MASTER DEVELOPMENT DRAINAGE PLAN
For
PARK VISTA SUBDIVISION

VOLUME I

August 2004

Prepared for:

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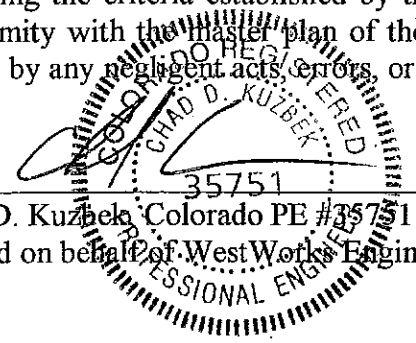
MASTER DEVELOPMENT DRAINAGE PLAN for PARK VISTA SUBDIVISION

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 the criteria established by the City/County 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.



Chad D. Kuzbek, Colorado PE #35751 — Date: 8-25-04
For and on behalf of WestWorks Engineering

Developer's Statement:
I, the developer have read and will comply with all of the requirements specified in this drainage report and plan.

Challenger Homes, Inc.
Business Name

By: Brian A Bach

Title: President

Address: 5140 N. Union Blvd #105
C6o Spgs, CO 80918

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.

For the City Engineer — Date: 8/30/04

Conditions:

MASTER DEVELOPMENT DRAINAGE PLAN for PARK VISTA SUBDIVISION

PURPOSE & SCOPE

The purpose of this drainage report is to recommend improvements required in the Park Vista area to protect and allow annexation and development of the Park Vista subdivision. The Park Vista area has been identified as a "problem area" in the "North Shook's Run – Templeton Gap Drainage Basin Planning Study," prepared by Lincoln DeVore, dated September 1977 (herein referred to as the DBPS). The Park Vista subdivision was designed and partially constructed prior to any drainage regulations and failed to make allowances for the quantity of upstream discharge routed through the area. As a result, the western crossing of Siferd Blvd was constructed across the Templeton Gap drainageway without an adequate crossing structure. During heavy rainfall, the Siferd Blvd crossing becomes inundated and is therefore a potential hazard to motorists, pedestrians, and several of the existing adjacent structures.

The scope of this report is to address improvements to the Templeton Gap drainageway through the Park Vista subdivision beginning at the existing box culvert under Academy Blvd to the existing bridge crossing at Hopeful Drive (approximately 3,300 LF upstream). This report also includes the south tributary branch of the Templeton Gap drainageway that extends to an existing 54" RCP outfall location (approximately 500 LF upstream from main branch).

The entire Park Vista subdivision was originally platted as unincorporated El Paso County land. Since then, portions of the Park Vista subdivision have been annexed into the City of Colorado Springs. The City continues to receive annexation requests in this area, however the City is uncertain about the extent and cost of improvements needed to safely stabilize and channelize the Templeton Gap drainageway. The analysis and report contained herein was requested by the City to identify the extent and cost of improvements to the Templeton Gap drainageway prior to the City allowing further annexation of properties within this area.

GENERAL LOCATION & DESCRIPTION

The Park Vista subdivision consists of approximately 71.7 acres southeast of the intersection of Academy Blvd and Austin Bluffs Parkway. More specifically, the subdivision forms a triangle that is roughly bounded by Austin Bluffs Parkway to the north and west and Siferd Blvd to the south and east. The unimproved Templeton Gap drainageway flows through the Park Vista subdivision. This section of the drainageway is unimproved and appears to be unstable. The existing sand-bed channel meanders through undeveloped lots and shows signs of historic erosion, local scour and bank sloughing.

Existing development along Austin Bluffs Pkwy consists of commercial and business uses. The majority of development surrounding the Park Vista subdivision to the east and south consists of single-family residential. Other than the corridor of commercial development along Austin Bluffs Pkwy, existing and proposed development within the Park Vista subdivision is zoned residential.

The existing soil conditions around this section of the Templeton Gap drainageway consists of Nunn clay loam (Map Symbol '59') as determined by the USDA SCS Soil Survey of El Paso County Area, Colorado. Characteristics of the Nunn clay loam, as listed in the SCS Soil Survey, are moderately slow permeability, high available water capacity, slow to medium surface runoff, and a slight hazard of erosion. Native vegetation is mainly western wheatgrass, blue grama, alkali sacaton, needleandthread, and side-oats grama. This deep soil is generally considered favorable for grassed waterways.

EXISTING DRAINAGEWAY CONDITIONS

Main Channel:

Both the main channel and South Tributary Branch of the Templeton Gap drainageway are ephemeral streams. That is, they are completely dry except during periods of heavy rainfall. The existing downstream limit of this report is the entrance to the existing 3-cell 12'x9' concrete box culvert under Academy Blvd. Based on the hydraulic modeling done with this MDDP study, it appears that this culvert has adequate capacity to handle 100-year developed conditions storm runoff. Approximately 300 LF upstream from this CBC the drainageway crosses over Siferd Blvd. This section of Siferd is improved with asphalt pavement and underground utilities, but there is no culvert or bridge structure to pass any runoff under the roadway. This section of Siferd Blvd can become a drainage hazard during periods of high runoff. The drainageway just upstream of Siferd Blvd is improved with an existing grouted riprap outside berm or levee for approximately 150 LF. This berm appears to have been installed to protect Date Street during minor storm events. This berm is not adequately sized to contain major storm events. For the next 1,350 LF the existing unimproved channel meanders through the undeveloped platted lots between Lotus Street and Siferd Blvd. The channel is largely a sand-bed bottom with vertical cut banks ranging from approximately 3' to 12' in height. There is evidence of historic sloughing of the banks into the channel as a result of the channel bed degradation. Approximately 1,800 LF upstream of the existing CBC is the confluence of the south tributary branch with the main channel of the Templeton Gap drainageway. The unimproved main channel continues upstream with near vertical cut banks for another 500 LF. This portion of the channel crosses platted Siferd Blvd once again. Siferd Blvd is not constructed across the drainageway at this time. Just upstream of this Siferd Blvd crossing, the channel bottom rises approximately 10 vertical feet. This section of the channel is improved with large grouted riprap. The base of this existing grouted riprap (an apparent scour hole) is considered the upper limit of the scope of this study. The riprap continues upstream between two existing platted and developed residential lots for 160 LF to the existing bridge crossing of Hopeful Drive. This bridge crossing is not adequate to safely pass the 100-year storm event runoff under Hopeful Drive. In fact, based on the hydraulic analysis of this MDDP study (in concurrence with the FEMA designated floodplain), this bridge crossing results in flooding of the existing surrounding developed residential lots. Upstream of the bridge crossing with Hopeful Drive the channel is improved with a natural bottom trapezoidal channel with concrete side slopes.

South Tributary Branch:

The confluence of the South Tributary Branch with the main channel occurs approximately 1,800 LF upstream of the existing 3-cell 12'x9' CBC. The South Tributary Branch is unimproved with near vertical cut banks. This reach is as deep as the main channel at the confluence (approx.

12'), but quickly rises to a depth of only a few feet where it crosses Siferd Blvd (approx. 300 LF upstream of confluence). This section of Siferd Blvd is improved with asphalt pavement. A pair of existing 30" CMP culverts runs under Siferd Blvd in this location. These culverts are not adequately sized to convey the major storm event. There is an existing 54" RCP discharging into the South Tributary Branch. This is the upper limit of the scope of this MDDP study. The existing South Branch is shallow and not well defined upstream of the 54" RCP. The channel continues between existing developed residential lots via a narrow concrete lined drainage tract to Hopeful Drive.

DRAINAGE BASIN DESCRIPTION

The total tributary area to the Park Vista subdivision (including Park Vista subdivision) is approximately 1,500 acres. The majority of the tributary area is developed. The limits of the overall tributary area are based on aerial topographic mapping at 2' contour intervals obtained from the City of Colorado Springs FIMS Department (Facilities Information Management Systems), basin delineation from the DBPS, and visual inspections.

MDDP Design Point 1 (DP1) is the entrance to the existing 3-cell 12'x9' concrete box culvert running under Academy Blvd (see Drainage Map Sheet 1 of 1 in Appendix). DP1 roughly corresponds with Federal Emergency Management Agency (FEMA) Floodway Study Section AG. The total tributary area to DP1 is roughly equivalent to DBPS overall Basin A. The only exception is that DBPS sub-basin A-12 drains into existing RCP's that discharge into the existing 3-cell 12'x9' CBC downstream of it's opening. Since DBPS Sub-Basin A-12 is not tributary to the open channel portion of the Templeton Gap drainageway being studied by this MDDP, it is not included in runoff calculations.

MDDP DP2 is the western crossing of the Templeton Gap drainageway and Siferd Blvd (see Drainage Map Sheet 1 of 1 in Appendix). DP2 roughly corresponds with FEMA Floodway Study Section AH.

MDDP DP3 is the confluence of the main channel with the South Branch (see Drainage Map Sheet 1 of 1 in Appendix). DP3 roughly corresponds to FEMA Floodway Study Section AJ.

MDDP DP4 is the existing bridge crossing of Hopeful Drive over the main channel (see Drainage Map Sheet 1 of 1 in Appendix). DP4 roughly corresponds to FEMA Floodway Study Section AN.

Runoff Curve Numbers for the large basins in this study are based on fully developed land uses as shown on the City of Colorado Springs zoning maps. The zoning maps used were current at the time this report was written. There are a total of 8 City of Colorado Springs and 2 El Paso County zoning designations within the overall tributary area. R1-6 is a City zone for single-family residential development with minimum individual lot sizes of 6,000 SF. PUD is a City zone for residential Planned Unit Development. Development within this zone typically consists of attached dwelling units, Townhome, condo, or mixed uses. PBC is City zone for "Planned Business Center." This zone consists of business and commercial uses. OC is a City zone for Office/Commercial uses. OR is a City zone for small office and residential uses. R5 is a City

zone for multi-family development. School is a City zone for schools. PK is a City zone for Parks. RR-1 is a County zone for rural residential consisting of single-family residential lots with a minimum size of ½-acre per lot. R-3 is a County zone for multi-family residential development.

The total acreage of each zone was calculated within each Basin in the MDDP. Runoff Curve Numbers were then given to each zone within the Basin and an overall composite Runoff Curve Number was calculated for each Basin. Runoff Curve Numbers within each zone were determined based on the most intense zone land use and the dominant Hydrologic Soil Group (HSG) within each zone. HSG designations were determined based on the Soil Conservation Service soil maps for the El Paso County area. The HSG(s) for each zone within each Basin was determined from the SCS maps. If a particular HSG was clearly dominant within a given zone and Basin, then its runoff characteristics were used when determining Runoff Curve Numbers. If there was no dominant HSG within a particular zone, then the "worst-case" HSG was used. Tables of zoning areas and HSG's for each Basin are shown in the Appendix. A zoning map is also shown in the Appendix (24"x36" Sheet 3 of 3).

DRAINAGE STUDY COMPARISON

Runoff quantities through the Park Vista Subdivision have been evaluated in several previous studies. The quantities calculated in this MDDP were compared to the runoff calculations of the DBPS and the FEMA Floodway Study. The comparison with the DBPS was done because it is the overall drainage study of record with the City for this area. The DBPS is used to determine Drainage Fees that pay for public drainage improvements. The comparison with the FEMA Floodway Study was done because the FEMA studies include their analysis of runoff quantities to determine the extent of floodplains. These comparisons are for reference purposes only. They provide an idea of how the results of this MDDP study fit in with the frame of reference established by previous studies.

The comparison of runoff quantities with the DBPS was of little help. The DBPS analysis was done in 1977 and uses a 6-hour Type IIA storm distribution for the 5-year and 100-year frequency intervals. The 6-hour storm distribution yields lower peak runoff quantities than those calculated in this MDDP using the 24-hour storm distribution. The useful portion of this comparison comes from the tributary basin area and runoff Curve Numbers. The total tributary area to MDDP DP1 calculated in the DBPS is 1,475 acres compared with 1,491 acres calculated in the MDDP. Also, the total composite Curve Number for the entire tributary area was 84 in the DBPS compared to 85 in the MDDP. This comparison shows a strong correlation and consistency between the basin characteristics determined in these 2 separate studies.

The comparison with the FEMA Floodway Study worked well for runoff quantities, but the FEMA study gives little information regarding basin characteristics. The FEMA study comparison is only for the 100-year, 24-hr storm event. The peak runoff at MDDP DP1 (Q_{100} = 5,082 cfs) correlates well with FEMA Section AG (Q_{100} = 5,050 cfs). The peak runoff at MDDP DP2 (Q_{100} = 5,079 cfs) correlates well with FEMA Section AH (Q_{100} = 5,029 cfs). The peak runoff at MDDP DP3 (Q_{100} = 4,956 cfs) does not carry a strong correlation with FEMA Section AJ (Q_{100} = 4,343 cfs). Likewise, the peak runoff at MDDP DP4 (Q_{100} = 4,546 cfs) does not

correlate well with FEMA Section AN (Q_{100} = 3,814 cfs). It is not apparent why this discrepancy exists upstream of the confluence of the South Branch with the main channel. The peak runoff quantities calculated in this MDDP are higher than those used in the FEMA study. Also, the basin characteristics used in this MDDP to calculate these higher peak flows is very similar to the basin characteristics of the DBPS. For these reasons, this MDDP uses the peak flows calculated in this MDDP for all channel hydraulics and floodplain delineation.

DRAINAGE DESIGN CRITERIA

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs and El Paso County Drainage Criteria Manual, updated in October 1994. This report has taken into the account the results and recommendations of the following previous drainage studies:

"North Shook's Run – Templeton Gap Drainage Basin Planning Study," prepared by Lincoln DeVore, dated September 1977

For this study, WestWorks Engineering used the SCS Hydrograph Procedure. The methodology was implemented in accordance with the City/County Drainage Criteria Manual Guidelines.

For the SCS Hydrograph Procedure, WestWorks Engineering uses the aid of HydroCAD version 6.00 for runoff calculations, routing quantities, and detention. Runoff quantities are analyzed for storms with recurrence intervals of 10 years and 100 years. The 2-hour storm distributions are input into the software based on Figure 5-5a in the City/County Drainage Criteria Manual. The 24-hour storm distributions are based on a Type IIA distribution as shown in Figure 5-5b of the City/County Drainage Criteria Manual. Runoff Curve Numbers are taken from Tables 5-6 and 5-7 (using AMC III) of the City/County Drainage Criteria Manual. Calculations for the SCS Hydrograph Procedure are shown in the Appendix of this report.

ALTERNATIVES

Solutions to the drainage problems in this area have been examined in previous studies, including the DBPS. The solutions range from very expensive and aggressive improvements with little loss of land, to less expensive, less intense improvements with significant loss of land.

The DBPS looked at the possibility of an underground box culvert through the entire Park Vista subdivision. While this alternative salvages the most surface ground for future development, it is considered cost prohibitive. The alternative recommended in the DBPS involved the City's purchase of all the lots surrounding the drainageway, regrade and lower the large area, and keep it as open space. This alternative is not completely feasible today because several of the lots recommended for purchase in the DBPS have since been developed. Also, even with the large area for the drainageway, significant improvements would still be required to fully stabilize the channel (i.e., significant grading, riprap sides, box culvert at west Siferd Blvd crossing, etc.). For these reasons, it is believed that this alternative, as stated in the DBPS, is no longer feasible and does not represent a significant cost savings over the recommended alternative.

Recommendation:
The alternative recommended by this MDDP seeks a middle ground, so-to-speak, between cost of improvements and land acquisition. The basic premise of this solution is a natural bottom trapezoidal channel at a 0.5% grade with sloping riprap drops to dissipate the energy. The channel section from the existing 3-cell 12'x9' CBC at DP1 to the west crossing of Siferd Blvd at DP2 will be a fully lined concrete trapezoidal channel with a 40' bottom width and 1.5:1 side slopes to a depth of 9 feet. This section of the channel is 1.0%.

The west crossing with Siferd Blvd at DP2 will be accomplished by a 3-cell 16'x10' concrete box culvert at 1.0%. This box culvert is designed to be relatively wide and flat because of the limited amount of headwater depth. There are existing developments near this crossing with Siferd Blvd that are not much higher in elevation that the current roadway elevation. Therefore, the proposed box culvert is planned so that it can adequately handle the major storm event while minimizing headwater depth. Construction of this proposed box culvert will require modifications to existing utilities in Siferd Blvd, as well as regrading and reconstruction of the surrounding streets. A small berm or levee may need to be constructed adjacent to Date Street to contain the headwater from overtopping into adjacent developed lots. Details of this berm/levee should be worked out with final design of the culvert and regraded streets.

Improvements for the remainder of the main channel will be a natural bottom trapezoidal channel with an 80' bottom width and buried riprap side slopes at 2.5:1 to a height of 8'. The overall existing grade through this section of the channel is approximately 1.7%. Therefore, grouted sloping riprap drops are placed along the channel to dissipate energy and control grade. This trapezoidal channel section will tie into the existing grouted riprap drop below the existing Hopeful Drive Bridge. This report does not recommend that the eastern crossing of the main channel and Siferd Blvd be constructed. It appears there is adequate access through the Park Vista area, as it has existed without this crossing for many years. The limited benefits from construction of this east crossing do not appear to justify the cost. Should future development, access, or emergency response require this crossing to be constructed, then the improvement costs and drainage fees shown in this MDDP may need to be revised. The South Tributary Branch to the main channel will be improved with a natural bottom trapezoidal channel with a 36' bottom width and buried riprap side slopes at 2.5:1 to a height of 8'. The crossing of the South Branch with Siferd Blvd can either be eliminated, or accomplished by the construction of 4 – 48" RCP's. The latter is used in this report. The South Branch will then rise to meet the existing 54" RCP outfall. The bottom of the South Branch shall be riprap from the Siferd Blvd crossing to the existing 54" RCP. Proposed ground cover for the natural bottom sections of both channels is likely to be native grasses. The existing soils in this area are sandy and the stream remains dry for most of the year. Therefore, it is not believed that this drainageway can support wetland or riparian vegetation. Further details of the hydraulic methodology are discussed later in this report.

Recommended land acquisition essentially consists of the area immediately adjacent to the proposed concrete lined channel (proposed City-owned Tract), the entire row of existing platted undeveloped lots south of Lotus Street, and the entire area between the main channel and South Branch. The row of lots along Lotus Street was selected because it has the lowest elevation

compared to surrounding ground and most of the existing drainageway is contained in this row. The minimum extent of land acquisition recommended by this MDDP is shown in the Appendix (see Land Acquisition Exhibit in Appendix – 11"x17" sheet). The total width of the proposed channel sections varies from 58' to 120'. The majority of the natural bottom main channel will require the 120' width (top width). This is the same width as the existing platted lots through this area. Most of the lots shown for acquisition have Lotus Street frontage. Lotus Street is an existing 60' right-of-way. Once annexed, the City of Colorado Springs only requires 50' for right-of-way. Therefore, there is a potential for an additional 10' of width, beyond the 120' width, for the channel along Lotus Street. This additional 10' can be used for grading, open-space, maintenance access, or a trail.

Maintenance access to the proposed channel section can be obtained from the existing Lotus Street right-of-way. Upstream of the confluence, maintenance access can be obtained from the existing Siferd Blvd right-of-way. Access roads can be graded to the bottom of the improved channel. Access to the concrete lined portion of the channel (between DP1 and DP2) will be through the proposed box culvert under Siferd Blvd.

HYDRAULIC ANALYSIS METHODOLOGY AND CRITERIA

General

The United States Army Corps of Engineers HEC-RAS (Hydrologic Engineering Center – River Analysis System) computer program, version 3.1, was utilized to model the existing and proposed conditions of the two stream reaches. The HEC-RAS computer model is a gradually varied flow calculation that uses the "standard step" method for determining water surface profile elevations in natural and constructed channels. The computational procedure is based on the one-dimensional energy equation. Changes in water surface elevations are quantified by the computation of friction and channel expansion and contraction energy losses. Standard input parameters required for the model include channel cross-section geometry, roughness coefficients (Manning's N values), contraction and expansion coefficients, design storm discharges and bridge/culvert data. Input parameters specific to this analysis included blocked obstructions (houses) and ineffective flow areas (levees).

Existing Conditions

Due to the evolving nature of natural streambeds, the reach studied has experienced some geometric changes since last studied. It is for this reason that current topography was needed to establish a baseline for the existing conditions model. WestWorks Engineering contracted the services of a land surveyor to perform a topographic survey of the project reach, from the Academy Blvd. box culvert upstream to the Hopeful Drive Bridge. This three dimensional data was spliced into the latest FIMS (Facilities Information Management Systems) topographic mapping (2' contour interval) by using an AutoDesk Land Development Desktop (LDD) terrain modeling program module. An alignment of the streams approximate thalweg was developed and sections were cut via the LDD hydrology module. This cross section data was then imported into HEC-RAS.

Prior to modeling, a field visit was conducted to determine roughness coefficients. The stream and overbank surface characteristics as determined by the presence of riprap, cobbles, gravel,

sand bed and vegetation limits were identified in the field and noted on a map. This mapped data was then entered into HEC-RAS for further refinement. Additional cross section geometry was needed at locations of changing roughness boundaries, channel geometric changes and at locations of structures such as culvert and bridge approaches. Refer to the Existing Conditions HEC-RAS report data for additional input parameters and hydraulic computational methodologies chosen.

Design flows for the existing conditions model were based on a hydrologic analysis of the entire contributing watershed as conducted by WestWorks Engineering and contained in this report. The City's respective engineering representatives felt that a new study was in order to better reflect the actual constructed development verses that determined by others in the past using assumed development values. WestWorks Engineering computed discharge values can be found in the hydrologic portion of this report.

Proposed Conditions

The City/County Drainage Criteria Manual (DCM) was utilized to determine a reasonable conveyance system to route flows through the project site. DCM open channel geometric design parameters along with sloped riprap drop structures were used to set the proposed conditions of the respective reaches. "Hard points" at each end of the Templeton Gap Floodway reach were established and a running channel grade of ~1.7% was determined. To adequately stabilize the channel and to reduce erosive discharge velocities, the channel bed was set at 0.5%, which necessitated the use of drop structures. The exception is the 1.0% slope used for concrete lined channel and proposed box culvert at Siferd Blvd. The LDD cross-section module was utilized to create templates to cut the proposed channel grade surface and subsequent contours.

The channel geometry in the main channel that can convey the 100 yr storm design flows was determined to be an 80' bottom width trapezoidal channel with 2.5:1 side slopes 8' in height for the majority of the reach in the main channel. South of the Siferd culvert crossing, a 40' bottom width trapezoidal channel with 1.5:1 side slopes 9' in height was used due to the site constraints by adjacent development. A three-cell 16' x 10' reinforced concrete box culvert was used at the west crossing Siferd Blvd to convey the flow under the roadway. For the South Tributary reach, a 36' bottom width trapezoidal channel with 2.5:1 side slopes 8' in height was used. At the Siferd Drive crossing, four 48" reinforced concrete pipes were needed to adequately convey the flow beneath the roadway. The aforementioned proposed channel geometry was then imported into HEC-RAS similarly to the method used for the existing conditions by use of the LDD hydrologic module. Overbank grading and culvert system components were then input into HEC-RAS manually.

Initial "runs" were made based on the constraints listed above. Iterative design was then needed to further refine the proposed improvement scope. Noteworthy items which were refined were; box culvert dimensions, side slope revetment, levee creation (adjacent to Date Street) and concrete channel lining. The resultant analysis as found in the appendix outlines the hydraulic properties of the proposed channel and system components. It should be noted that this analysis was prepared in an effort to establish a reasonable conveyance system to route flows through the subject site to aid in the determination of drainage fees. WestWorks Engineering makes no claim that this is the only viable option for channel stabilization and re-routing. There are

certainly other alternative solutions that can be determined with a more detailed and thorough analysis and design effort, which is out of the scope of this study.

HYDRAULIC RESULTS

The results of the HEC-RAS analysis are included in the Appendix. Existing and proposed channel modeling geometry along with structure locations are shown in the map pockets.

FLOODPLAIN STATEMENT

The Templeton Gap Floodway and the Templeton Gap South Tributary reaches as studied in this report are drainage corridors and are designated FEMA flood zones as determined by the Flood Insurance Rate Map Community Panel Numbers 08041C0519 and 08041C0538, effective date March 17, 1997. The conceptual improvements as outlined in this report will change the 100-year water surface profile and will necessitate a more detailed analysis and subsequent submittal to FEMA to obtain a LOMR (Letter Of Map Revision).

COST/FEE ANALYSIS

A cost analysis of the preferred channel improvement alternative (as discussed above) was performed. Quantities were estimated for the improvements and cost information is based on published CDOT cost information, firm experience, discussions with landowners, and other historical data. The DBPS is used to establish the scope and cost of drainage improvements within an overall drainage basin to determine the Drainage Fees within the basin. The DBPS identified the need for improvements to the Templeton Gap drainageway through the Park Vista subdivision, however did not include this area in the City Drainage Fee calculations based on the area being part of El Paso County. Therefore any City Drainage Fees collected for the Templeton Gap Drainage Basin do not include the cost of improvements in the Park Vista subdivision.

The DBPS recommended a low-cost solution for the Park Vista area. The solution was for the City to purchase all the surrounding lots adjacent to the drainageway, regrade them lower than surrounding land, and leave the area open. As discussed earlier in this MDDP, this solution is thought to be overly simplistic using today's standards. Also, some of the lots recommended for purchase in the DBPS have since been developed. For these reasons, the DBPS recommendation is not supported by this MDDP. Regardless of the solution and cost recommended by the DBPS, the Park Vista subdivision improvement costs were excluded from all of the Templeton Gap Drainage Basin Fee calculations.

In short, this MDDP recommends that a Park Vista Sub-Fund be created within the Templeton Gap Drainage Basin. All the lots in the Park Vista Subdivision shall pay the Park Vista Sub-Fund Drainage Fee prior to annexation into the City of Colorado Springs. The basis for calculating the Park Vista Sub-Fund is simply to make it equivalent to the highest existing City of Colorado Springs Drainage Basin Fee.

The Park Vista Sub-Fund Drainage Fee shall be $10,523 per acre. This is based on the total 2004 fee in the Windmill Gulch Drainage Basin. This fee shall be collected on any land in the Park Vista area that is annexed into the City of Colorado Springs, excluding the annexation of any platted public right-of-way. The total area of Park Vista is approximately 71.7 acres. The area of existing public right-of-way outside of the future channel area is approximately 15.2 acres. Fees shall be paid on the 9.6 acres of land to be dedicated to the City of Colorado Springs as the future improved channel area. However, dedication of this land is entitled to a reimbursement for the land cost. This land cost is included in the overall opinion of probable cost for the channel improvements in the Appendix of this report.

14.7 acres of Park Vista has already been annexed into the City of Colorado Springs. It is possible that the City could request additional Drainage Fees from the Park Vista properties already annexed into the City. At the time these properties annexed into the City they paid the Templeton Gap Drainage Fee. The City could collect the difference between the amount that they paid and the new Park Vista Sub-Fund Drainage Fee amount. The mechanism for collection of such a fee is not known. This MDDP brings this issue up only for informational purposes.

The total preparation cost of this MDDP drainage study is included in the total reimbursable costs of the Park Vista Sub-Fund Drainage Fee calculation. Therefore, Challenger Homes is entitled to a Park Vista Sub-Fund Drainage Fee credit in the amount of $ 17,320.

The total opinion of probable cost to construct the improvements recommended in this report is $3,993,000. The Park Vista area alone cannot bear the entire cost of the proposed drainage improvements. The overall Templeton Gap Drainage Basin is almost completely platted and developed, therefore trying to distribute the drainage improvement costs for the Park Vista area over the remaining unplatted Templeton Gap Basin will only generate a small amount of fees. The remaining cost of channel improvements will need to be collected through a funding source other than Drainage Basin Fees. The following is a discussion of several possible alternatives with advantages and disadvantages:

1) Development within the Park Vista area could be asked to pay for all channel improvements.

   Advantage(s): The City (essentially the taxpayers of the City) does not burden this cost.

   Disadvantage(s): The cost is way too excessive for this small of an area to burden and will likely sterilize this area. Also, almost all runoff in this section of the drainageway comes from upstream development; therefore it is unfair for a downstream property owner to pay for all improvements caused by upstream development.

2) An improvement district could be created within the surrounding Park Vista area or overall Templeton Gap Basin area.

   Advantage(s): This alternative seeks to distribute the cost of improvements over a greater area and keeps the burden of paying for improvements within the basin requiring them.

   Disadvantage(s): It is not clear how this district would be formed and how people in the basin would be convinced to join and pay into it. Even if the cost is distributed

over the entire basin the fee would still be great enough per acre (roughly $2,600/ac over entire 1500 acre basin) that this idea would be strongly opposed by residents.

3) The City could establish a Drainage Utility Fee. This fee would charge all residents in the City a Utility Fee for drainage improvements and maintenance similar to the way Utility Fees are collected for Gas, Electric, Water, and Wastewater. This fee could be a flat fee per lot, based on lot size, or based on impervious area. Revenue generated by this fee could be used for citywide drainage improvements including the Park Vista subdivision.

   Advantage(s): The cost of improvements is distributed over the greatest area. This alternative could fund not only the Park Vista improvements, but it could also help the City address other areas in need of drainage improvements, upgrades, and ongoing maintenance. The fee could be structured to offer incentives to individuals for reducing impervious area or implementing storm water runoff quality BMP's. These incentives could help reduce runoff and pollution, in turn reducing the cost to the City for ongoing repair, upgrades, and maintenance.

   Disadvantages(s): Establishing this fee would likely require the passage of a new City Ordinance by City Council. This issue could be politically sensitive and would require the support of a majority of the City Council constituency. City residents may not support an additional fee or tax without having a direct say in how the money is spent.

4) The City could burden the remaining cost. This would likely be achieved through a voter approved tax increase or a bond issue.

   Advantage(s): The cost of improvements is distributed over the greatest area.

   Disadvantages(s): Historically, passing a tax increase or bond issue has proved difficult. If the City failed to approve the tax increase, then this area would remain unimproved and a public safety hazard.

5) El Paso County may participate in the funding of channel improvements.

PHASING OF DEVELOPMENT AND IMPROVEMENTS

It is unlikely that all funds for improvements will be obtained at once. For this reason it is suggested that the installation of improvements be phased. Given that the Templeton Gap drainageway currently flows OVER the western crossing of Siferd Blvd, it is recommended that this box culvert crossing be constructed first. Once this crossing is built, then the channel improvements between this proposed box culvert at Siferd and the existing box culvert can be constructed. From here it is recommended that improvements be installed as funding becomes available from downstream to upstream or as localized erosion dictates.

Recommendations for annexation and development of lots in the Park Vista Subdivision are divided into 4 categories as shown on the "Park Vista Subdivision Development Exhibit" shown in the Appendix (11"x17" sheet). The first category is lots that are completely outside of the existing floodplain (23.2 acres). These lots should be allowed to annex into the City and develop prior to any channel improvements. Development of these lots will allow the City to begin collecting Drainage Fees for the first phase of improvements. The second category is lots that are partially in the existing floodplain (3.6 acres). These lots can be annexed and developed as long as development follows the City Floodplain Ordinance. These are lots that have buildable

areas or pads outside of the existing floodplain, even though a small portion of the lot may be within the floodplain. The third category is lots that cannot be developed prior to channel improvements (4.7 acres). These are lots that are mostly within the existing floodplain but will be out of the floodplain once channel improvements are installed. The fourth category is lots that will become part of the proposed channel itself (9.6 acres).

SUMMARY & CONCLUSION

The Templeton Gap drainageway currently traverses through the Park Vista subdivision in an unimproved state. Improvements are required to this section of the drainageway in order to safely develop and annex this area into the City of Colorado Springs. The DBPS for the Templeton Gap Drainage Basin was prepared in 1977. When establishing drainage and bridge fees for the Templeton Gap basin, the DBPS did not include the cost of improvements to this section of the Templeton Gap drainageway. This MDDP recommends a drainage improvement solution to safely and adequately address the drainage concerns in this area. The recommended solution includes the acquisition of approximately 7.9 acres of land and the construction of a trapezoidal channel from the existing 3-cell 12'x9' RCBC up to the existing grouted riprap drop below the existing Hopeful Drive bridge. The channel section from the existing 3-cell 12'x9' CBC at DP1 to the west crossing of Siferd Blvd at DP2 will be a fully lined concrete trapezoidal channel with a 40' bottom width and 1.5:1 side slopes to a height of 9 feet. The west crossing with Siferd Blvd at DP2 will be accomplished by a 3-cell 16'x10' concrete box culvert. Improvements for the remainder of the main channel will be a natural bottom trapezoidal channel with an 80' wide bottom and buried riprap side slopes at 2.5:1 to a height of 8'. The main channel will also have sloping riprap drop structures to dissipate energy. The South Tributary Branch to the main channel will be improved with a natural bottom trapezoidal channel with a 36' wide bottom and buried riprap side slopes at 2.5:1 to a height of 8'. The crossing of the South Branch with Siferd Blvd can be accomplished by 4 – 48" RCP's. The total opinion of probable cost for these improvements is approximately $3,993,000 (a portion of this cost shall be paid by a recommended Park Vista Sub-Fund Drainage Fee). The majority of this cost will need to be paid by some other funding mechanism. Several possible funding alternatives along with their advantages and disadvantages are discussed in this report. Further details of the recommended improvements will need to be addressed during final design, including the processing of a Letter of Map Revision (LOMR) with FEMA.

REFERENCES

1. "Engineering Study and Revision Of The North Shook's Run – Templeton Gap Drainage Basin," prepared by Lincoln DeVore, dated September 1977.

2. "Soil Survey for El Paso County Area, Colorado," prepared by United States Department of Agriculture Soil Conservation Service, dated June 1981.

3. "Flood Insurance Rate Map," prepared by the Federal Emergency Management Agency, dated March 17th, 1997.

4. "The City of Colorado Springs Official Zoning Map," prepared by City of Colorado Springs Planning Department, dated March 1st, 1999.

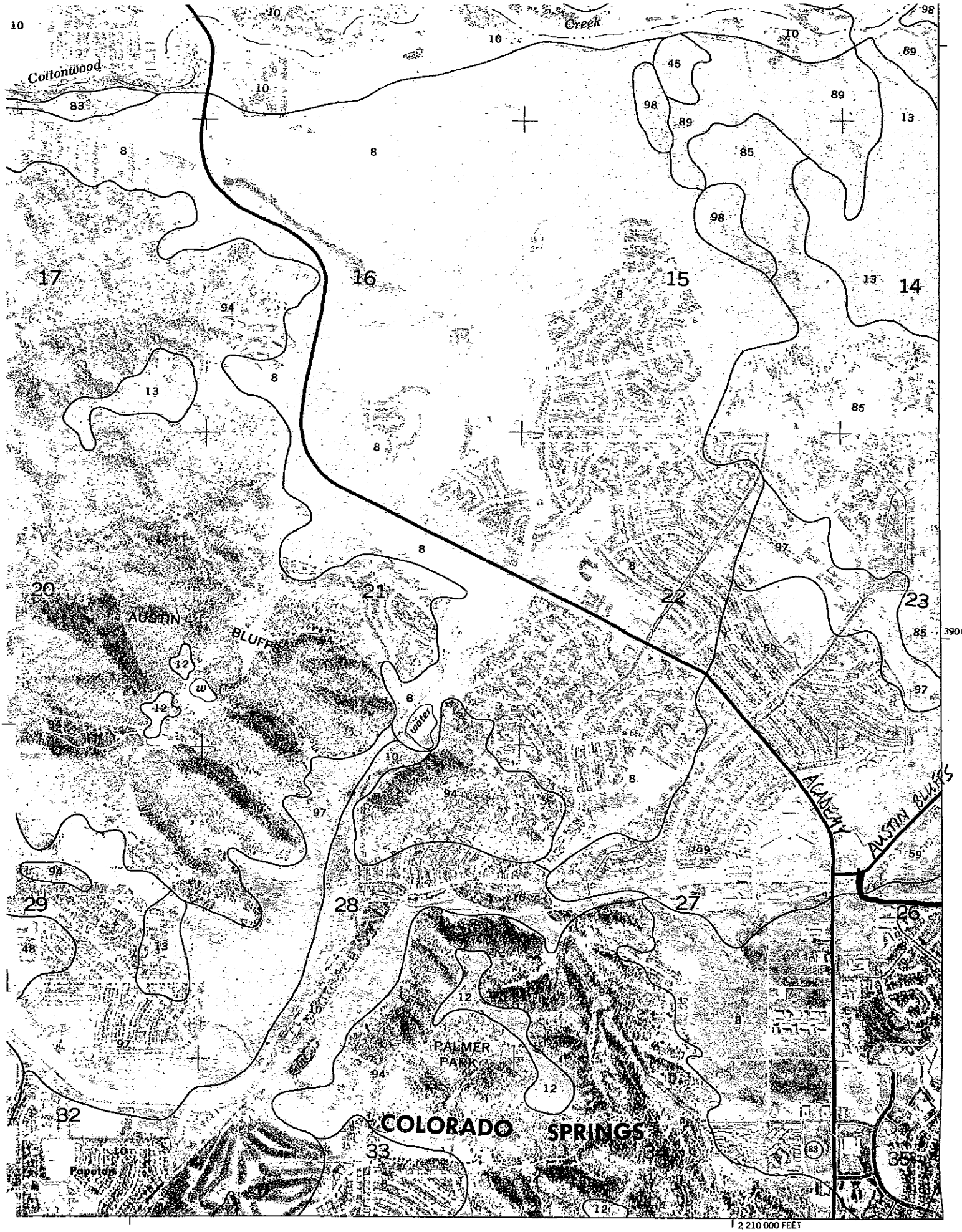
5. "HEC-RAS River Analysis System, Applications Guide, Version 3.1," prepared by the United States Army Corp of Engineers, dated November 2002.

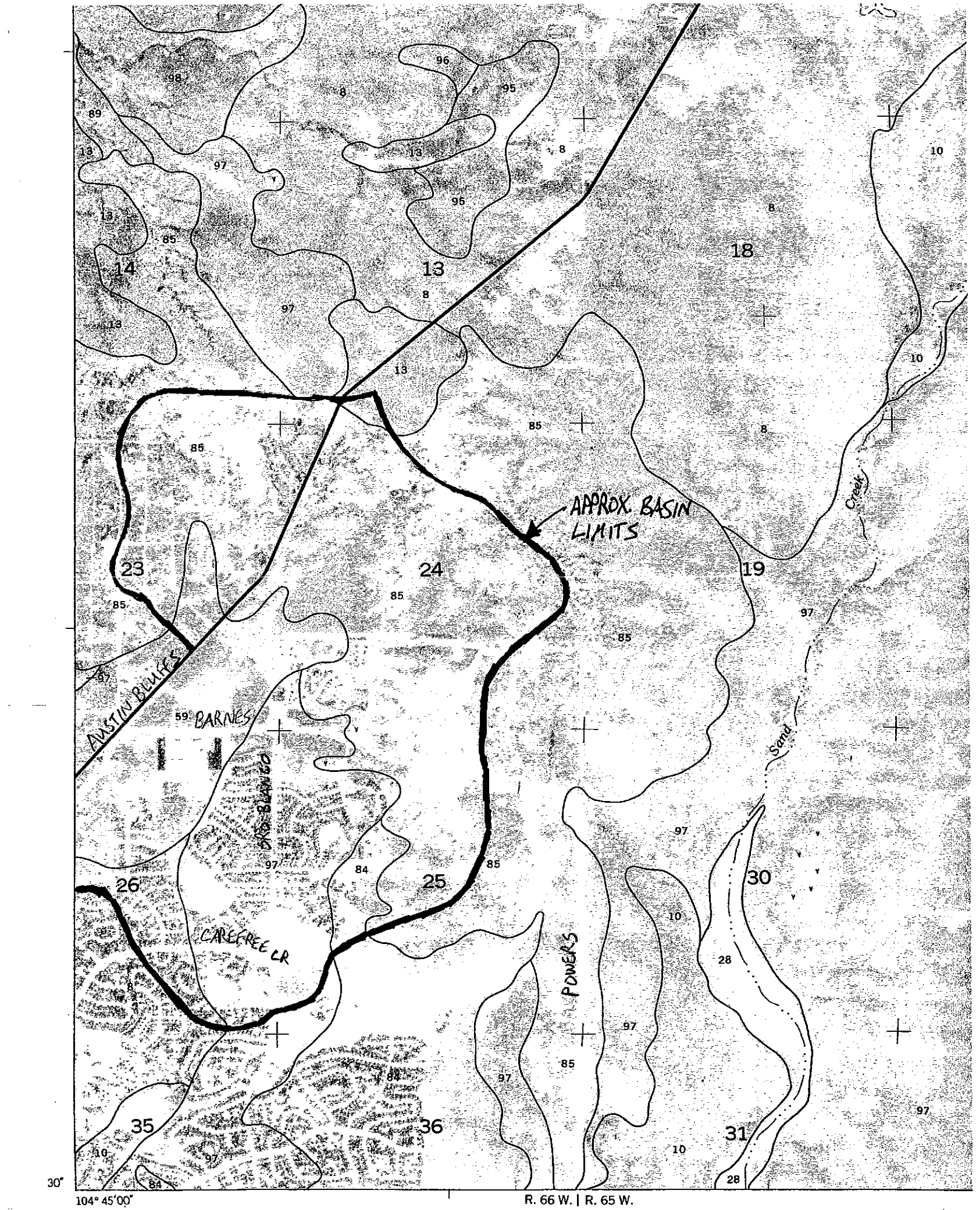
6. "HEC-RAS River Analysis System, Hydraulic Reference Manual, Version 3.1," prepared by the United States Army Corp of Engineers, dated November 2002.

7. "HEC-RAS River Analysis System, User's Manual, Version 3.1," prepared by the United States Army Corp of Engineers, dated November 2002.

8. "Open-Channel Hydraulics," prepared by Vente Chow, dated June 1st, 1959.

APPENDIX

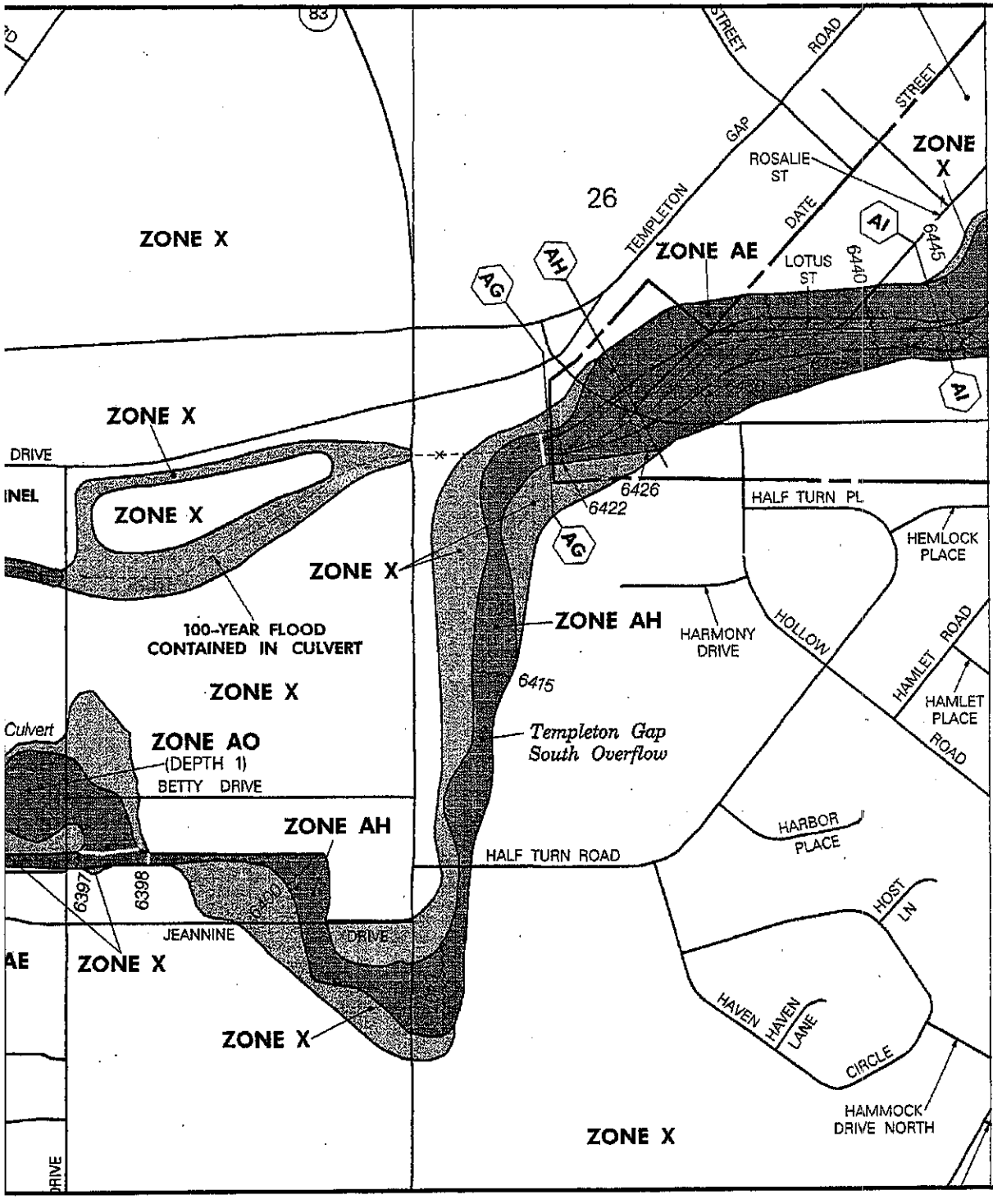

Cottonwood Creek
AUSTIN BLUFFS
water
ACADEMY
AUSTIN BLUFFS
PALMER PARK
COLORADO SPRINGS
Papeton
16
15
14
17
20
21
22
23
26
27
28
29
32
33
34
35
2 210 000 FEET



30°

104° 45'00"

R. 66 W. | R. 65 W.



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 519 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

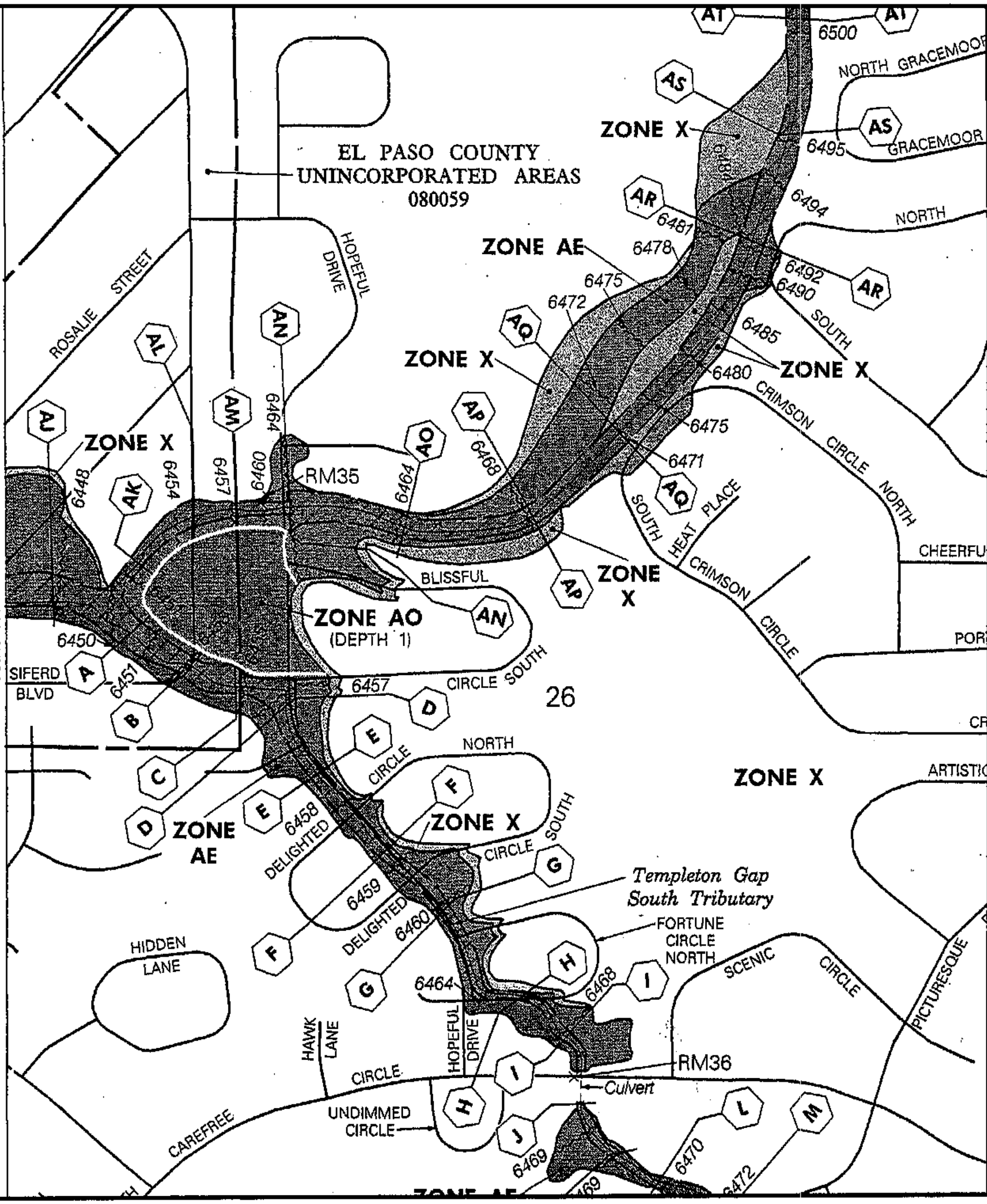
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0519	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0519	F

MAP NUMBER
08041C0519 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 538 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0538	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0538	F

MAP NUMBER
08041C0538 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Templeton Gap Floodway (Cont'd)								
AA	15,775	60	492	16.2	6,292.0	6,292.0	6,292.0	0.0
AB	16,885	70	548	14.6	6,309.2	6,309.2	6,309.2	0.0
AC	17,535	30	302	17.5	6,324.2	6,324.2	6,324.2	0.0
AD	17,635	30	496	10.7	6,330.3	6,330.3	6,330.3	0.0
AE	17,995	110	1,158	4.6	6,332.2	6,332.2	6,332.2	0.0
AF	18,605	130	479	11.1	6,334.3	6,334.3	6,334.3	0.0
AG	22,993	69	443	11.4	6,421.8	6,421.8	6,422.5	0.7
AH	23,319	156	493	10.2	6,426.5	6,426.5	6,426.6	0.1
AI	24,745	83	396	11.0	6,444.5	6,444.5	6,444.8	0.3
AJ	25,025	109	430	10.1	6,447.9	6,447.9	6,448.2	0.3
AK	25,385	36	211	13.1	6,451.5	6,451.5	6,451.5	0.0
AL	25,615	82	694	4.0	6,454.6	6,454.6	6,454.7	0.1
AM	25,765	40	210	13.2	6,457.0	6,457.0	6,457.0	0.0
AN	25,920	123	489	7.8	6,463.6	6,463.6	6,463.6	0.0
AO	26,315	67	384	9.9	6,464.1	6,464.1	6,465.1	1.0
AP	26,735	65	339	10.3	6,468.1	6,468.1	6,468.1	0.0
AQ	27,120	81	289	10.4	6,470.9	6,470.9	6,471.1	0.2
AR	27,870	81	255	10.2	6,492.1	6,492.1	6,492.1	0.0
AS	28,195	71	294	9.4	6,495.1	6,495.1	6,495.4	0.3
AT	28,570	71	246	10.7	6,500.4	6,500.4	6,500.4	0.0
AU	28,965	61	246	10.0	6,504.8	6,504.8	6,504.8	0.0

[1] Feet Above Confluence With Monument Creek

OPINION OF PROBABLE COST

This opinion of probable cost is made on the basis of experience and qualifications and represents WestWorks Engineering's best judgment as an experienced and qualified professional firm, familiar with the construction industry. WestWorks Engineering cannot and will not guarantee that actual construction costs will not vary from this opinion of probable cost.

PARK VISTA MDDP

Challenger Homes

Conceptual Cost Estimate - Templeton Gap Floodway/South Tributary Improvements

WestWorks Engineering

May 13, 2003

Revised October 31, 2003

Item Description	Quantity	Unit	Unit Price	Cost	Cost Extension	Remarks
Project Earthwork Summary (For Information Only)						
				Cut (CY)	Fill (CY)	
Templeton Gap Floodway						
Station 100+00 to 102+48				6,000	1,000	Academy RCBC to Siferd RCBC
Station 104+34 to 122+56				43,700	7,400	Siferd RCBC to 250' W. of Hopeful Drive
Templeton Gap South Tributary						
Station 200+75 to 203+10				5,700	1,000	
Adjustment for Fill Compaction					1,100	Assumed 12% compaction factor
Earthwork Subtotals				55,400	10,500	
Major Items						
Earthwork Pay Item - Unclassified Excavation (CIP)	55,400	CY	$5.75	$318,550	**$318,550**	
Templeton Gap Floodway						
Concrete Class B (Low Flow Channel)	460	CY	$210	$96,600		10' wide, 1' high
Concrete Class B (Cutoff Wall)	100	CY	$220	$22,000		3 drop loc's, assumed 9' depth, 10" width, 120' length
Concrete Class D (Box Culvert)	1,202	CY	$250	$300,500		Siferd X'ing 3-Cell 16'x10' RCBC (incl wingwalls, headwalls & toewalls)
Concrete Slope Paving	395	CY	$230	$90,850		Academy RCBC to Siferd RCBC, 12' high, 45' bottom, 1:5 side slope, 5" thick
Steel Reinforcing	323,150	LB	$0.52	$168,038		RCBC and sloping drop structure cutoff walls
Riprap (24 inch)	19,650	CY	$24	$471,600		Channel side slope protection
Riprap (36 inch)	3,700	CY	$33	$122,100		Sloping drop structure mat
Filter Material Class A	2,700	CY	$27	$72,900		Channel and drop structure bedding
Structural Excavation	5,460	CY	$6	$32,760		Siferd RCBC
Structural Backfill (Class 2)	1,240	CY	$9.50	$11,780		Siferd RCBC
					$1,389,128	
Templeton Gap South Tributary						
Concrete Class D (Wall)	10	CY	$220	$2,200		Siferd X'ing headwalls & toewalls
48" Reinforced Concrete Pipe	300	LF	$105	$31,500		Siferd crossing
Steel Reinforcing	980	LB	$0.52	$510		Headwall/toewall
Riprap (24 inch)	2,700	CY	$24	$64,800		Channel side slope protection and energy dissapator
Filter Material Class A	620	CY	$27	$16,740		Channel and dissapator bedding
Structural Excavation	1,000	CY	$6	$6,000		Siferd quad 48" rcp
Structural Backfill (Class 2)	200	CY	$9.50	$1,900		Siferd quad 48" rcp
					$123,650	
Utility Relocations @ Siferd RCBC						
36" City Water Line Relocation	1	LS	$125,000	$125,000		Assumed 150 LF of relocation
8" City Water Line Relocation	1	LS	$15,000	$15,000		Assumed 150 LF of relocation
(2) City High Pressure Gas Line Relocations	1	LS	$50,000	$50,000		Assumed 150 LF of relocation
12" City San Sewer Line Relocation	1	LS	$40,000	$40,000		Assumed 150 LF of relocation, inverted siphon construction
8" City San Sewer Line Relocation	1	LS	$35,000	$35,000		Assumed 150 LF of relocation, inverted siphon construction
					$265,000	
Major Item Subtotal					**$2,096,328**	

PARK VISTA MDDP
Challenger Homes
Conceptual Cost Estimate - Templeton Gap Floodway/South Tributary Improvements

WestWorks Engineering

May 13, 2003

Revised October 31, 2003

Item Description	Quantity	Unit	Unit Price	Cost	Cost Extension	Remarks
Miscellaneous Items as Percentages						
			% of Major Items			
Utilities			1%	$20,963		Dry utilities and residential services only
Removals, Resets & Adjustments			4%	$83,853		Includes Siferd & Date roadway recon and Academy RCBC headwall & wingwall work
Drainage			3%	$62,890		Minor adjacent outfall facilities
Erosion & Sediment Control			2%	$41,927		Temporary and permanent
Signing, Striping & Lighting			0.5%	$10,482		Siferd Rd reconstruction, two locations
Traffic Control			2%	$41,927		Assumed Siferd Rd resident access only
Miscellaneous Item Subtotal			**13%**		**$262,041**	
Construction Cost Summary						
Major Item Subtotal					$2,096,328	
Miscellaneous Item Subtotal					$262,041	
Subtotal					**$2,358,369**	Subtotal construction items
Mobilization (6%)					**$141,502**	
Construction Contingencies (4%)					**$94,335**	
Contingencies (25%)					**$624,968**	Assumed 25% of subtotal + mobilization
TOTAL CONSTRUCTION COST					**$3,219,173**	
TOTAL PROJECT COST						
Total MDDP Preparation Cost					$17,320	
Construction Cost					$3,219,173	
Property Acquisition					$209,088	Assumed 9.6 acres (418,176 SF) at $0.50/SF
Design Engineering					$321,917	Assumed 10% of Construction Cost
Construction Engineering					$225,342	Assumed 7% of Construction Cost
TOTAL PROJECT COST					**$3,993,000**	Rounded to nearest $1k

HYDROLOGIC CALCULATIONS

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BASIN ANALYSIS

PARK VISTA MDDP

BASIN A

Zone	Area [ac]	H.S.G.	CN
R1-6			
PUD			
R5	4	C	94
PBC			
OC			
OR			
SCHOOL			
PK			
RR-1			
R3			
TOTAL	**4**		**94**

BASIN B

Area [ac]	H.S.G.	CN
19	C	94
39	C	90
58		**91**

BASIN C

Area [ac]	H.S.G.	CN
11	B	85
11		**85**

BASIN E

Zone	Area [ac]	H.S.G.	CN
R1-6	86	B	85
PUD	22	B	85
R5	19	B	92
PBC	11	B	92
OC			
OR			
SCHOOL	5	B	77
PK	10	B	69
RR-1			
R3	6	B	85
TOTAL	**159**		**85**

BASIN F

Area [ac]	H.S.G.	CN
687	D	92
191	D	92
45	D	95
64	C	94
21	D	95
5	D	95
55	C	84
36	D	84
147	D	85
8	C	90
1259		**85**

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ENGINEERING

BASIN ANALYSIS (cont.)

DBPS COMPARISON

DBPS Basin	Area [ac]	CN	Equivalent MDDP Basin
A-1	236	83	E
A-2	128	85	E
A-3	145	85	E
A-4	92	85	E
A-5	38	87	E
A-6	50	86	E
A-7	98	81	E
A-8	75	80	E
A-9	75	83	E
A-10	118	81	E
A-11	160	81	D
A-13	153	85	C & E
A-14	107	87	A & B
DBPS TOTAL	**1475**	**84**	

	Area [ac]	CN
MDDP TOTAL	**1491**	**85**

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FLOW ANALYSIS

PARK VISTA MDDP

DP	Flow [cfs] 10-Yr, 2-Hr	100-Yr, 2-Hr		10-Yr, 24-Hr	100-Yr, 24-Hr	FEMA Section
1	1,182	2,786		2,651	5,082	AG
2	1,180	2,782		2,650	5,079	AH
3	1,153	2,716		2,591	4,956	AJ
4	1,079	2,504		2,405	4,546	AN

DBPS

Storm	Flow [cfs] 5-Year *A+B+C+E	*Basin D	*DP 1	100-Year *A+B+C+E	*Basin D	*DP 1
6-Hour	180	158	284	3,650	409	3,962

*Basin and DP designations shown are MDDP equivalents.

FEMA STUDY

Section	Flow [cfs] 100-Year	Total
AG		5,050
AH		5,029
AI		4,356
AJ		4,343
AK		2,764
AL		2,776
AM		2,772
AN		3,814

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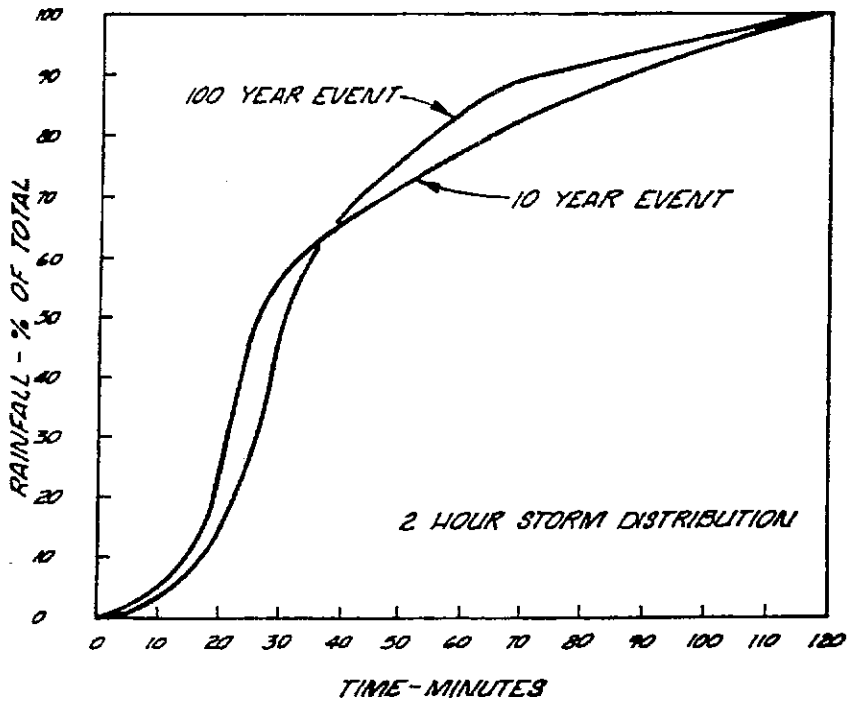
TABLE 5-5
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition:	grass cover on 75% or more of the area	39*	61	74	80
Fair condition:	grass cover on 50% to 75% of the area	49*	69	79	84
Commercial and Business areas (85% Impervious)		89*	92	94	95
Industrial Districts 72% Impervious)		81*	88	91	93
Residential: 2/					
Acres per Dwelling Unit	Average % Impervious 3/				
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and Roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

1/ For a more detailed description of agricultural land use curve numbers, refer to the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).
2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.



2-HR DESIGN STORM DISTRIBUTION

Time (Minutes)	Percent of 1-Hr Rainfall 10 Year	Cum	100 Year	Cum
5	2.0	2.0	1.0	1.0
10	3.7	5.7	3.0	4.0
15	8.2	13.9	4.6	8.6
20	15.0	28.9	8.0	16.6
25	25.0	53.9	14.0	30.6
30	12.0	65.9	25.0	55.6
35	5.6	71.5	14.0	69.6
40	4.3	75.8	8.0	77.6
45	3.8	79.6	6.2	83.8
50	3.2	82.8	5.0	88.8
55	3.2	86.0	4.0	92.8
60	3.2	89.2	4.0	96.8
65	3.2	92.4	4.0	100.8
70	3.2	95.6	2.0	102.8
75	3.2	98.8	2.0	104.8
80	2.5	101.3	1.2	106.0
85	1.9	103.2	1.2	107.2
90	1.9	105.1	1.2	108.4
95	1.9	107.0	1.2	109.6
100	1.9	108.9	1.2	110.8
105	1.9	110.8	1.2	112.0
110	1.9	112.7	1.2	113.2
115	1.7	114.4	1.2	114.4
120	1.3	115.7	1.2	115.6
	115.7		115.6	

RE: Urban Drainage & Flood Control District

HDR Infrastructure, Inc.
A Centerra Company

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

Critical Storm Rainfall Distributions

Date: OCT. 1987

Figure: 5-5a

```
// HydroCAD Rainfall table
// Copyright (c) 1990-2001 Applied Microcomputer Systems
// For details see Rainfall.txt

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timeunits=hours
duration=2
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depth=  1.089 1.108 1.127 1.144 1.157
```

```
// HydroCAD Rainfall table
// Copyright (c) 1990-2001 Applied Microcomputer Systems
// For details see Rainfall.txt

name=100YR 2HR
timeunits=hours
duration=2
comment=100YR 2HR Design Storm Colorado Springs DCM
smoothing=false
depth=  0.000 0.010 0.040 0.086 0.166 0.306 0.556 0.696 0.776 0.838
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depth=  1.108 1.120 1.132 1.144 1.156
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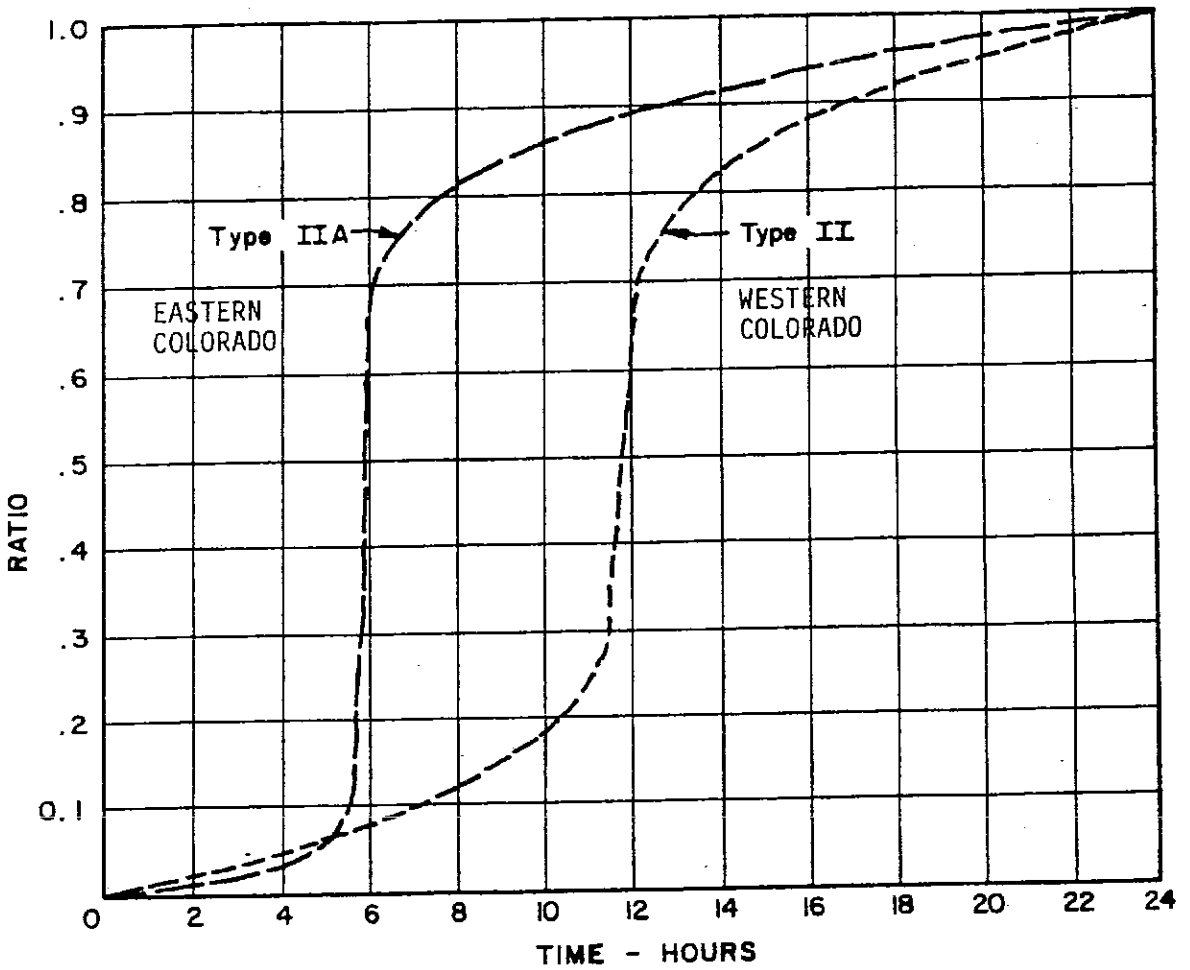

RE: SCS

HDR Infrastructure, Inc.
A Centerra Company

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

24 HOUR RAINFALL DISTRIBUTIONS

Date: OCT. 1987

Figure: 5-5b

TABLE 5-3
STANDARD SCS 24-HOUR
TYPE IIA CUMULATIVE RAINFALL DISTRIBUTION
FOR TR-20 INPUT

Minute Intervals				Hour
15	30	45	60	
0.0005	0.0015	0.0030	0.0045	1
0.0060	0.0080	0.0100	0.0120	2
0.0143	0.0165	0.0188	0.0210	3
0.0233	0.0255	0.0278	0.0320	4
0.0390	0.0460	0.0530	0.0600	5
0.0750	0.1000	0.4000	0.7000	6
0.7250	0.7500	0.7650	0.7800	7
0.7900	0.8000	0.8100	0.8200	8
0.8250	0.8300	0.8350	0.8400	9
0.8450	0.8500	0.8550	0.8600	10
0.8638	0.8675	0.8713	0.8750	11
0.8788	0.8825	0.8863	0.8900	12
0.8938	0.8975	0.9013	0.9050	13
0.9083	0.9115	0.9148	0.9180	14
0.9210	0.9240	0.9270	0.9300	15
0.9325	0.9350	0.9375	0.9400	16
0.9425	0.9450	0.9475	0.9500	17
0.9525	0.9550	0.9575	0.9600	18
0.9625	0.9650	0.9675	0.9700	19
0.9725	0.9750	0.9775	0.9800	20
0.9813	0.9825	0.9838	0.9850	21
0.9863	0.9875	0.9888	0.9900	22
0.9913	0.9925	0.9938	0.9950	23
0.9963	0.9975	0.9988	1.0000	24

```
// HydroCAD Rainfall table
// Copyright (c) 1990-2001 Applied Microcomputer Systems
// For details see Rainfall.txt

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timeunits=hours
duration=24
comment=SCS Type IIA Colorado Springs Modified
smoothing=false
depth=  0.000 0.001 0.002 0.003 0.005 0.006 0.008 0.010 0.012 0.014
depth=  0.017 0.019 0.021 0.023 0.026 0.028 0.032 0.039 0.046 0.053
depth=  0.060 0.075 0.100 0.400 0.700 0.725 0.750 0.765 0.780 0.790
depth=  0.800 0.810 0.820 0.825 0.830 0.835 0.840 0.845 0.850 0.855
depth=  0.860 0.864 0.868 0.871 0.875 0.879 0.883 0.886 0.890 0.894
depth=  0.898 0.901 0.905 0.908 0.912 0.915 0.918 0.921 0.924 0.927
depth=  0.930 0.933 0.935 0.938 0.940 0.943 0.945 0.948 0.950 0.953
depth=  0.955 0.958 0.960 0.963 0.965 0.968 0.970 0.973 0.975 0.978
depth=  0.980 0.981 0.983 0.984 0.985 0.986 0.988 0.989 0.990 0.991
depth=  0.993 0.994 0.995 0.996 0.998 0.999 1.000
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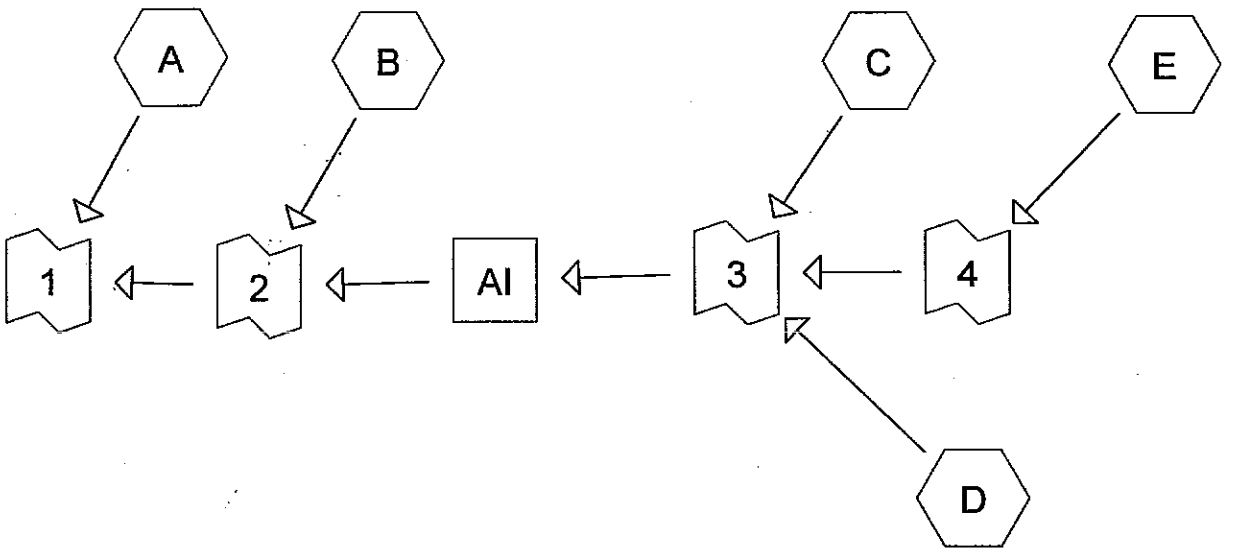


Subcat Reach Pond Link

Drainage Diagram
Prepared by WestWorks Engineering 5/9/2003

10-YEAR 2-HOUR STORM

Time span=0.00-2.00 hrs, dt=0.05 hrs, 41 points
Runoff by SCS TR-20 method, UH=SCS, 10-yr 2-hr Rainfall=1.75"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Basin A
Tc=10.3 min CN=94 Area=4.000 ac Runoff= 8.52 cfs 0.377 af

Subcatchment B: Basin B
Tc=24.0 min CN=91 Area=58.000 ac Runoff= 60.56 cfs 4.141 af

Subcatchment C: Basin C
Tc=17.3 min CN=85 Area=11.000 ac Runoff= 7.48 cfs 0.521 af

Subcatchment D: Basin D - South Branch
Tc=15.0 min CN=85 Area=159.000 ac Runoff= 115.47 cfs 7.637 af

Subcatchment E: Basin E
Tc=33.3 min CN=91 Area=1,259.000 ac Runoff= 1,078.70 cfs 84.983 af

Reach AI: Main Branch @ FIS Section AI Inflow= 1,152.54 cfs 93.141 af
Length= 1,550.0' Max Vel= 11.0 fps Capacity= 4,356.00 cfs Outflow= 1,137.73 cfs 90.206 af

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3) Inflow= 1,182.39 cfs 94.723 af
Primary= 1,182.39 cfs 94.723 af

Link 2: FIS XSect AH - Siferd & Date St Inflow= 1,180.22 cfs 94.346 af
Primary= 1,180.22 cfs 94.346 af

Link 3: FIS XSect AJ - just downstream of confluence Inflow= 1,152.54 cfs 93.141 af
Primary= 1,152.54 cfs 93.141 af

Link 4: FIS XSect AN - Xing @ Hopeful Drive Inflow= 1,078.70 cfs 84.983 af
Primary= 1,078.70 cfs 84.983 af

Runoff Area = 1,491.000 ac Volume = 97.658 af Average Depth = 0.79"

Subcatchment A: Basin A

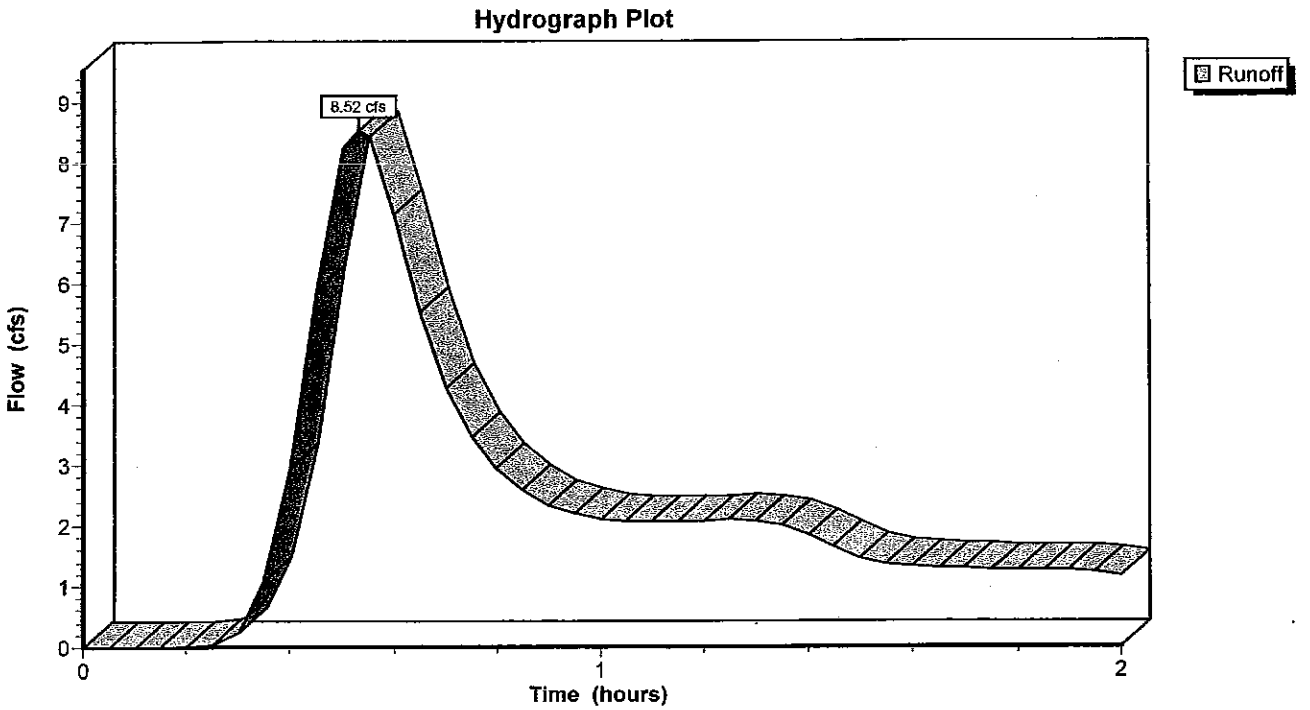
Runoff = 8.52 cfs @ 0.53 hrs, Volume= 0.377 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
10-yr 2-hr Rainfall=1.75"

Area (ac)	CN	Description
4.000	94	(R5) Urban commercial, 85% imp, HSG C

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
10.3	0	Total			

Subcatchment A: Basin A



Subcatchment B: Basin B

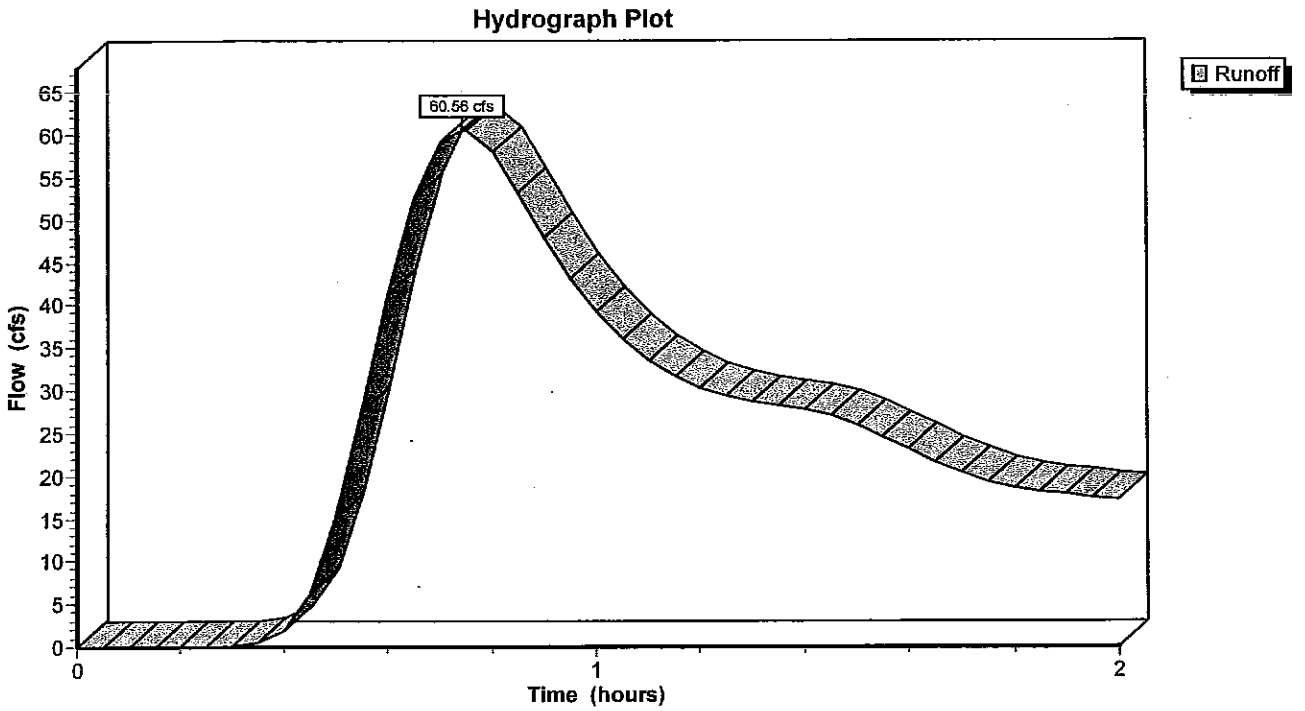
Runoff = 60.56 cfs @ 0.74 hrs, Volume= 4.141 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
10-yr 2-hr Rainfall=1.75"

Area (ac)	CN	Description
19.000	94	(PBC) Urban commercial, 85% imp, HSG C
39.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
58.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Overland**
2.0					**Direct Entry, Channel**
24.0	0	Total			

Subcatchment B: Basin B



Subcatchment C: Basin C

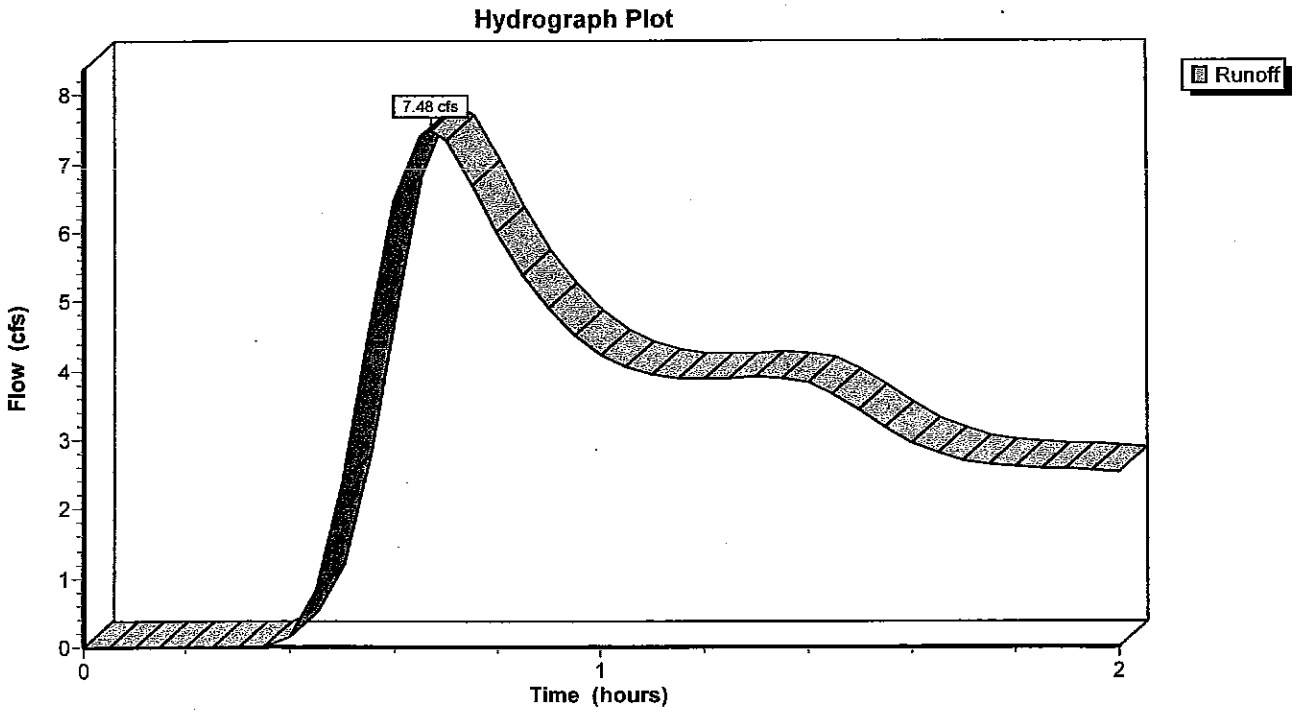
Runoff = 7.48 cfs @ 0.67 hrs, Volume= 0.521 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
10-yr 2-hr Rainfall=1.75"

Area (ac)	CN	Description
11.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
17.3	0	Total			

Subcatchment C: Basin C



Subcatchment D: Basin D - South Branch

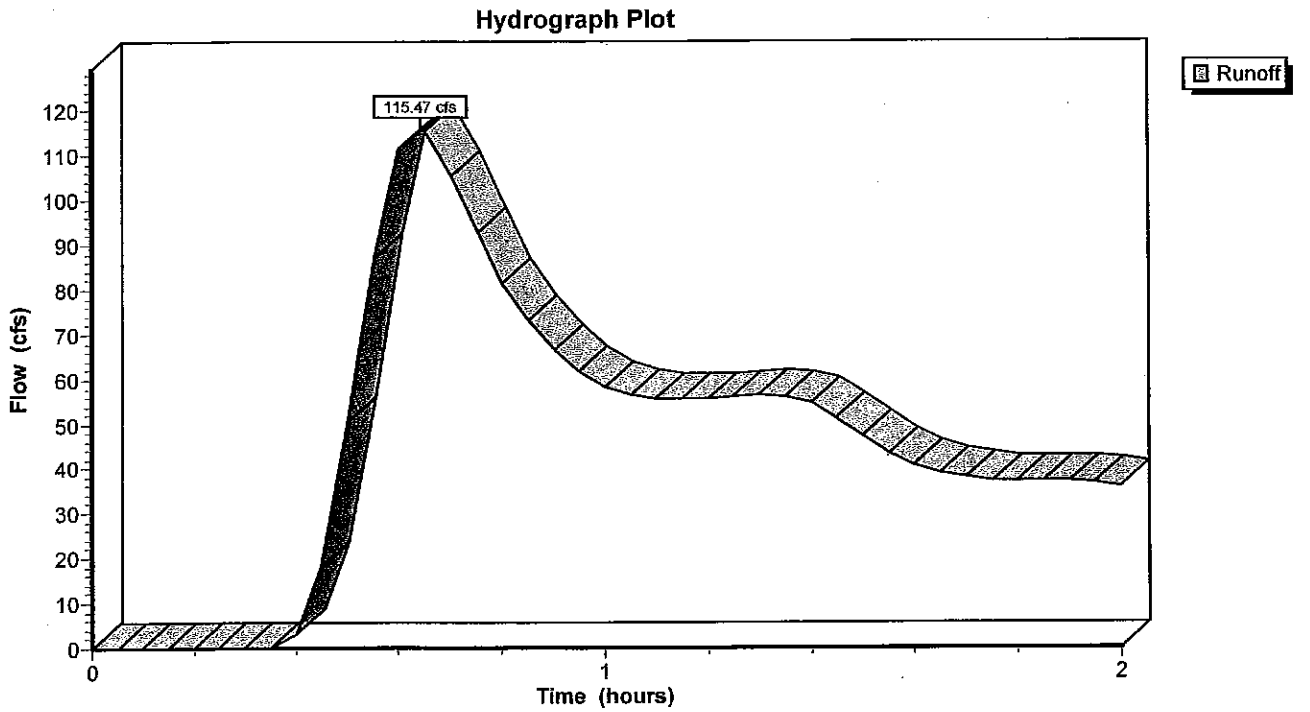
Runoff = 115.47 cfs @ 0.64 hrs, Volume= 7.637 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
10-yr 2-hr Rainfall=1.75"

Area (ac)	CN	Description
86.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B
22.000	85	(PUD) 1/8 acre lots, 65% imp, HSG B
19.000	92	(R5) Urban commercial, 85% imp, HSG B
11.000	92	(PBC) Urban commercial, 85% imp, HSG B
10.000	69	(PK) 50-75% Grass cover, Fair, HSG B
6.000	85	(R3) 1/8 acre lots, 65% imp, HSG B
5.000	77	(SCHOOL) 1/2 park, 1/2 commercial, HSG B
159.000	85	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, from DBPS Basin A-11**

Subcatchment D: Basin D - South Branch



Subcatchment E: Basin E

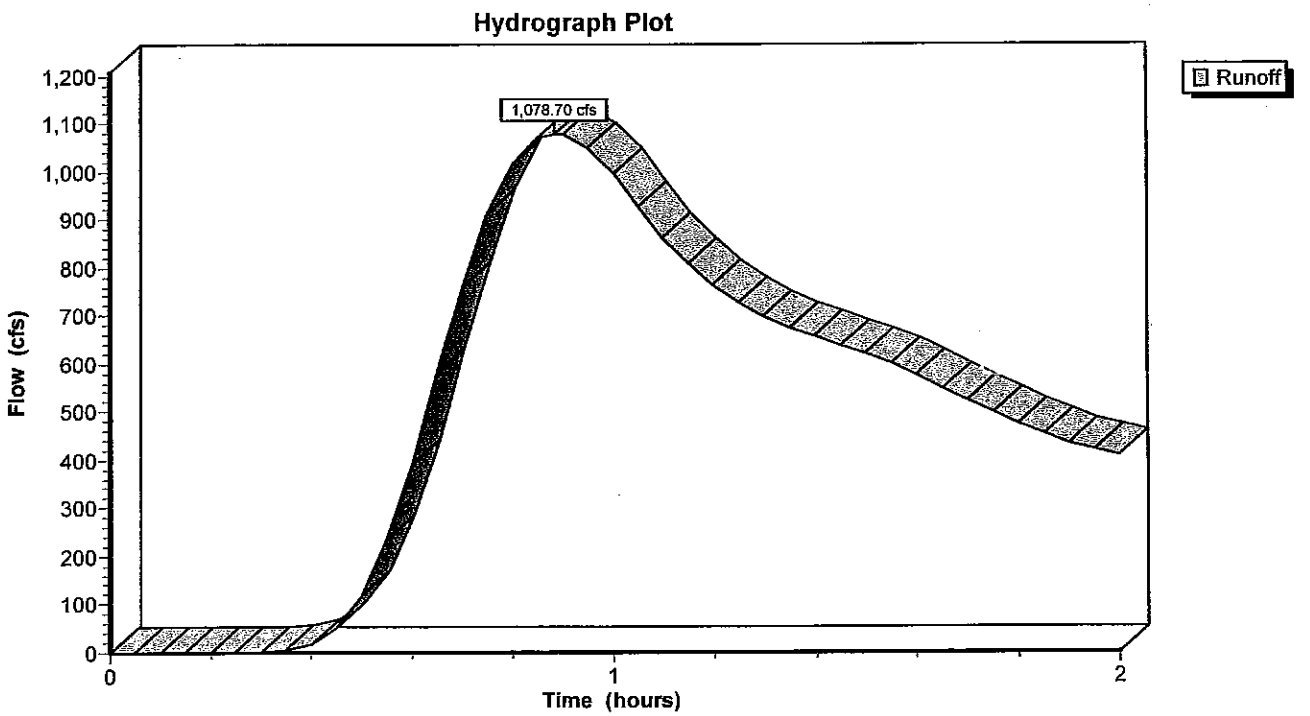
Runoff = 1,078.70 cfs @ 0.89 hrs, Volume= 84.983 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
10-yr 2-hr Rainfall=1.75"

Area (ac)	CN	Description
687.000	92	(R1-6) 1/8 acre lots, 65% imp, HSG D
191.000	92	(PUD) 1/8 acre lots, 65% imp, HSG D
147.000	85	(RR-1) 1/2 acre lots, 25% imp, HSG D
64.000	94	(PBC) Urban commercial, 85% imp, HSG C
55.000	84	(SCHOOL) 1/2 open space, 1/2 commercial, HSG C
45.000	95	(R5) Urban commercial, 85% imp, HSG D
8.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
36.000	84	(PK) 50-75% Grass cover, Fair, HSG D
21.000	95	(OC) Urban commercial, 85% imp, HSG D
5.000	95	(OR) Urban commercial, 85% imp, HSG D
1,259.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3					**Direct Entry, Overland Flow**
9.8					**Direct Entry, Street Flow**
6.2					**Direct Entry, Channel Flow**
33.3	0	Total			

Subcatchment E: Basin E



Reach AI: Main Branch @ FIS Section AI

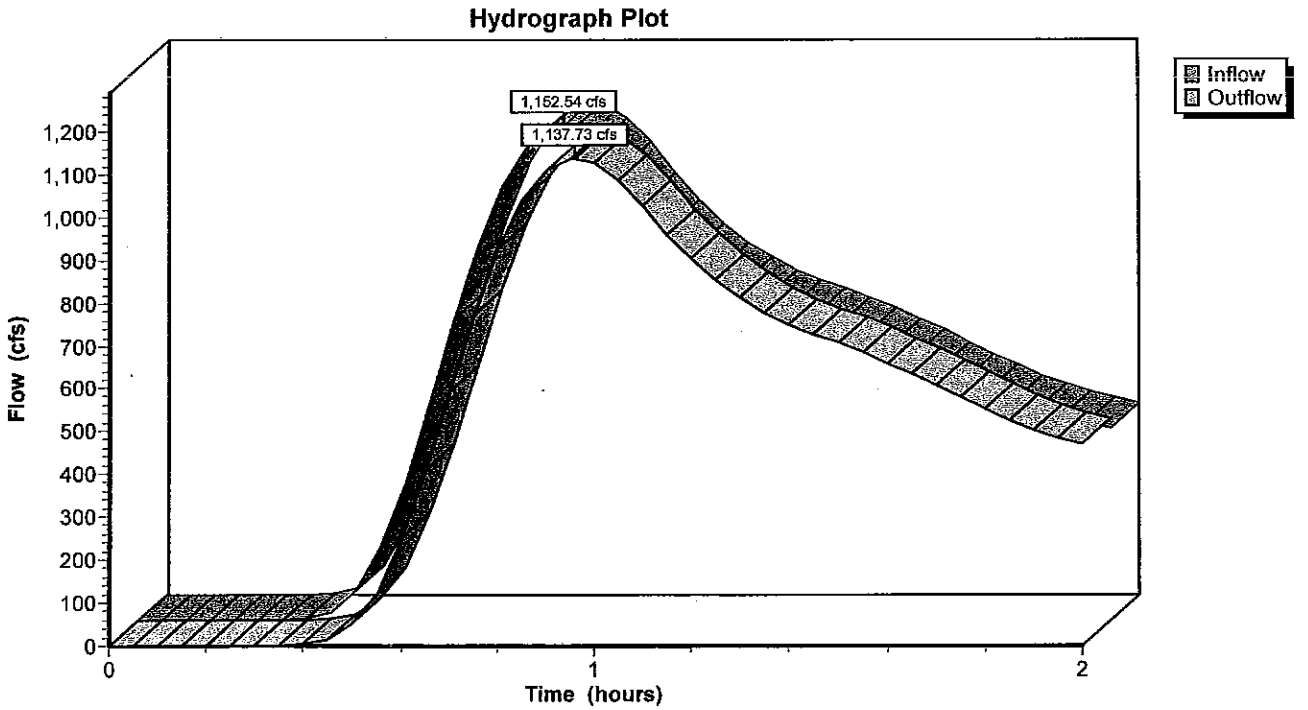
Inflow = 1,152.54 cfs @ 0.88 hrs, Volume= 93.141 af
Outflow = 1,137.73 cfs @ 0.96 hrs, Volume= 90.206 af, Atten= 1%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.0 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 11.0 fps, Avg. Travel Time= 2.3 min

Peak Depth= 3.27'
Capacity at bank full= 4,356.00 cfs
Inlet Invert= 6,440.00', Outlet Invert= 6,424.00'
Custom stage-discharge table, Length= 1,550.0'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
12.50	396.0	613,800	4,356.00

Reach AI: Main Branch @ FIS Section AI

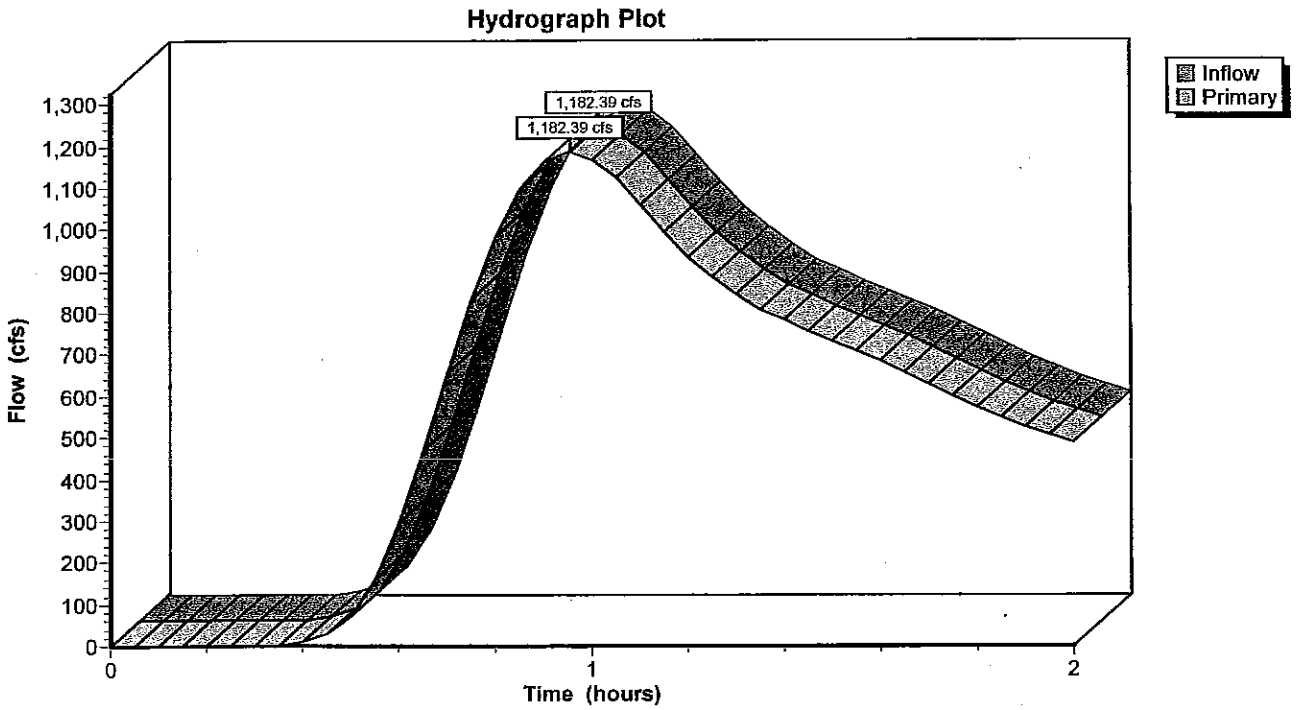


Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

Inflow = 1,182.39 cfs @ 0.95 hrs, Volume= 94.723 af
Primary = 1,182.39 cfs @ 0.95 hrs, Volume= 94.723 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

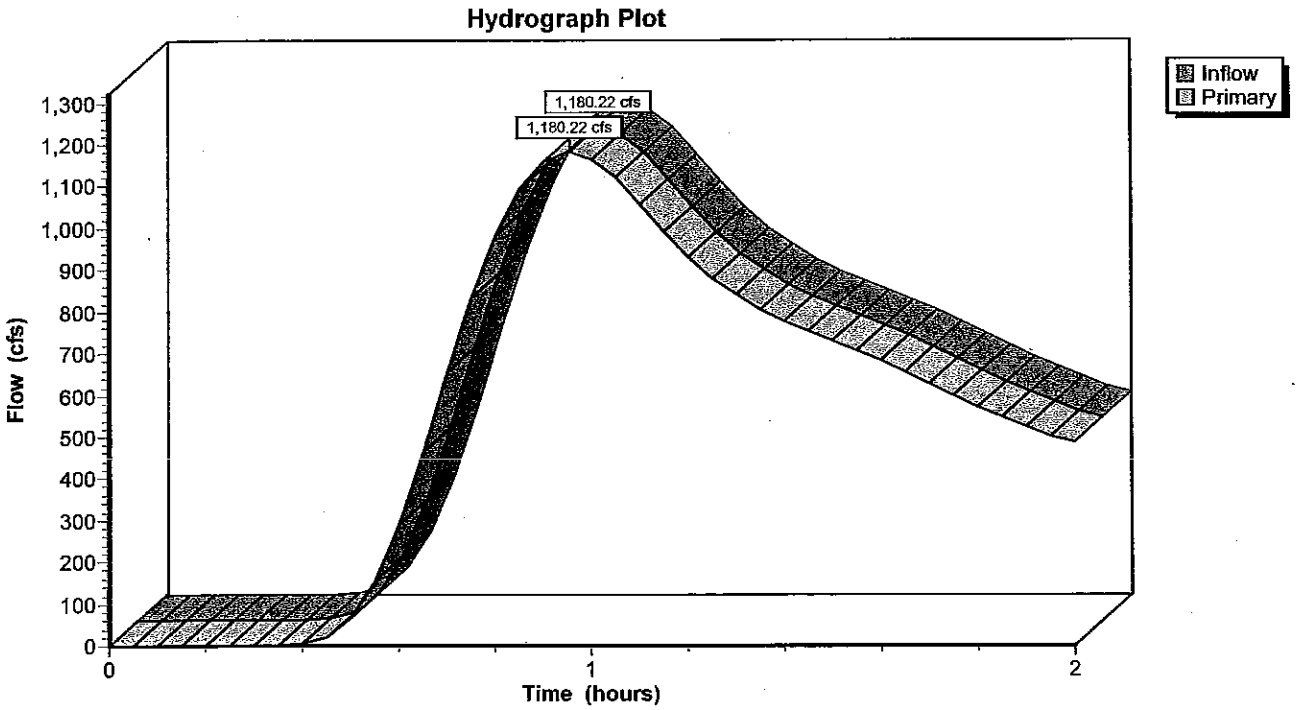


Link 2: FIS XSect AH - Siferd & Date St

Inflow = 1,180.22 cfs @ 0.95 hrs, Volume= 94.346 af
Primary = 1,180.22 cfs @ 0.95 hrs, Volume= 94.346 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 2: FIS XSect AH - Siferd & Date St

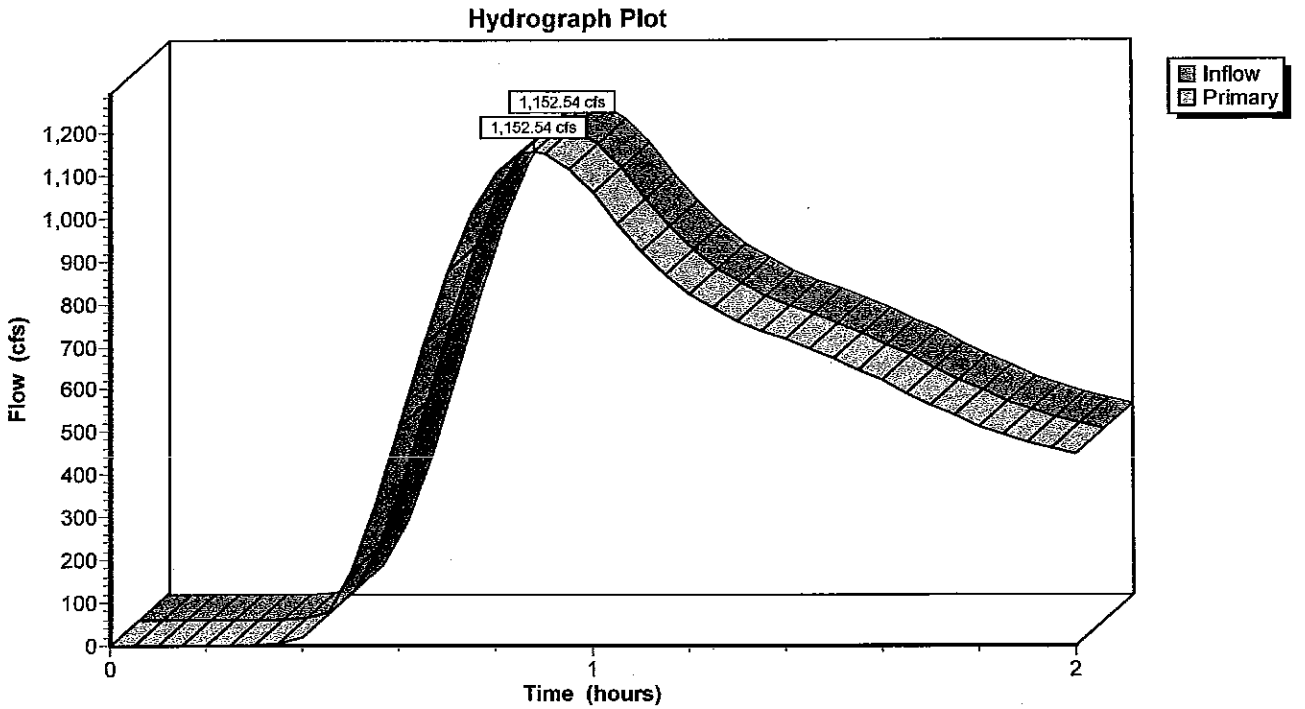


Link 3: FIS XSect AJ - just downstream of confluence

Inflow = 1,152.54 cfs @ 0.88 hrs, Volume= 93.141 af
Primary = 1,152.54 cfs @ 0.88 hrs, Volume= 93.141 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 3: FIS XSect AJ - just downstream of confluence

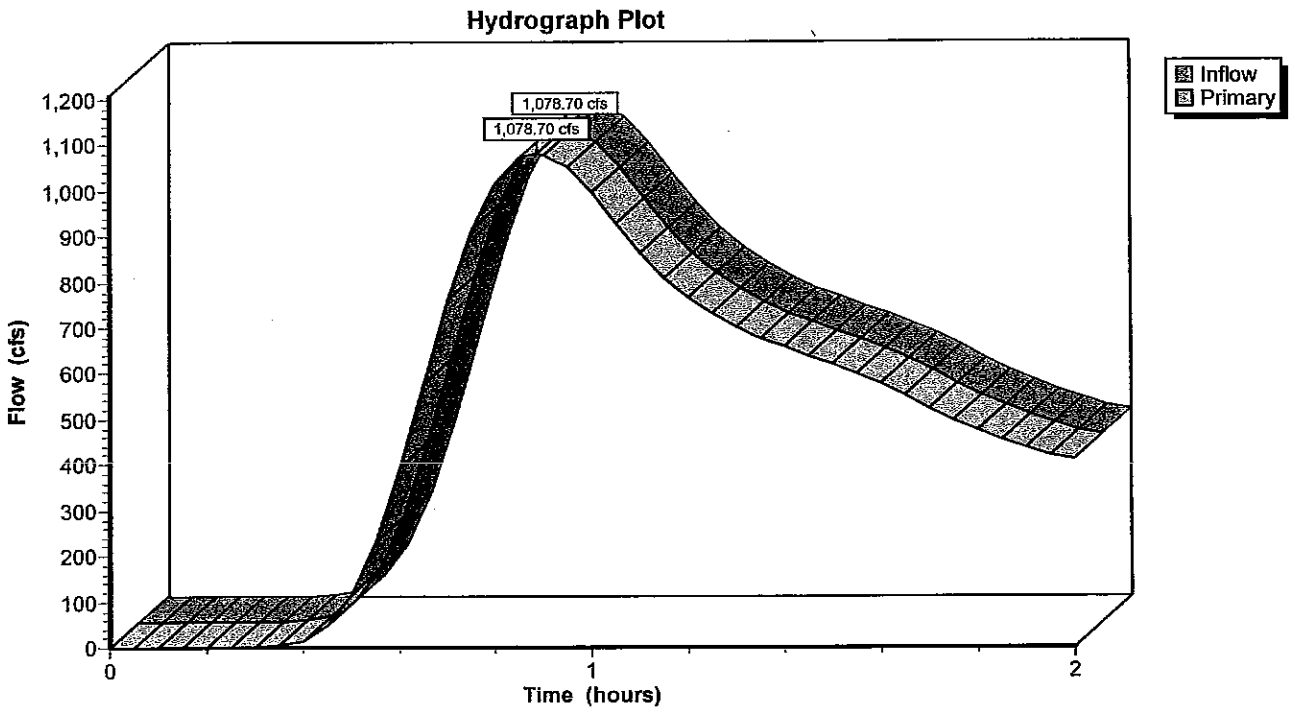


Link 4: FIS XSect AN - Xing @ Hopeful Drive

Inflow = 1,078.70 cfs @ 0.89 hrs, Volume= 84.983 af
Primary = 1,078.70 cfs @ 0.89 hrs, Volume= 84.983 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 4: FIS XSect AN - Xing @ Hopeful Drive



100-YEAR 2-HOUR STORM

Time span=0.00-2.00 hrs, dt=0.05 hrs, 41 points
Runoff by SCS TR-20 method, UH=SCS, 100-yr 2-hr Rainfall=2.67"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Basin A
Tc=10.3 min CN=94 Area=4.000 ac Runoff= 16.50 cfs 0.663 af

Subcatchment B: Basin B
Tc=24.0 min CN=91 Area=58.000 ac Runoff= 138.09 cfs 8.018 af

Subcatchment C: Basin C
Tc=17.3 min CN=85 Area=11.000 ac Runoff= 21.31 cfs 1.146 af

Subcatchment D: Basin D - South Branch
Tc=15.0 min CN=85 Area=159.000 ac Runoff= 328.30 cfs 16.690 af

Subcatchment E: Basin E
Tc=33.3 min CN=91 Area=1,259.000 ac Runoff= 2,504.12 cfs 168.067 af

Reach AI: Main Branch @ FIS Section AI Inflow= 2,715.92 cfs 185.903 af
Length= 1,550.0' Max Vel= 11.0 fps Capacity= 4,356.00 cfs Outflow= 2,680.05 cfs 182.354 af

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3) Inflow= 2,786.18 cfs 191.035 af
Primary= 2,786.18 cfs 191.035 af

Link 2: FIS XSect AH - Siferd & Date St Inflow= 2,781.53 cfs 190.372 af
Primary= 2,781.53 cfs 190.372 af

Link 3: FIS XSect AJ - just downstream of confluence Inflow= 2,715.92 cfs 185.903 af
Primary= 2,715.92 cfs 185.903 af

Link 4: FIS XSect AN - Xing @ Hopeful Drive Inflow= 2,504.12 cfs 168.067 af
Primary= 2,504.12 cfs 168.067 af

Runoff Area = 1,491.000 ac Volume = 194.584 af Average Depth = 1.57"

Subcatchment A: Basin A

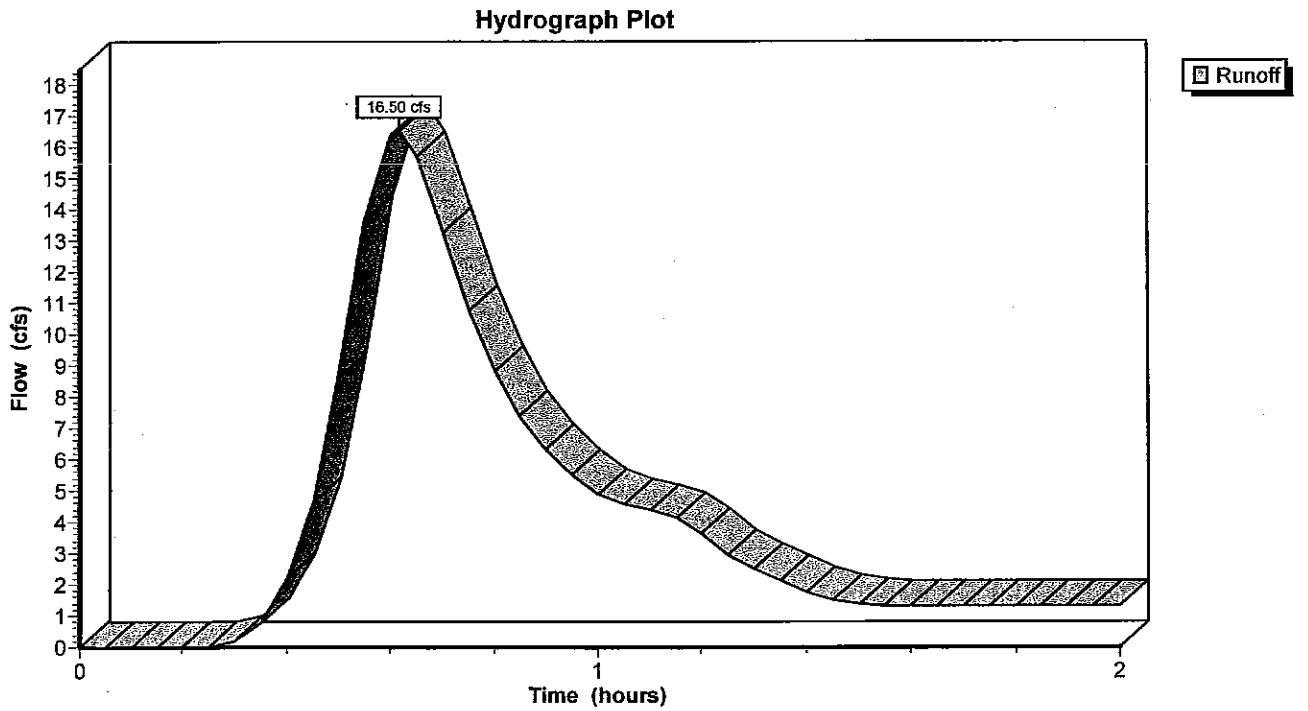
Runoff = 16.50 cfs @ 0.61 hrs, Volume= 0.663 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
100-yr 2-hr Rainfall=2.67"

Area (ac)	CN	Description
4.000	94	(R5) Urban commercial, 85% imp, HSG C

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
10.3	0	Total			

Subcatchment A: Basin A



Subcatchment B: Basin B

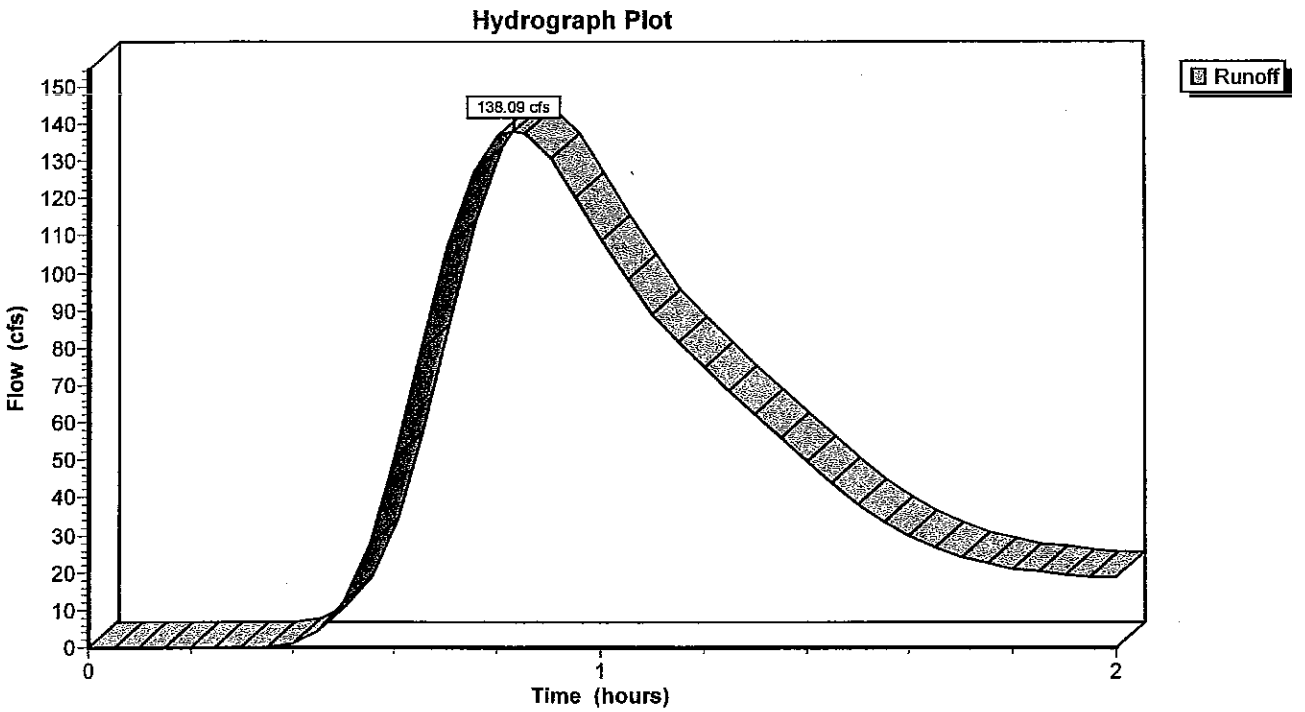
Runoff = 138.09 cfs @ 0.83 hrs, Volume= 8.018 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
100-yr 2-hr Rainfall=2.67"

Area (ac)	CN	Description
19.000	94	(PBC) Urban commercial, 85% imp, HSG C
39.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
58.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Overland**
2.0					**Direct Entry, Channel**
24.0	0	Total			

Subcatchment B: Basin B



Subcatchment C: Basin C

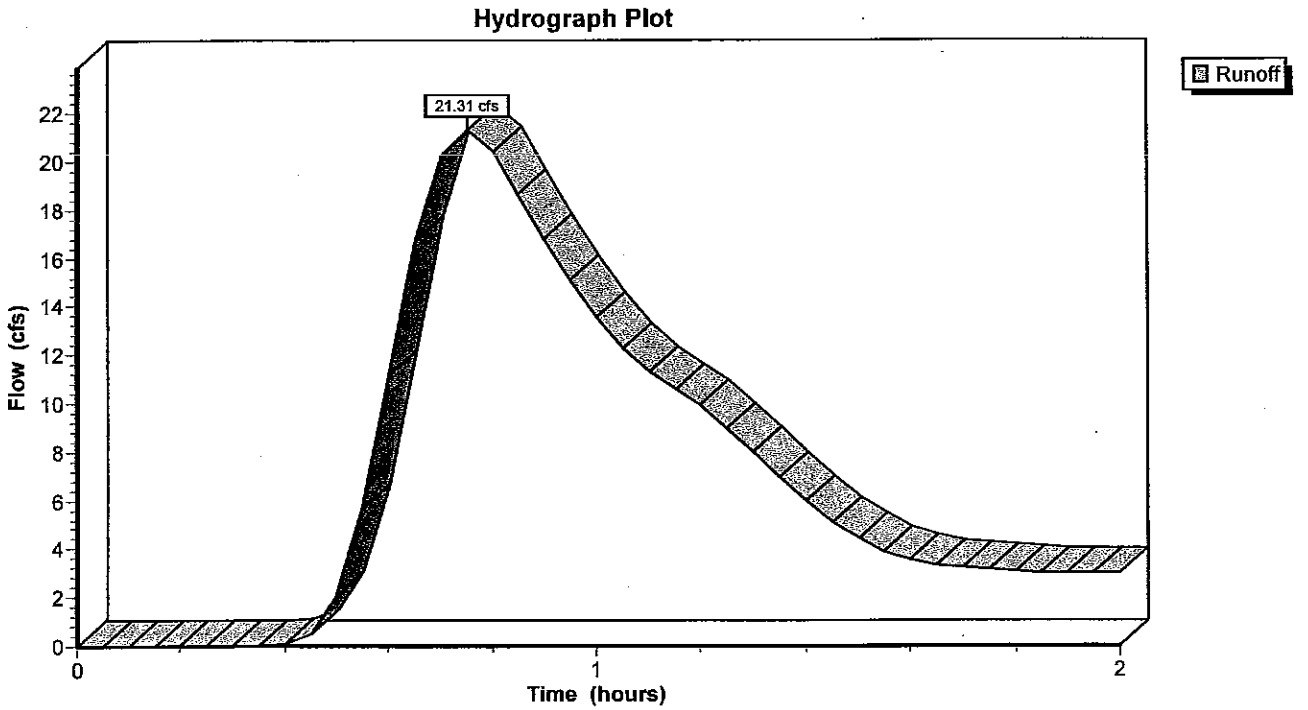
Runoff = 21.31 cfs @ 0.75 hrs, Volume= 1.146 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
100-yr 2-hr Rainfall=2.67"

Area (ac)	CN	Description
11.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
17.3	0	Total			

Subcatchment C: Basin C



Subcatchment D: Basin D - South Branch

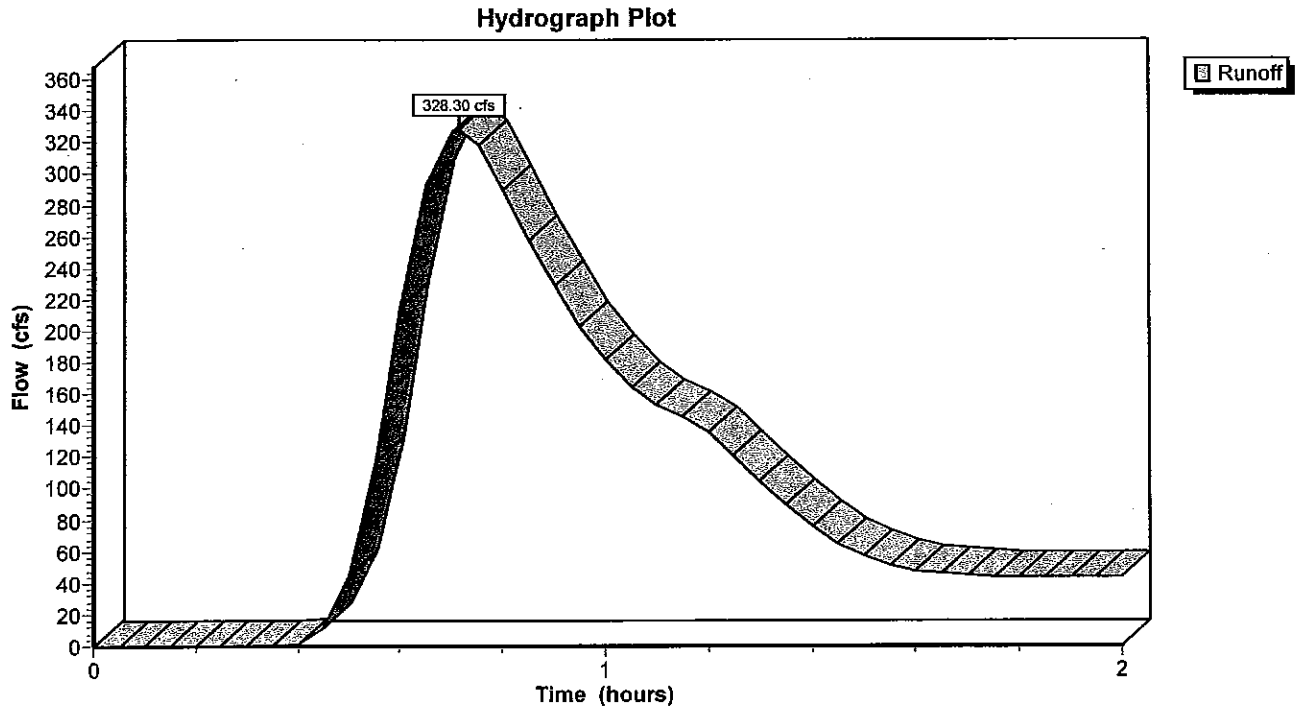
Runoff = 328.30 cfs @ 0.71 hrs, Volume= 16.690 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
100-yr 2-hr Rainfall=2.67"

Area (ac)	CN	Description
86.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B
22.000	85	(PUD) 1/8 acre lots, 65% imp, HSG B
19.000	92	(R5) Urban commercial, 85% imp, HSG B
11.000	92	(PBC) Urban commercial, 85% imp, HSG B
10.000	69	(PK) 50-75% Grass cover, Fair, HSG B
6.000	85	(R3) 1/8 acre lots, 65% imp, HSG B
5.000	77	(SCHOOL) 1/2 park, 1/2 commercial, HSG B
159.000	85	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, from DBPS Basin A-11**

Subcatchment D: Basin D - South Branch



Subcatchment E: Basin E

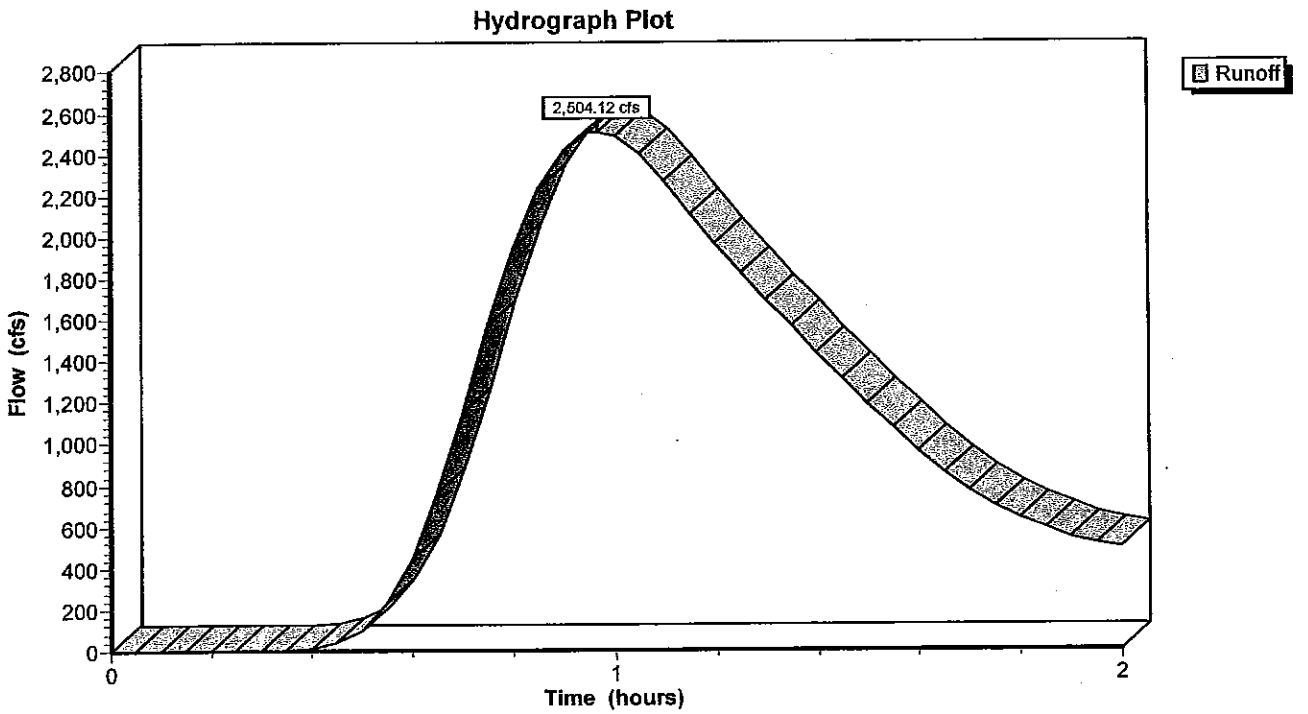
Runoff = 2,504.12 cfs @ 0.97 hrs, Volume= 168.067 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
100-yr 2-hr Rainfall=2.67"

Area (ac)	CN	Description
687.000	92	(R1-6) 1/8 acre lots, 65% imp, HSG D
191.000	92	(PUD) 1/8 acre lots, 65% imp, HSG D
147.000	85	(RR-1) 1/2 acre lots, 25% imp, HSG D
64.000	94	(PBC) Urban commercial, 85% imp, HSG C
55.000	84	(SCHOOL) 1/2 open space, 1/2 commercial, HSG C
45.000	95	(R5) Urban commercial, 85% imp, HSG D
8.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
36.000	84	(PK) 50-75% Grass cover, Fair, HSG D
21.000	95	(OC) Urban commercial, 85% imp, HSG D
5.000	95	(OR) Urban commercial, 85% imp, HSG D
1,259.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3					**Direct Entry, Overland Flow**
9.8					**Direct Entry, Street Flow**
6.2					**Direct Entry, Channel Flow**
33.3	0	Total			

Subcatchment E: Basin E



Reach AI: Main Branch @ FIS Section AI

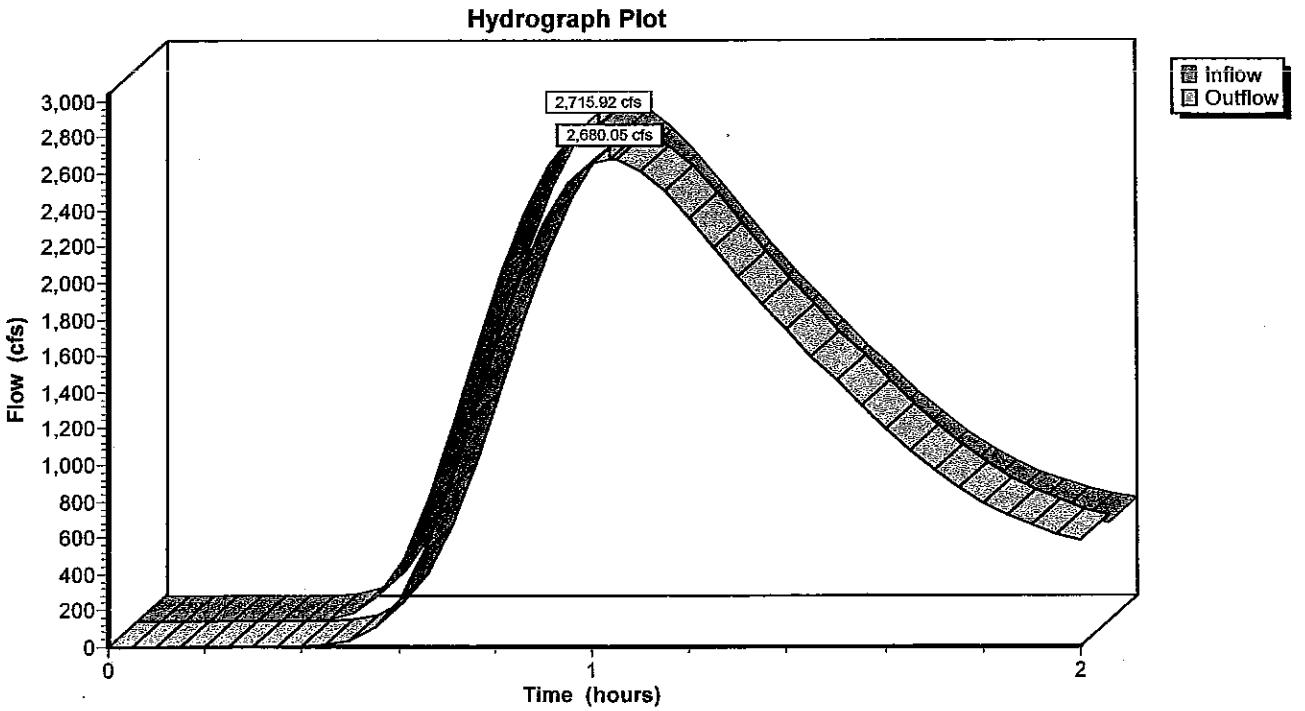
Inflow = 2,715.92 cfs @ 0.96 hrs, Volume= 185.903 af
Outflow = 2,680.05 cfs @ 1.04 hrs, Volume= 182.354 af, Atten= 1%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.0 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 11.0 fps, Avg. Travel Time= 2.3 min

Peak Depth= 7.71'
Capacity at bank full= 4,356.00 cfs
Inlet Invert= 6,440.00', Outlet Invert= 6,424.00'
Custom stage-discharge table, Length= 1,550.0'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
12.50	396.0	613,800	4,356.00

Reach AI: Main Branch @ FIS Section AI

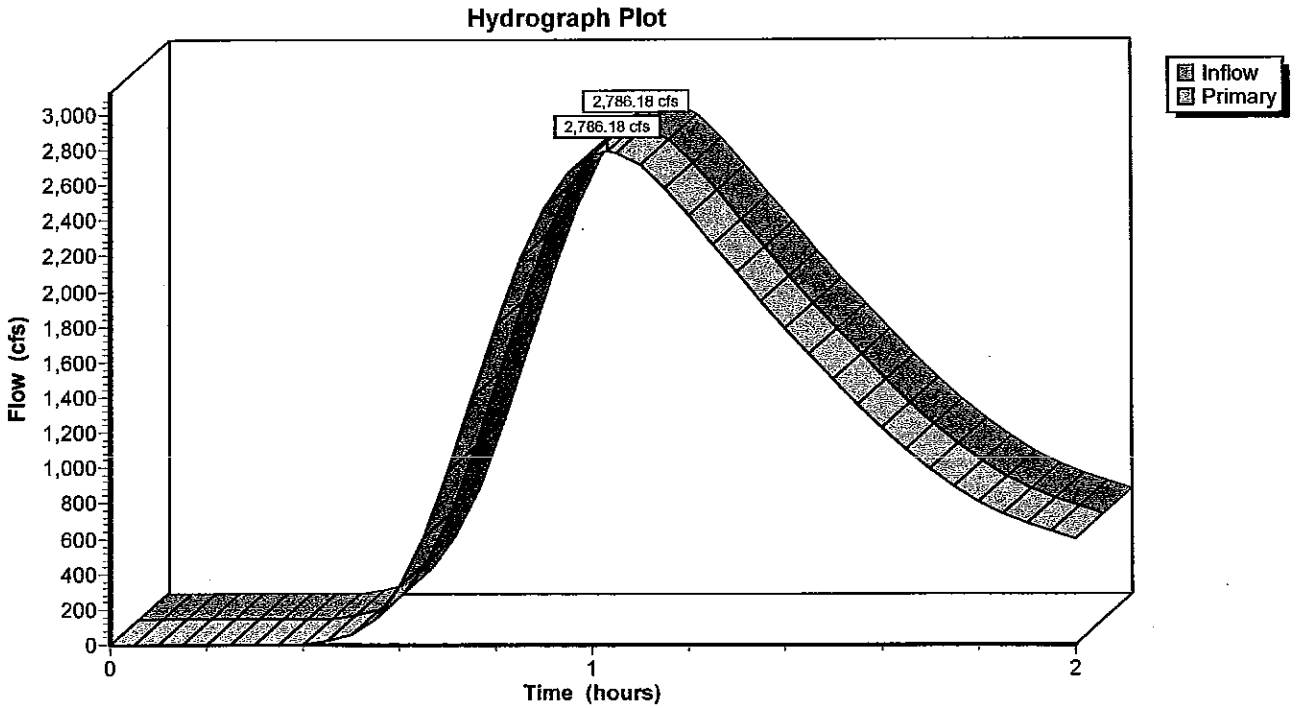


Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

Inflow = 2,786.18 cfs @ 1.03 hrs, Volume= 191.035 af
Primary = 2,786.18 cfs @ 1.03 hrs, Volume= 191.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

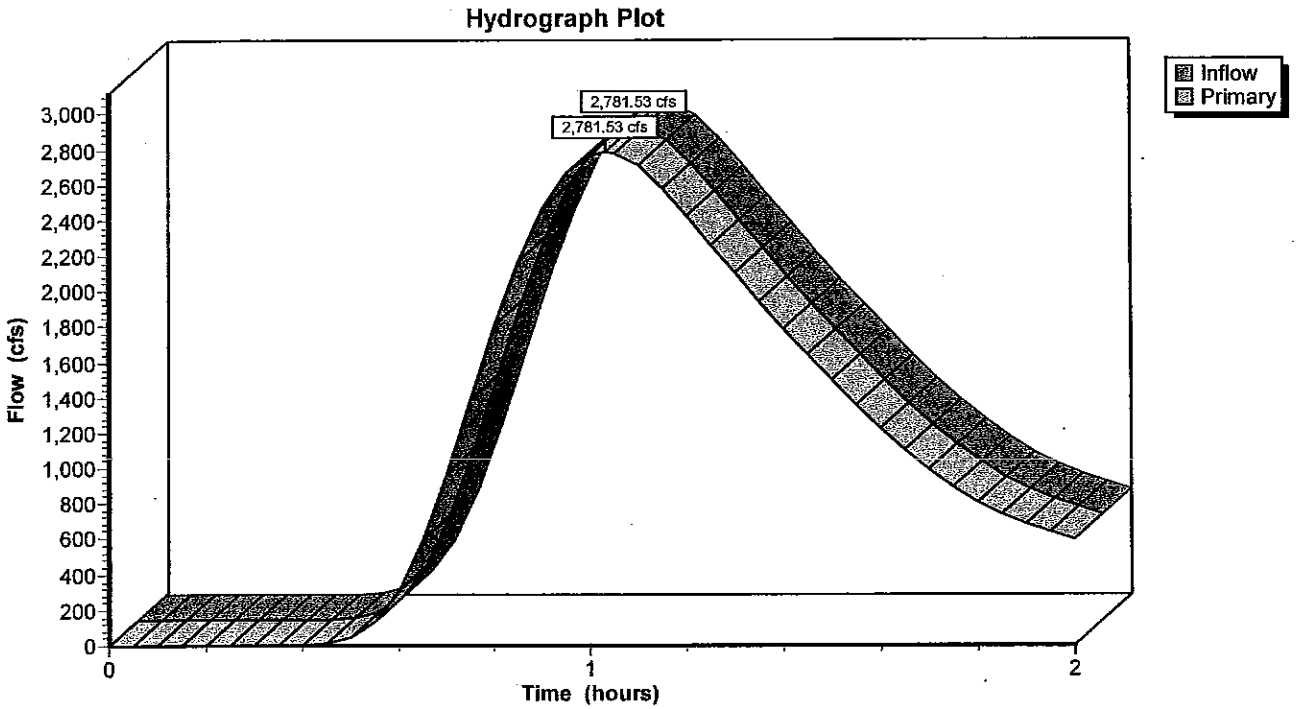


Link 2: FIS XSect AH - Siferd & Date St

Inflow = 2,781.53 cfs @ 1.03 hrs, Volume= 190.372 af
Primary = 2,781.53 cfs @ 1.03 hrs, Volume= 190.372 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 2: FIS XSect AH - Siferd & Date St

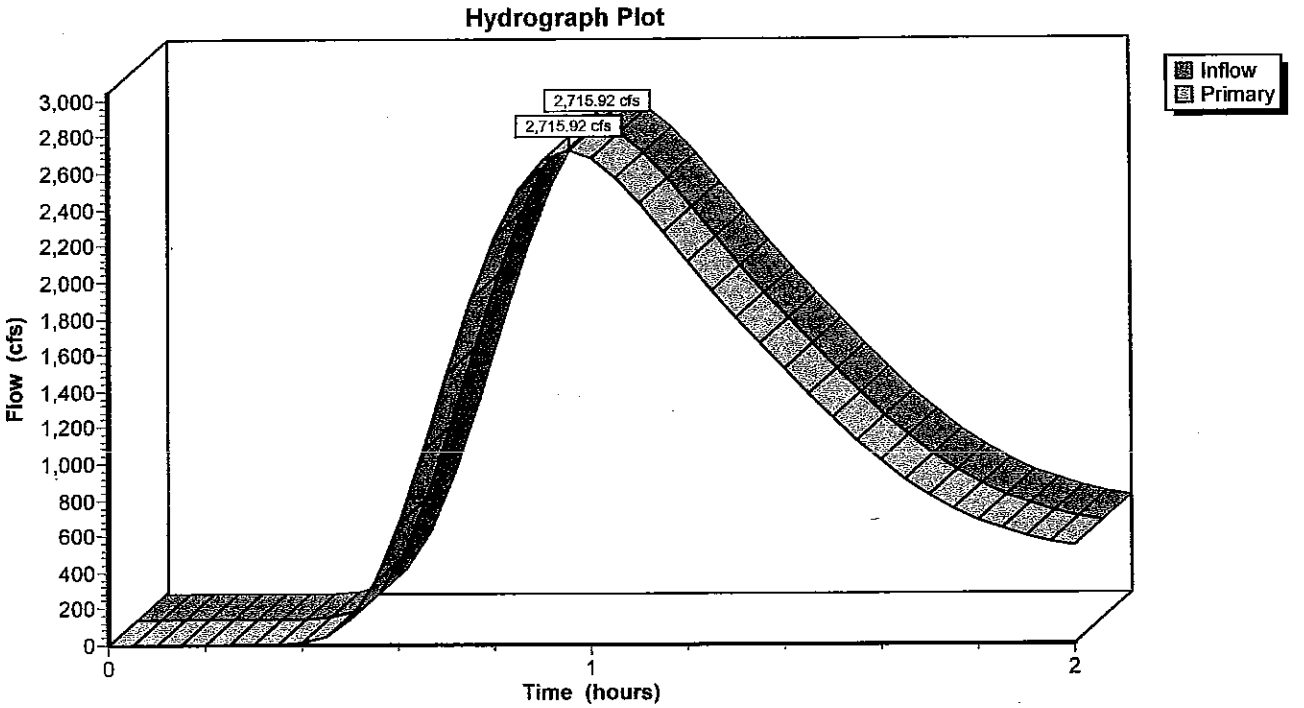


Link 3: FIS XSect AJ - just downstream of confluence

Inflow = 2,715.92 cfs @ 0.96 hrs, Volume= 185.903 af
Primary = 2,715.92 cfs @ 0.96 hrs, Volume= 185.903 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 3: FIS XSect AJ - just downstream of confluence

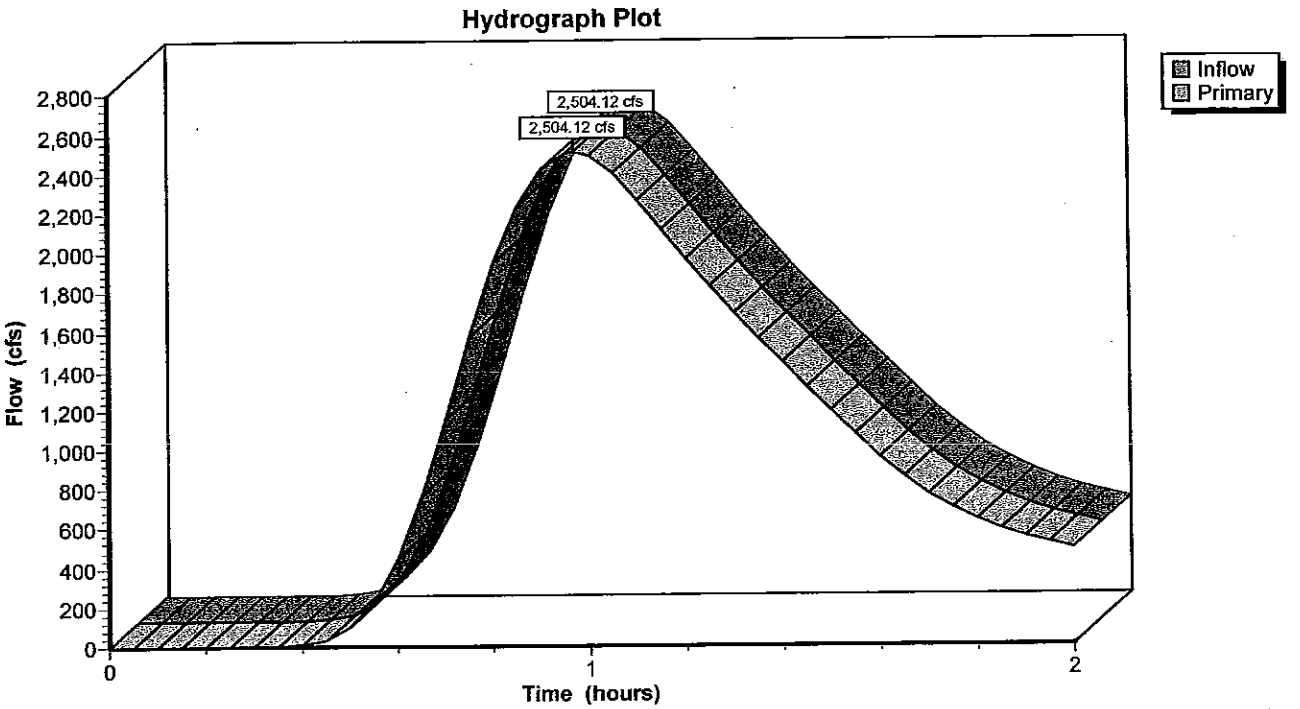


Link 4: FIS XSect AN - Xing @ Hopeful Drive

Inflow = 2,504.12 cfs @ 0.97 hrs, Volume= 168.067 af
Primary = 2,504.12 cfs @ 0.97 hrs, Volume= 168.067 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-2.00 hrs, dt= 0.05 hrs

Link 4: FIS XSect AN - Xing @ Hopeful Drive



10-YEAR 24-HOUR STORM

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Type IIA 24-hr Rainfall=2.85"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Basin A
Tc=10.3 min CN=94 Area=4.000 ac Runoff= 12.22 cfs 0.735 af

Subcatchment B: Basin B
Tc=24.0 min CN=91 Area=58.000 ac Runoff= 130.00 cfs 9.318 af

Subcatchment C: Basin C
Tc=17.3 min CN=85 Area=11.000 ac Runoff= 21.02 cfs 1.339 af

Subcatchment D: Basin D - South Branch
Tc=15.0 min CN=85 Area=159.000 ac Runoff= 319.49 cfs 19.360 af

Subcatchment E: Basin E
Tc=33.3 min CN=91 Area=1,259.000 ac Runoff= 2,405.18 cfs 202.070 af

Reach AI: Main Branch @ FIS Section AI Inflow= 2,590.53 cfs 222.769 af
Length= 1,550.0' Max Vel= 11.0 fps Capacity= 4,356.00 cfs Outflow= 2,549.85 cfs 222.642 af

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3) Inflow= 2,651.44 cfs 232.695 af
Primary= 2,651.44 cfs 232.695 af

Link 2: FIS XSect AH - Siferd & Date St Inflow= 2,649.56 cfs 231.961 af
Primary= 2,649.56 cfs 231.961 af

Link 3: FIS XSect AJ - just downstream of confluence Inflow= 2,590.53 cfs 222.769 af
Primary= 2,590.53 cfs 222.769 af

Link 4: FIS XSect AN - Xing @ Hopeful Drive Inflow= 2,405.18 cfs 202.070 af
Primary= 2,405.18 cfs 202.070 af

Runoff Area = 1,491.000 ac Volume = 232.822 af Average Depth = 1.87"

Subcatchment A: Basin A

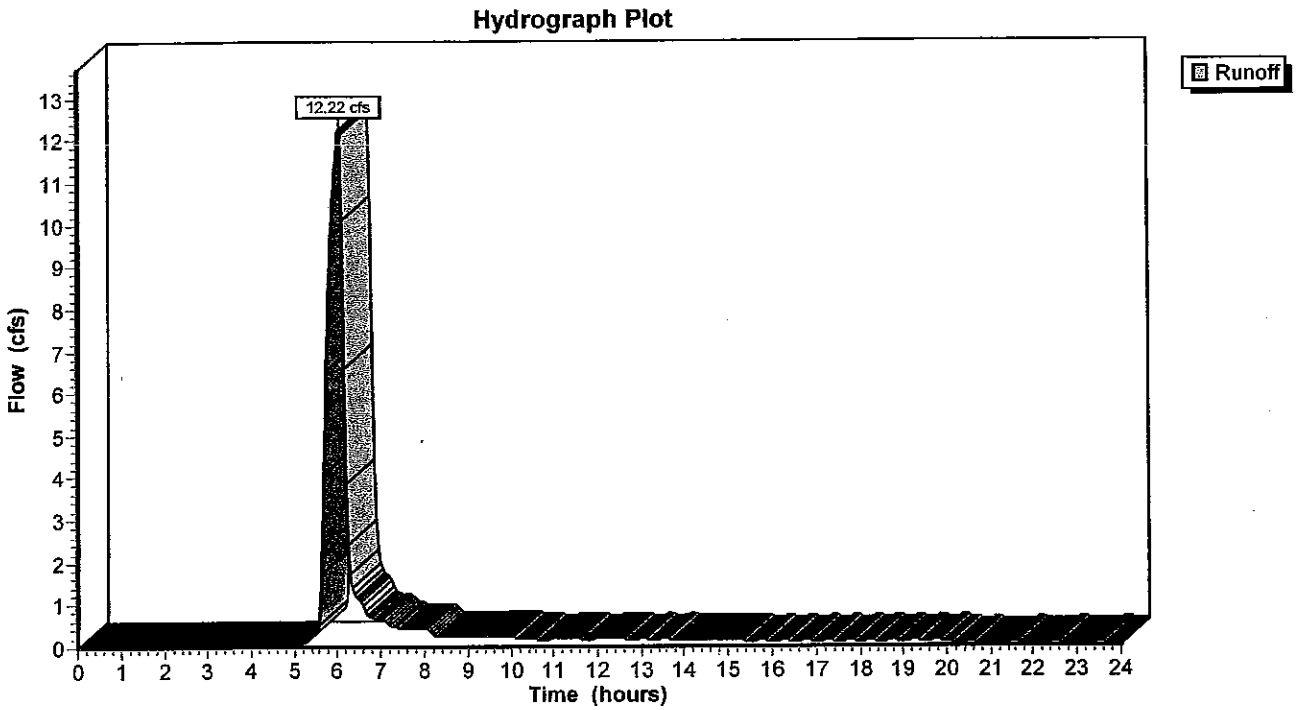
Runoff = 12.22 cfs @ 6.02 hrs, Volume= 0.735 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=2.85"

Area (ac)	CN	Description
4.000	94	(R5) Urban commercial, 85% imp, HSG C

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
10.3	0	Total			

Subcatchment A: Basin A



Subcatchment B: Basin B

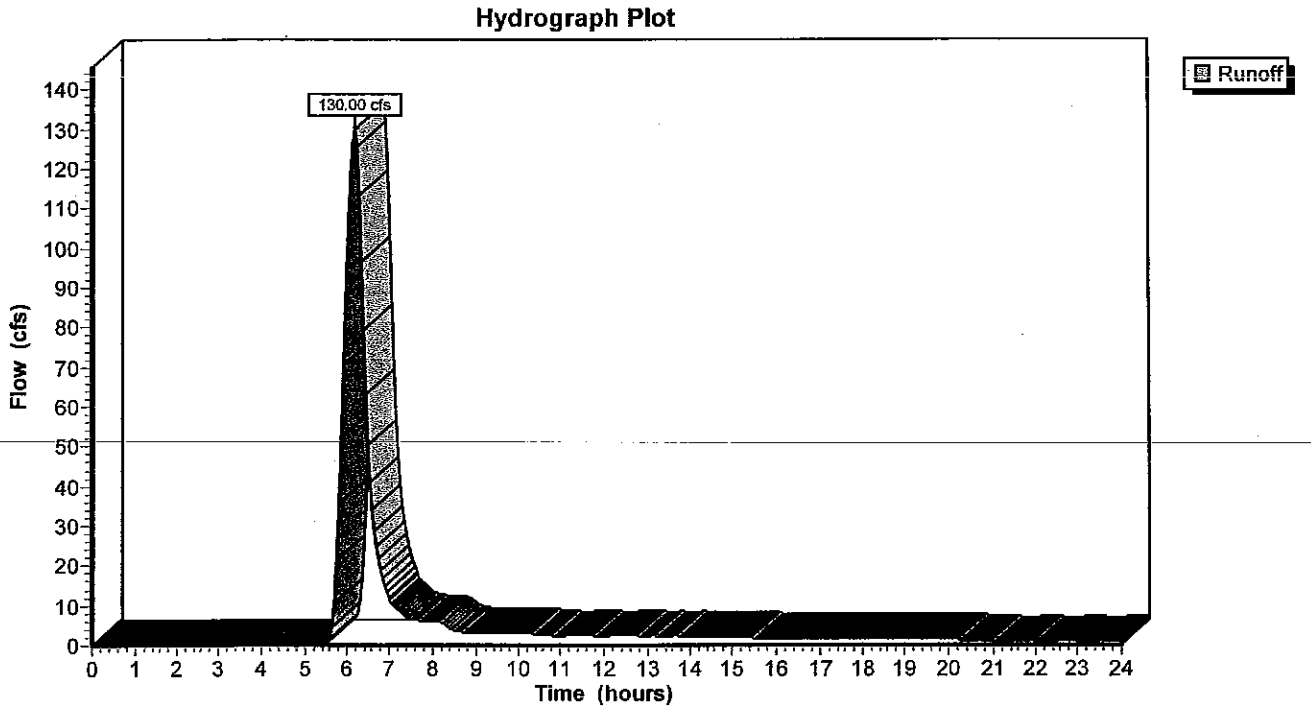
Runoff = 130.00 cfs @ 6.15 hrs, Volume= 9.318 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=2.85"

Area (ac)	CN	Description
19.000	94	(PBC) Urban commercial, 85% imp, HSG C
39.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
58.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Overland**
2.0					**Direct Entry, Channel**
24.0	0	Total			

Subcatchment B: Basin B



Subcatchment C: Basin C

Runoff = 21.02 cfs @ 6.10 hrs, Volume= 1.339 af

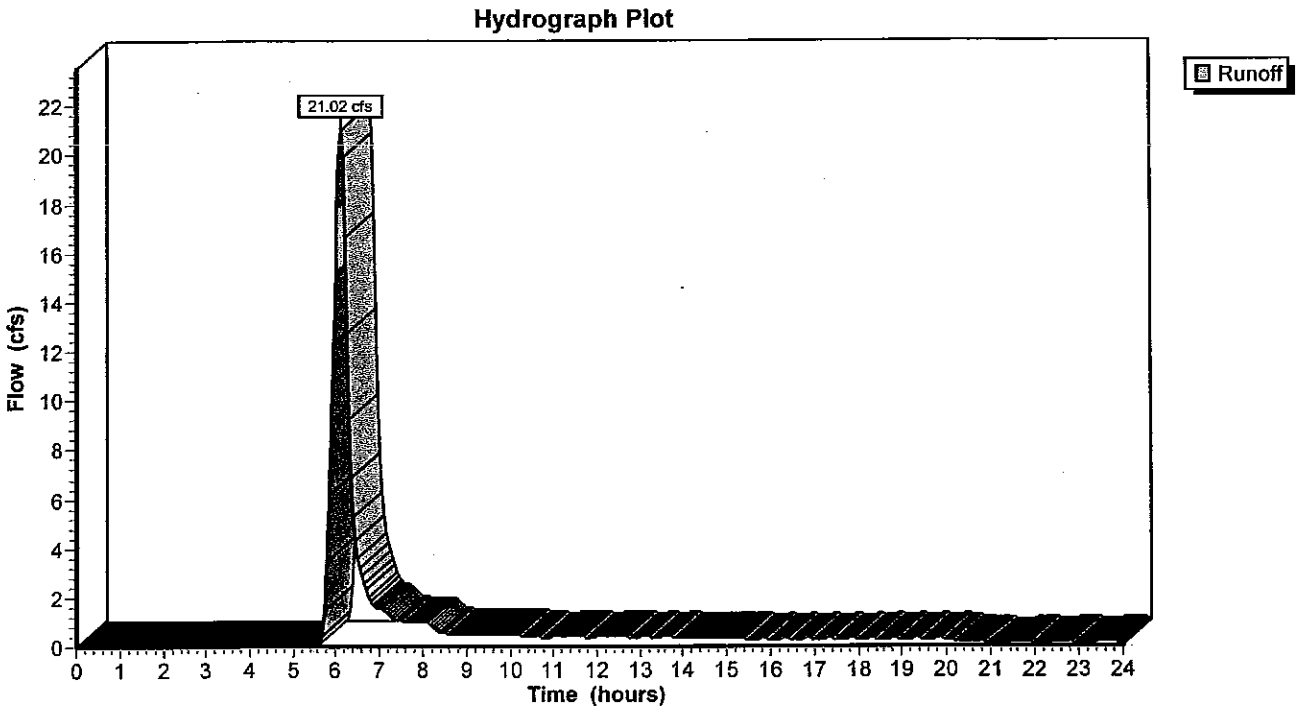
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=2.85"

Area (ac)	CN	Description
11.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
17.3	0	Total			

Subcatchment C: Basin C

Hydrograph Plot



Subcatchment D: Basin D - South Branch

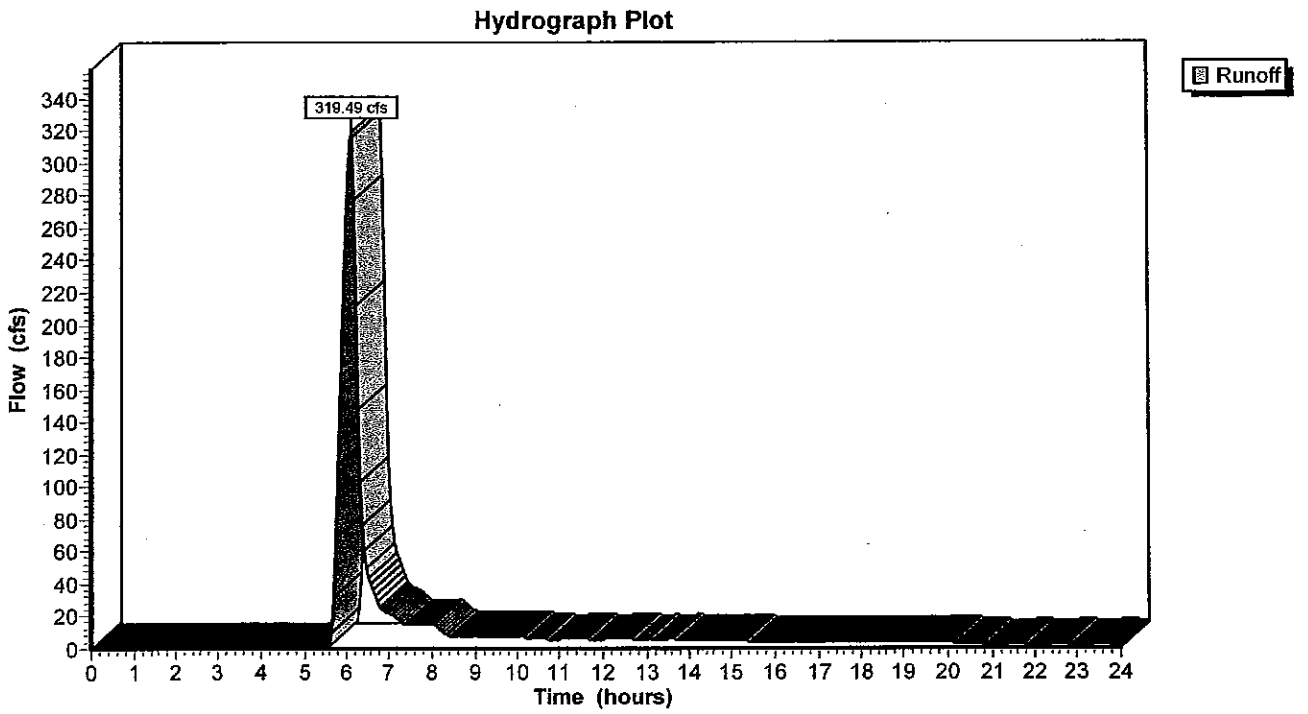
Runoff = 319.49 cfs @ 6.08 hrs, Volume= 19.360 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=2.85"

Area (ac)	CN	Description
86.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B
22.000	85	(PUD) 1/8 acre lots, 65% imp, HSG B
19.000	92	(R5) Urban commercial, 85% imp, HSG B
11.000	92	(PBC) Urban commercial, 85% imp, HSG B
10.000	69	(PK) 50-75% Grass cover, Fair, HSG B
6.000	85	(R3) 1/8 acre lots, 65% imp, HSG B
5.000	77	(SCHOOL) 1/2 park, 1/2 commercial, HSG B
159.000	85	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, from DBPS Basin A-11**

Subcatchment D: Basin D - South Branch



Subcatchment E: Basin E

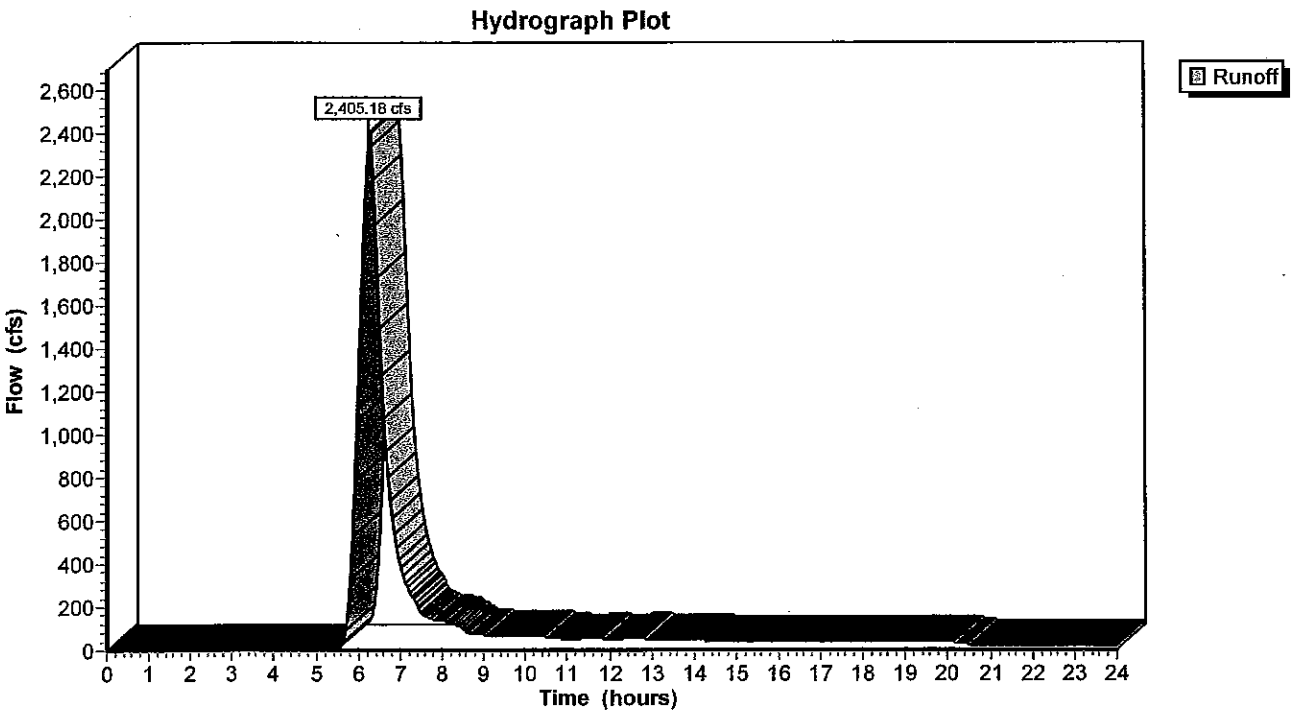
Runoff = 2,405.18 cfs @ 6.25 hrs, Volume= 202.070 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=2.85"

Area (ac)	CN	Description
687.000	92	(R1-6) 1/8 acre lots, 65% imp, HSG D
191.000	92	(PUD) 1/8 acre lots, 65% imp, HSG D
147.000	85	(RR-1) 1/2 acre lots, 25% imp, HSG D
64.000	94	(PBC) Urban commercial, 85% imp, HSG C
55.000	84	(SCHOOL) 1/2 open space, 1/2 commercial, HSG C
45.000	95	(R5) Urban commercial, 85% imp, HSG D
8.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
36.000	84	(PK) 50-75% Grass cover, Fair, HSG D
21.000	95	(OC) Urban commercial, 85% imp, HSG D
5.000	95	(OR) Urban commercial, 85% imp, HSG D
1,259.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3					**Direct Entry, Overland Flow**
9.8					**Direct Entry, Street Flow**
6.2					**Direct Entry, Channel Flow**
33.3	0	Total			

Subcatchment E: Basin E



Reach AI: Main Branch @ FIS Section AI

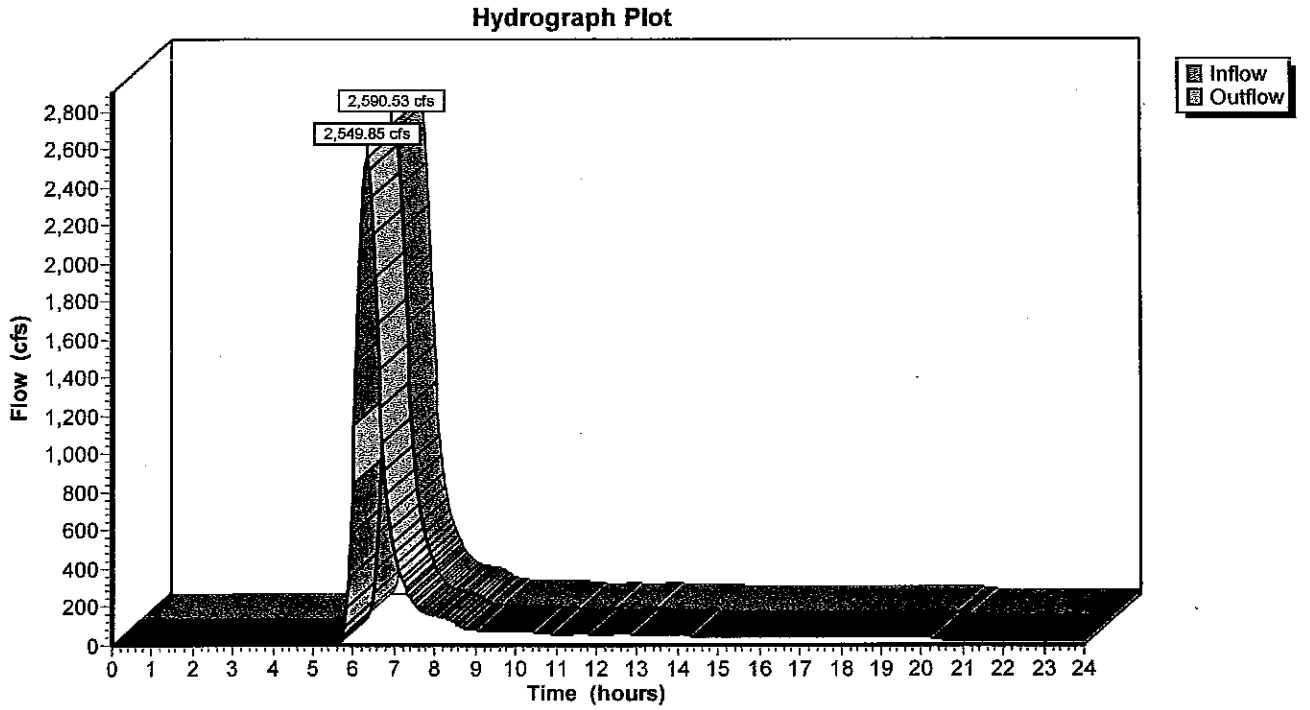
Inflow = 2,590.53 cfs @ 6.22 hrs, Volume= 222.769 af
Outflow = 2,549.85 cfs @ 6.30 hrs, Volume= 222.642 af, Atten= 2%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.0 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 11.0 fps, Avg. Travel Time= 2.3 min

Peak Depth= 7.34'
Capacity at bank full= 4,356.00 cfs
Inlet Invert= 6,440.00', Outlet Invert= 6,424.00'
Custom stage-discharge table, Length= 1,550.0'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
12.50	396.0	613,800	4,356.00

Reach AI: Main Branch @ FIS Section AI

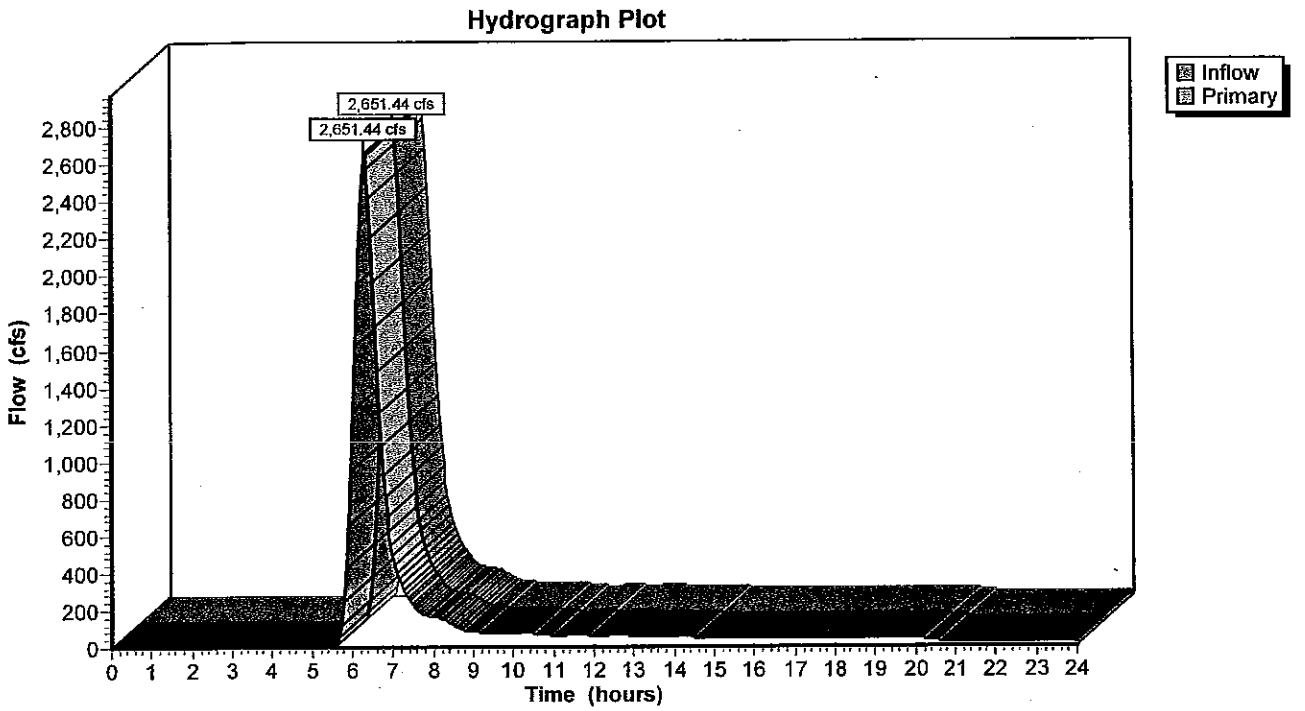


Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

Inflow = 2,651.44 cfs @ 6.29 hrs, Volume= 232.695 af
Primary = 2,651.44 cfs @ 6.29 hrs, Volume= 232.695 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

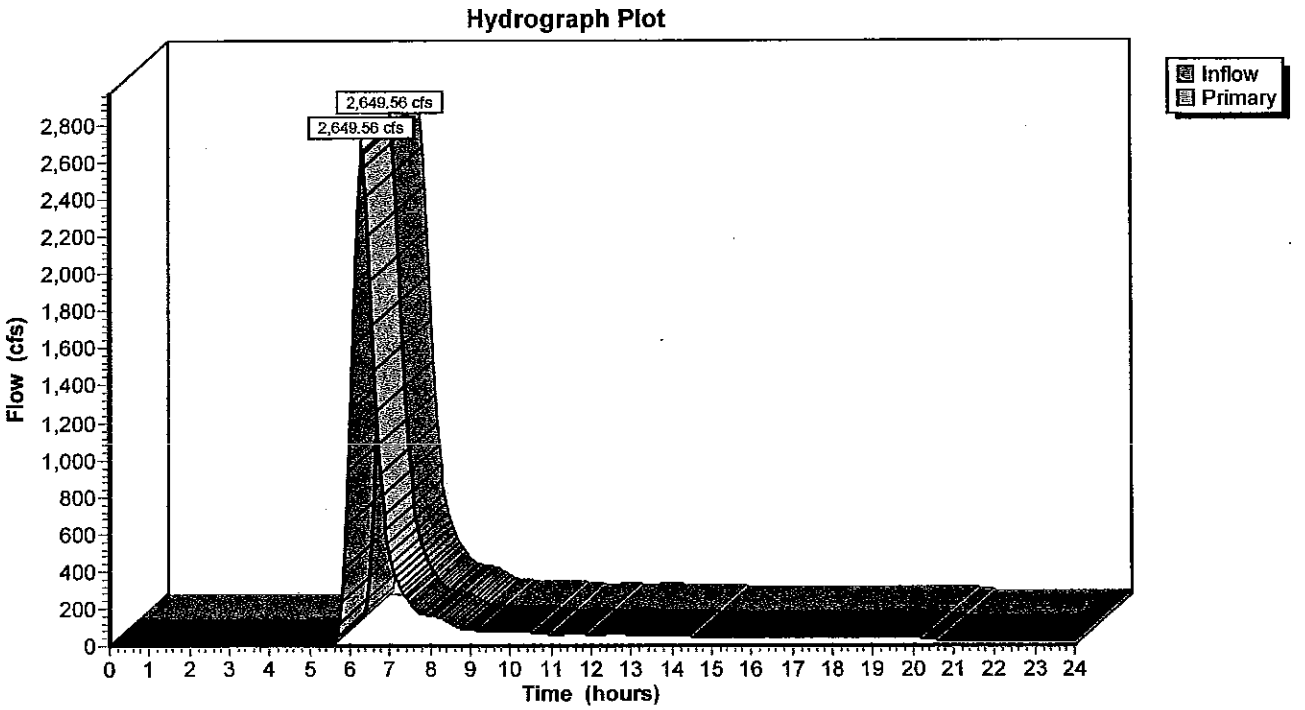


Link 2: FIS XSect AH - Siferd & Date St

Inflow	=	2,649.56 cfs @	6.29 hrs,	Volume=	231.961 af
Primary	=	2,649.56 cfs @	6.29 hrs,	Volume=	231.961 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2: FIS XSect AH - Siferd & Date St

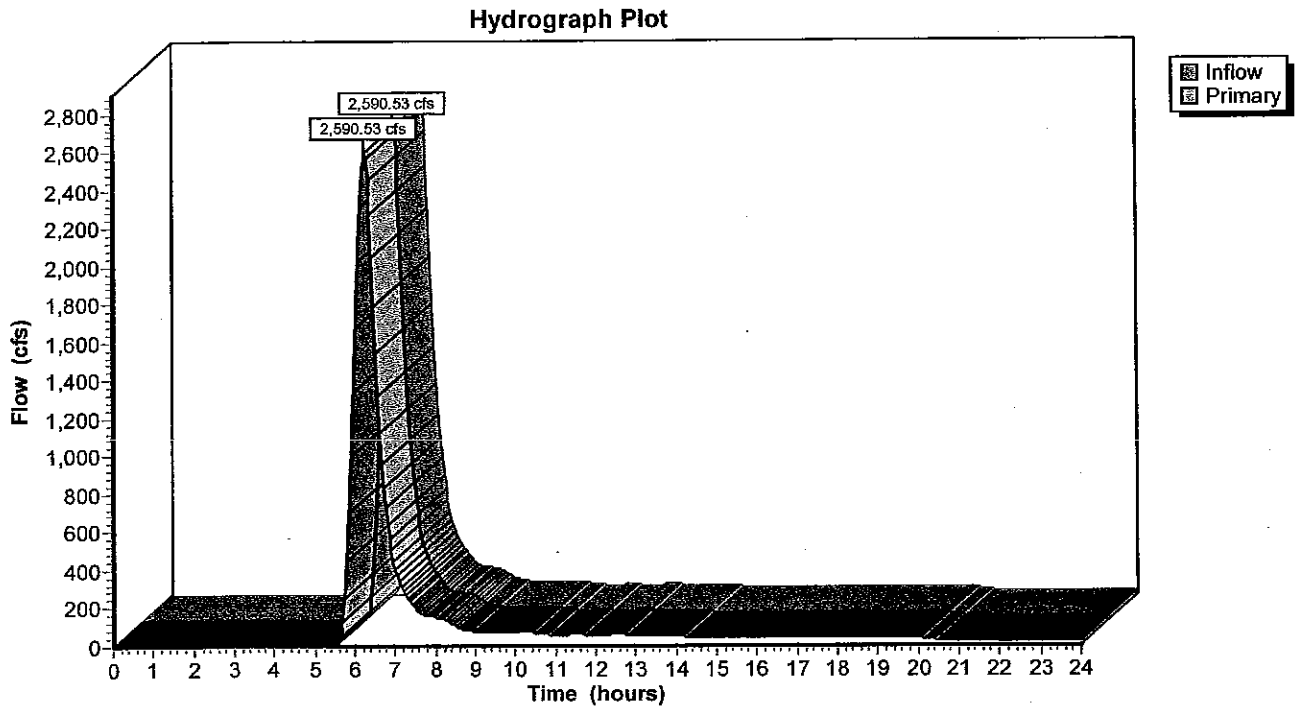


Link 3: FIS XSect AJ - just downstream of confluence

Inflow = 2,590.53 cfs @ 6.22 hrs, Volume= 222.769 af
Primary = 2,590.53 cfs @ 6.22 hrs, Volume= 222.769 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3: FIS XSect AJ - just downstream of confluence

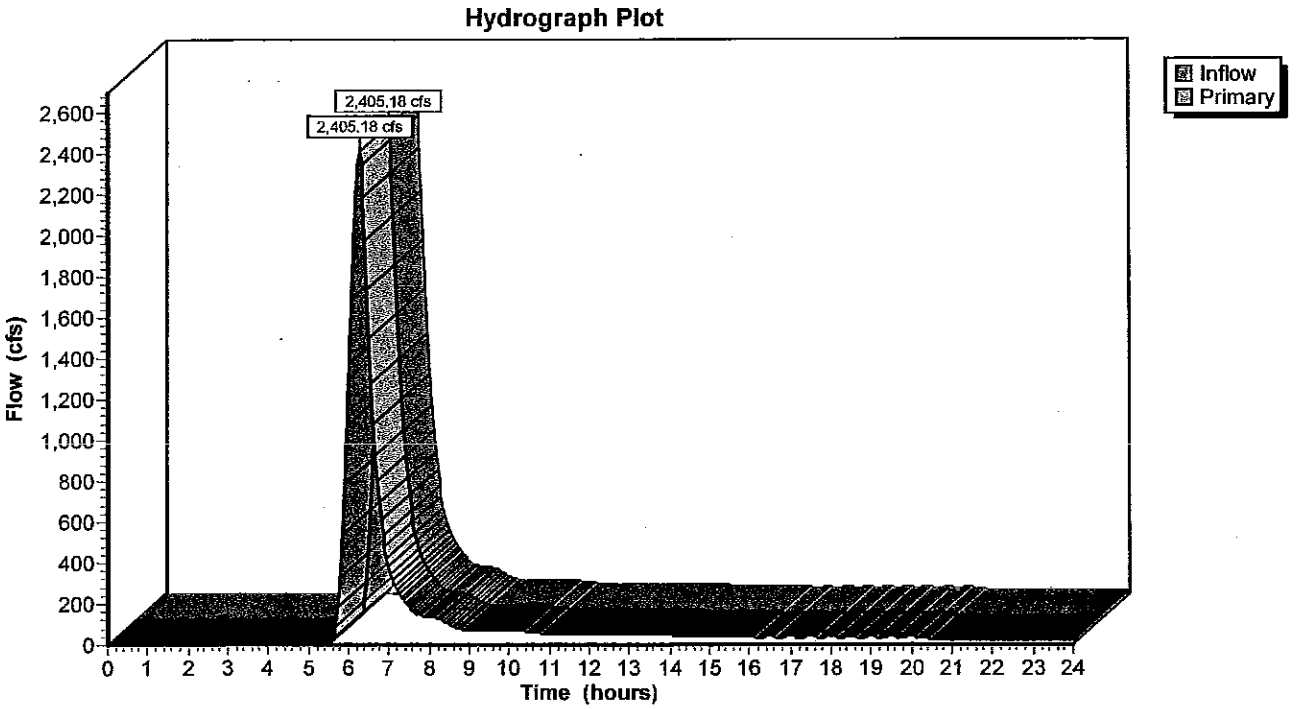


Link 4: FIS XSect AN - Xing @ Hopeful Drive

Inflow = 2,405.18 cfs @ 6.25 hrs, Volume= 202.070 af
Primary = 2,405.18 cfs @ 6.25 hrs, Volume= 202.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 4: FIS XSect AN - Xing @ Hopeful Drive



100-YEAR 24-HOUR STORM

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Type IIA 24-hr Rainfall=4.60"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Basin A
Tc=10.3 min CN=94 Area=4.000 ac Runoff= 21.00 cfs 1.304 af

Subcatchment B: Basin B
Tc=24.0 min CN=91 Area=58.000 ac Runoff= 242.61 cfs 17.342 af

Subcatchment C: Basin C
Tc=17.3 min CN=85 Area=11.000 ac Runoff= 43.31 cfs 2.747 af

Subcatchment D: Basin D - South Branch
Tc=15.0 min CN=85 Area=159.000 ac Runoff= 647.28 cfs 39.708 af

Subcatchment E: Basin E
Tc=33.3 min CN=91 Area=1,259.000 ac Runoff= 4,545.57 cfs 376.108 af

Reach AI: Main Branch @ FIS Section AI Inflow= 4,956.39 cfs 418.563 af
Length= 1,550.0' Max Vel= 11.0 fps Capacity= 4,356.00 cfs Outflow= 4,884.33 cfs 418.349 af

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3) Inflow= 5,082.19 cfs 436.995 af
Primary= 5,082.19 cfs 436.995 af

Link 2: FIS XSect AH - Siferd & Date St Inflow= 5,078.64 cfs 435.692 af
Primary= 5,078.64 cfs 435.692 af

Link 3: FIS XSect AJ - just downstream of confluence Inflow= 4,956.39 cfs 418.563 af
Primary= 4,956.39 cfs 418.563 af

Link 4: FIS XSect AN - Xing @ Hopeful Drive Inflow= 4,545.57 cfs 376.108 af
Primary= 4,545.57 cfs 376.108 af

Runoff Area = 1,491.000 ac Volume = 437.209 af Average Depth = 3.52"

Subcatchment A: Basin A

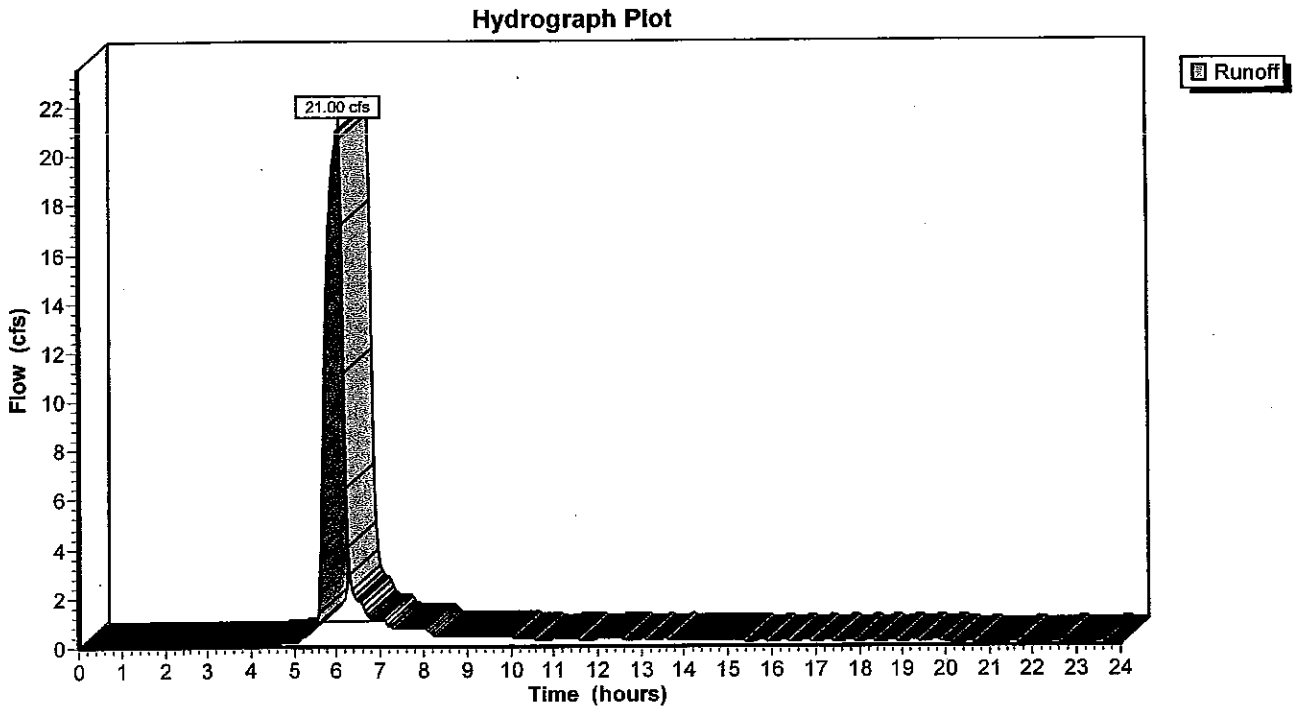
Runoff = 21.00 cfs @ 6.00 hrs, Volume= 1.304 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=4.60"

Area (ac)	CN	Description
4.000	94	(R5) Urban commercial, 85% imp, HSG C

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
10.3	0	Total			

Subcatchment A: Basin A



Subcatchment B: Basin B

Runoff = 242.61 cfs @ 6.13 hrs, Volume= 17.342 af

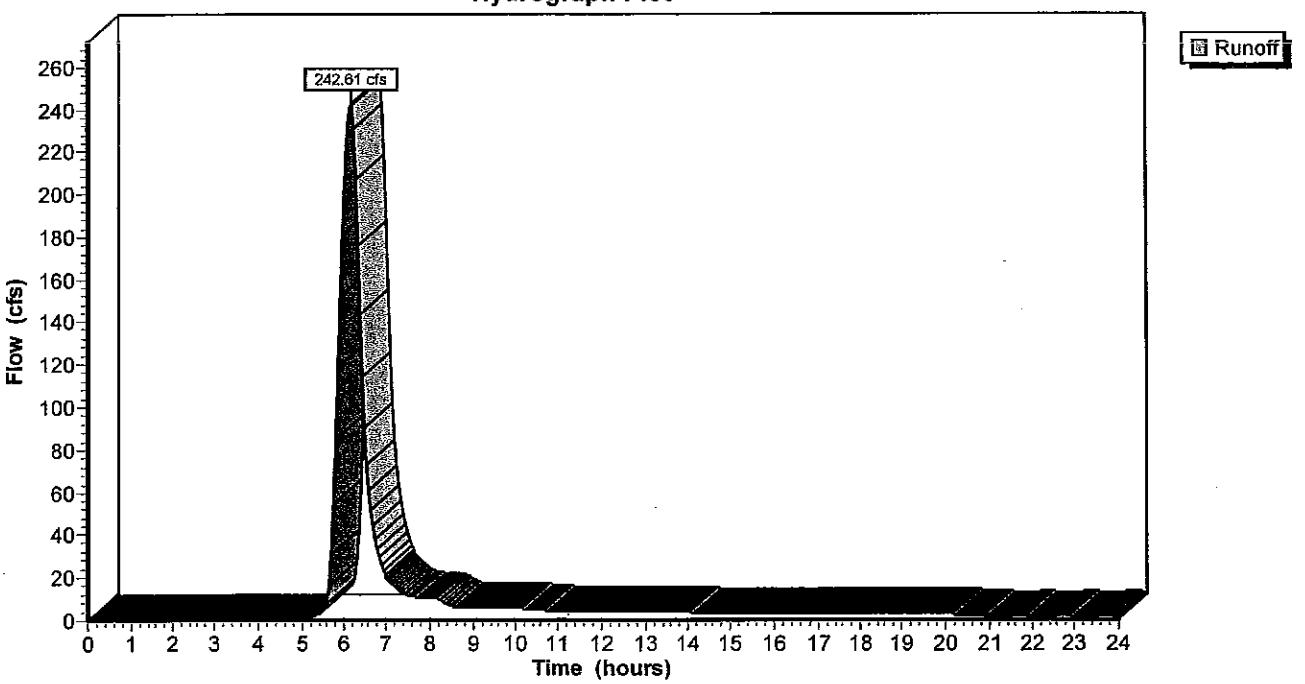
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=4.60"

Area (ac)	CN	Description
19.000	94	(PBC) Urban commercial, 85% imp, HSG C
39.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
58.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0					**Direct Entry, Overland**
2.0					**Direct Entry, Channel**
24.0	0	Total			

Subcatchment B: Basin B

Hydrograph Plot



Subcatchment C: Basin C

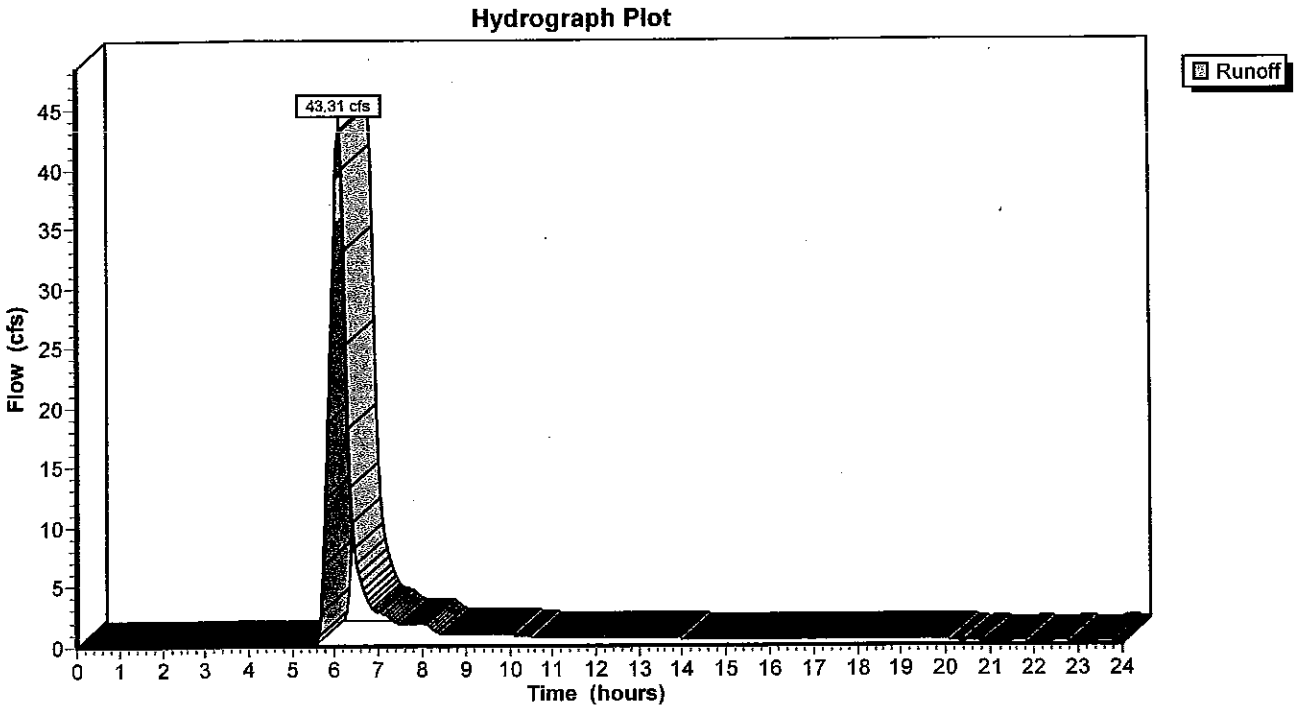
Runoff = 43.31 cfs @ 6.09 hrs, Volume= 2.747 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=4.60"

Area (ac)	CN	Description
11.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Overland**
0.3					**Direct Entry, Channel**
17.3	0	Total			

Subcatchment C: Basin C



Subcatchment D: Basin D - South Branch

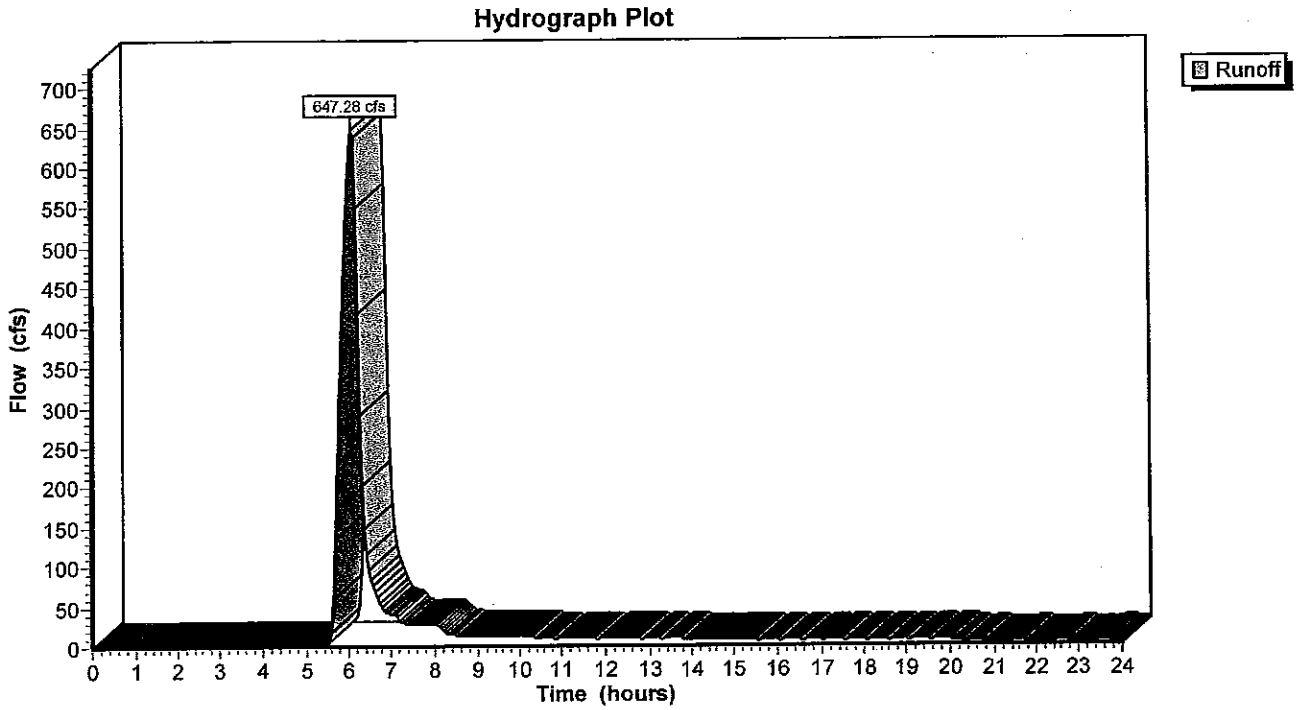
Runoff = 647.28 cfs @ 6.07 hrs, Volume= 39.708 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=4.60"

Area (ac)	CN	Description
86.000	85	(R1-6) 1/8 acre lots, 65% imp, HSG B
22.000	85	(PUD) 1/8 acre lots, 65% imp, HSG B
19.000	92	(R5) Urban commercial, 85% imp, HSG B
11.000	92	(PBC) Urban commercial, 85% imp, HSG B
10.000	69	(PK) 50-75% Grass cover, Fair, HSG B
6.000	85	(R3) 1/8 acre lots, 65% imp, HSG B
5.000	77	(SCHOOL) 1/2 park, 1/2 commercial, HSG B
159.000	85	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, from DBPS Basin A-11**

Subcatchment D: Basin D - South Branch



Subcatchment E: Basin E

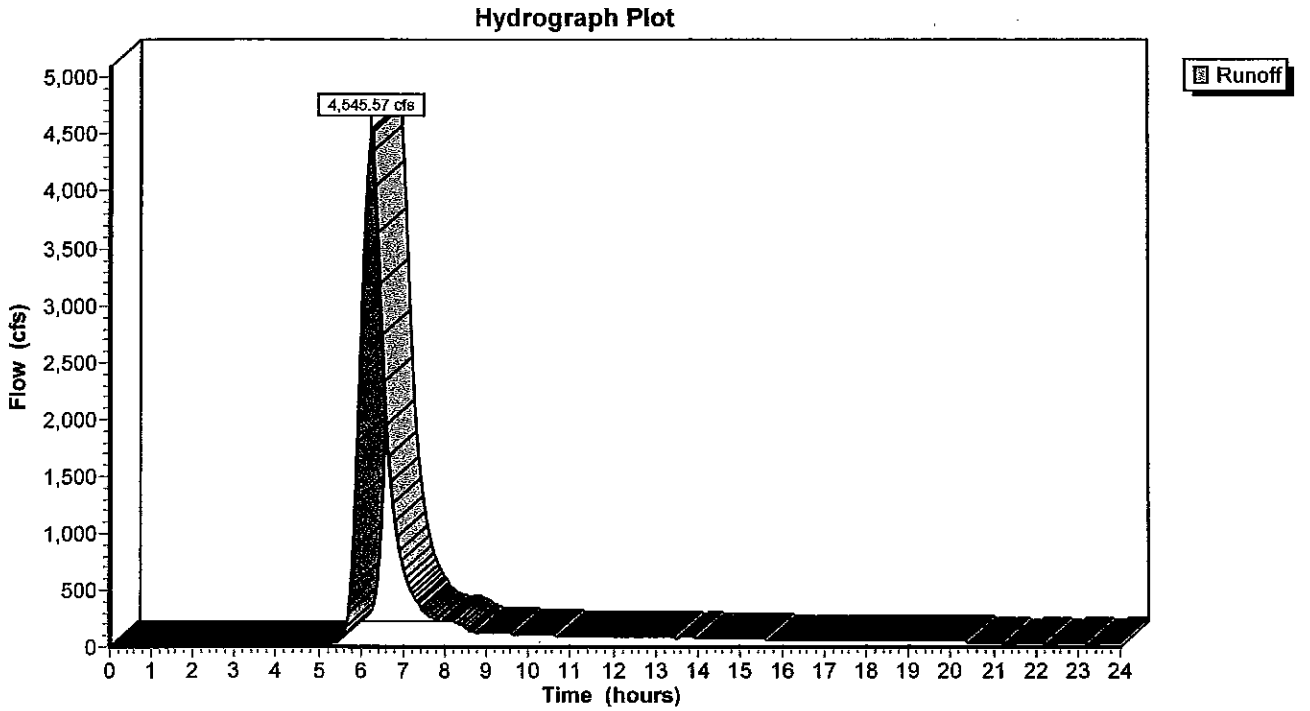
Runoff = 4,545.57 cfs @ 6.23 hrs, Volume= 376.108 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type IIA 24-hr Rainfall=4.60"

Area (ac)	CN	Description
687.000	92	(R1-6) 1/8 acre lots, 65% imp, HSG D
191.000	92	(PUD) 1/8 acre lots, 65% imp, HSG D
147.000	85	(RR-1) 1/2 acre lots, 25% imp, HSG D
64.000	94	(PBC) Urban commercial, 85% imp, HSG C
55.000	84	(SCHOOL) 1/2 open space, 1/2 commercial, HSG C
45.000	95	(R5) Urban commercial, 85% imp, HSG D
8.000	90	(R3) 1/8 acre lots, 65% imp, HSG C
36.000	84	(PK) 50-75% Grass cover, Fair, HSG D
21.000	95	(OC) Urban commercial, 85% imp, HSG D
5.000	95	(OR) Urban commercial, 85% imp, HSG D
1,259.000	91	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.3					**Direct Entry, Overland Flow**
9.8					**Direct Entry, Street Flow**
6.2					**Direct Entry, Channel Flow**
33.3	0	Total			

Subcatchment E: Basin E



Reach AI: Main Branch @ FIS Section AI

[91] Warning: Storage range exceeded by 1.56'
[55] Hint: Peak inflow is 114% of Manning's capacity

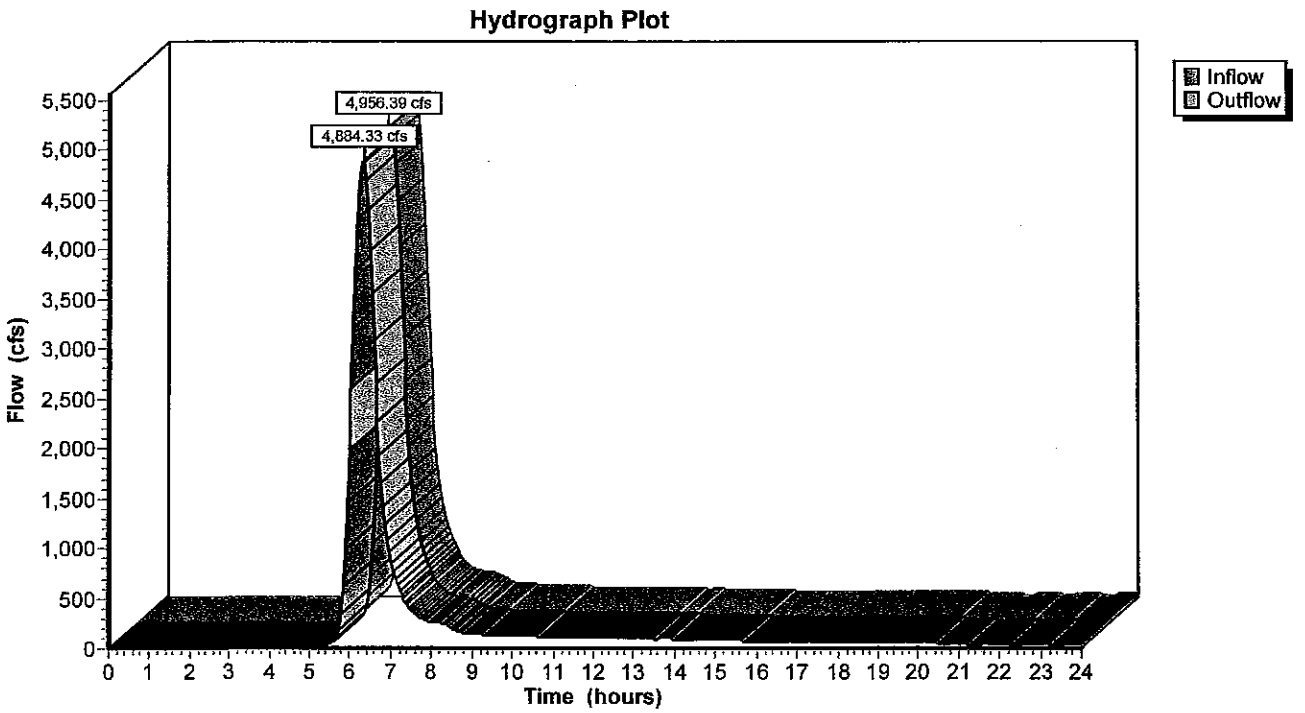
Inflow = 4,956.39 cfs @ 6.20 hrs, Volume= 418.563 af
Outflow = 4,884.33 cfs @ 6.27 hrs, Volume= 418.349 af, Atten= 1%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 11.0 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 11.0 fps, Avg. Travel Time= 2.3 min

Peak Depth= 14.06'
Capacity at bank full= 4,356.00 cfs
Inlet Invert= 6,440.00', Outlet Invert= 6,424.00'
Custom stage-discharge table, Length= 1,550.0'

Depth (feet)	End Area (sq-ft)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	0	0.00
12.50	396.0	613,800	4,356.00

Reach AI: Main Branch @ FIS Section AI

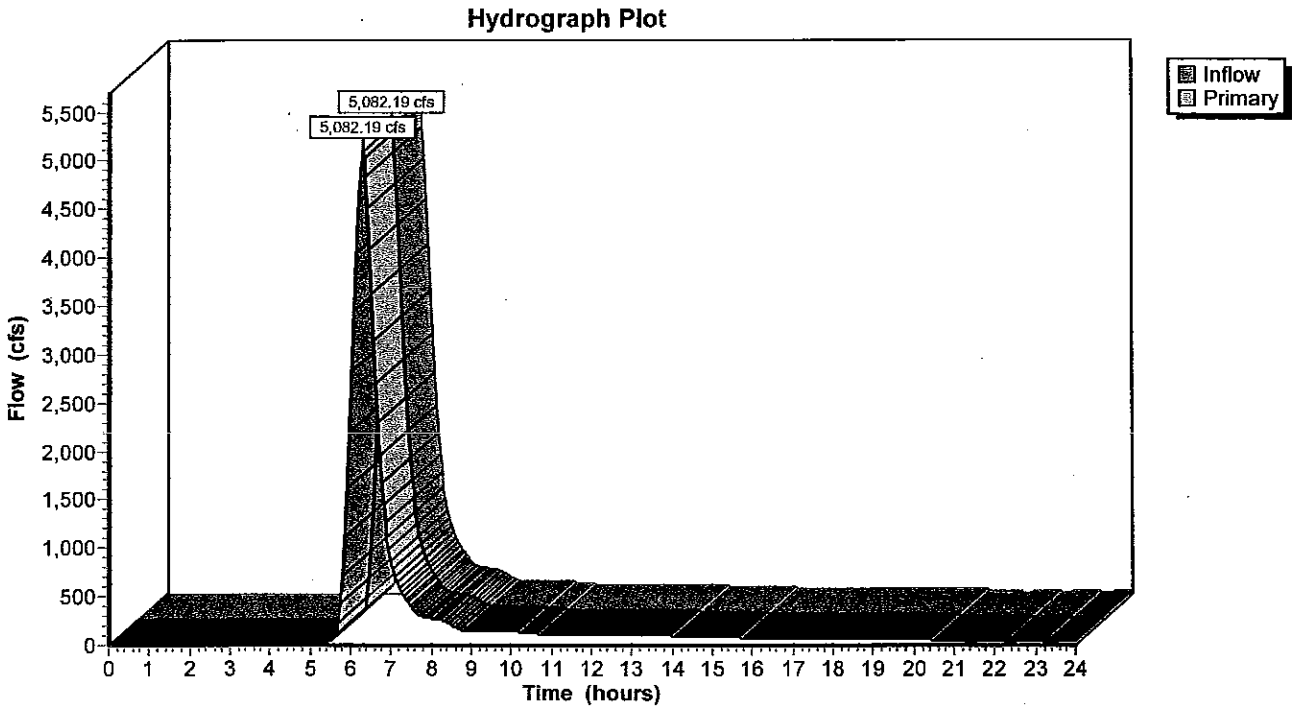


Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

Inflow = 5,082.19 cfs @ 6.27 hrs, Volume= 436.995 af
Primary = 5,082.19 cfs @ 6.27 hrs, Volume= 436.995 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 1: FIS XSect AG - Ex Box Culvert (10'x12'x3)

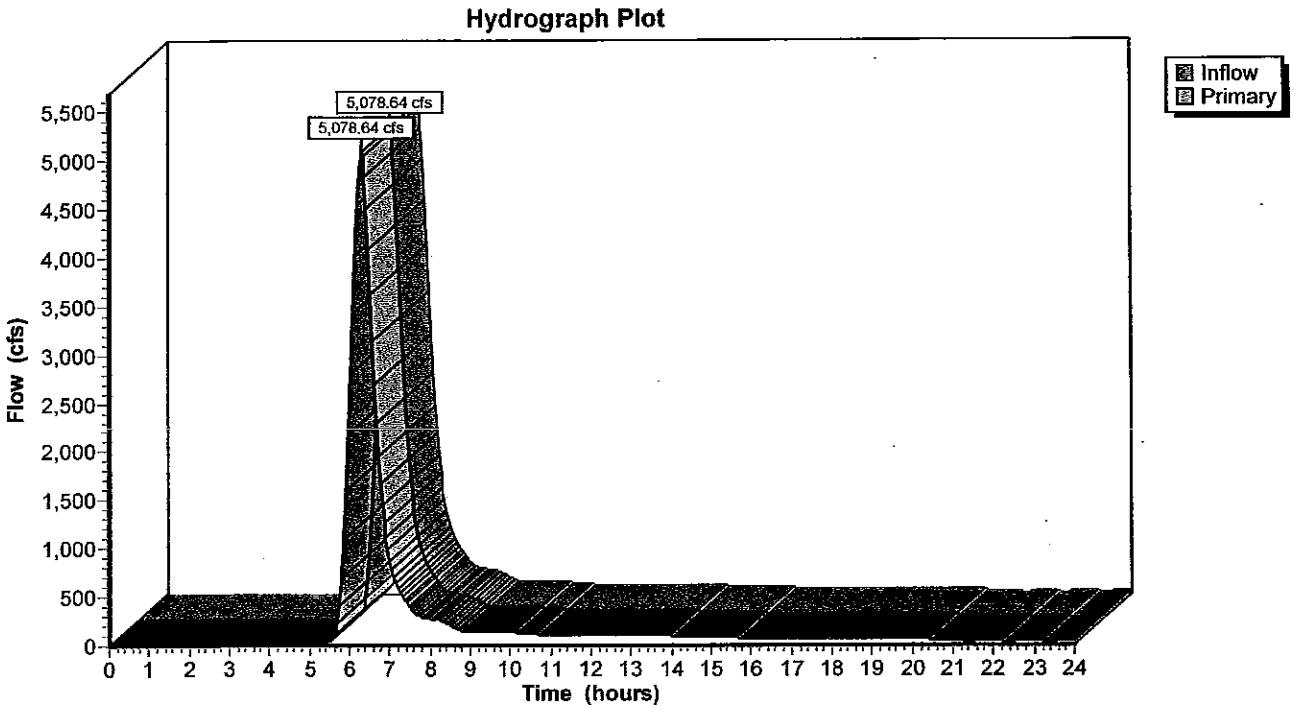


Link 2: FIS XSect AH - Siferd & Date St

Inflow = 5,078.64 cfs @ 6.27 hrs, Volume= 435.692 af
Primary = 5,078.64 cfs @ 6.27 hrs, Volume= 435.692 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 2: FIS XSect AH - Siferd & Date St

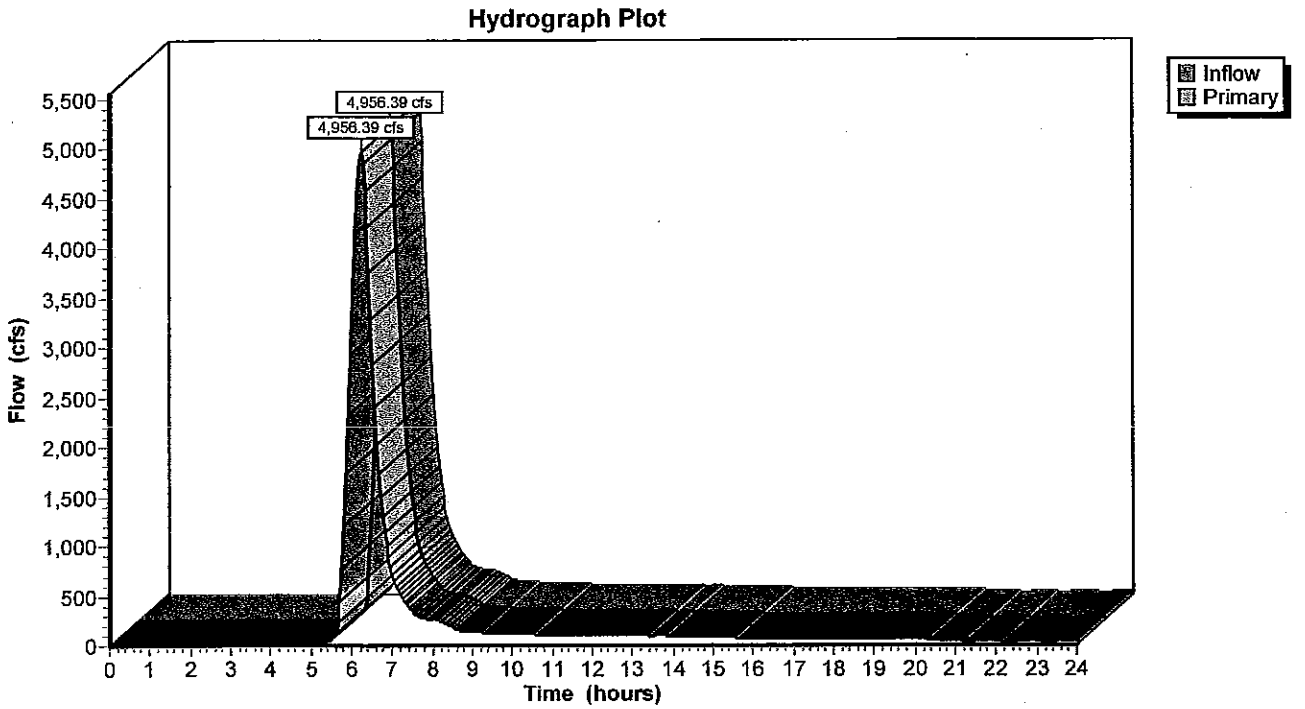


Link 3: FIS XSect AJ - just downstream of confluence

Inflow = 4,956.39 cfs @ 6.20 hrs, Volume= 418.563 af
Primary = 4,956.39 cfs @ 6.20 hrs, Volume= 418.563 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Link 3: FIS XSect AJ - just downstream of confluence

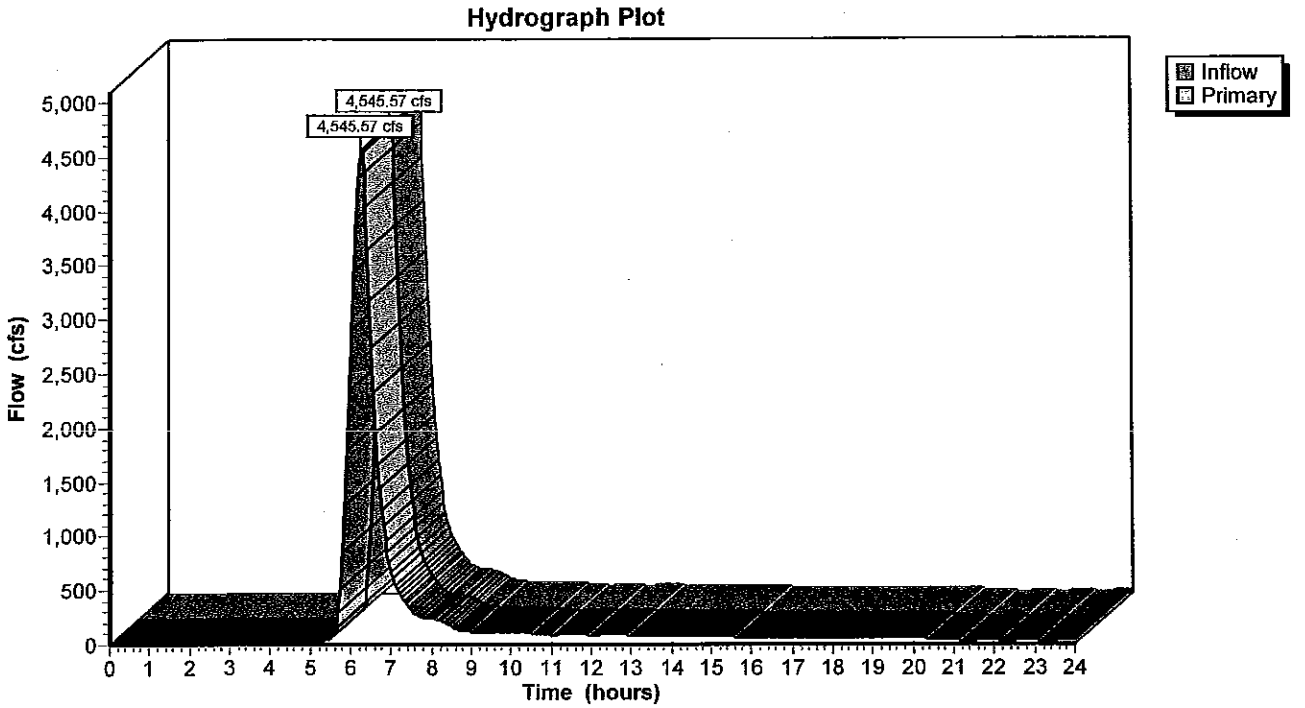


Link 4: FIS XSect AN - Xing @ Hopeful Drive

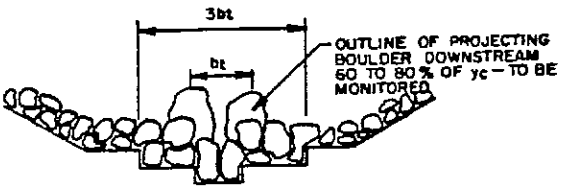
Inflow = 4,545.57 cfs @ 6.23 hrs, Volume= 376.108 af
Primary = 4,545.57 cfs @ 6.23 hrs, Volume= 376.108 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

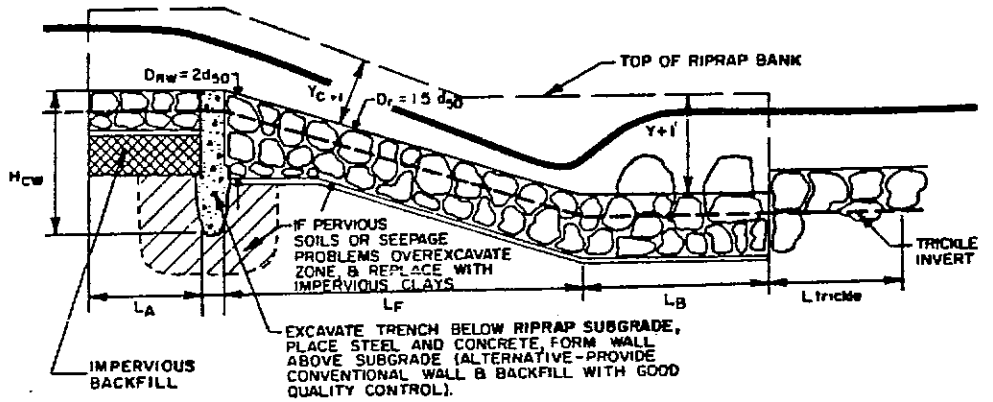
Link 4: FIS XSect AN - Xing @ Hopeful Drive



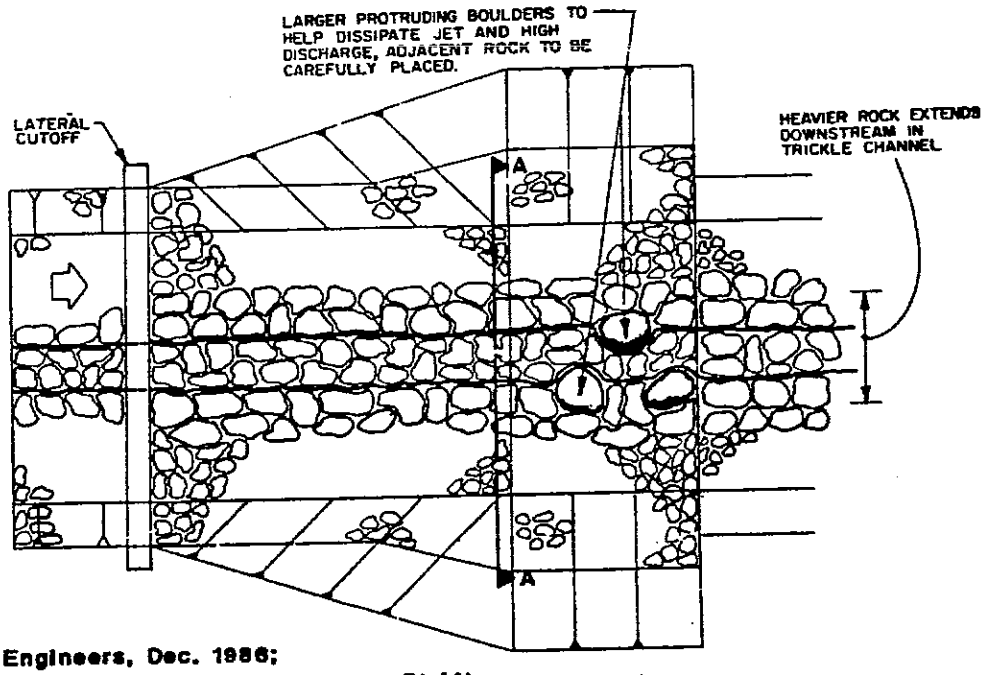
MAPS & EXHIBIT DRAWINGS



SECTION "A"



PROFILE

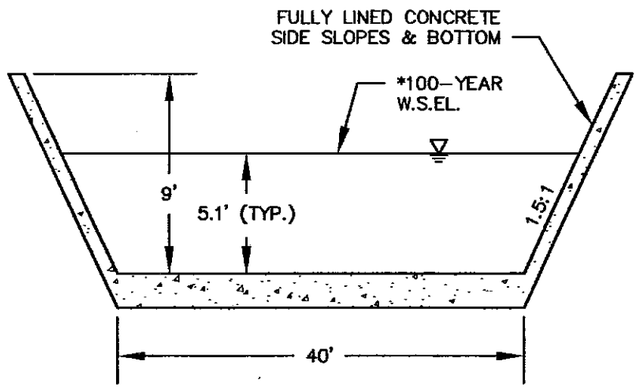


PLAN

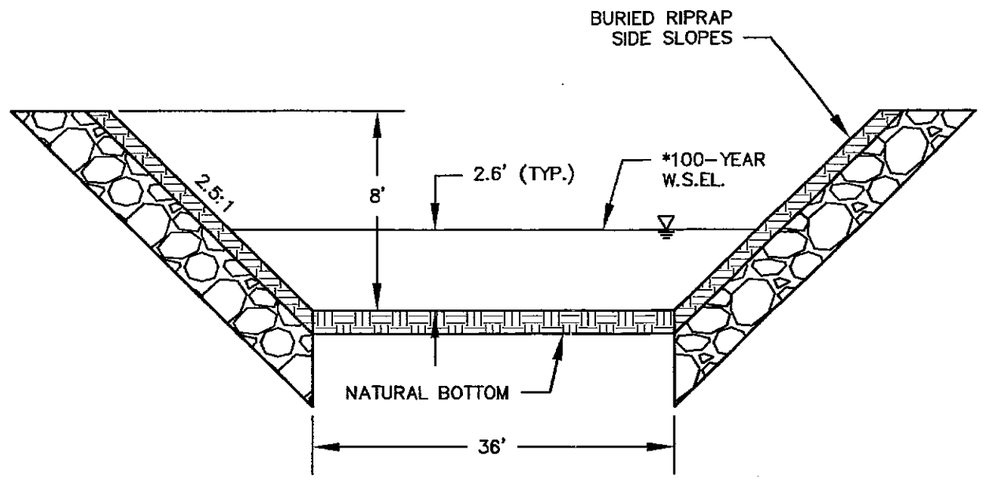
REFERENCE :

McLaughlin Water Engineers, Dec. 1986; Drop Structures in the Denver Metropolitan Area

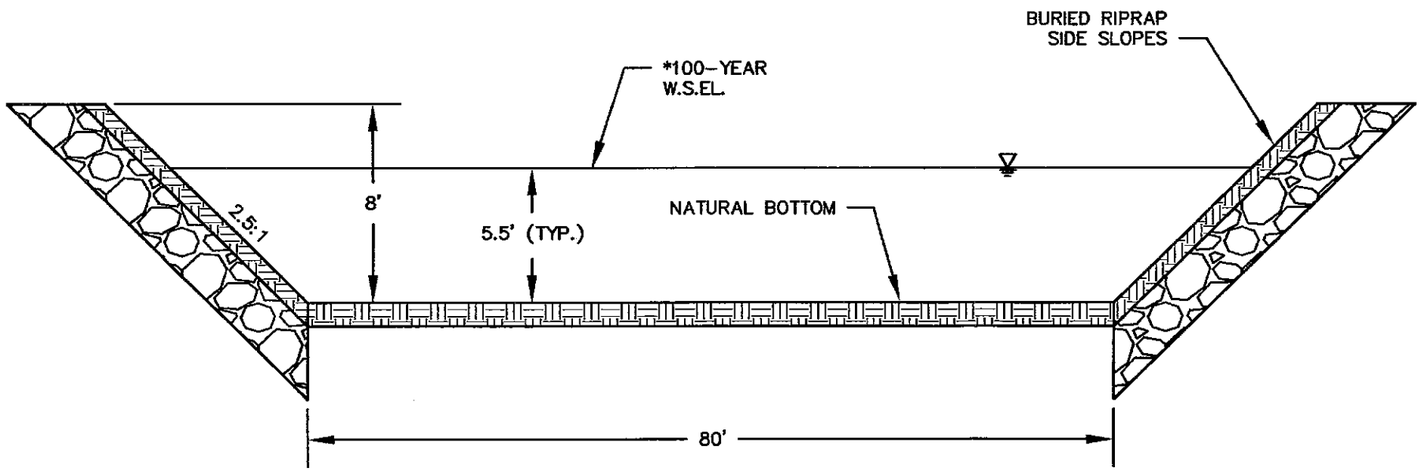
SLR - Sloping Large Riprap Drop



TRAPEZOIDAL CONCRETE CHANNEL TYPICAL SECTION
FROM DP1 TO DP2 (MAIN CHANNEL)
N.T.S.



TRAPEZOIDAL NATURAL CHANNEL TYPICAL SECTION
SOUTH BRANCH
N.T.S.



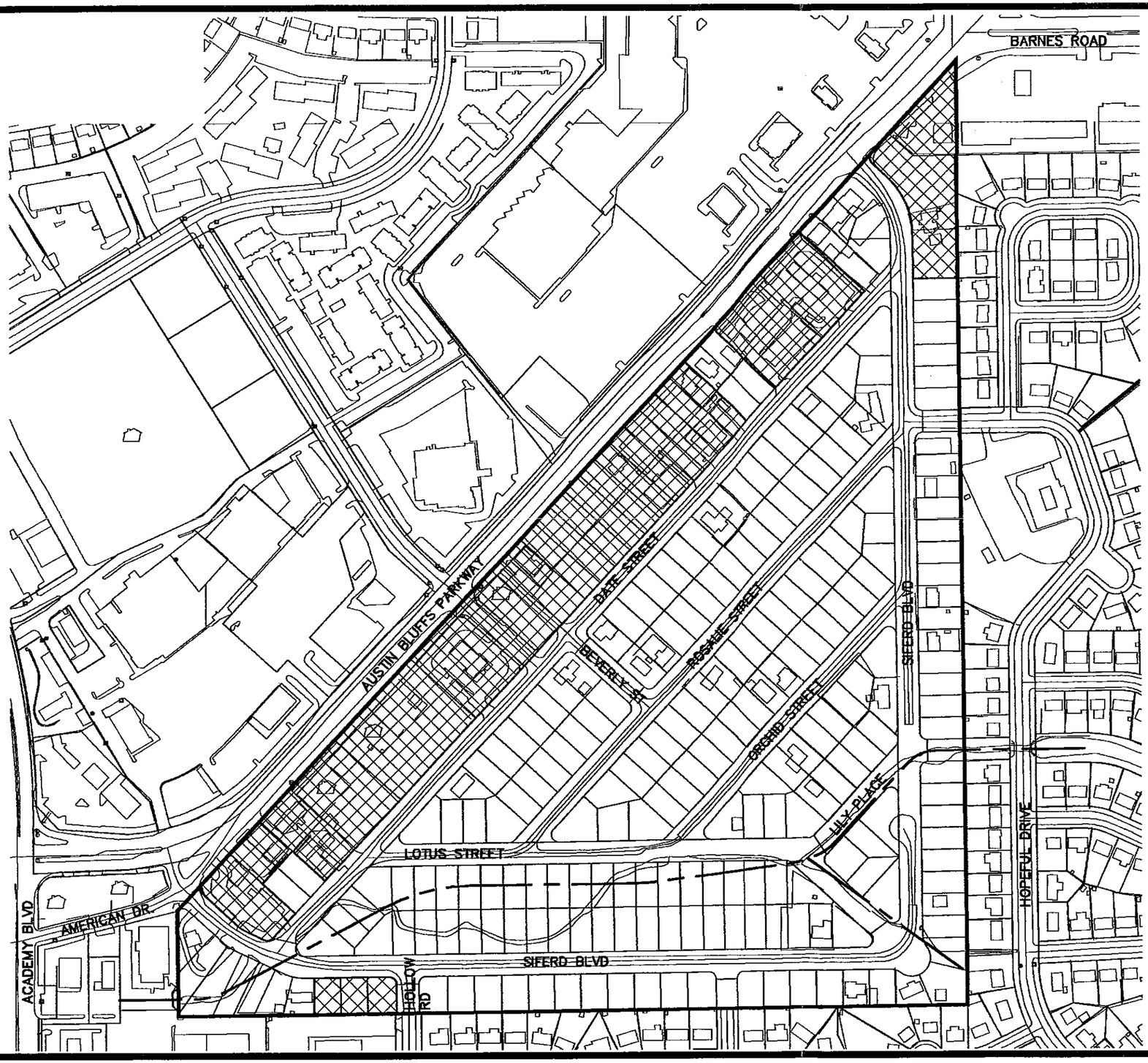
TRAPEZOIDAL NATURAL CHANNEL TYPICAL SECTION
FROM DP2 TO DP4 (MAIN CHANNEL)
N.T.S.

***NOTE:**
ACTUAL WATER SURFACE ELEVATIONS VARY WITH CHANGES IN SLOPE (AT DROPS), GROUND COVER (AT DROPS), AND HEADWATER CONDITIONS (AT CULVERTS). SEE HEC-RAS DATA FOR MORE DETAILED WATER SURFACE INFORMATION.

PROPOSED TYPICAL TEMPLETON GAP DRAINAGEWAY IMPROVEMENT SECTIONS

WESTWORKS ENGINEERING
945 OSAGE AVENUE MANITOU SPRINGS, CO 80829 (719) 685-1670

DRAWN BY:	CDK
SCALE:	N.T.S.
DATE:	10/31/03
JOB NUMBER	SHEET
90305	1 OF 4



LEGEND:

AREA ANNEXED INTO CITY OF COLORADO SPRINGS (14.7 AC)

AREA IN UNINCORPORATED EL PASO COUNTY (57.0 AC)

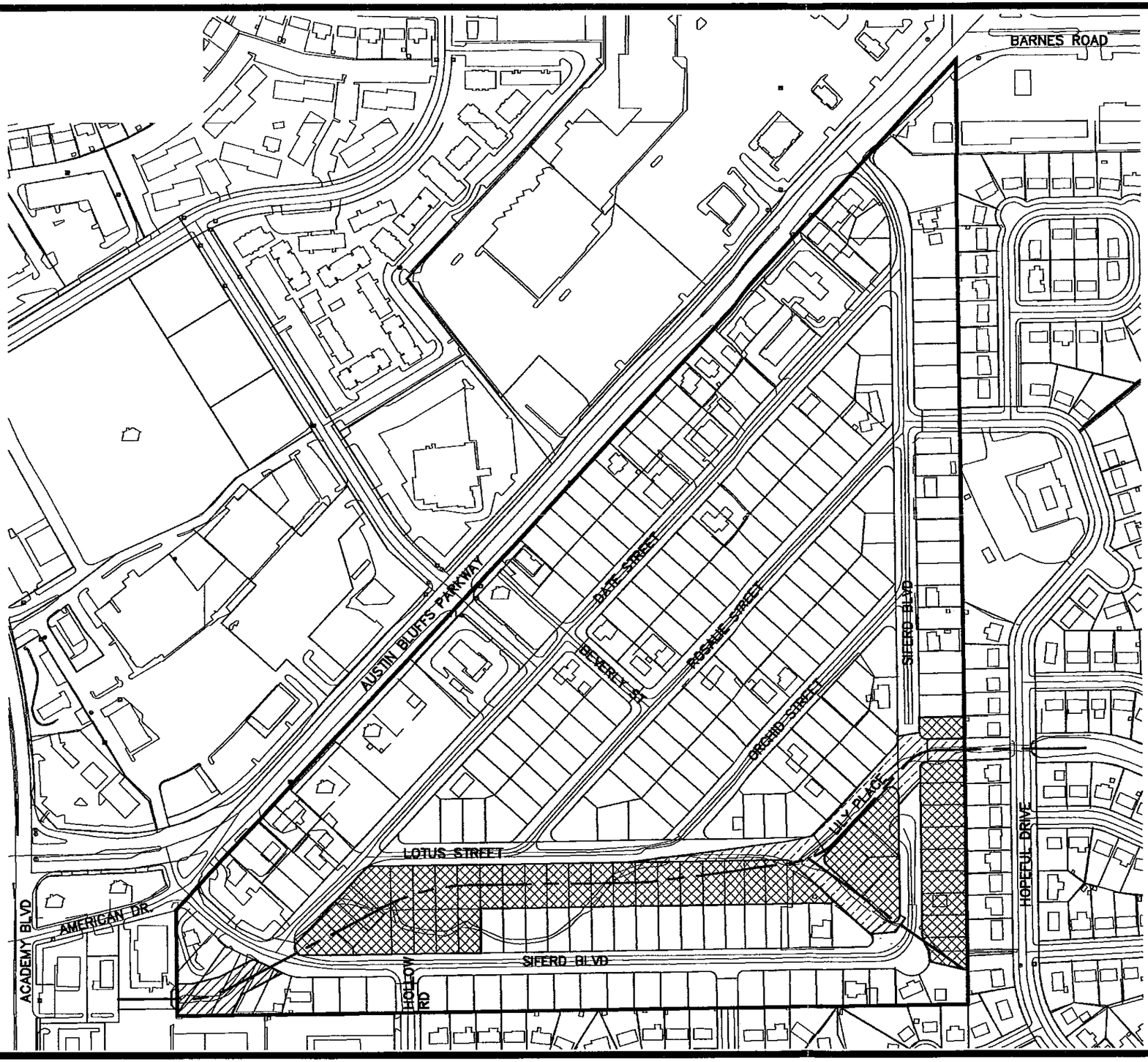
CL OF PROP. CHANNEL

N

PARK VISTA SUBDIVISION SHOWING AREA ANNEXED INTO CITY OF COLORADO SPRINGS

WESTWORKS ENGINEERING
945 OSAGE AVENUE MANITOU SPRINGS, CO 80829 (719) 685-1670

DRAWN BY:	CDK
SCALE:	1" = 300'
DATE:	10/31/03
JOB NUMBER	SHEET
90305	2 OF 4



LEGEND:

AREA OF TRACT (0.5 AC)

LOTS TO BE AQUIRED (43 LOTS)

ROW TO BE USED AS OPEN CHANNEL

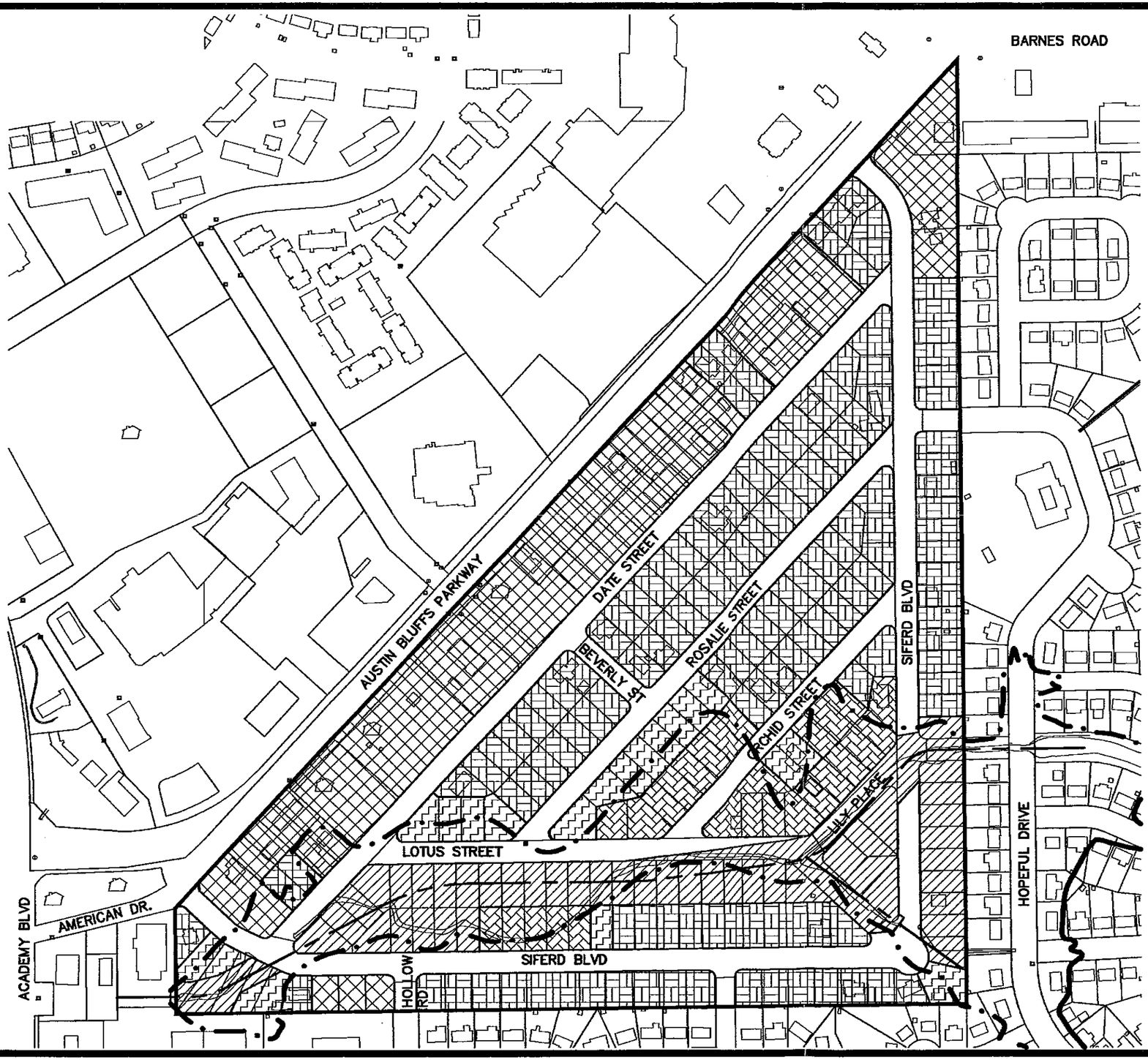
CL OF PROP. CHANNEL

N

PARK VISTA SUBDIVISION AREA AND MINIMUM RECOMMENDED LAND AQUISITION EXHIBIT

WESTWORKS ENGINEERING
945 OSAGE AVENUE MANITOU SPRINGS, CO 80829 (719) 685-1670

DRAWN BY:	CDK
SCALE:	1" = 300'
DATE:	10/31/03
JOB NUMBER	SHEET
90305	3 OF 4



LEGEND:

AREA ANNEXED INTO CITY OF COLORADO SPRINGS	(14.7 AC)	
AREA OF PROP. CHANNEL	(9.6 AC)	
AREA OF LOTS THAT CAN BE ANNEXED & DEVELOPED PRIOR TO CHANNEL IMPVMTS	(23.2 AC)	
AREA OF LOTS THAT CAN BE ANNEXED & DEVELOPED IF CITY FLOODPLAIN ORDINANCE FOLLOWED	(3.6 AC)	
AREA OF LOTS THAT CANNOT BE ANNEXED & DEVELOPED PRIOR TO CHANNEL IMPVMTS	(4.7 AC)	
EX 100-YR FLOODPLAIN		
CL OF PROP. CHANNEL		

N

PARK VISTA SUBDIVISION DEVELOPMENT EXHIBIT

WESTWORKS ENGINEERING
945 OSAGE AVENUE MANITOU SPRINGS, CO 80829 (719) 685-1670

DRAWN BY:	CDK
SCALE:	1" = 300'
DATE:	10/31/03
JOB NUMBER	SHEET
90305	4 OF 4