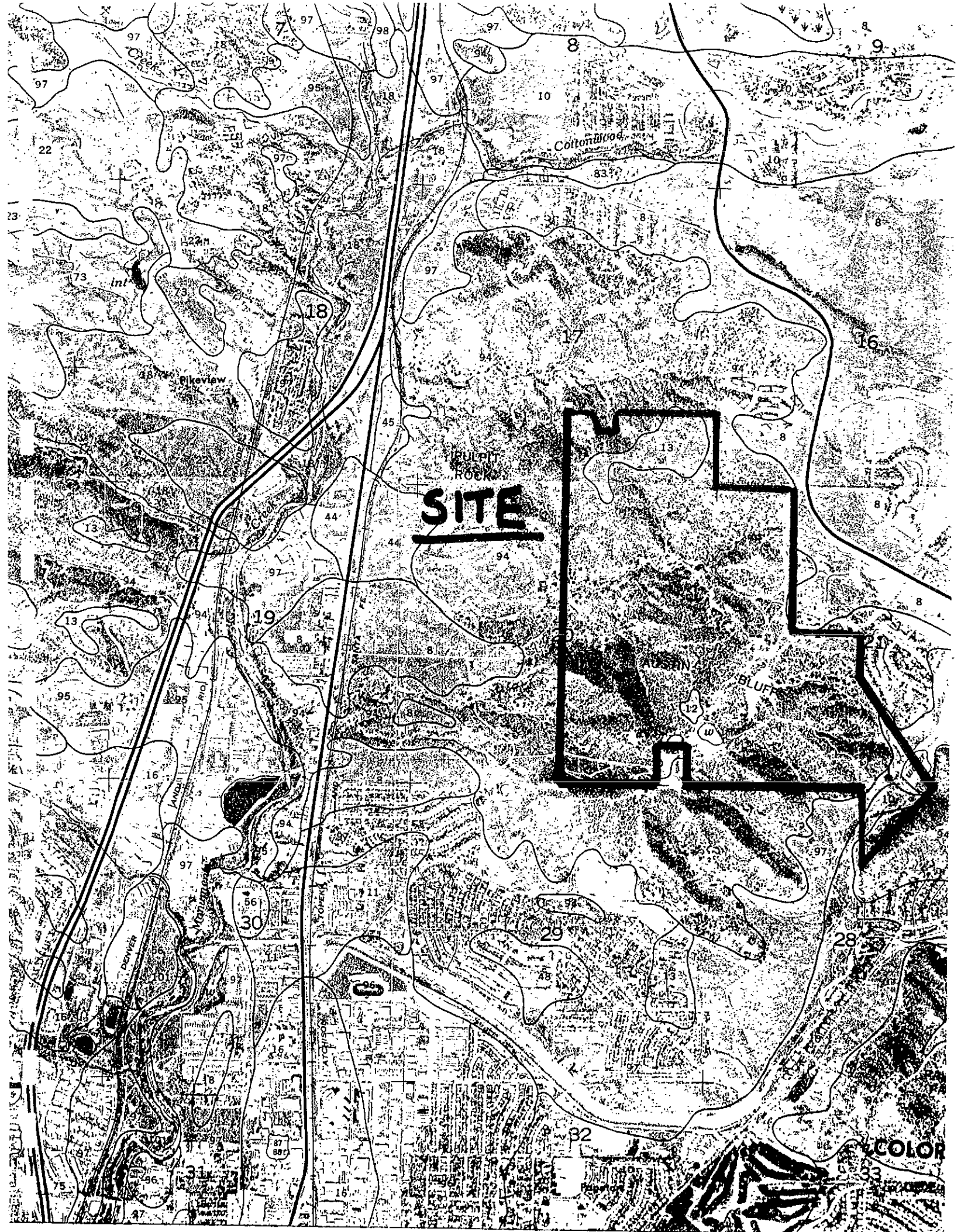
N.T.S.

SOIL MAP (S.C.S. SURVEY)

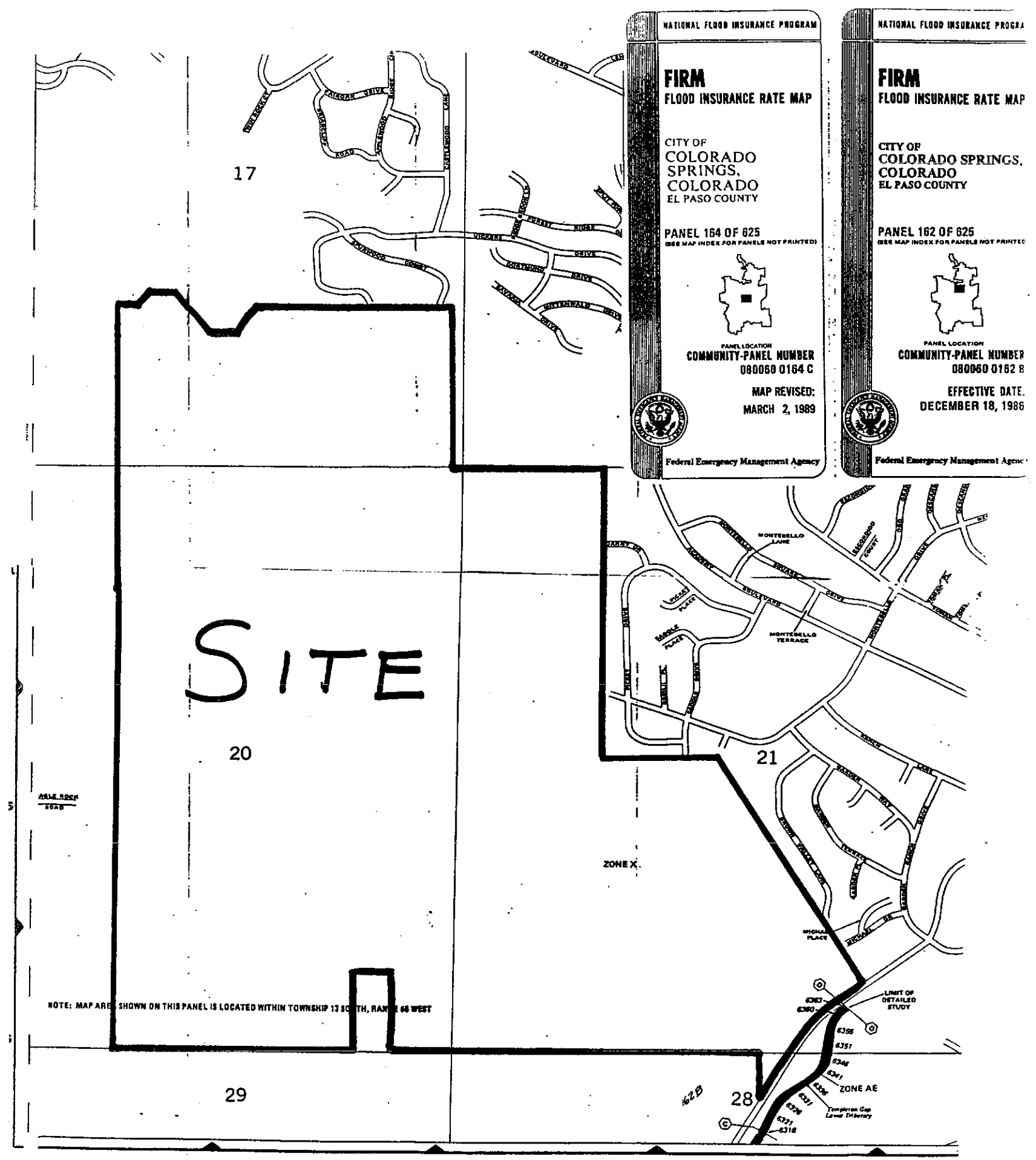
UNIVERSITY PARK

SOIL TYPES

TYPE	HYDROLOGIC NAME	GROUP
94	TRAVESSILLA ROCK OUTCROP COMPLEX	D
12	BRESSER SANDY LOAM	B
13	BRESSER SANDY LOAM	B
10	BLENDON SANDY LOAM	B
97	TRUCKTON SANDY LOAM	B
8	BLAKELAND LOAMY SAND	A


SITE
PULPIT ROCK
Pikeview
Cottonwood
AUSTIN BLUFFS
COLOR

F.E.M.A. MAP


NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
CITY OF
COLORADO
SPRINGS,
COLORADO
EL PASO COUNTY
PANEL 164 OF 625
(SEE MAP INDEX FOR PANELS NOT PRINTED)
PANEL LOCATION
COMMUNITY-PANEL NUMBER
080060 0164 C
MAP REVISED:
MARCH 2, 1989
Federal Emergency Management Agency
NATIONAL FLOOD INSURANCE PROGRA
FIRM
FLOOD INSURANCE RATE MAP
CITY OF
COLORADO SPRINGS,
COLORADO
EL PASO COUNTY
PANEL 162 OF 625
PANEL LOCATION
COMMUNITY-PANEL NUMBER
080060 0162 B
EFFECTIVE DATE:
DECEMBER 18, 1986
Federal Emergency Management Agency
SITE
17
20
21
29
28
ZONE X
ZONE AE
LIMIT OF DETAILED STUDY
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 66 WEST

HYDROLOGIC CALCULATIONS

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING AND PROPOSED NORTHERLY CONDITIONS
(Area Runoff Coefficient Summary)

BASIN	AREA TOTAL (Ac)	STREETS / DEVELOPED AREA (Ac)	C(5)	C(100)	OVERLAND / UNDEVELOPED AREA (Ac)	C(5)	C(100)	WEIGHTED C(5)	WEIGHTED C(100)
E-1	12.4	0.0	-	-	12.4	0.35	0.45	0.35	0.45
E-2	1.8	0.0	-	-	1.8	0.35	0.45	0.35	0.45
E-3	17.5	0.0	-	-	17.5	0.35	0.45	0.35	0.45
E-4	0.9	0.0	-	-	0.9	0.35	0.45	0.35	0.45
E-5	7.0	0.0	-	-	7.0	0.35	0.45	0.35	0.45
E-6	1.1	0.0	-	-	1.1	0.35	0.45	0.35	0.45
E-7	3.8	0.0	-	-	3.8	0.35	0.45	0.35	0.45
E-8	0.6	0.0	-	-	0.6	0.35	0.45	0.35	0.45
E-9	6.4	0.0	-	-	6.4	0.35	0.45	0.35	0.45
E-10	0.8	0.0	-	-	0.8	0.35	0.45	0.35	0.45
E-11	19.4	3.0	0.40	0.55	16.4	0.35	0.45	0.36	0.47
E-12	3.9	2.7	0.65	0.75	1.2	0.35	0.45	0.56	0.66
E-13	16.7	12.7	0.65	0.75	4.0	0.35	0.45	0.58	0.68
P-1	11.6	3.0	0.35	0.45	8.6	0.35	0.45	0.35	0.45
P-2	1.8	0.5	0.35	0.45	1.3	0.35	0.45	0.35	0.45
P-3	15.8	5.5	0.40	0.55	10.3	0.35	0.45	0.37	0.48
P-4	0.7	0.3	0.40	0.55	0.4	0.35	0.45	0.37	0.49
P-5	3.9	2.0	0.40	0.55	1.9	0.35	0.45	0.38	0.50
P-6	1.1	0.5	0.40	0.55	0.6	0.35	0.45	0.37	0.50
P-7	1.1	0.7	0.40	0.55	0.4	0.35	0.45	0.38	0.51
P-8	0.5	0.2	0.40	0.55	0.3	0.35	0.45	0.37	0.49
P-9	0.9	0.5	0.40	0.55	0.4	0.35	0.45	0.38	0.51
P-10	0.9	0.4	0.40	0.55	0.5	0.35	0.45	0.37	0.49
P-11	14.3	3.5	0.90	0.95	10.8	0.40	0.55	0.52	0.65
P-12	10.0	10.0	0.55	0.65	0.0	-	-	0.55	0.65
P-13	16.7	12.7	0.65	0.75	4.0	0.35	0.45	0.58	0.68
P-14	8.3	8.3	0.65	0.75	0.0	0.35	0.45	0.65	0.75

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING AND PROPOSED NORTHERLY CONDITIONS
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
E-1	12.40	0.35	0.45	0.35	50	3.00	5.5	100	10.0%	11.1	0.2	17.6	3.2	5.4	14	30
				0.35	100	10.00	6.6									
				0.35	150	50.00	5.4									
E-2	1.80	0.35	0.45	0.35	100	12.00	6.2					15.3	3.4	5.8	2	5
				0.35	50	10.00	3.7									
				0.35	150	50.00	5.4									
E-3	17.50	0.35	0.45	0.35	230	20.00	10.4	400	10.0%	11.1	0.6	20.6	3.0	5.0	18	39
				0.35	470	155.00	9.6									
E-4	0.90	0.35	0.45	0.35	100	12.00	6.2					12.8	3.7	6.4	1	3
		0.35	0.45	0.35	160	32.00	6.6									
E-5	7.00	0.35	0.45	0.35	500	35.00	16.5	400	10.0%	11.1	0.6	26.4	2.7	4.4	7	14
		0.35	0.45	0.35	200	20.00	9.3									
E-6	1.10	0.35	0.45	0.35	150	19.00	7.4					15.0	3.5	5.9	1	3
		0.35	0.45	0.35	190	32.00	7.6									
E-7	3.80	0.35	0.45	0.35	400	28.00	14.8	100	10.0%	11.1	0.2	25.3	2.7	4.5	4	8
		0.35	0.45	0.35	400	80.00	10.4									

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING AND PROPOSED NORTHERLY CONDITIONS
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5) * For Calcs See Runoff Summary	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
E-8	0.60	0.35	0.45	0.35	300	27.00	11.8					11.8	3.8	6.6	1	2
E-9	6.40	0.35	0.45	0.35	950	95.00	20.2					20.2	3.0	5.1	7	15
E-10	0.80	0.35	0.45	0.35	320	32.00	11.7					11.7	3.8	6.6	1	2
E-11	19.40	0.36 0.36	0.47 0.47	0.35 0.35	350 200	10.50 50.00	18.3 6.9	300	10.0%	11.1	0.5	25.6	2.7	4.4	19	40
E-12	3.90	0.56	0.66	0.35	350	42.00	11.6	200	4.0%	7.0	0.5	12.0	3.8	6.5	8	17
E-13	16.70	0.58	0.68	0.35	60	1.20	8.6	250 600 150	1.0% 6.7% 2.5%	3.5 9.1 5.5	1.2 1.1 0.5	11.4	3.9	6.7	37	76

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING AND PROPOSED NORTHERLY CONDITIONS
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
P-1	11.60	0.35 0.35 0.35	0.45 0.45 0.45	0.25 0.35 0.35	50 100 150	4.00 20.00 50.00	5.7 5.2 5.4	250	10.0%	11.1	0.4	16.7	3.3	5.6	**13**	**29**
P-2	1.80	0.35 0.35 0.35	0.45 0.45 0.45	0.25 0.35 0.35	50 50 150	4.00 10.00 50.00	5.7 3.7 5.4					14.7	3.5	5.9	**2**	**5**
P-3	15.70	0.37 0.37 0.37	0.48 0.48 0.48	0.25 0.35 0.35	50 70 220	4.00 14.00 44.00	5.7 4.4 7.7	400	5.0%	7.8	0.9	18.6	3.2	5.3	**18**	**40**
P-4	0.70	0.37 0.37	0.49 0.49	0.25 0.35	50 150	4.00 50.00	5.7 5.4					11.1	3.9	6.8	**1**	**2**
P-5	3.90	0.38 0.38 0.38	0.50 0.50 0.50	0.25 0.35 0.35	50 150 100	4.00 50.00 33.00	5.7 5.4 4.4	250	10.0%	11.1	0.4	15.9	3.4	5.7	**5**	**11**
P-6	1.10	0.37 0.37	0.50 0.50	0.25 0.35	50 250	4.00 50.00	5.7 8.3					13.9	3.6	6.1	**1**	**3**
P-7	1.10	0.38 0.38	0.51 0.51	0.25 0.35	50 150	4.00 50.00	5.7 5.4					11.1	3.9	6.8	**2**	**4**

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING AND PROPOSED NORTHERLY CONDITIONS
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5) * For Calcs See Runoff Summary	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL FLOW Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
P-8	0.50	0.37 0.37	0.49 0.49	0.25 0.35	50 100	4.00 15.00	5.7 5.7					11.4	3.9	6.7	1	2
P-9	0.90	0.38 0.38	0.51 0.51	0.25 0.35	50 150	2.00 22.50	7.1 7.0					14.1	3.6	6.1	1	3
P-10	0.90	0.37 0.37	0.49 0.49	0.25 0.35	50 100	4.00 15.00	5.7 5.7					11.4	3.9	6.7	1	3
P-11	14.30	0.52	0.65	0.25	75	1.50	11.0	250 150 500 300	8.0% 6.0% 3.0% 2.0%	9.9 8.6 6.1 4.9	0.4 0.3 1.4 1.0	14.0	3.6	6.1	27	56
P-12	10.00	0.55	0.65	0.25	75	1.50	11.0	350 500	3.0% 6.0%	6.1 8.6	1.0 1.0	12.9	3.7	6.3	20	41
P-13	16.70	0.58	0.68	0.25	60	1.20	9.8	250 600 150	1.0% 6.7% 2.5%	3.5 9.1 5.5	1.2 1.1 0.5	12.5	3.7	6.4	36	73
P-14	8.30	0.65	0.75	0.25	100	2.60	11.6	70 270	6.7% 3.0%	9.1 6.1	0.1 0.7	12.5	3.7	6.4	20	40

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
(Area Runoff Coefficient Summary)

BASIN	AREA TOTAL (Ac)	OVERLAND / DEVELOPED AREA (Ac)	C(5)	C(100)	UNDEVELOPED AREA (Ac)	C(5)	C(100)	WEIGHTED C(5)	WEIGHTED C(100)
J	52.5	29.0	0.50	0.60	23.5	0.35	0.45	0.43	0.53
K	56.4	28.7	0.35	0.45	27.7	0.35	0.45	0.35	0.45
L	34.7	25.1	0.58	0.68	9.6	0.35	0.45	0.52	0.62
M	28.8	24.9	0.50	0.60	3.9	0.35	0.45	0.48	0.58
N	99.8	37.2	0.60	0.70	62.6	0.35	0.45	0.44	0.54
O	44.2	27.1	0.50	0.60	17.1	0.35	0.45	0.44	0.54
P	36.8	28.7	0.38	0.50	8.1	0.35	0.45	0.37	0.49
Q	66.3	7.9	0.60	0.70	58.4	0.35	0.45	0.38	0.48
R	20.6	18.4	0.40	0.55	2.2	0.35	0.45	0.39	0.54
S	42.0	34.4	0.68	0.78	7.6	0.35	0.45	0.62	0.72
T	52.2	39.5	0.55	0.65	12.7	0.35	0.45	0.50	0.60
U	30.1	30.1	0.47	0.57	0.0	-	-	0.47	0.57
V	34.1	6.2	0.60	0.70	27.9	0.35	0.45	0.40	0.50
W	33.8	14.0	0.55	0.65	19.8	0.35	0.45	0.43	0.53
X	27.4	15.9	0.35	0.45	11.5	0.35	0.45	0.35	0.45
Y	8.9	2.0	0.35	0.45	6.9	0.35	0.45	0.35	0.45
Z	3.0	0.2	0.35	0.45	2.8	0.35	0.45	0.35	0.45

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
J	52.50	0.43	0.53	0.25	100	1.00	15.9	250	3.9%	6.9	0.6	26.3	2.7	4.4	**60**	**122**
		0.43	0.53	0.25	150	30.00	7.2	450	4.0%	7.0	1.1					
		0.43	0.53					1000	10.0%	11.1	1.5					
		0.43	0.53													
K	56.40	0.35	0.45	0.25	60	2.40	7.8	600	10.0%	11.1	0.9	25.3	2.7	4.5	**54**	**113**
		0.35	0.45	0.25	75	0.75	13.8	800	4.0%	7.0	1.9					
		0.35	0.45					500	6.0%	8.6	1.0					
		0.35	0.45													
L	34.70	0.52	0.62	0.25	300	9.00	19.2	550	10.0%	6.1	1.5	20.7	3.0	5.0	**54**	**107**
		0.52	0.62													
		0.52	0.62													
		0.52	0.62													
M	28.80	0.48	0.58	0.25	120	1.00	18.5	200	2.0%	4.9	0.7	22.0	2.9	4.8	**40**	**81**
		0.48	0.58					500	4.0%	7.0	1.2					
		0.48	0.58					300	6.0%	8.6	0.6					
		0.48	0.58					500	5.0%	7.8	1.1					
N	99.80	0.44	0.54	0.25	150	9.00	10.8	1000	7.0%	5.1	3.3	27.6	2.6	4.3	**115**	**231**
		0.44	0.54	0.25	100	4.00	10.1	800	4.0%	3.8	3.5					
		0.44	0.54													
		0.44	0.54													
O	44.20	0.44	0.54	0.25	120	1.00	18.5	400	10.0%	11.1	0.6	22.3	2.9	4.8	**56**	**115**
		0.44	0.54					800	6.0%	8.6	1.6					
		0.44	0.54					700	4.0%	7.0	1.7					
		0.44	0.54													

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
P	36.80	0.37	0.49	0.25	300	12.00	17.4	600	4.0%	3.8	2.6	20.0	3.0	5.1	42	92
		0.37	0.49													
		0.37	0.49													
		0.37	0.49													
Q	66.30	0.38	0.48	0.25	200	8.00	14.2	900	33.0%	11.0	1.4	25.2	2.7	4.5	68	143
		0.38	0.48	0.25	100	15.00	6.5	700	10.0%	6.1	1.9					
		0.38	0.48					300	5.0%	4.3	1.2					
		0.38	0.48													
R	20.60	0.39	0.54	0.25	100	1.00	15.9	350	3.7%	6.7	0.9	18.6	3.2	5.3	26	59
		0.39	0.54					250	3.5%	6.5	0.6					
		0.39	0.54					500	4.0%	7.0	1.2					
		0.39	0.54													
S	42.00	0.62	0.72	0.25	100	1.00	15.9	370	2.8%	5.9	1.1	23.2	2.8	4.7	74	142
		0.62	0.72					320	5.0%	7.8	0.7					
		0.62	0.72					250	2.5%	5.5	0.8					
		0.62	0.72					250	2.9%	6.0	0.7					
		0.62	0.72					480	1.0%	3.5	2.3					
		0.62	0.72					300	3.6%	6.6	0.8					
		0.62	0.72					600	6.7%	9.1	1.1					
T	52.20	0.50	0.60	0.25	200	4.00	17.9	300	2.0%	4.9	1.0	22.4	2.9	4.8	76	150
		0.50	0.60					500	10.0%	11.1	0.8					
		0.50	0.60					750	6.0%	8.6	1.5					
		0.50	0.60					400	2.2%	5.2	1.3					
U	30.10	0.47	0.57	0.25	200	4.00	17.9	300	2.0%	4.9	1.0	22.0	2.9	4.8	41	83
		0.47	0.57					500	10.0%	11.1	0.8					
		0.47	0.57					750	6.0%	8.6	1.5					
		0.47	0.57					300	2.5%	5.5	0.9					

UNIVERSITY PARK
MASTER DEVELOPMENT DRAINAGE PLAN
(Area Drainage Summary)

BASIN	AREA TOTAL (Ac)	WEIGHTED C(5)	WEIGHTED C(100)	OVERLAND C(5)	OVERLAND Length (ft)	OVERLAND Height (ft)	OVERLAND Tc (min)	STREET / CHANNEL Length (ft)	STREET / CHANNEL Slope (%)	STREET / CHANNEL Velocity (fps)	STREET / CHANNEL Tc (min)	Tc TOTAL (min)	INTENSITY I(5) (in/hr)	INTENSITY I(100) (in/hr)	TOTAL FLOWS Q(5) (c.f.s.)	TOTAL FLOWS Q(100) (c.f.s.)
		* For Calcs See Runoff Summary														
V	34.10	0.40 0.40 0.40 0.40	0.50 0.50 0.50 0.50	0.25	300	10.00	18.5	700 550	33.0% 15.0%	11.0 7.4	1.1 1.2	20.8	3.0	5.0	**40**	**84**
W	33.80	0.43 0.43 0.43 0.43	0.53 0.53 0.53 0.53	0.25	200	4.00	17.9	550 1000	33.0% 10.0%	11.0 11.1	0.8 1.5	20.2	3.0	5.1	**44**	**91**
X	27.40	0.35 0.35 0.35 0.35	0.45 0.45 0.45 0.45	0.25 0.35	120	1.00	18.5	250 200 250 200	7.0% 5.0% 6.0% 2.5%	9.3 7.8 8.6 5.5	0.4 0.4 0.5 0.6	20.5	3.0	5.0	**29**	**62**
Y	8.90	0.35 0.35 0.35 0.35	0.45 0.45 0.45 0.45	0.25 0.25	75 200	0.75 67.00	13.8 7.1					20.8	3.0	5.0	**9**	**20**
Z	3.00	0.35 0.35 0.35 0.35	0.45 0.45 0.45 0.45	0.25 0.25	100 200	20.00 67.00	5.9 7.1					13.0	3.7	6.3	**4**	**9**

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: UNIVERSITY PARK

Comment: EXIST. 18" RCP CAPACITY (5-YR SYSTEM)

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	1.50 ft
Slope.....	0.0500 ft/ft
Manning's n.....	0.013
Discharge.....	23.49 cfs

Computed Results:

Full Flow Capacity.....	23.49 cfs
Full Flow Depth.....	1.50 ft
Velocity.....	13.29 fps
Flow Area.....	1.77 sf
Critical Depth....	1.48 ft
Critical Slope....	0.0458 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	23.49 cfs
QMAX @.94D.....	25.27 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: UNIVERSITY PARK

Comment: EXIST. 30" RCP CAPACITY (5-YR SYSTEM)

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	2.50 ft
Slope.....	0.0400 ft/ft
Manning's n.....	0.013
Discharge.....	82.03 cfs

Computed Results:

Full Flow Capacity.....	82.03 cfs
Full Flow Depth.....	2.50 ft
Velocity.....	16.71 fps
Flow Area.....	4.91 sf
Critical Depth.....	2.47 ft
Critical Slope.....	0.0365 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	82.03 cfs
QMAX @.94D.....	88.24 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: UNIVERSITY PARK

Comment: EXIST. 24" RCP CAPACITY (5-YR SYSTEM)

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	2.00 ft
Slope.....	0.0200 ft/ft
Manning's n.....	0.013
Discharge.....	31.99 cfs

Computed Results:

Full Flow Capacity.....	31.99 cfs
Full Flow Depth.....	2.00 ft
Velocity.....	10.18 fps
Flow Area.....	3.14 sf
Critical Depth....	1.89 ft
Critical Slope....	0.0173 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	31.99 cfs
QMAX @.94D.....	34.41 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: UNIVERSITY PARK

Comment: EXIST. 36" RCP CAPACITY (ERINDALE SYSTEM)

Solve For Full Flow Capacity

Given Input Data:

Diameter.....	3.00 ft
Slope.....	0.0500 ft/ft
Manning's n.....	0.013
Discharge.....	149.14 cfs

Computed Results:

Full Flow Capacity.....	149.14 cfs
Full Flow Depth.....	3.00 ft
Velocity.....	21.10 fps
Flow Area.....	7.07 sf
Critical Depth....	2.98 ft
Critical Slope....	0.0466 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	149.14 cfs
QMAX @.94D.....	160.43 cfs
Froude Number.....	FULL

Quick TR-55 Ver.5.46 S/N:
Executed: 07:00:58 10-18-1995

>>>>> I-D-F Curve <<<<<

COLORADO SPRINGS 5 YEAR STORM
INPUT OCTOBER 18, 1995

Recurrence Frequency = 5

DURATION minutes	INTENSITY inches/hour
5	5.2
7	4.7
9	4.2
10	4.1
15	3.4
20	2.9
25	2.6
30	2.4
35	2.1
40	1.9
45	1.8
50	1.7
55	1.55
60	1.5
70	1.4
80	1.25
90	1.15
100	1.05
110	1.0
120	0.95

Quick TR-55 Ver.5.46 S/N:
Executed: 06:56:07 10-18-1995

>>>>> I-D-F Curve <<<<<

COLORADO SPRINGS IDF (100 YEAR)

Recurrence Frequency = 100

DURATION minutes	INTENSITY inches/hour
5	9
7	8
9	7.3
10	7
15	5.85
20	5.15
25	4.55
30	4.1
35	3.75
40	3.45
45	3.20
50	3
55	2.75
60	2.60
65	2.2
70	2.10
75	1.9
80	1.7
90	1.4
100	1.1

PRELIMINARY DETENTION POND CALCULATIONS
PRIVATE SOUTHERLY DETENTION FACILITY
(A)

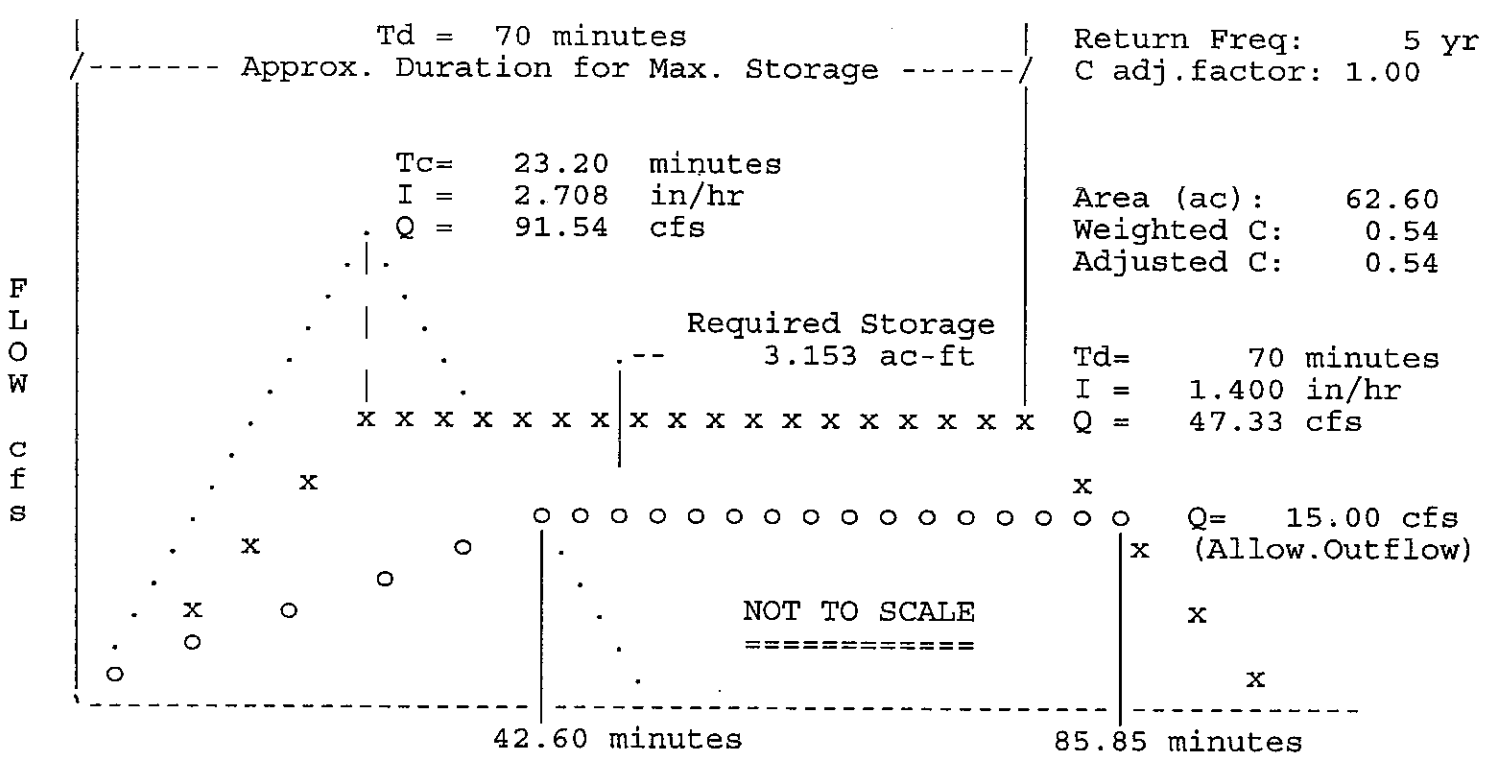
Quick TR-55 Ver.5.46 S/N:
Executed: 07:07:23 10-18-1995

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND 5-12
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 5 yr	Allowable Outflow: 15.00 cfs
'C' Adjustment: 1.000	Required Storage: 3.153 ac-ft
Peak Inflow: 47.33 cfs	Inflow .HYD stored: UP5 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 07:07:23 10-18-1995

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 5 yr 'C' Adjustment = 1.000 Allowable Q = 15.00 cfs

Hydrograph file duration= 70.00 minutes
Hydrograph file: UP5 .HYD Tc = 23.20 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.540	0.540	23	2.708	62.60	91.54	2.925	2.446
0.540	0.540	30	2.400	62.60	81.13	3.352	2.738
0.540	0.540	40	1.900	62.60	64.23	3.539	2.729
0.540	0.540	50	1.700	62.60	57.47	3.958	2.948
0.540	0.540	60	1.500	62.60	50.71	4.191	2.983
0.540	0.540	70	1.400	62.60	47.33	4.563	3.153
0.540	0.540	120	0.950	62.60	32.11	5.308	2.901

Storage Maximum

Quick TR-55 Ver.5.46 S/N:
Executed: 07:07:23 10-18-1995

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

**** Modified Rational Hydrograph *****

Weighted C = 0.540 Area= 62.600 acres Tc = 23.20 minutes

Adjusted C = 0.540 Td= 70.00 min. I= 1.40 in/hr Qp= 47.33 cfs

RETURN FREQUENCY: 5 year storm Adj.factor = 1.00
Output file: UP5 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 5 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.003	0.41	2.45	4.49	6.53	8.57	10.61	12.65
0.120	14.69	16.73	18.77	20.81	22.85	24.89	26.93
0.237	28.97	31.01	33.05	35.09	37.13	39.17	41.21
0.353	43.25	45.29	47.33	47.33	47.33	47.33	47.33
0.470	47.33	47.33	47.33	47.33	47.33	47.33	47.33
0.587	47.33	47.33	47.33	47.33	47.33	47.33	47.33
0.703	47.33	47.33	47.33	47.33	47.33	47.33	47.33
0.820	47.33	47.33	47.33	47.33	47.33	47.33	47.33
0.937	47.33	47.33	47.33	47.33	47.33	47.33	47.33
1.053	47.33	47.33	47.33	47.33	47.33	47.33	47.33
1.170	46.92	44.88	42.84	40.80	38.76	36.72	34.68
1.287	32.64	30.60	28.56	26.52	24.48	22.44	20.40
1.403	18.36	16.32	14.28	12.24	10.20	8.16	6.12
1.520	4.08	2.04	0.00				

Quick TR-55 Ver.5.46 S/N:
Executed: 07:07:23 10-18-1995

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 5 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.540	62.60						
			23.20	0.540	0.540	2.708	62.60	91.54

Quick TR-55 Ver.5.46 S/N:
Executed: 07:07:23 10-18-1995

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* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

Area = 62.60 acres Tc = 23.20 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
5	0.540	70	1.400	47.33	15.00	4.563	3.153

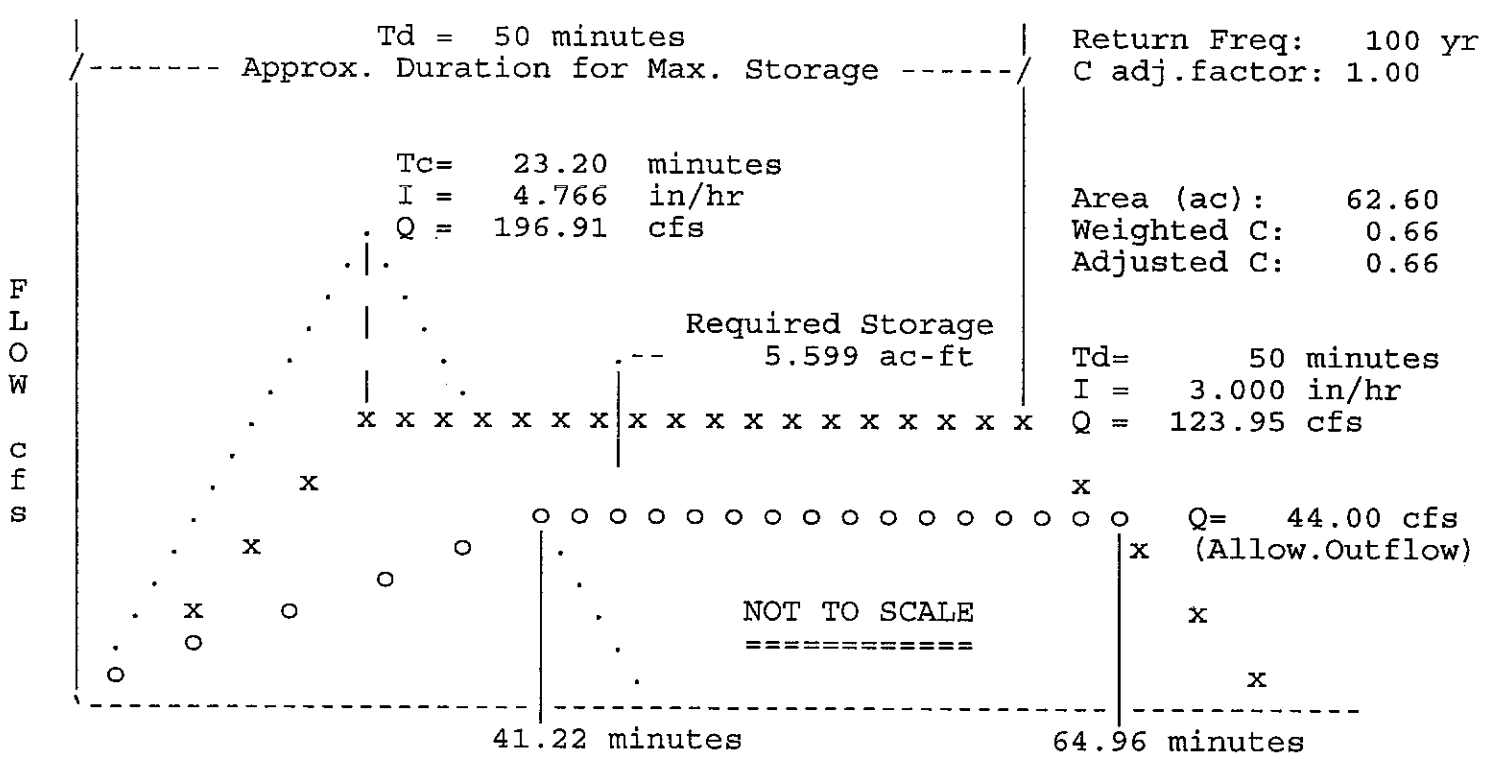
Quick TR-55 Ver.5.46 S/N:
Executed: 07:10:13 10-18-1995

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND 100 YR
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 100 yr	Allowable Outflow: 44.00 cfs
'C' Adjustment: 1.000	Required Storage: 5.599 ac-ft
Peak Inflow: 123.95 cfs	Inflow .HYD stored: UP100 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 07:10:13 10-18-1995

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

**** Modified Rational Hydrograph *****
Weighted C = 0.660 Area= 62.600 acres Tc = 23.20 minutes

Adjusted C = 0.660 Td= 50.00 min. I= 3.00 in/hr Qp= 123.95 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: UP100 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.003	1.07	6.41	11.75	17.10	22.44	27.78	33.12
0.120	38.47	43.81	49.15	54.49	59.84	65.18	70.52
0.237	75.86	81.21	86.55	91.89	97.24	102.58	107.92
0.353	113.26	118.61	123.95	123.95	123.95	123.95	123.95
0.470	123.95	123.95	123.95	123.95	123.95	123.95	123.95
0.587	123.95	123.95	123.95	123.95	123.95	123.95	123.95
0.703	123.95	123.95	123.95	123.95	123.95	123.95	123.95
0.820	123.95	122.88	117.54	112.19	106.85	101.51	96.17
0.937	90.82	85.48	80.14	74.80	69.45	64.11	58.77
1.053	53.43	48.08	42.74	37.40	32.06	26.71	21.37
1.170	16.03	10.69	5.34	0.00			

Quick TR-55 Ver.5.46 S/N:
Executed: 07:10:13 10-18-1995

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.660	62.60						
			23.20	0.660	0.660	4.766	62.60	196.91

Quick TR-55 Ver.5.46 S/N:
Executed: 07:10:13 10-18-1995

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* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

Area = 62.60 acres Tc = 23.20 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.660	50	3.000	123.95	44.00	8.536	5.599

Quick TR-55 Ver.5.46 S/N:
Executed: 07:10:13 10-18-1995

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK SOUTHERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 44.00 cfs

Hydrograph file duration= 50.00 minutes
Hydrograph file: UP100 .HYD Tc = 23.20 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)	
0.660	0.660	23	4.766	62.60	196.91	6.293	4.886	
0.660	0.660	30	4.100	62.60	169.40	7.000	5.207	
0.660	0.660	40	3.450	62.60	142.54	7.853	5.489	
0.660	0.660	50	3.000	62.60	123.95	8.536	5.599	Storage Maximum
0.660	0.660	60	2.600	62.60	107.42	8.878	5.372	

PRELIMINARY DETENTION POND CALCULATIONS
PUBLIC NORTHERLY DETENTION FACILITY
(B)

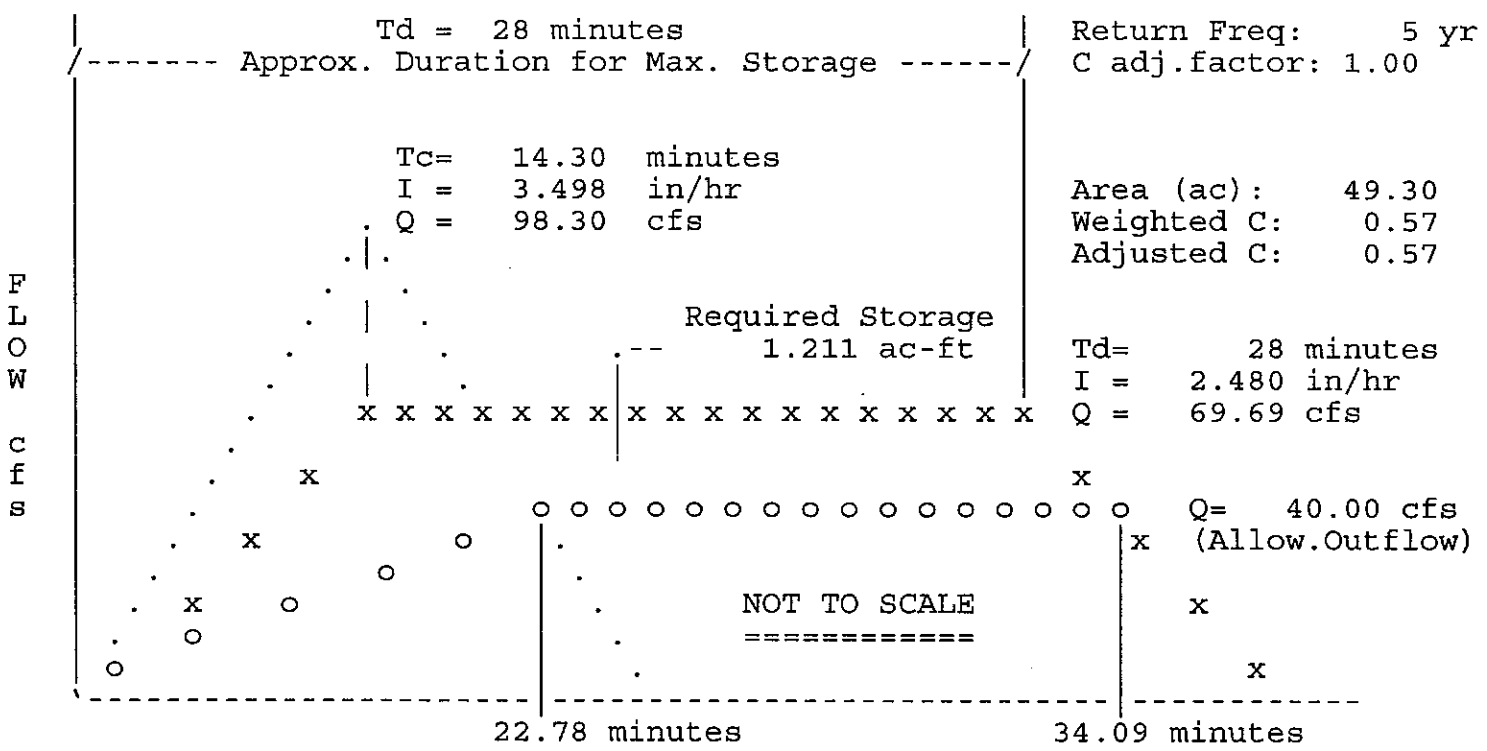
Quick TR-55 Ver.5.46 S/N:
Executed: 16:44:49 02-26-1996

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY 5 YR.
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 5 yr	Allowable Outflow: 40.00 cfs
'C' Adjustment: 1.000	Required Storage: 1.211 ac-ft
Peak Inflow: 69.69 cfs	Inflow .HYD stored: UPNLY5 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 16:44:49 02-26-1996

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

**** Modified Rational Hydrograph *****

Weighted C = 0.570 Area= 49.300 acres Tc = 14.30 minutes

Adjusted C = 0.570 Td= 28.00 min. I= 2.48 in/hr Qp= 69.69 cfs

RETURN FREQUENCY: 5 year storm Adj.factor = 1.00
Output file: UPNLY5 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 5 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.005	1.46	6.34	11.21	16.08	20.96	25.83	30.70
0.122	35.58	40.45	45.32	50.20	55.07	59.94	64.82
0.238	69.69	69.69	69.69	69.69	69.69	69.69	69.69
0.355	69.69	69.69	69.69	69.69	69.69	69.69	69.69
0.472	68.23	63.35	58.48	53.61	48.73	43.86	38.99
0.588	34.11	29.24	24.37	19.49	14.62	9.75	4.87
0.705	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 16:44:49 02-26-1996

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 5 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.570	49.30						
			14.30	0.570	0.570	3.498	49.30	98.30

Quick TR-55 Ver.5.46 S/N:
Executed: 16:44:49 02-26-1996

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* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

Area = 49.30 acres Tc = 14.30 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
5	0.570	28	2.480	69.69	40.00	2.688	1.211

Quick TR-55 Ver.5.46 S/N:
Executed: 16:44:49 02-26-1996

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 5 yr 'C' Adjustment = 1.000 Allowable Q = 40.00 cfs

Hydrograph file duration= 28.00 minutes
Hydrograph file: UPNLY5 .HYD Tc = 14.30 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.570	0.570	14	3.498	49.30	98.30	1.936	1.148
0.570	0.570	15	3.400	49.30	95.54	1.974	1.152
0.570	0.570	20	2.900	49.30	81.49	2.245	1.176
0.570	0.570	28	2.480	49.30	69.69	2.688	1.211 Storage Maximum
0.570	0.570	30	2.400	49.30	67.44	2.787	1.207
0.570	0.570	40	1.900	49.30	53.39	2.942	0.873
0.570	0.570	50	1.700	49.30	47.77	3.290	0.705
0.570	0.570	60	1.500	49.30	42.15	3.484	0.391
0.570	0.570	120	0.950	49.30	26.70	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:53 02-26-1996

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY 100 YR.
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 100 yr	Allowable Outflow: 80.00 cfs
'C' Adjustment: 1.000	Required Storage: 2.636 ac-ft
Peak Inflow: 164.60 cfs	Inflow .HYD stored: UPPARK .HYD

Td = 22 minutes
Approx. Duration for Max. Storage

Return Freq: 100 yr
C adj.factor: 1.00

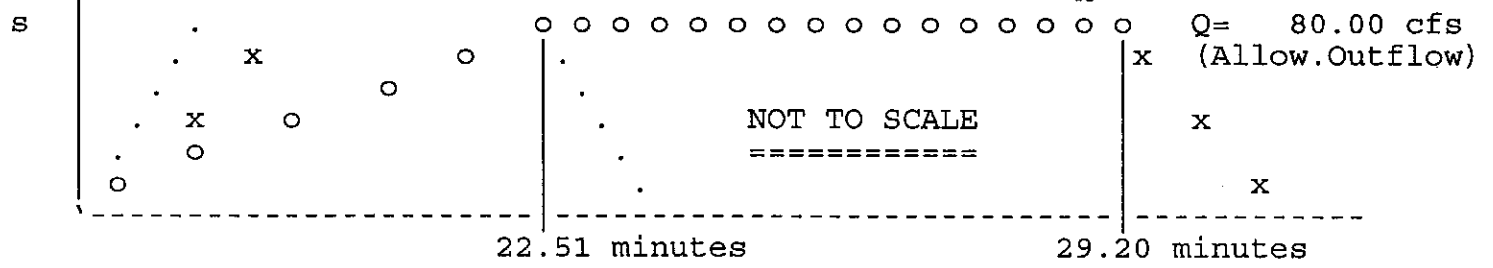
Tc= 14.00 minutes
I = 6.080 in/hr
Q = 203.83 cfs

Area (ac): 49.30
Weighted C: 0.68
Adjusted C: 0.68

Required Storage
2.636 ac-ft

Td= 22 minutes
I = 4.910 in/hr
Q = 164.60 cfs

Q= 80.00 cfs
(Allow.Outflow)



Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:53 02-26-1996

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

**** Modified Rational Hydrograph *****

Weighted C = 0.680 Area= 49.300 acres Tc = 14.00 minutes

Adjusted C = 0.680 Td= 22.00 min. I= 4.91 in/hr Qp= 164.60 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: UPPARK .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.000	0.00	11.76	23.51	35.27	47.03	58.79	70.54
0.117	82.30	94.06	105.82	117.57	129.33	141.09	152.85
0.233	164.60	164.60	164.60	164.60	164.60	164.60	164.60
0.350	164.60	164.60	152.85	141.09	129.33	117.57	105.82
0.467	94.06	82.30	70.54	58.79	47.03	35.27	23.51
0.583	11.76	0.00					

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:53 02-26-1996

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.680	49.30						
			14.00	0.680	0.680	6.080	49.30	203.83

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:53 02-26-1996

MODIFIED RATIONAL METHOD
---- Grand Summary For All Storm Frequencies ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

Area = 49.30 acres Tc = 14.00 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.680	22	4.910	164.60	80.00	4.988	2.636

Quick TR-55 Ver.5.46 S/N:
Executed: 15:59:53 02-26-1996

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK NORTHERLY PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 80.00 cfs

Hydrograph file duration= 22.00 minutes
Hydrograph file: UPPARK .HYD Tc = 14.00 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.680	0.680	14	6.080	49.30	203.83	3.931	2.388
0.680	0.680	15	5.850	49.30	196.12	4.052	2.411
0.680	0.680	20	5.150	49.30	172.65	4.756	2.607
**********	**********	**********	**********	**********	**********	Storage Maximum	
0.680	0.680	22	4.910	49.30	164.60	4.988	2.636
0.680	0.680	30	4.100	49.30	137.45	5.680	2.520
0.680	0.680	40	3.450	49.30	115.66	6.372	2.195
0.680	0.680	50	3.000	49.30	100.57	6.926	1.728
0.680	0.680	60	2.600	49.30	87.16	7.204	0.997

PRELIMINARY DETENTION POND CALCULATIONS
ALTNERATE 1 PRIVATE TEMPORARY DETENTION FACILITY
(C)

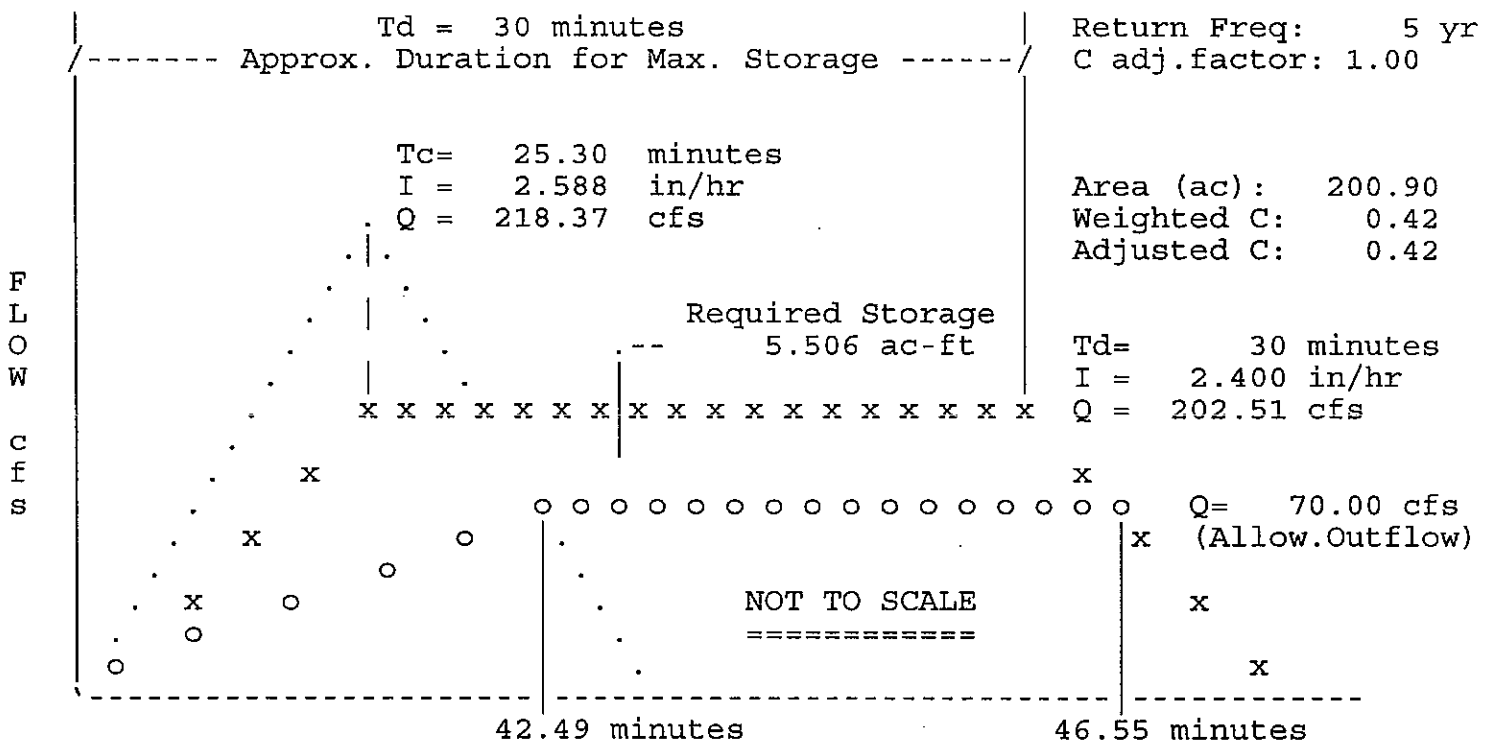
Quick TR-55 Ver.5.46 S/N:
Executed: 07:33:15 10-18-1995

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND 5 YR
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995
(TEMPORARY)

RETURN FREQUENCY: 5 yr	Allowable Outflow: 70.00 cfs
'C' Adjustment: 1.000	Required Storage: 5.506 ac-ft
Peak Inflow: 202.51 cfs	Inflow .HYD stored: UPW5 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 07:33:15 10-18-1995

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

**** Modified Rational Hydrograph *****

Weighted C = 0.420 Area= 200.900 acres Tc = 25.30 minutes

Adjusted C = 0.420 Td= 30.00 min. I= 2.40 in/hr Qp= 202.51 cfs

RETURN FREQUENCY: 5 year storm Adj.factor = 1.00
Output file: UPW5 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 5 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.005	2.40	10.41	18.41	26.41	34.42	42.42	50.43
0.122	58.43	66.44	74.44	82.44	90.45	98.45	106.46
0.238	114.46	122.46	130.47	138.47	146.48	154.48	162.49
0.355	170.49	178.49	186.50	194.50	202.51	202.51	202.51
0.472	202.51	202.51	200.11	192.10	184.10	176.09	168.09
0.588	160.08	152.08	144.08	136.07	128.07	120.06	112.06
0.705	104.06	96.05	88.05	80.04	72.04	64.03	56.03
0.822	48.03	40.02	32.02	24.01	16.01	8.00	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 07:33:15 10-18-1995

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 5 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.420	200.90						
			25.30	0.420	0.420	2.588	200.90	218.37

Quick TR-55 Ver.5.46 S/N:
Executed: 07:33:15 10-18-1995

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* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

Area = 200.90 acres Tc = 25.30 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
5	0.420	30	2.400	202.51	70.00	8.368	5.506

Quick TR-55 Ver.5.46 S/N:
Executed: 07:33:15 10-18-1995

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 5 yr 'C' Adjustment = 1.000 Allowable Q = 70.00 cfs

Hydrograph file duration= 30.00 minutes
Hydrograph file: UPW5 .HYD Tc = 25.30 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.420	0.420	25	2.588	200.90	218.37	7.610	5.170
**********	**********	**********	**********	**********	**********	Storage Maximum	
0.420	0.420	30	2.400	200.90	202.51	8.368	5.506
0.420	0.420	40	1.900	200.90	160.32	8.833	5.118
0.420	0.420	50	1.700	200.90	143.44	9.879	5.262
0.420	0.420	60	1.500	200.90	126.57	10.460	4.959
0.420	0.420	120	0.950	200.90	80.16	13.249	2.353

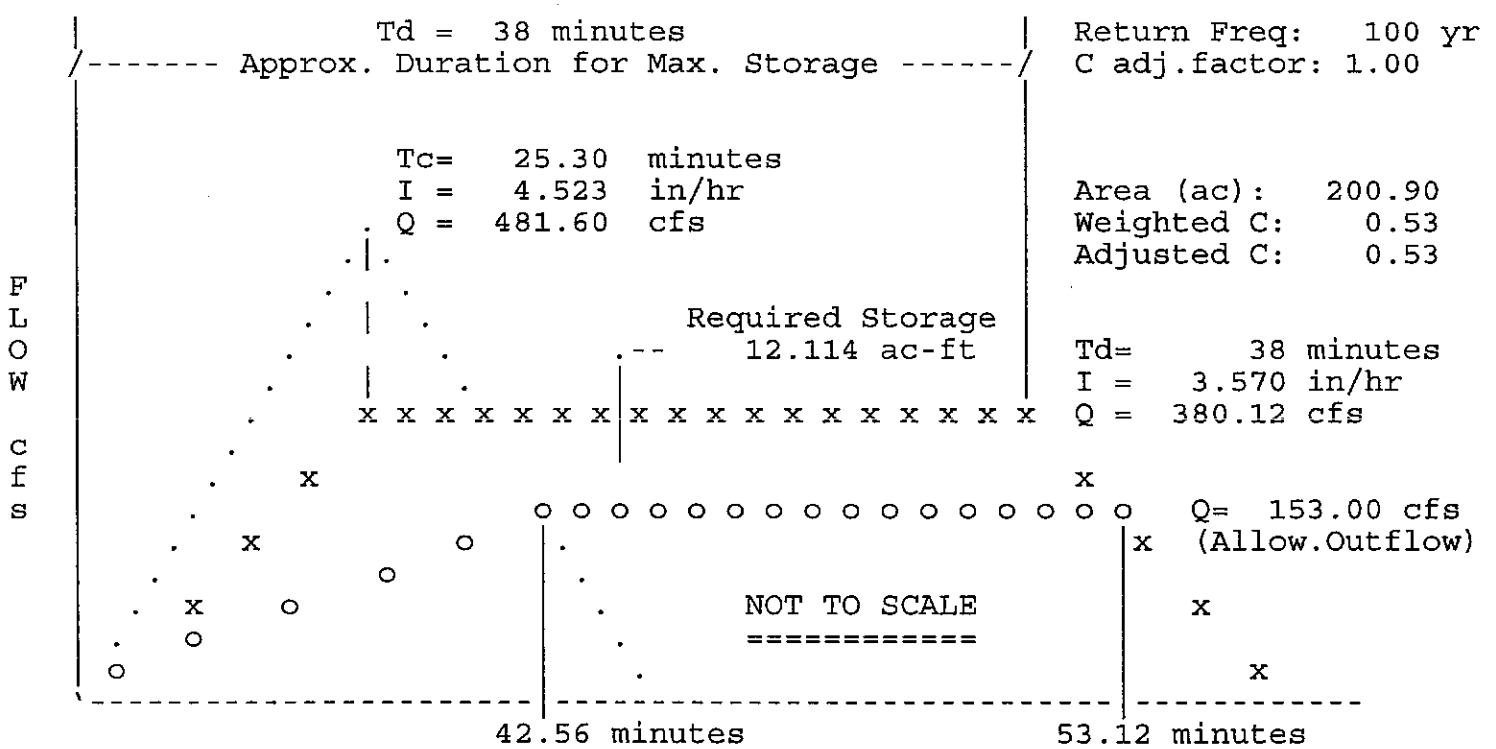
Quick TR-55 Ver.5.46 S/N:
Executed: 07:36:55 10-18-1995

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND 100YR
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995
(TEMPORARY)

RETURN FREQUENCY: 100 yr	Allowable Outflow: 153.00 cfs
'C' Adjustment: 1.000	Required Storage: 12.114 ac-ft
Peak Inflow: 380.12 cfs	Inflow .HYD stored: UPW100 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 07:36:55 10-18-1995

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

**** Modified Rational Hydrograph *****
Weighted C = 0.530 Area= 200.900 acres Tc = 25.30 minutes

Adjusted C = 0.530 Td= 38.00 min. I= 3.57 in/hr Qp= 380.12 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: UPW100 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.005	4.51	19.53	34.56	49.58	64.61	79.63	94.66
0.122	109.68	124.70	139.73	154.75	169.78	184.80	199.83
0.238	214.85	229.88	244.90	259.93	274.95	289.98	305.00
0.355	320.02	335.05	350.07	365.10	380.12	380.12	380.12
0.472	380.12	380.12	380.12	380.12	380.12	380.12	380.12
0.588	380.12	380.12	380.12	375.62	360.59	345.57	330.54
0.705	315.52	300.49	285.47	270.44	255.42	240.39	225.37
0.822	210.34	195.32	180.30	165.27	150.25	135.22	120.20
0.938	105.17	90.15	75.12	60.10	45.07	30.05	15.02
1.055	0.00						

Quick TR-55 Ver.5.46 S/N:
Executed: 07:36:55 10-18-1995

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.530	200.90						
			25.30	0.530	0.530	4.523	200.90	481.60

Quick TR-55 Ver.5.46 S/N:
Executed: 07:36:55 10-18-1995

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* MODIFIED RATIONAL METHOD *
* ---- Grand Summary For All Storm Frequencies ---- *
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First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

Area = 200.90 acres Tc = 25.30 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.530	38	3.570	380.12	153.00	19.896	12.114

Quick TR-55 Ver.5.46 S/N:
Executed: 07:36:55 10-18-1995

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK WESTERLY DETENTION POND
PRELIMINARY DETENTION REQUIREMENTS
OCTOBER 18, 1995

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 153.00 cfs

Hydrograph file duration= 38.00 minutes
Hydrograph file: UPW100 .HYD Tc = 25.30 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.530	0.530	25	4.523	200.90	481.60	16.783	11.451
0.530	0.530	30	4.100	200.90	436.56	18.039	11.805
0.530	0.530	38	3.570	200.90	380.12	19.896	12.114
0.530	0.530	40	3.450	200.90	367.35	20.239	12.073
0.530	0.530	50	3.000	200.90	319.43	21.999	11.892
0.530	0.530	60	2.600	200.90	276.84	22.879	10.861

********** Storage Maximum **********

PRELIMINARY DETENTION POND CALCULATIONS
ALTERNATE 2 PUBLIC WESTERLY DETENTION FACILITY
(D)

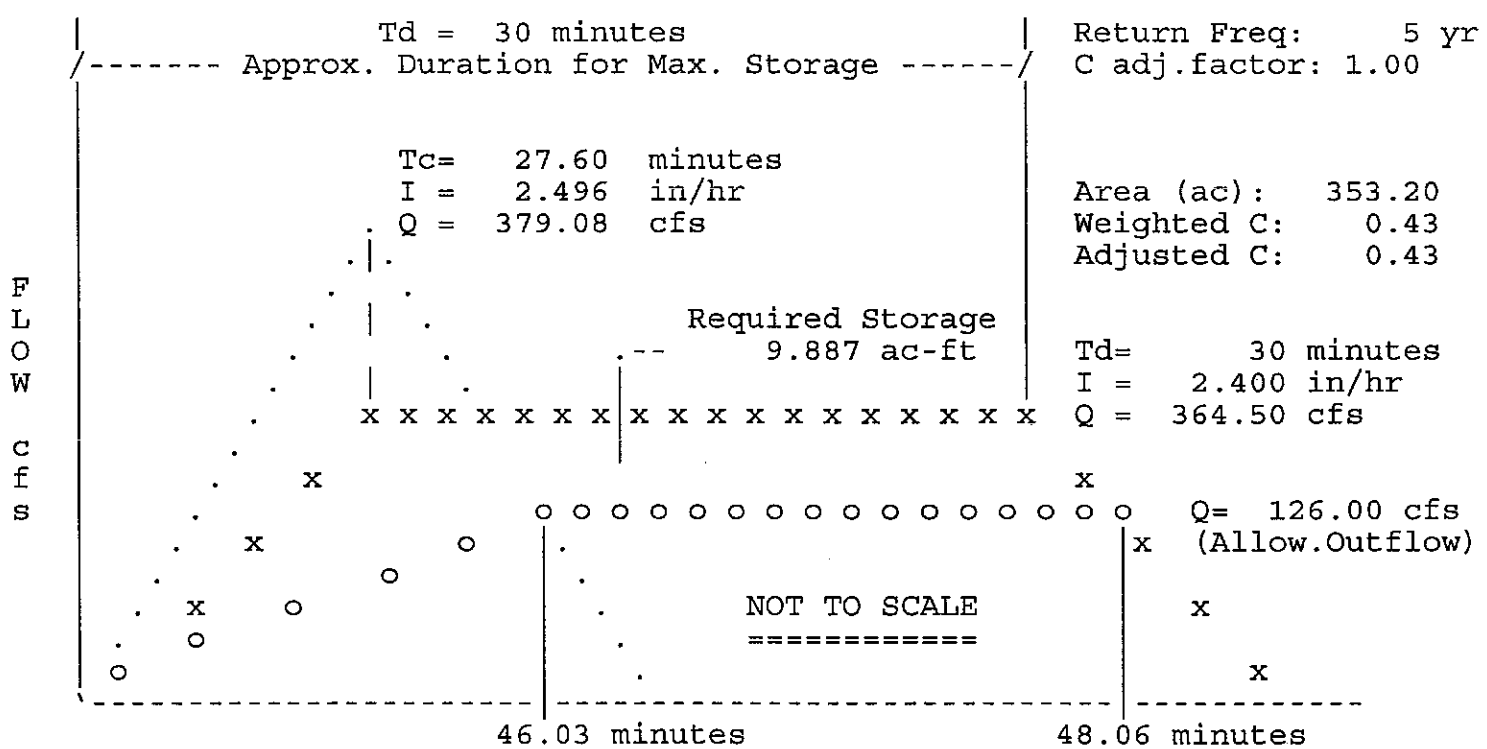
Quick TR-55 Ver.5.46 S/N:
Executed: 16:02:58 02-26-1996

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY 5 YR.
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 5 yr	Allowable Outflow: 126.00 cfs
'C' Adjustment: 1.000	Required Storage: 9.887 ac-ft
Peak Inflow: 364.50 cfs	Inflow .HYD stored: UPPERM5 .HYD



Quick TR-55 Ver.5.46 S/N:
Executed: 16:02:58 02-26-1996

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

**** Modified Rational Hydrograph *****
Weighted C = 0.430 Area= 353.200 acres Tc = 27.60 minutes

Adjusted C = 0.430 Td= 30.00 min. I= 2.40 in/hr Qp= 364.50 cfs

RETURN FREQUENCY: 5 year storm Adj.factor = 1.00
Output file: UPPERM5 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 5 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.010	7.92	21.13	34.34	47.54	60.75	73.96	87.16
0.127	100.37	113.58	126.78	139.99	153.20	166.40	179.61
0.243	192.82	206.02	219.23	232.44	245.64	258.85	272.06
0.360	285.26	298.47	311.68	324.88	338.09	351.30	364.50
0.477	364.50	364.50	356.58	343.37	330.17	316.96	303.75
0.593	290.55	277.34	264.13	250.93	237.72	224.51	211.31
0.710	198.10	184.89	171.69	158.48	145.27	132.07	118.86
0.827	105.65	92.45	79.24	66.03	52.83	39.62	26.41
0.943	13.21	0.00					

Quick TR-55 Ver.5.46 S/N:
Executed: 16:02:58 02-26-1996

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 5 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.430	353.20						
			27.60	0.430	0.430	2.496	353.20	379.08

Quick TR-55 Ver.5.46 S/N:
Executed: 16:02:58 02-26-1996

MODIFIED RATIONAL METHOD
---- Grand Summary For All Storm Frequencies ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

Area = 353.20 acres Tc = 27.60 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
5	0.430	30	2.400	364.50	126.00	15.062	9.887

Quick TR-55 Ver.5.46 S/N:
Executed: 16:02:58 02-26-1996

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 5 yr 'C' Adjustment = 1.000 Allowable Q = 126.00 cfs

Hydrograph file duration= 30.00 minutes
Hydrograph file: UPPERM5 .HYD Tc = 27.60 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.430	0.430	28	2.496	353.20	379.08	14.411	9.621
**********	**********	**********	**********	**********	**********	Storage Maximum	
0.430	0.430	30	2.400	353.20	364.50	15.062	9.887
**********	**********	**********	**********	**********	**********	**********	**********
0.430	0.430	40	1.900	353.20	288.56	15.899	9.206
0.430	0.430	50	1.700	353.20	258.19	17.782	9.477
0.430	0.430	60	1.500	353.20	227.81	18.828	8.943
0.430	0.430	120	0.950	353.20	144.28	23.848	4.317

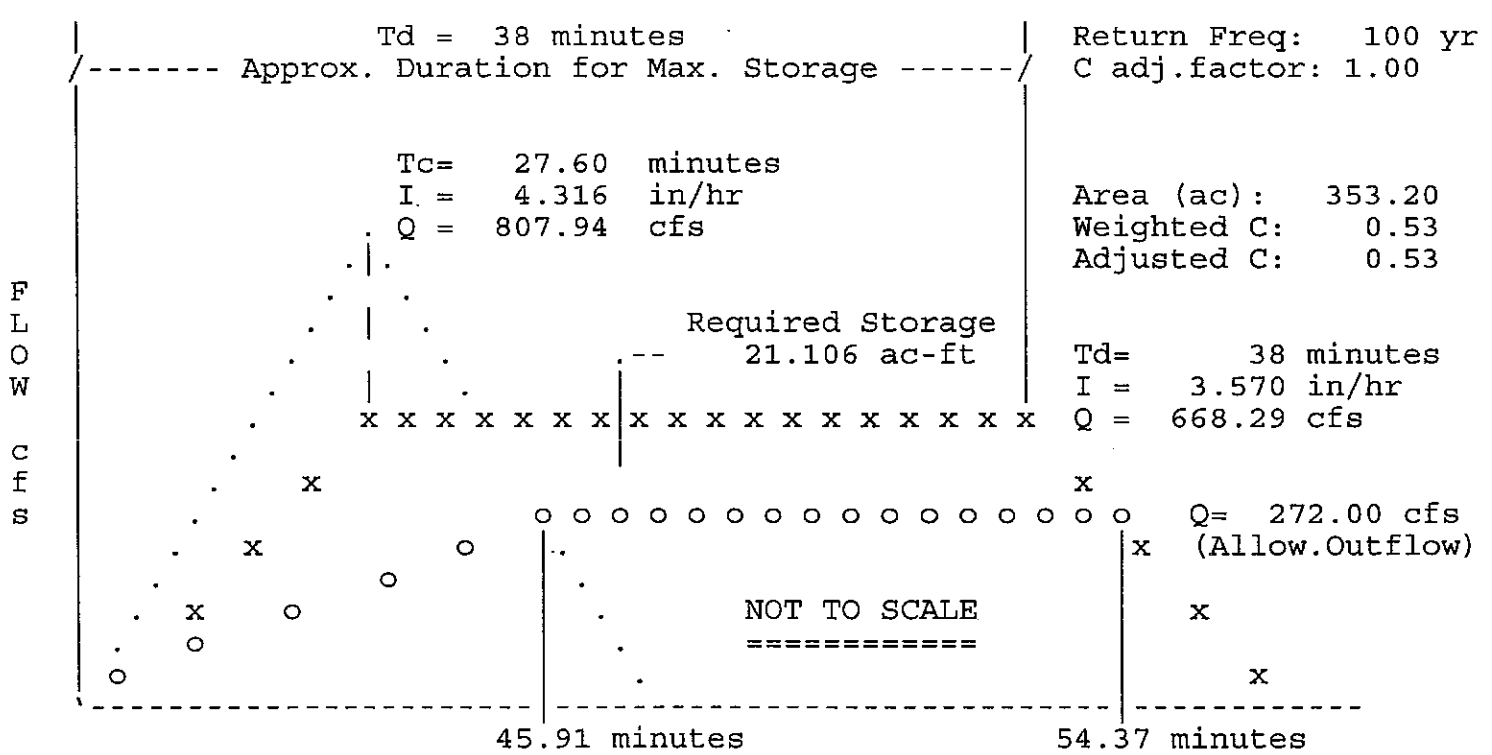
Quick TR-55 Ver.5.46 S/N:
Executed: 16:03:43 02-26-1996

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY 100 YR.
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 100 yr	Allowable Outflow: 272.00 cfs
'C' Adjustment: 1.000	Required Storage: 21.106 ac-ft
Peak Inflow: 668.29 cfs	Inflow .HYD stored: UPPER100.HYD



F L O W c f s

Quick TR-55 Ver.5.46 S/N:
Executed: 16:03:43 02-26-1996

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

**** Modified Rational Hydrograph *****
Weighted C = 0.530 Area= 353.200 acres Tc = 27.60 minutes

Adjusted C = 0.530 Td= 38.00 min. I= 3.57 in/hr Qp= 668.29 cfs

RETURN FREQUENCY: 100 year storm Adj.factor = 1.00
Output file: UPPER100.HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Hours	Time increment = 0.017 Hours Time on left represents time for first Q in each row.						
0.010	14.53	38.74	62.95	87.17	111.38	135.60	159.81
0.127	184.02	208.24	232.45	256.66	280.88	305.09	329.30
0.243	353.52	377.73	401.94	426.16	450.37	474.58	498.80
0.360	523.01	547.22	571.44	595.65	619.86	644.08	668.29
0.477	668.29	668.29	668.29	668.29	668.29	668.29	668.29
0.593	668.29	668.29	668.29	653.76	629.55	605.33	581.12
0.710	556.91	532.69	508.48	484.27	460.05	435.84	411.63
0.827	387.41	363.20	338.99	314.77	290.56	266.35	242.13
0.943	217.92	193.71	169.49	145.28	121.07	96.85	72.64
1.060	48.43	24.21	0.00				

Quick TR-55 Ver.5.46 S/N:
Executed: 16:03:43 02-26-1996

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

* * * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * * *

Q = adj * C * I * A
Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
'C' adjustment, k = 1
Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
INFLOW	0.530	353.20						
			27.60	0.530	0.530	4.316	353.20	807.94

Quick TR-55 Ver.5.46 S/N:
Executed: 16:03:43 02-26-1996

MODIFIED RATIONAL METHOD
---- Grand Summary For All Storm Frequencies ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

Area = 353.20 acres Tc = 27.60 minutes

Frequency (years)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
100	0.530	38	3.570	668.29	272.00	34.979	21.106

Quick TR-55 Ver.5.46 S/N:
Executed: 16:03:43 02-26-1996

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at Tc hydrograph recession leg.

UNIVERSITY PARK PERMANENT PUBLIC DETENTION FACILITY
PRELIMINARY DETENTION REQUIREMENTS
FEBRUARY 22, 1996

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.000 Allowable Q = 272.00 cfs

Hydrograph file duration= 38.00 minutes
Hydrograph file: UPPER100.HYD Tc = 27.60 minutes

Weighted 'C'	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	VOLUMES Inflow (ac-ft)	VOLUMES Storage (ac-ft)
0.530	0.530	28	4.316	353.20	807.94	30.715	20.375
0.530	0.530	30	4.100	353.20	767.50	31.715	20.567
**********	**********	**********	**********	**********	**********	Storage Maximum	
0.530	0.530	38	3.570	353.20	668.29	34.979	21.106
0.530	0.530	40	3.450	353.20	645.83	35.583	21.033
0.530	0.530	50	3.000	353.20	561.59	38.677	20.708
0.530	0.530	60	2.600	353.20	486.71	40.224	18.893

TRIPLE J
COLORADO DEPARTMENT OF TRANSPORTATION LETTER

JR Engineering, Ltd.
4935 North 30th Street
Colorado Springs, Colorado 80919
(719) 593-2593 • FAX (719) 528-6613

6110 Greenwood Plaza Blvd.
Englewood, Colorado 80111
(303) 740-9393 • FAX (303) 721-9019

4812 South College Avenue
Fort Collins, Colorado 80525
(303) 282-4335 • FAX (303) 282-4340

November 6, 1995

State of Colorado
Department of Transportation, District 1
905 Erie
Pueblo, CO 81001

ATTN: Department of Transportation Hydraulics Unit

RE: University Park Development (Colorado Springs, CO)
Preliminary Drainage Analysis of Proposed
University Parkway and Existing North Academy Boulevard (U.S. 83)

Dear Sirs or Mesdames:

Please consider this letter and attached exhibit the Preliminary Drainage Analysis for the intersection at proposed University Parkway and existing North Academy Boulevard (U.S. 83). This "T" intersection is proposed as a part of the University Park Development in Colorado Springs, CO.

EXISTING DRAINAGE CONDITIONS

The parcel that University Parkway is proposed to cross is Triple J Subdivision Filing No. 2 (see Exhibit "A"). The 5.4 acre parcel is currently undeveloped and contains native vegetation. This site sheet flows to an existing swale that runs parallel to the westerly side of Academy Boulevard. A small 1.4 acre lot directly north of Triple J discharges developed flows of $Q_5 = 6$ cfs and $Q_{100} = 11$ cfs into the previously mentioned swale. These combined flows continue southerly to the intersection of Academy Boulevard and Saddle Drive where they enter Academy Boulevard. Preliminary drainage analysis done by others anticipated a developed discharge of $Q_5 = 31$ cfs and $Q_{100} = 48$ cfs at Saddle Drive. This was assuming a commercial buildout (runoff coefficient of 0.85±) of the entire 5.4 acre Triple J site. This scenario obviously discharges a significant amount of drainage flows into existing Academy Boulevard.

PROPOSED DRAINAGE CHARACTERISTICS

The proposed University Parkway bisects the Triple J parcel. Proposed use of the north portion (3.0 acres) is for commercial/office use and the south (1.3 acres) will also be commercial/office use. The introduction of University Parkway into the Triple J parcel is beneficial to the overall drainage situation on Academy Boulevard. University Parkway will be designed to drain westerly from a proposed highpoint at the entryway. These flows will ultimately discharge into the storm facilities being proposed for the on-site drainage of the University Park Development.

The on-site storm facilities will be in relatively close proximity to the northerly commercial/office office area so that all developed flows (approximately $Q_5 = 20$ cfs and $Q_{100} = 35$ cfs including off-site flows from the north) can be intercepted by inlets on the commercial/office site and diverted to the proposed University Park storm system. This proposed diversion dramatically decreases the amount of developed flows entering Academy Boulevard.

The remaining 1.3 acre commercial/office site to the south of University Parkway generates flows ($Q_5 = 6$ cfs and $Q_{100} = 10$ cfs) that are directed towards the southeast corner of a proposed parking lot (see Exhibit "B"). On-site parking lot detention will restrict discharge to the existing grass swale to $Q_5 = 1$ cfs and $Q_{100} = 3$ cfs.. The proposed total flow at Saddle Drive would then be $Q_5 = 5$ cfs and $Q_{100} = 10$ cfs instead of the $Q_5 = 31$ cfs and $Q_{100} = 48$ cfs mentioned previously.

SUMMARY

The installation of University Parkway through the Triple J Subdivision appears to have a very positive influence on the overall drainage characteristics of Academy Boulevard. Total developed flows entering Academy Boulevard will be greatly reduced by diverting a majority of the discharge to a westerly outfall to be constructed as a part of University Park. This analysis is a preliminary review of the existing and proposed drainage characteristics of the area influenced by the proposed University Parkway intersection at Academy Boulevard. This drainage letter is intended to act as a reference for the evaluation of the proposed intersection. This area will be studied in greater detail upon commencement of final design. All updates and final documentation of drainage for this site will be submitted to the Department of Transportation for review and approval.

If you have any questions or comments regarding this drainage letter, please do not hesitate to call.

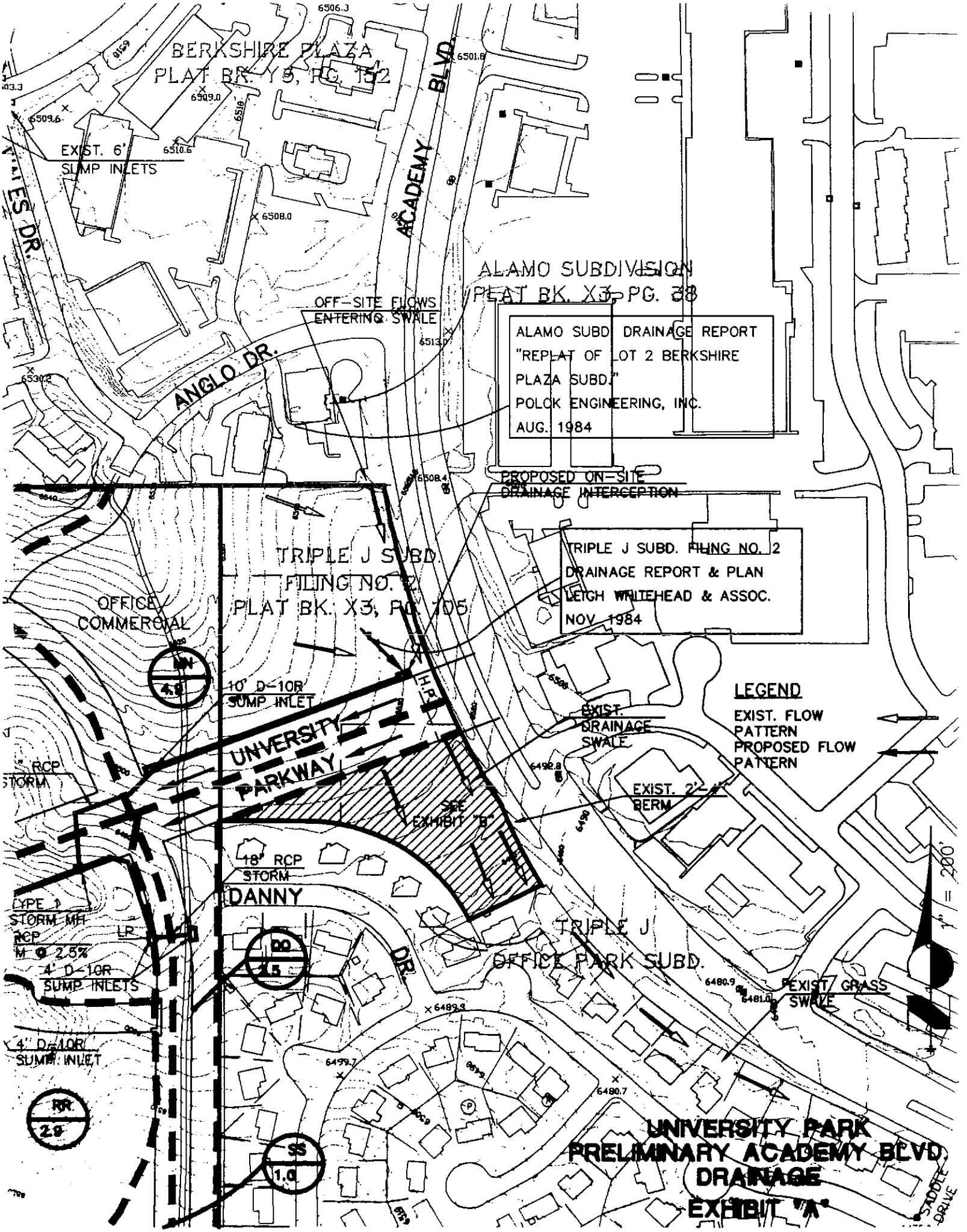
Respectfully submitted,

Kyle R. Campbell, P.E.
Project Manager
For and On Behalf of JR Engineering, Ltd.

/pj/876000/drainage.ltr

Enclosures: Exhibit "A"
Exhibit "B"

cc: Jerry Novak, JBS Corporation
A.T. Stoddard, Leigh, Scott & Cleary, Inc.
Doug Stimple, JBS Corporation


BERKSHIRE PLAZA
PLAT BK. Y3, PG. 152
ACADEMY BLVD.
EXIST. 6' SUMP INLETS
ALAMO SUBDIVISION
PLAT BK. X3, PG. 38
OFF-SITE FLOWS ENTERING SWALE
ANGLO DR.
ALAMO SUBD. DRAINAGE REPORT
"REPLAT OF LOT 2 BERKSHIRE PLAZA SUBD."
POLOK ENGINEERING, INC.
AUG. 1984
PROPOSED ON-SITE DRAINAGE INTERCEPTION
TRIPLE J SUBD. FILING NO. 2
PLAT BK. X3, PG. 105
TRIPLE J SUBD. FILING NO. 2
DRAINAGE REPORT & PLAN
LEIGH WHITEHEAD & ASSOC.
NOV. 1984
OFFICE COMMERCIAL
10' D-10R SUMP INLET
UNIVERSITY PARKWAY
LEGEND
EXIST. FLOW PATTERN
PROPOSED FLOW PATTERN
EXIST. DRAINAGE SWALE
EXIST. 2'-4" BERM
SEE EXHIBIT "B"
18" RCP STORM
DANNY
TRIPLE J OFFICE PARK SUBD.
4' D-10R SUMP INLETS
EXIST. GRASS SWALE
1" = 200'
UNIVERSITY PARK
PRELIMINARY ACADEMY BLVD.
DRAINAGE
EXHIBIT "A"

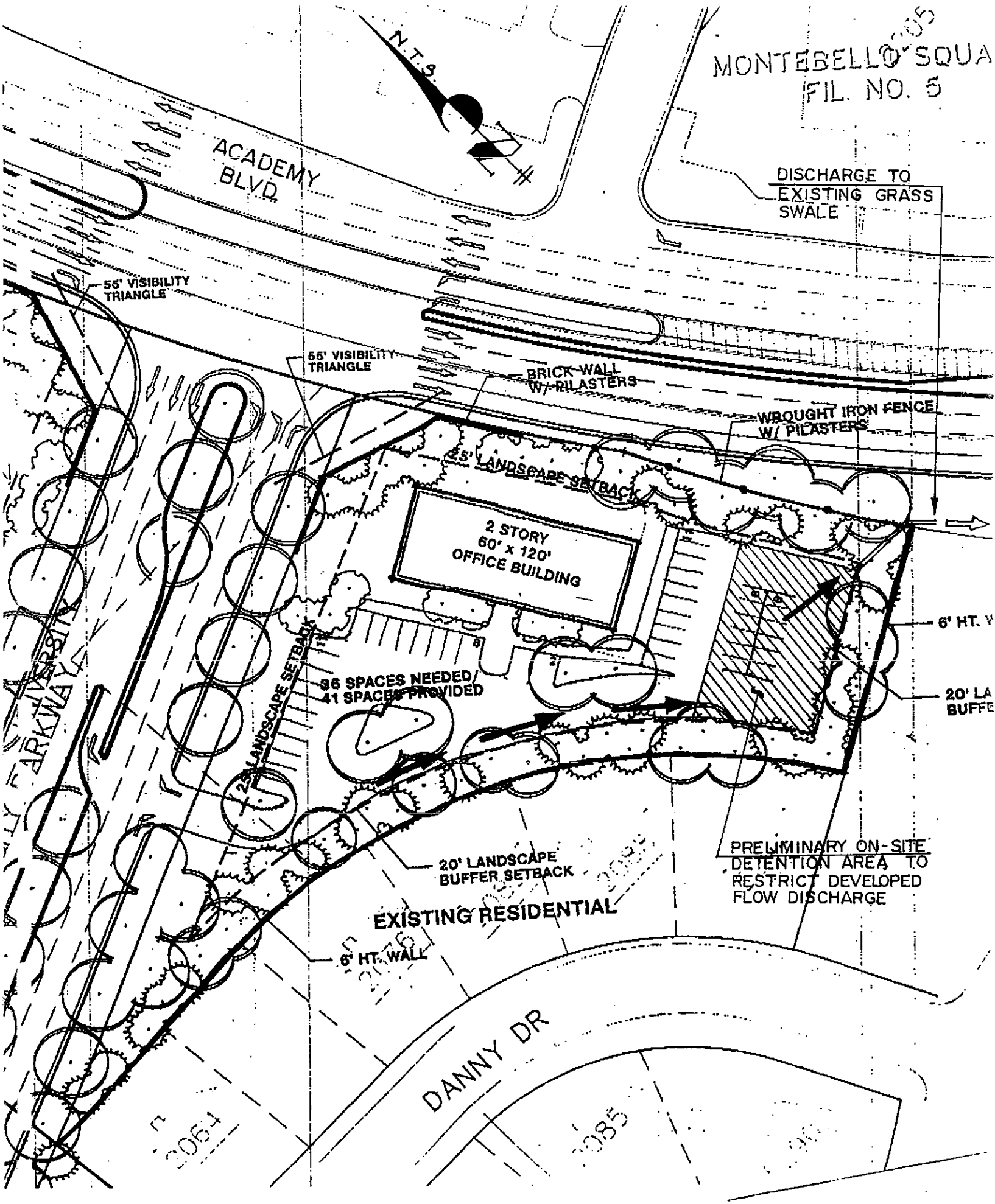

N.T.S.
MONTEBELLO SQUA
FIL. NO. 5
ACADEMY BLVD.
DISCHARGE TO EXISTING GRASS SWALE
55' VISIBILITY TRIANGLE
55' VISIBILITY TRIANGLE
BRICK WALL W/ PILASTERS
WROUGHT IRON FENCE W/ PILASTERS
25' LANDSCAPE SETBACK
2 STORY 60' x 120' OFFICE BUILDING
6' HT. W
20' LA BUFFE
25' LANDSCAPE SETBACK
36 SPACES NEEDED/ 41 SPACES PROVIDED
20' LANDSCAPE BUFFER SETBACK
PRELIMINARY ON-SITE DETENTION AREA TO RESTRICT DEVELOPED FLOW DISCHARGE
EXISTING RESIDENTIAL
6' HT. WALL
DANNY DR
2064
2085

EXHIBIT "B"

CITY OF COLORADO SPRINGS LETTER
NORTHERLY DRAINAGE (SPURWOOD COURT)

CITY ENGINEERING DIVISION

CITY OF COLORADO SPRINGS

COPY

Mr. William Reif
5834 Spurwood Court
Colorado Springs, Colorado 80918

April 11, 1995

Re: Spurwood Court Drainage

Dear Mr. Reif:

Per our previous phone conversations regarding the above referenced subject please be advised of the following:

1. A review of copies of the initial drainage reports for the Erindale Heights Filing No. 9 Subdivision indicate that storm water flows ranging from 113 cfs to 120 cfs were projected to be routed down the natural channel adjacent to your residence. These flows are representative of a 50 yr. frequency storm (the probability of this magnitude storm occurring is 50% each year). A brief review of the topography in the area indicate that the average channel slopes can range between 2% and 8%.

2. Assuming that the information above is representative of a majority of the existing natural channel system in your area the velocity of the water can range from 8fps to 17fps in these average channel sections. In general the existing channel cross section appears to be of adequate size to handle these flows but erosion of the bank sides present a concern.

3. Stabilization of the channel banks may be approached in several ways dependent upon the soil characteristics, geometry, and slope of the existing channel bed. In areas where the exist. channel bed is relatively straight and soil conditions allow, a rip- rap lining may be installed along the sides of the channel to control erosion. The average size of the rock should be 24" in diameter , 48" thick , placed on a geotextile filter fabric, protected by at least 6" thick layer of bedding material. The size of the rock mentioned is based upon velocities approaching 17fps.The height of the lining should be at least 3ft above the exist. stream bed where a min. bottom width of 5 ft. is available. The rip -rap should be "toed in " to the channel bottom at least 1.5 ft. to try and minimize undermining. Sections of channel that are steeper than 8% will require larger diameter rock to avoid being dislodged. In areas of the channel that have relatively sharp bends in them ,

30 S. Nevada Ave., Suite 403 • TEL 719-578-6606 FAX 719-578-6216
Mailing Address: Post Office Box 1575, Mail Code 435 • Colorado Springs, Colorado 80901-1575

the lining should be "superelevated" to account for the bend in the channel. The water has a tendency to rise up out of the normal water level in these bends. The rip-rap lining should extend up an additional 4.0 ft above the normal lining depth of 4ft. based upon a very tight radius of 50 ft. The more gentle the radius the less superelevation is required.

4. Alternative treatments of the channel may be utilized i.e.: railroad ties, shotcrete, grouted rip-rap, etc. but the theory behind the treatment should be the same. The mass of the treatment must be able to withstand the erosive effects of the water at high velocities.

5. Attached are copies of sections of the City/County Drainage Manual which deal with "plunge pools" and "stilling basins" which may be useful in certain sections of the channel. They are presented to you as conceptual ideas only. The intent of the pools is to take advantage of abrupt grade changes to slow down the velocity of the water and thus minimize the erosion potential.

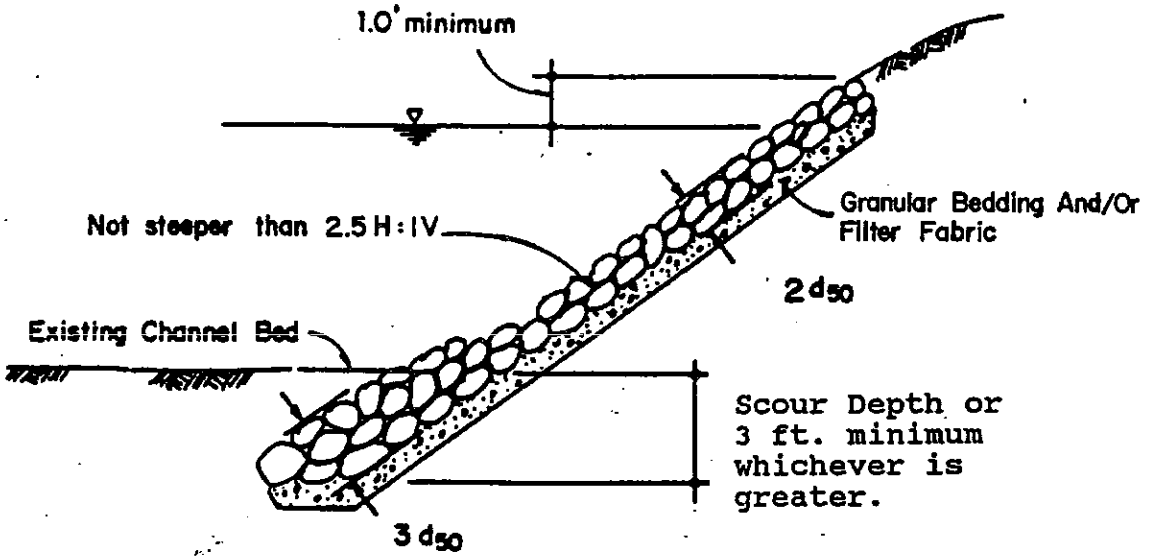
6. The costs involved in the lining of a channel with rip-rap of this size and configuration (one side only, height is 4.5 ft.)range from $15.20/l.f. to $21.80/l.f., depending on the amount constructed and the accessibility of the site.

Please understand that the suggestions listed above are based upon limited information available on the hydraulics of the channel as well as simple field observations of the existing system. The comments/ suggestions made above are not intended to supersede the need for a full engineering analysis of the system.. I strongly urge you to obtain the services of a private engineering firm to perform the appropriate analysis of the system particularly since it is to be privately funded and maintained.

Sincerely,

Chris Smith, Civil Engineer

cc: Subdivision File
Administrative Coordinator



Reference: Urban Drainage & Flood Control District, Urban Storm Drainage Criteria Manual, November 15, 1982.

9/30/90

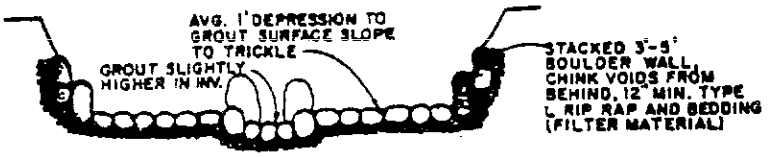
HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

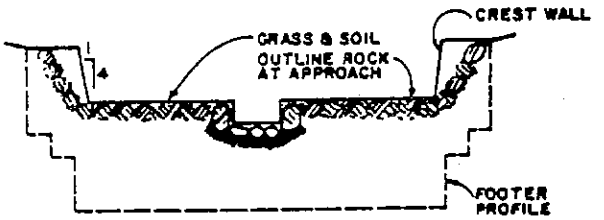
Toe Protection Riprap Channel Lining

Date: OCT. 1987

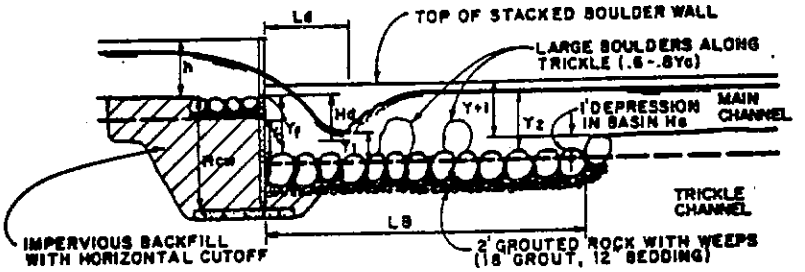
Figure: 10-20



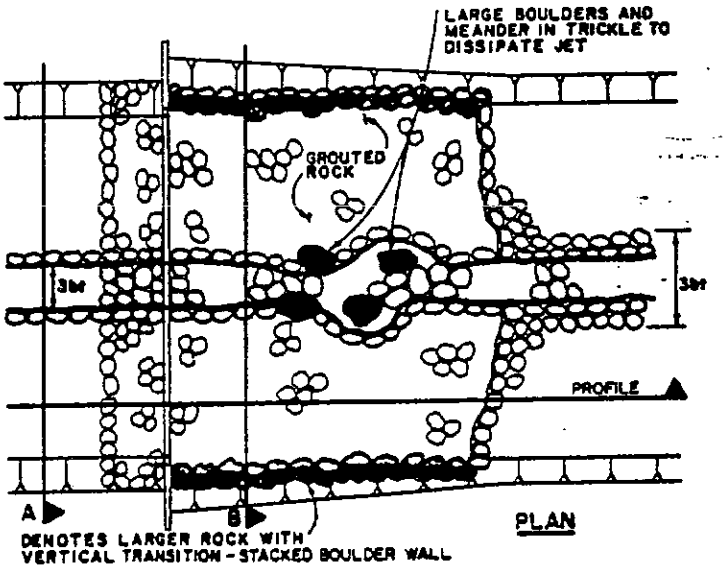
SECTION-B



SECTION-A



PROFILE



PLAN

VHB - Vertical Hard Basin Drop

REFERENCE : McLaughlin Water Engineers, Dec. 1966;Drop Structures in the Denver Metropolitan Area

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Date
OCT. 1987

Figure
10-12

CITY OF COLORADO SPRINGS LETTER
NORTHERLY DRAINAGE (SENATOR BIRD'S PROPERTY)

CITY OF COLORADO SPRINGS
The "America the Beautiful" City
DEPARTMENT OF PUBLIC WORKS CITY ENGINEERING DIVISION (719) 578-6606
30 S. NEVADA SUITE 403 P.O. BOX 1575
COLORADO SPRINGS, COLORADO 80901

June 21, 1990

Senator Michael Bird
5810 Spurwood Court
Colorado Springs, CO 80907

Re: CHANNEL EROSION, ERINDALE HEIGHTS FILING NO. 9

Dear Senator Bird:

I apologize for the amount of time that this report has required. Following my meeting with you and others on May 30, 1990, my staff has looked into this matter. They have visited the site a couple of times and have determined a cost estimate for a rock rip-rap repair of the erosion area, which we discussed.

The proposed rip-rap would begin at the outlet of the pipe and be constructed in a two level drop structure. Our estimate of cost is approximately $12,000.00.

I hope that this gives you an idea of the magnitude of the repair. As explained to you at the site, I am unable to commit engineering assistance to this project since it is viewed by the City as a private responsibility. However, I will be open to discussions with you and the neighborhood association concerning advice on how to proceed. This does not mean that I will review engineering designs or propose solutions. It does mean that I will review costs of alternative plans and indicate whether said plans would meet City criteria.

Please understand that the cost estimate given to you is based upon a visual inspection of the site and is not intended to be the final or exact cost for the project.

Sincerely,

Gary R. Haynes
City Engineer

c: Hugh King, Acting Director of Public Works
Bruce A. Thorson, Assistant City Engineer
Dave Lethbridge, Subdivision Development Specialist

ghl0621

CITY OF COLORADO SPRINGS
The "America the Beautiful" City
DEPARTMENT OF PUBLIC WORKS CITY ENGINEERING DIVISION (303) 578-6606
30 S. NEVADA SUITE 403 P.O. BOX 1575
COLORADO SPRINGS, COLORADO 80901

September 16, 1987

Senator and Mrs. Bird
5810 Spurwood Court
Colorado Springs, CO. 80907

Sold 1/12/99

Re: Channel Erosion in Erindale Heights Filing No. 9

Dear Senator and Mrs. Bird:

I have investigated the drainage situation near the end of the Spurwood Court cul-de-sac that is in Erindale Heights Filing No. 9. My observations were as follows: There has been some scouring at the outlet of the concrete culvert which crosses the common driveway access adjacent to lots 16 and 17. In addition, for a distance downstream of the outlet, the grade of the natural channel increases substantially. This has caused substantial erosion in this area of the channel including erosion and breaking up of some existing gunite lining.

Approximately 200 feet upstream of the culvert at the driveway access, a storm sewer system outfalls. This storm sewer system was installed with the Berkshire Plaza Subdivision. The drainage report for this subdivision was approved in 1980 and the drainage improvements were constructed in 1981. The drainage report was prepared in accordance with the approved drainage criteria at that time. Stormwater flows were calculated based on commercial and high density residential land uses which were proposed for this area. The report indicated that the need for a possible detention structure was studied. However, the report stated that because of the relatively small additional runoff generated because of the development, a detention facility was not required. Also, the report indicated that in reviewing the Erindale Heights No. 9 Drainage Report, the downstream improvements had the capacity to handle any additional flows that were generated upstream. It is my opinion that due to the grade of the downstream natural channel, erosion would be expected to occur even with undeveloped flows or lesser flows due to a lower density of development. I believe this alternative was acceptable at the time of platting Erindale Heights Filing No. 9 in order to keep this area in its natural state. If the area was to have been designated a public drainage area, permanent drainage improvements would have been necessary along the entire existing natural area and the natural area would have been significantly disturbed. For this reason, the plat for Erindale Heights Filing No. 9 stipulates that the drainage swales in this area will be kept natural and maintained

by the adjacent lot owners.

In discussing this problem with you, you indicated that the City replaced the driveway culvert with a larger pipe several years ago. This was accomplished even though the City had no responsibility in this private drainage area. You have requested that the City stabilize the channel at the outlet of the driveway culvert by placing rip rap or implementing other stabilization alternatives. Unfortunately, I cannot recommend that the City perform this work as the drainage area is private and maintenance has been stipulated to be the responsibility of the property owners. Maintenance should be expected to be needed on a periodic basis and I would recommend that a group of homeowners or a homeowner's association, if available, address and be responsible for these maintenance needs.

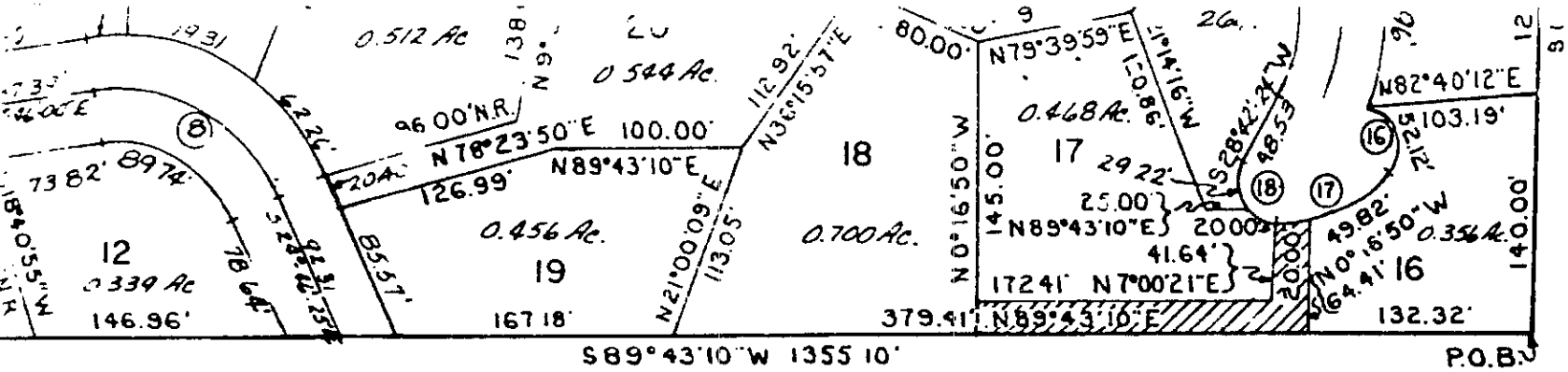
Sincerely,

Bruce A. Thorson

Bruce A. Thorson
Assistant City Engineer

Attachment

cc: DeWitt Miller, Director of Public Works
Gary R. Haynes, City Engineer
Ray Abeyta, Public Works Inspector



UNPLATTED

INDICATES COMMON ACCESS EASEMENT FOR THE ADJOINING LOTS ONLY.

Note:

The drainage swales adjacent to Lots 16 thru 36 in Block 3, Lots 7 thru 10 in Block 1, and Lots 11 and 12 in Block 2 will be kept natural and maintained by the adjacent lot owners.

THE UNDERSIGNED, THE PLANNING DIRECTOR OF THE CITY OF COLORADO SPRINGS HAVING FOUND THAT THIS FINAL SUBDIVISION PLAT CONFORMS TO THE PRELIMINARY THEREOF HERETOFORE APPROVED BY THE CITY COUNCIL, ACCORDINGLY APPROVES SAID PLAT WITH ALL PROVISIONS THERETO, THIS____DAY OF_____AD. 1976

_____

PLANNING DIRECTOR

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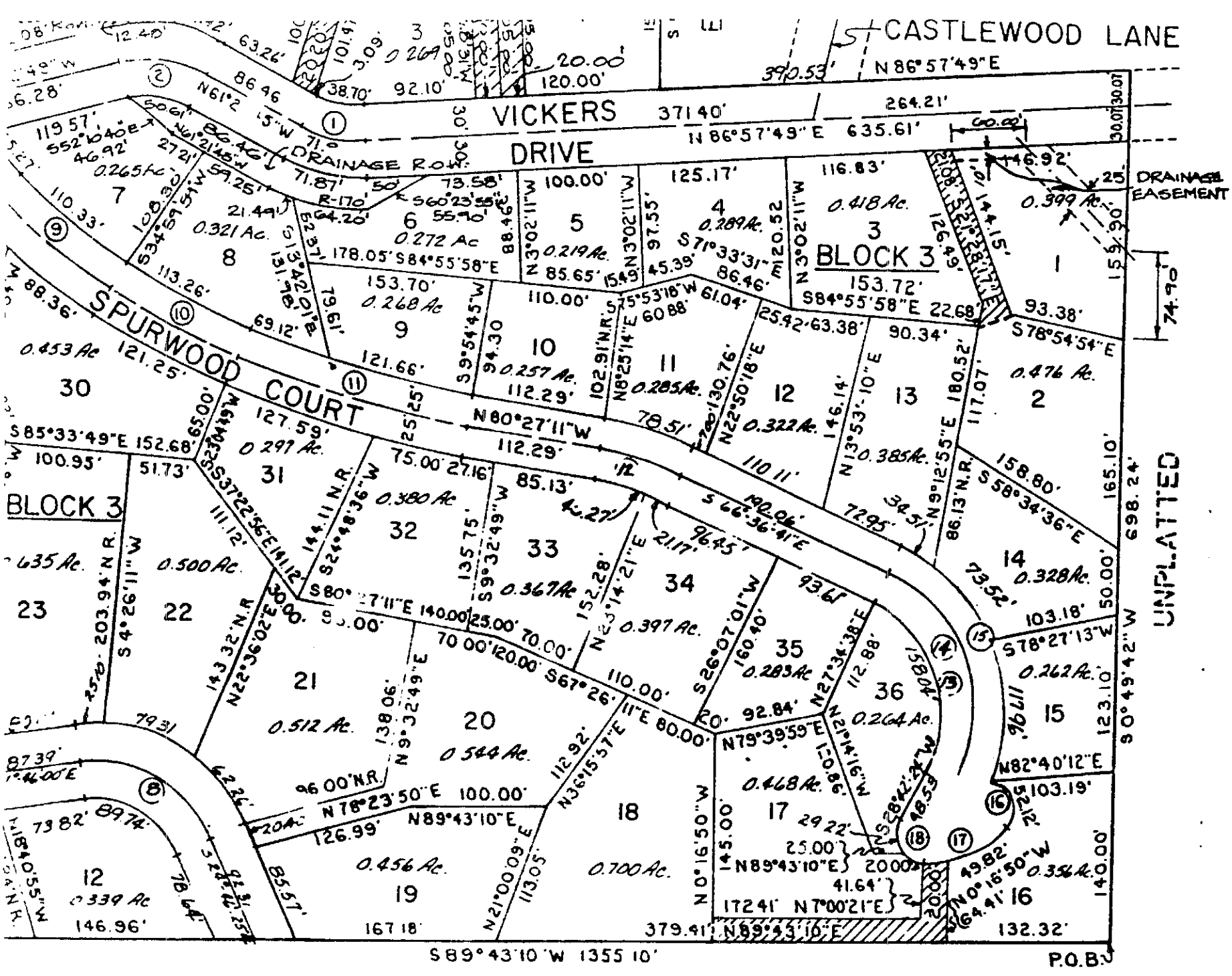

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DRAINAGE MAP "A"

DRAINAGE MAP "B"

DRAINAGE MAP "C"