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January 17, 1994

Mr. Larry Kostaneski P.E.
Engineering Division Manager
City of Rapid City
300 Sixth Street
Rapid City, SD 57701

RE: Design Plan for Knollwood Drainage Basin

Dear Mr. Kostaneski:

Presented herewith is our DESIGN PLAN FOR KNOLLWOOD DRAINAGE BASIN. The plan is a comprehensive basinwide design plan for stormwater management in the Knollwood Drainage Basin. It will provide guidance to the City, Pennington County, developers, and others in the basin. It contains the necessary information to insure the basin is developed with proper stormwater controls.

Please be assured of our readiness to meet with City Officials to discuss the contents of the report. We are available to answer any questions and are prepared to proceed with the design of the recommended improvements if desired.

Thank you for the opportunity to be of service.

Respectfully submitted,

FMG, Inc.

Richard A. Wells P.E.,L.S.

cc: File 7379

Civil Engineering
Geotechnical Engineering
Materials Testing Laboratory
Land Surveying
Environmental Services
Water Resources

DESIGN PLAN

FOR

KNOLLWOOD DRAINAGE BASIN

JANUARY 1994

PREPARED FOR:

CITY OF RAPID CITY

RAPID CITY, SOUTH DAKOTA

FMG, INC. 1823 West Main, Rapid City, South Dakota 57702-2591 605/342-4105
FAX 605/342-4222

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INTRODUCTION

INTRODUCTION

BACKGROUND

Proper management of urban drainage has historically been neglected as cities develop. Management has consisted of piecemeal planning, crisis control, after the fact corrective solutions, and generally hoping the problem will go away or not happen again. Development has been allowed to occur with little or no consideration given to basinwide impacts on flooding. Consequently severe and damaging flooding has occurred.

The City of Rapid City has recognized that this traditional method of urban drainage management is no longer appropriate. Rapid City now views drainage control as a significant component of the urban infrastructure system rather than a problem that is simply tolerated. Consequently the City of Rapid City has implemented a program for comprehensive basinwide drainage design planning. This design plan was thus prepared by FMG, Inc., for the Knollwood Drainage Basin. It is one of many design plans prepared for drainage basins in and around the City of Rapid City.

OBJECTIVE

The purpose of this design plan is to define existing and future stormwater related problems in the study area and to present a basinwide conceptual design plan for prevention and control of the problems. The design is intended to provide stormwater guidance to the City, Pennington County, developers, and others in the basin. It provides the necessary information to insure the basin is developed with proper stormwater controls.

DESIGN PLAN LIMITATIONS

It was beyond the scope of work to provide final engineering drawings suitable for construction. The design plan presented herein is conceptual and is intended to provide the general information necessary for the final working design of an efficient, planned system. The design plan is based on a practical hydraulic system which is suitable for further evaluation and implementation as the basin develops.

It is unlikely that the final design of any recommended improvement will exactly follow guidelines presented in this report; therefore it will be necessary to make a final detailed technical analysis of the proposed improvements prior to their construction. Time lags play an important role in a planned basinwide system thus the final project design must include a computer analysis of the system even if the final design flows are smaller than those proposed in this report. The computer models used in the design plan allow the final design analysis to be performed quite easily as well as allowing for easy updating or changing of the design plan.

Since the plan lends itself to updating or revisions, users of the plan are advised to contact the City of Rapid City to determine if this original document has been modified.

It should be noted that this design plan provides for only major drainage. Unless specifically addressed in the report, localized or minor drainage was beyond the scope of the study

It should also be noted that the runoff/routing analysis used with the design plan is considered an approximation since storms rarely follow ideal patterns and other factors such as ground cover, infiltration, and channel conditions may vary with time or from assumed conditions. The intent of a hydrologic runoff/routing analysis is to provide a reasonably dependable and consistent approximation of rainfall-runoff characteristics.

BASIN DESCRIPTION

BASIN DESCRIPTION

GENERAL INFORMATION

The study area consists of the "Primary Knollwood Drainage Basin" and the smaller "Secondary Tributary" areas located directly west of the Primary basin.

The drainage areas are tributaries to Rapid Creek with the stream confluence for the primary basin located east of the bridge over Rapid Creek, on Cambell St. and the Secondary Tributaries have stream confluences at various locations along Rapid Creek from Cambell St. west to Roosevelt Park.

The study area originates approximately 3.5 miles north of the confluence with Rapid Creek and includes an area of approximately 876 acres in the main basin and approximately 286 acres in the two secondary basins. Approximately 95 percent of main basin is within the current city limits with the remaining portion being in Pennington County. The secondary basins are entirely located within the city limits.

SUB-BASIN DESCRIPTION

The complete drainage basin was subdivided in 17 smaller drainage basins as shown on Figure 2.

Sub-basins 1-9, are located in the part of the study area referenced as the "Knollwood Tributary".

Sub-basins 10-13, 15, 20, 30, and 40 are located in the "Secondary Tributary" areas of the study.

Subdivision of a drainage basin provides a more realistic approach to stormwater design as it allows flows to be calculated at various locations and then routed though a basin rather than simply assuming all runoff reaches the outlet simultaneously. There is no established rule for basin subdivision and it is primarily based on specific project engineering needs and judgement. The sub-basins used in the final design were arrived at after reviewing project needs and discussions with city staff. It should be noted that basins were added or changed during the study as necessary for proper modeling of proposed improvements.

Sub-basin boundaries were established following major flow patterns and unaccounted for sub-basin transfer may occur. Unless otherwise specified it is intended that sub-basin transfer will be prevented upon plan implementation, however owing to map scale limitations, difficulties in establishing exact flow patterns, etc., some sub-basin transfer may still occur.

Basin boundaries were determined from aerial topography maps. It should be noted that contours shown on the USGS quadrangle maps do not necessarily reflect all effects of urbanization and are misleading as to certain drainage boundaries.

LAND USE AND ZONING

In accordance with the City of Rapid City Drainage Criteria Manual this design plan is based on a fully developed drainage basin. To ensure that facilities are sized properly it was therefore necessary to make a realistic forecast of how the study area will develop.

The great majority of the study area is already developed. The only areas currently undeveloped consist of subbasin #9 located north of Mall Dr., the area just north and east of the intersection of Lacrosse and Anamosa Streets, the area south of Omaha St. between Lacrosse and Cambell Streets, and a few other isolated parcels of land scattered throughout the basin.

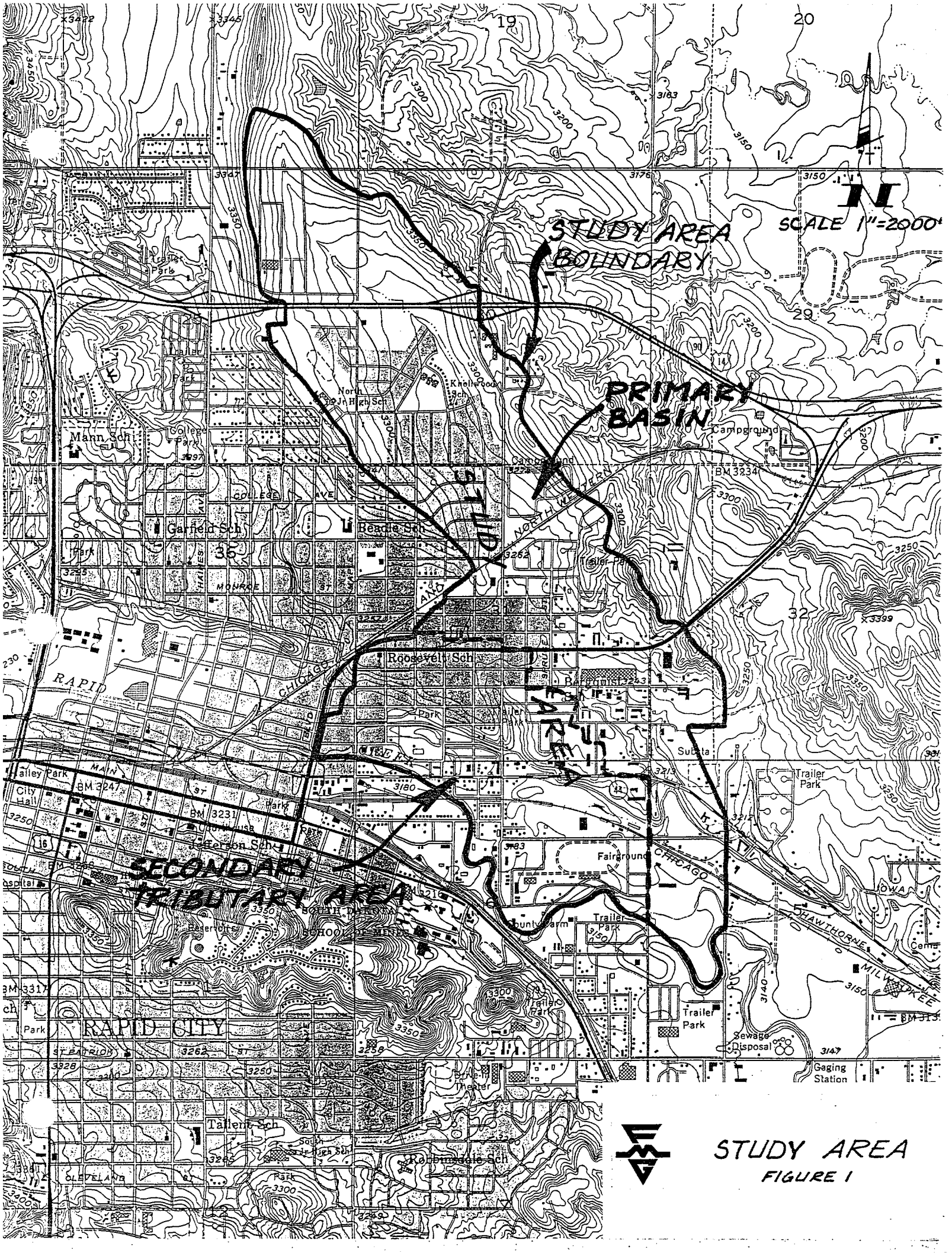
Existing development primarily consists of industrial use, commercial use, and low to medium density residential use. Other uses such as parks, churches, schools, and offices are mixed in throughout the basin.

It is expected that future development in the study area will follow existing trends. Figure 3 at the rear of this chapter is a map of the anticipated future land use conditions used during preparation of this design plan. City officials were involved in future land use projections.

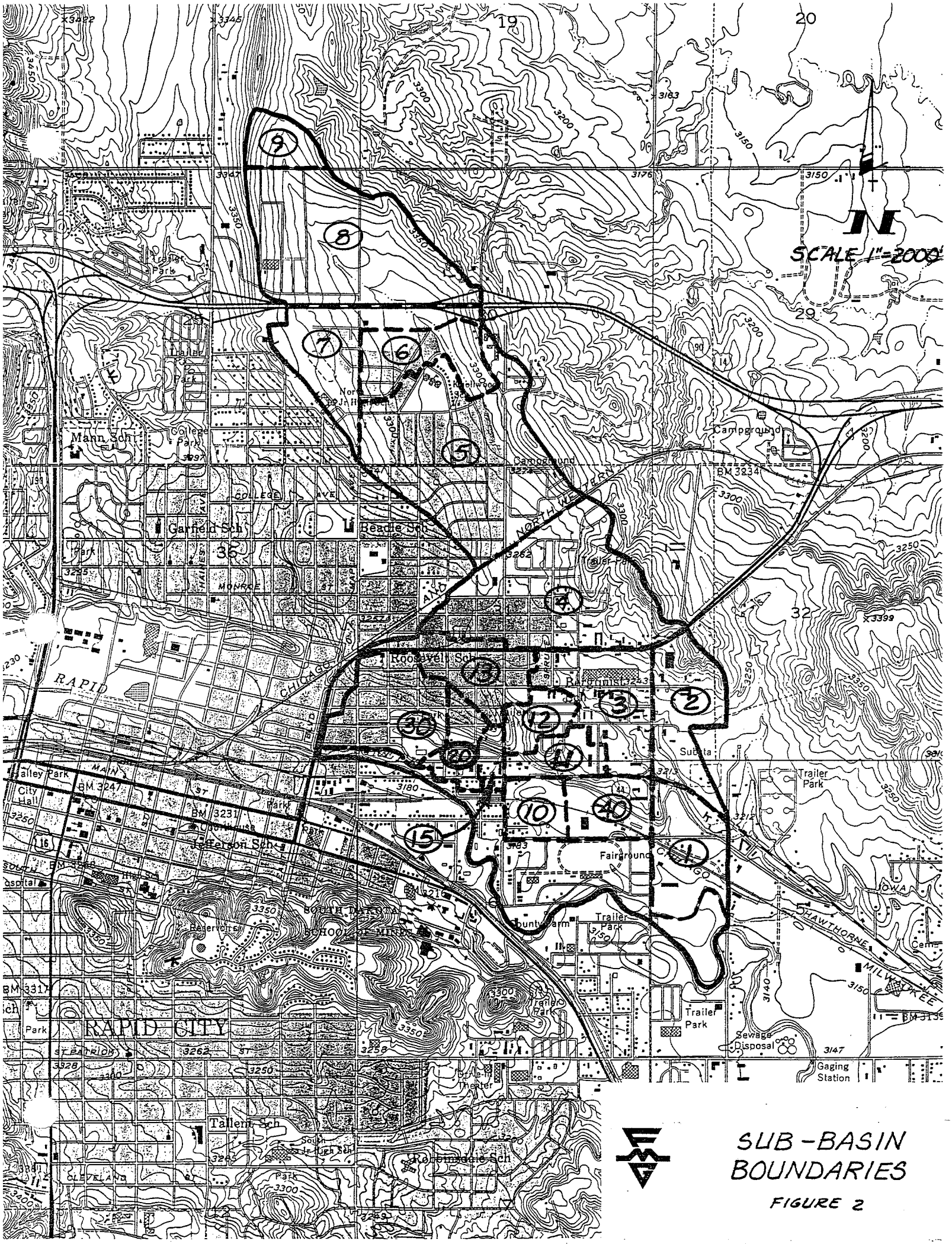
TOPOGRAPHY AND SPECIAL FEATURES

Basin topography is characteristic of the eastern foothills region of the Black Hills. Elevations vary from approximately 3150 feet at the stream confluence to a maximum of approximately 3430 feet at the basin divide.

Numerous roadways and utilities are located in or planned for the study area. Maps of these items are too large for inclusion in this report and are on file at the City Engineering Department.

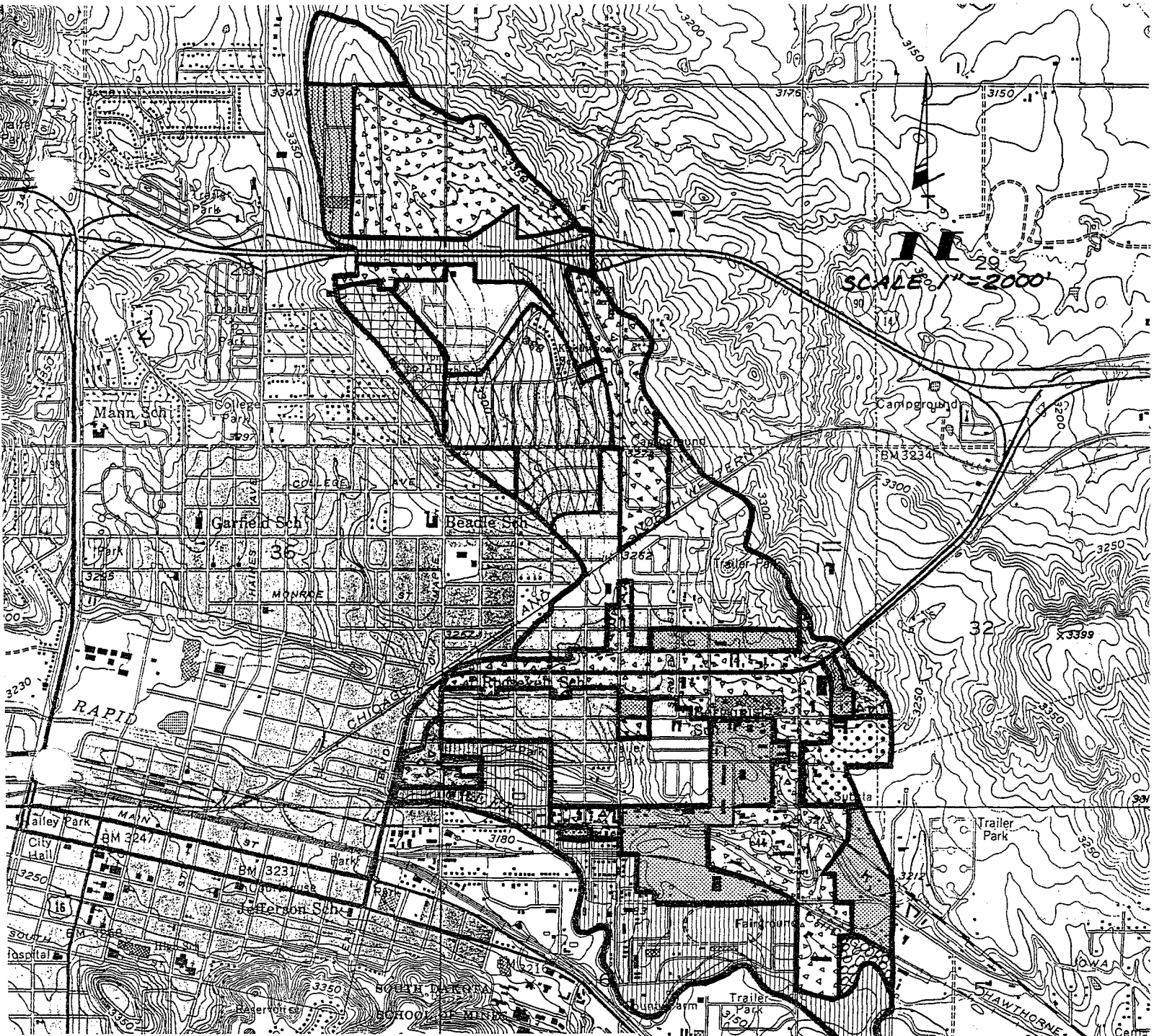


STUDY AREA
FIGURE 1



SUB-BASIN BOUNDARIES

FIGURE 2



LOW DENSITY RESIDENTIAL - INCLUDES EXIST. MIXED USES SUCH AS APARTMENTS, CHURCHES, ETC.

LIGHT INDUSTRIAL

OPEN SPACE - INCLUDES PARKS, GREENBELTS, PLAY GROUNDS, R.O.W., ETC.

COMMERCIAL

SCHOOLS

MEDIUM DENSITY RESIDENTIAL

HEAVY INDUSTRIAL

AGRICULTURAL

FUTURE LAND USE

FIGURE 3

DESIGN PLAN

DESIGN PLAN

GENERAL

Preparing the design plan involved completion of various tasks in an orderly process. The process involved sub-basin flow calculations, routing of the flows, problem identification, and evaluation of proposed solutions. A basinwide approach was used to determine effects of flows, problems, and improvements on the entire basin.

The entire basin was subdivided into numerous smaller basins with a network of hydraulic elements connecting the sub-basins. Flows were then calculated and routed using CUHPE/PC and UDSWM2-PC computer models. After flows were calculated for various scenarios it was possible to identify problems and begin the design analysis.

After completion of the above steps, the analysis became a systematic evaluation of solutions. Evaluation of time lags between various points was an important part of the process. Economics, development needs, multi-purpose use, and engineering judgement were included in the design plan evaluation and recommendation process.

The result of the above process is the KNOLLWOOD DRAINAGE BASIN DESIGN PLAN. This plan is not intended to be a final project design suitable for construction and a detailed engineering analysis and design is necessary prior to construction of any proposed improvement. The design plan presented herein is conceptual and is intended to provide the general information necessary for the final design of an efficient, planned system. It has been prepared within the limits of computer modeling to provide a functional drainage development guide. Rarely will a drainage basin respond and develop exactly as assumed thus this design is based on a practical hydraulic system. The plan is suitable for further evaluation as the basin develops, improvements become necessary, or various changes are requested.

Since the plan lends itself to updating or revisions, users of the plan are advised to check with the City of Rapid City to determine if this original document has been modified.

DESIGN PLAN OVERVIEW

In accordance with the City of Rapid City Drainage Criteria Manual the design plan presented herein is based on a 100 year - 1 hour storm occurring in a fully developed basin.

Major channel improvements and new storm sewers are necessary. Construction or modification of detention ponds is required. Additional easements or enlargement of existing easements will be necessary in various locations.

Certain streets carry significant flows and in some instances the 10 year depth of flow or 100 year depth times velocity product exceeds City of Rapid City criteria. Optional improvements, in addition to design plan recommended improvements, are included at these locations.

Determining a floodplain boundary was beyond the scope of the project. The recommended improvements are intended to generally confine flows to primary flow routes without structure flooding; however, it is possible that certain structures, especially low lying houses along streets with major flows, may be within future flooding boundaries.

Numerous plan summaries are given in figures and tables at the back of this chapter; however, the user is cautioned to refer to the INDIVIDUAL ELEMENT DESIGN section for a complete understanding of the design plan. The user should also be familiar with the HYDROLOGY and HYDRAULICS chapters. A summary of the design plan recommendations and estimated costs of each element is given as Table 1, a summary of the design plan optional improvements and estimated costs is given as Table 2, a summary of future condition peak flows for the sub-basins is given as Table 3, and a summary of individual element peak routed flows with design plan conditions is given as Table 4. A schematic of the hydrologic routing network is shown on Figure 4.

Aerial photos depicting the design plan are included under separate cover. Design plan hydrographs for sub-basins, direct flow elements, and detention ponds are included as Appendix A. Design plan CUHPE/PC computer printouts are included as Appendix B and design plan UDSWM2-PC computer printout are included as Appendix C.

COST ESTIMATE

Recommended design plan improvements are estimated to cost $5,255,000. The cost estimate is itemized for each specific improvement on Table 1. A complete description of each recommended improvement is given in the INDIVIDUAL ELEMENT DESIGN section of this chapter.

Optional improvements, in addition to recommended design plan improvements, for certain elements are estimated to cost $1,424,000. The optional improvements are included at certain locations in order to meet City of Rapid City criteria for street flooding depths or depth times velocity products. A complete description of each optional improvement is given in the INDIVIDUAL ELEMENT DESIGN section of this chapter. The cost estimate for each optional improvement is given on Table 2.

The combined cost of the recommended design plan improvements and the additional optional improvements is $6,679,000. The total costs of the recommended and optional improvements include a 5% contingency cost and 25% engineering/administration costs. Cost estimates do not include any costs for multiple purpose improvements.

INDIVIDUAL ELEMENT DESIGN

Following is a discussion of each element used in the design plan. This section expands on the summarized information presented in the design plan overview. Included is a description of each element, special problems encountered, design data, recommendations, and other appropriate information.

The individual element discussion is separated into the two defined tributaries described in the BASIN DESCRIPTION chapter. The two tributaries are the "Knollwood Tributary" and the "Secondary Tributaries".

"Knollwood Tributary"

Elements 1 and 20

Element 1 represents the existing 60 inch RCP with street overflow beginning at Rapid Creek, following along Cambell St. and ending approximately 250 ft. east of the intersection of Cambell and Centre Streets. No improvements are recommended to Element 1. Element 20 is a proposed new open channel beginning at Rapid Creek and ending at Centre St.

The capacity of the existing 60" RCP is 200 cfs. Interpolated flow at the junction of Element 1 and Element 20 is approximately 1500 cfs. A major open channel represented by Element 20 is recommended to contain the 1300 cfs not conveyed by the existing pipe.

It is recommended that the Element 20 channel be graded with a 20 foot wide bottom, 5:1 side slopes, a longitudinal slope of 0.009 ft/ft, and an n value of 0.05. It is anticipated that only minor grading will be necessary in the lower reach of Element 20 where an adequate natural channel exists. Where Element 20 intersects Rapid Creek, channel stabilization and erosion control is anticipated. Peak routed flow in Element 20 is 1,142 cfs however the interpolated flow used for design analysis is approximately 1,300 cfs. Normal depth for the recommended Element 20 channel is about 5.4 feet at a velocity of approximately 5 fps.

Approximately 750 ft north of Rapid Creek Element 20 crosses the Hawthorne Irrigation Ditch. At this location an appropriate diversion structure will be necessary to prevent flooding of the irrigation ditch.

Element 20 is proposed to follow adjacent to the old railroad right of way, and bend south, west of Creek Dr.. Thus an easement will be required to construct this improvement. In the event an easement cannot be acquired, an alternative route for the

entire Element 20 is possible. This consists of routing flows under the Cambell and Centre St. intersection to the Pennington County Fairgrounds and connect to Element 90 in the adjacent Secondary Tributary. This would require the modification of the Element 90 recommendations to generally match the Element 20 recommendations. Note that this alternative has not been modeled for this design plan and additional computer analysis is recommended if this alternative is chosen. Note that the alternative route will be significantly more expensive to construct due to the increased box length required to cross Cambell St., and since a channel as per Element 20 rather than a pipe per Element 90 is anticipated, then significant parking displacement at the fairgrounds is anticipated.

The typical channel for UDSWM2 routing used a 20 foot bottom, 5:1 side slopes, invert slope of 0.009 ft/ ft and n value of 0.063.

At the north end of Element 20 a split flow was modeled with Element 103 to reflect the intersection with Elements 1 and 20. At this intersection an inlet for Element 1 presently exists and a culvert to convey the remaining flow to Element 20 is recommended.

The culvert recommended consists of a double 12 ft by 5 ft RCB. The approximate slope is 0.01 ft/ft, and a length of approximately 200 ft. is anticipated.

Element 2

Element 2 represents the existing open channel north of Centre St. It conveys flows from Element 3 south to Elements 1 and 20

The existing channel is not well defined and will generally allow flow to spread over a large area. Additionally it is expected that requests will be made to modify the channel as adjacent property is developed; thus an improved channel is recommended.

The recommended channel has a bottom width of 20 feet, 5:1 side slopes, invert slope of 0.013 ft/ft, and n value of 0.050. Peak routed flow is 1,389 cfs, however the interpolated flow used for design analysis is approximately 1,480 cfs. Normal depth for the recommended Element 2 channel is about 5.3 feet at a velocity of approximately 6 fps.

The typical channel for UDSWM2 routing used a 20 foot bottom, 5:1 side slopes, invert slope of 0.013 ft/ ft and n value of 0.063.

Element 3

Element 3 represents the existing storm sewer and overflow channel for the Hwy 44 crossing. The current facilities are undersized and overtopping of Hwy 44 as well as backwater onto Cambell St. will occur in only a 10 year storm. Improvements are recommended.

Peak routed flow in Element 3 is 1,395 cfs. The existing system here consists of two 48" RCP under Hwy 44 connected to a 60" RCP which then flows south and connects to a 78" CMP. The system was analyzed considering the need to convey flow under Hwy 44 and still minimizing the backwater effect at Cambell St.. Using this criteria the existing system capacity is 325 cfs, thus additional capacity required is 1070 cfs

Recommended improvements include installing in addition to the existing system, a 12 ft by 7 ft RCB. The approximate slope is .015 ft/ft, and a length of approximately 600 ft. is anticipated.

Element 3 UDSWM2 routing used an 15 ft dia RCP with an n value of 0.016 and invert slope of 0.015 ft/ft. The pipe simulates the combined capacity of the existing system mentioned above plus the proposed 12 ft by 7 ft RCB.

Element 4

Element 4 represents the existing open channel beginning at Highway 44 and ending at Cambell St. Flow capacity is adequate and no improvements are necessary.

The typical channel for UDSWM2 routing used a 20 foot bottom, 4:1 side slopes, invert slope of 0.015 ft/ ft and n value of .063. Peak routed flow in Element 4 is 1395 cfs and depth of flow calculated is 5.3 feet at a velocity of approximately 5 fps.

Element 5

Element 5 represents the existing open channel beginning at Cambell St. and ending just south of Denver St. Crossings of Cambell St. and Chicago St. are located in Element 5.

The channel is a combination of the natural existing stream and an improved channel. The condition of the existing channel varies along the reach, but for the most part is inadequate in size , grade, overgrown with vegetation, and has been known to collect debris from adjacent properties causing plugging of culvert structures. Improvements to the channel, the Cambell St. crossing and the Chicago St. crossing are recommended. Permanent easements will need to be acquired.

Cambell St Crossing

Peak routed flow at Cambell St. is reflected by Element 105 and is 1,156 cfs. The existing improvements at Cambell St. have a capacity of 225 cfs, and overtopping will occur. Because of the Cambell Street arterial classification no flow is allowed to cross the street, thus additional improvements are recommended so that the remaining 932 cfs will be conveyed under Cambell St.

Recommended improvements include installing in addition to the existing system, a 12 ft by 7 ft RCB, this will allow for approximately 2 ft. of freeboard at the sag on Cambell St.

and prevent flooding of the Bi-Rite store to the north. The approximate culvert slope is 0.005 ft/ft, and a length of approximately 400 ft. is anticipated.

Chicago St. Crossing

Peak interpolated flow at Chicago St. is 1078 cfs. The existing improvements at Chicago St. have a capacity of 338 cfs. Because of the elevation of the existing residence on the NW corner of Chicago St. and Riley St., and the need to prevent flow from overtopping Chicago St. and flowing east onto Cambell St., the recommended improvement is to convey the entire peak flow under Chicago St, and optimize the head on the upstream pipes so that flooding of the residence will not occur.

Recommended improvements here consist of installing in addition to the existing 2 - 48" RCP, a 12 ft by 5 ft RCB to convey the remaining 740 cfs. The approximate slope is 0.01 ft/ft, and a length of approximately 275 ft. is anticipated.

Channel Improvements

The channel section between Cambell and Chicago streets in general requires regrading to attain proper flow area and grade. It is recommended that this channel be graded with a 20 foot wide bottom, an n value of 0.050, side slopes of 5:1 and an invert slope of 0.011 ft/ft to carry the peak interpolated flow of 1157 cfs. Depth of flow calculated is approximately 5.0 feet at a velocity of approximately 5 fps.

The channel section north of Chicago St. to the approximate intersection of the New York St. and Cherry St. right of way is for the most part adequate to convey the peak flow, however grading will be required to help in attaining channel slope in the upper part of the reach. Also the property just north of Chicago St. is presently operating as a small detention pond, the hydraulic benefit to the overall system being negligible, and this area has been a catch all for garbage and debris.

The channel section north of the approximate New York St. and Cherry St. right of way to Denver St. is inadequate in size and slope, and overgrown with vegetation. Flooding of a residential property at the northeast corner of Spruce and Philadelphia Streets has occurred in the past. The portion of the channel just south of Denver St. is severely constricted between an existing second hand store on the west and the storage yard for the store on the east. Recommended improvement includes acquisition of additional easement on the property where the second hand storage yard exists (east of existing channel), and construction of the recommended channel. The channel should be graded with a 20 foot wide bottom, an n value of 0.050, side slopes of 5:1 and an invert slope of 0.011 ft/ft. The channel construction will eliminate the flooding of the residential property mentioned above. Peak interpolated flow in this section of Element 5 is 988 cfs and depth of flow calculated by UDSWM2 is 4.6 feet at a velocity of approximately 5 fps.

An existing shallow sanitary sewer main exists in this reach which may conflict with the proposed channel improvement. The sanitary sewer may need to be relocated to follow along adjacent to the channel.

The Element 5 typical channel for UDSWM2 routing used a 20 foot wide bottom, an n value of 0.063, side slopes of 5:1 and an invert slope of 0.011 ft/ft.

Element 6

Element 6 is an existing storm sewer system with street overflow that begins at the north end of Element 5, follows west along Denver St. and north along Pine St. to E. North where it ends at Element 106. Under existing conditions there will be significant flow splits and basin transfer from Element 6. However; due to modeling limitations and the need to evaluate downstream elements with complete flows, it was assumed that Element 6 conveyed the entire flow.

Design criteria for Element 6 is dictated mainly by the street design criteria for E. North St. The arterial classification for E. North St. allows for no street overtopping, thus the design for Element 6 assumes that all runoff from the north will be contained in the system prior to it crossing E. North St.

The peak routed flow in Element 6 is 987 cfs. An existing 60" RCP on Pine St. has a capacity of 180 cfs and an existing 48" RCP on Spruce St. has a capacity of 140 cfs, thus an additional 668 cfs is required to be conveyed under E. North St.

The recommended improvements consist of installing in addition to the existing system, a 12 ft by 5 ft RCB to convey the remaining 668 cfs. The approximate slope is .005 ft/ft, and a length of approximately 550 ft. is anticipated. The proposed RCB would start at the north end of Element 5, follow Denver St. west to Spruce St., then north to E. North St. where storm sewer in Subbasin 4 will connect. Note that this proposed RCB assumes that downstream grading is to occur which lowers the channel flowline approximately 2 - 3 feet in order to obtain proper cover and grade for the upstream improvements.

Element 6 UDSWM2 routing used a 10 ft dia RCP with an n value of .016 and invert slope of .005 ft/ft. The pipe simulates the combined capacity of the existing system mentioned above plus the proposed 12 ft by 5 ft RCB.

Element 7

Element 7 is an existing storm sewer with street overflow along Pine St. It begins at Element 6 and ends at the Element 300 detention pond. Improvements are recommended. Miscellaneous improvements within sub-basin 4 to connect to Element 7 are also recommended. The miscellaneous storm sewers are shown on the design plan aerial photos

Design criteria for Element 7, as was for Element 6 is dictated mainly by the street design criteria for E. North St. The arterial classification for E. North St. allows for no street overtopping, thus the design for Element 7 assumes that all runoff will be contained in the system prior to crossing E. North.

The routed 100 year flow in Element 7 is 559 cfs however the peak flow used for design analysis was increased by interpolation at various locations to reflect additional flow expected from Subbasin 4.

Peak interpolated flow at the intersection of Spruce St. and the alley between North St. and Watertown St. is approximately 620 cfs. The recommended improvements consist of installing a 12 ft by 5 ft RCB to convey the peak interpolated flow of 620 cfs. The approximate slope is .005 ft/ft, and a length of approximately 150 ft. The proposed RCB would start at the north end of the proposed 12 ft by 5 ft RCB mentioned in Element 6 and follows Spruce St. north to the alley between North St. and Watertown St.

Peak interpolated flow at the intersection of Pine St. and the alley between North St. and Watertown St. is approximately 715 cfs. The existing 60"RCP in Pine St has a capacity of approximately 180 cfs, thus the recommended improvements consist of installing a 12 ft by 4 ft RCB to convey the remaining flow of 535 cfs. The approximate slope is .005 ft/ft, and a length of approximately 550 ft. The proposed RCB would start at the intersection of Spruce St. and the alley between North St. and Watertown St and end at the intersection of Watertown St. and Pine St. Inlet capacity for approximately 410 cfs will be required at this point to capture surface flows.

Pine St. is the location of the existing major storm sewer and is modeled as Element 7 in UDSWM2. Peak routed flow in Element 7 is 557 cfs in a 100 year storm and 275 cfs in a 10 year storm, however the peak interpolated flow expected north of the intersection of Pine St. and Watertown St. is approximately 650 cfs and 318 cfs respectively. This interpolated flow is calculated by summing flows from Element 7 and interpolation of the flows from that portion of sub-basin 4 that will directly impact Pine St.

The existing 60" RCP storm sewer has a capacity of 240 cfs north of E. North St., and street flow capacity on Pine St. is adequate for the remaining 100 year discharge of 410 cfs at the downstream end, and 319 cfs at the upstream end, with the flow depths at the gutter being approximately 17" and 14" respectively. The DVP is 15 sf/sec which exceeds the RCDCM criteria. Although no improvements are required to meet the RCDCM depth criteria, it may be necessary to install additional storm sewer and inlet capacity on Pine St. to intercept runoff above over E. North St. The above discussion is based on the

assumption that storm sewer on Spruce St. and Lacrosse St. are constructed as per recommendations. No improvements are required for the 10 yr. flows.

At the intersection of Pine St. and Adams St., Pine St. ends, and an open channel through an existing trailer park will convey flow beyond storm sewer capacity. The existing channel varies in dimension and has an approximate capacity of 90 cfs. If the design plan recommendation is implemented where no additional storm sewer is installed on Pine St., then the open channel shall require a capacity of approximately 319 cfs. The recommended channel would have a 20 foot wide bottom, an n value of 0.040, side slopes of 20:1 and an invert slope of 0.005 ft/ft. Depth of flow calculated would be 1.9 feet at a velocity of approximately 2.9 fps. If the following option to reduce the DVP on Pine St. is implemented, then required channel capacity may be reduced to approximately 123 cfs.

In order to reduce the Pine St. DVP to meet the RCDCM criteria an option is to reduce the street flow to approximately 123 cfs. This flow reduction will require installing in addition to the existing system, storm sewer to carry approximately 287 cfs that starts at the proposed 12 ft by 4 ft RCB in the intersection of Pine St. and Watertown St and follows north along Pine St. to E. Monroe St., then through the trailer park to the railroad right of way where the storm sewer capacity can be reduced to carry 196 cfs. Recommended improvements consist of installing a 72" RCP at a slope of approximately .005 ft/ft, from the alley between Watertown St. and E. North St. north to Monroe St., and installing a 66" RCP at a slope of approximately .005 ft/ft, from Monroe St. north to the railroad right of way where outflow from Element 300 detention pond will occur. The resulting street flow depth will be 10", DVP will be 5 sf/sec, and the 10 year flow will be contained entirely within the system. Inlet capacity along Pine St. shall need to increase approximately 90 cfs. Excluding the cost of the recommended improvements, the system to reduce the DVP is estimated to cost $525,000. The cost of this storm sewer is included in the Design Plan Cost Estimate as an optional item.

Note that the above improvement recommendation to reduce the DVP assumes that the remaining 123 cfs street flow can be captured prior to crossing E. North St.. The recommendation for capturing the remaining flow is to route the flow to the alley between Watertown St. and E. North St. and to provide inlet capacity to capture the remaining 123 cfs. If during final design this recommendation is found not to be feasible then the proposed storm sewer on Pine street will need to be increased in size to accommodate the 100 year discharge of 410 cfs at the downstream end, and 319 cfs at the upstream end.

In order to collect all runoff in the system as mentioned above a series of smaller storm sewers are required at critical design points. These design points were chosen based upon practical locations for trapping the runoff, or the need to reduce street flow depths as required. These smaller storm sewer systems have not been modeled using UDSWM2, however the interpolated flows from the basins that they serve were carefully analyzed and play a key roll in design of the collection system.

Element 7 UDSWM2 routing used a 5 ft dia RCP with an n value of .016 and invert slope of .005 ft/ft. An overflow section is modeled to reflect street flow.

Lacrosse St.

The arterial classification per the RCDCM for Lacrosse St. allows for no street overtopping to occur, thus the design for this minor storm sewer assumes that all runoff will be contained in the system prior to crossing Lacrosse St.. Peak interpolated flow at the intersection of Lacrosse St. and Watertown St is approximately 165 cfs. The existing 30" RCP at this location has a capacity of 30 cfs.
Recommended improvements include installing in addition to the existing system, a 54" RCP along Watertown St, from Pine St. to Lacrosse St., to convey the remaining 135 cfs. Also in order to maintain the required flow depth and DVP as well as trapping the runoff at the intersecting streets west of Lacrosse St., it is necessary to install storm sewer north along Lacrosse St.
Recommended improvements along Lacrosse St. consist of installing a 36" RCP with a capacity of approximately 70 cfs from Watertown St. north to Madison St., and installing a 30" RCP with a capacity of approximately 50 cfs from Madison to Monroe St. It is recommended that smaller collection pipes with appropriate inlet capacity be extended west of Lacrosse St. at the intersecting streets to assist in runoff collection.

The 10 year storm would be entirely contained in the recommended storm sewer system. The 100 year surface flow would be about 16 cfs at a depth of about 6" with a DVP of about 1.4 sf/sec.

Spruce St.

Storm sewer is recommended on Spruce St. in order to alleviate multiple problems that could occur. As mentioned above the storm sewer locations were chosen based upon practical locations for trapping the runoff, or the need to reduce street flow depths. Street flow on E. North St. as well as Pine St. is impacted severely by the flow of runoff from the basin area east of Spruce St. Presently no storm sewer exists on Spruce St. and uncontrolled runoff flows to E. North St. and Pine St., also flow depths and DVP on Spruce St. exceed the RCDCM criteria.

Based upon RCDCM criteria, and assuming runoff on the east side of the street only, allowable flow on Spruce St. between E. North St. and Monroe St. is approximately 26 cfs with depth of .5 ft and DVP=3 sf/sec, and to the north of Monroe St. is approximately 17 cfs with a depth of .5 ft and DVP=2. Because of changing cross slope on Spruce St., all flow should be picked up prior to the intersection of Watertown St. and Spruce St. so that runoff can be efficiently captured. Thus recommendations reflect this need.

Recommended improvements consist of installing a 48" RCP from the alley north of E. North St. to Watertown St., then a 42" RCP from Watertown St. to Adams St., and a 36"

RCP north of Adams St. Peak interpolated flows expected at North St., Watertown St., Madison St, Monroe St., and Adams St. are 180 cfs, 165 cfs, 148 cfs, 126 cfs, and 97 cfs respectively.

E. North St.

Storm sewer is recommended on E. North St. due to the need to meet the Arterial street design criteria for overtopping as well as flow depths. Based upon RCDCM criteria, and assuming runoff on the north side of the street only, allowable flow on North St. between Spruce St. and Riley Ave. is approximately 50 cfs with depth of .5 ft and DVP=3 sf/sec, and to the east of Riley Ave. is approximately 70 cfs with a depth of .5 ft and DVP=4. However all flow should be trapped prior to intersecting Spruce St. so that runoff can be efficiently captured.

Recommended improvements consist of installing a 48" RCP from Spruce St. to Cherry Ave., then a 42" RCP from Cherry Ave. to Riley Ave., then a 24 " RCP from Riley Ave. east. Peak interpolated flows expected at Spruce St., Cherry Ave., Riley Ave., and east of Riley Ave. are 230 cfs, 230 cfs, 138 cfs, and 50 cfs respectively.

Element 8

Element 8 is an existing storm sewer with street overflow. It begins at the Element 300 detention pond and ends at Element 301 detention pond. The existing storm sewer varies in size (72" to 36") along the reach and begins at Element 300 and follows north along Lacrosse St. for approximately 1000 ft. then west to the alley between Racine and Lacrosse streets then north to Anamosa St., then west to Racine, then north to Element 301 detention pond. Improvements are recommended. Miscellaneous improvements within sub-basin 5 to connect to Element 8 are also recommended. The miscellaneous storm sewers are shown on the design plan aerial photos

Design criteria for Element 8 is dictated mainly by street flow depth criteria for Anamosa St., Racine St., and Lacrosse St.

The routed 100 year flow in Element 8 is 88 cfs however the peak flow used for design analysis is interpolated to reflect additional flow expected from Subbasin 5 and is more accurately reflected by peak flow in Element 107. As can be seen by analyzing the UDSWM2 output, the peak flows in this basin are dictated mainly by the runoff from Subbasin 5. Flows at specific design points discussed are a result of interpolation of peak flow in Subbasin 5, and time lag analysis of Element 8.

Runoff in Subbasin 5 collects at various points throughout, crosses and runs down the streets. These streets are hence the design points studied and are each discussed below.

Element 8 UDSWM2 routing used a 5 ft dia RCP with an n value of .016 and invert slope of .003 ft/ft. An overflow section is modeled to reflect street flow.

Lacrosse St.

At the downstream end of Element 8, detention pond Element 300 exists due to the railroad grade that bisects the Knollwood Basin. Under existing conditions the inadequate pond storage and storm sewer that serves the pond will cause severe backwater flooding. Specific recommendations for Element 300 are discussed in that section, and in general includes storage increase and outlet modifications.

Under current conditions flow into detention pond Element 300 is restricted due to the existing undersized pipes at Lacrosse St., and the runoff attempting to move from west to east from Waterloo St. over Lacrosse St. is constricted by the Walmart parking lot. Thus severe backwater flooding is expected to occur, and Lacrosse St. will be inundated.

Peak interpolated flow at the intersection of Lacrosse St. and Waterloo St is approximately 715 cfs. Existing improvements have an approximate capacity of 170 cfs. With design plan improvements, a peak interpolated flow of approximately 545 cfs will need to be conveyed across Lacrosse St. Improvement recommendations for conveying the flow across Lacrosse St. are based upon the RCDCM criteria for eliminating overtopping on Arterial streets.

In conjunction with improvements at detention pond Element 300, recommended improvements include disconnecting the two existing 48" RCP under Lacrosse St. from the existing 72" RCP and extending them south to the Element 300 detention pond. The approximate slope is .007 ft/ft, and a length of approximately 250 ft. is anticipated. With design plan improvements, capacity of these pipes will total approximately 190 cfs. Also it will be necessary to remove approximately 150 l.f. of 72" RCP along the east side of Lacrosse St. to facilitate recommended improvements. The remaining 72" RCP will continue to be used for conveying flows from the north and modifications at the new outlet location in Element 300 detention pond are anticipated.

It is recommended to convey the remaining 355 cfs using a proposed 10 ft by 4 ft RCB. The proposed RCB will begin just west of the intersection of Lacrosse St. and Waterloo St., and follow Lacrosse St. south to the detention pond. The approximate slope is .004 ft/ft, and a length of 350 ft. is anticipated. In order to collect runoff to facilitate the RCB use, it will be necessary to install additional inlet capacity on Waterloo St.

Waterloo St. and Racine St.

Under existing conditions, peak interpolated flow on Waterloo St. and Racine St. between Lacrosse St. and Anamosa St. is approximately 545 cfs at the south end and approximately 360 cfs at Anamosa St., with the flow depth of approximately 2 ft. and, and 1.7 ft respectively. Improvements are recommended to meet RCDCM flow depth criteria.

Recommendations for the design plan include improvements to control street overtopping on Anamosa and to optimize the use of the existing 60" RCP at the intersection of Anamosa St. and Racine St. Per RCDCM criteria, the maximum depth of

flow at Anamosa St. is 1 ft.(6" overtopping at crown) for a 100 year storm and equates to a flow of approximately 240 cfs. No overtopping is allowed in the 10 year storm.

Peak interpolated flow at the Racine St. and Anamosa St. intersection is approximately 360 cfs, and the interpolated 10 year flow is approximately 190 cfs. At this location the existing 60" RCP has a capacity of approximately 110 cfs, thus additional capacity of 80 cfs (10 yr.) and 10 cfs (100 yr.) is needed. Recommendation is to control runoff by diverting the flows using the available capacity of the 60" RCP mentioned above, and providing storm sewer on Racine St. to reduce flow depths.

Design plan recommendation is to provide additional storm sewer capacity to convey approximately 80 cfs at Anamosa St. to eliminate overtopping in the 10 year storm. Also Racine St being a local street, the maximum flow depth allowed is 1.5 ft.; thus the maximum flow allowed is approximately 330 cfs. Peak interpolated flow at the intersection of Waterloo St. and Racine St. is approximately 490 cfs, approximately 425 cfs at Custer St., and approximately 365 cfs at College Ave. The existing 30" RCP has an approximate capacity of 20 cfs. In order to reduce 100 year flows on Racine St., storm sewer capacities of 140 cfs at Waterloo St to 15 cfs at College Ave. are required, however as mentioned above, a minimum capacity of 80 cfs is required north of College Ave. to carry 10 year flows to eliminate the above mentioned overtopping.

Recommended improvements in addition to the existing 30" RCP, consist of installing two 42" RCP on Waterloo St. from Lacrosse St. to Racine St. at a slope of approximately .005 ft/ft, then a single 42" RCP from Waterloo St. to Anamosa St. at a slope of approximately .005 ft/ft. 100 yr. flow depth expected is approximately 1.5 ft. and DVP= 10.5 sf/sec.

In order to reduce the DVP to meet RCDCM criteria an option in lieu of the recommended improvements will be to install storm sewer to reduce street flow to approximately 144 cfs. On Waterloo St. and Racine St. it will be necessary to install a 4 ft by 8 ft RCB from Lacrosse St. to Racine St., then a 4 ft by 7 ft RCB from Waterloo St. to Custer St., then a 4 ft by 6 ft RCB from Custer St. to College Ave., then twin 42" RCP from College Ave. to Anamosa St., all at a slope of approximately .005 ft/ft. The 10 year storm would be entirely contained in the storm sewer system, the DVP would be approximately 5 sf/sec, and flow depth would be approximately 0.9 ft.

Excluding the cost of the recommended improvements, the system to reduce the DVP is estimated to cost $320,000. The cost of this storm sewer is included in the Design Plan Cost Estimate as an optional item.

No improvements to Element 8 on Racine St. north of Anamosa St. are necessary.

Anamosa St. and Woodlawn St.

As mentioned above, design recommendations are to capture runoff north of Anamosa St. to reduce or eliminate overtopping. In order to capture runoff, storm sewer is recommended to be installed on Anamosa St. and north of Anamosa St. on Woodlawn.

Also recommendation is to divert the additional flows to the existing 60" RCP to fully utilize its capacity, and to provide additional storm sewer on Racine St. The additional storm sewer on Racine St. is discussed in the previous section, Waterloo and Racine Streets.

Woodlawn St. presently acts as the main conveyance facility for runoff in the portion of Subbasin 5 north of Anamosa St. Existing condition runoff causes significant flows on the street due to the lack of a storm sewer system. Some localized flooding is possible.

Street flow capacity on Woodlawn St. is adequate for the interpolated 100 year discharge of 285 cfs at the downstream end, and 250 cfs at the upstream end where Woodlawn St. intersects Downing St., with the flow depth at the gutter being approximately 1.4 ft and 1.3 ft respectively. The DVP is 11 and 9 sf/sec respectively which exceeds the RCDCM criteria.

10 year interpolated flow on Woodlawn St. is 150 cfs at the downstream end and 130 cfs at the upstream end. 10 yr. maximum allowable depth on this street is .5 ft. with a maximum flow of 30 cfs. Recommended improvements include installing a 48" RCP at a slope of .0065 ft/ft at the intersection of Anamosa St. and Woodlawn St. to a slope of .005 ft/ft at Downing St.

It should be noted that although additional storm sewer north of the intersection of Woodlawn St. and Downing St. is not required to meet RCDCM criteria it will most likely be necessary to install facilities to collect runoff upstream of the intersection so that the proposed system use is optimized.

In order to reduce the DVP to meet RCDCM criteria an option in lieu of the recommended improvements will be to install storm sewer to reduce street flow to approximately 105 cfs. Recommendation is to install a 60" RCP at the south end decreasing to a 54" RCP at the north end. The 10 year storm would be entirely contained in the storm sewer system. Excluding the cost of the recommended improvements, the system to reduce the DVP is estimated to cost $180,000. The cost of this storm sewer is included in the Design Plan Cost Estimate as an optional item.

In order to eliminate crown overtopping at the intersection of Anamosa St. and Racine St. all runoff on Woodlawn St. for the 10 year storm (150 cfs) shall need to be collected upstream of the intersection; thus the recommendation is to install a 54" RCP at a slope of .007 ft/ft and additional inlets along the north side of Anamosa St from Woodlawn St. to Racine St. where it will connect to the proposed system at the intersection of Anamosa and Racine St.

On Anamosa St. peak interpolated flows from that portion of Sub-basin 5, south of Anamosa St. and west of Woodlawn St. are 50 cfs(100 yr) and 30 cfs(10 yr). 100 year flow depth expected is approximately .5 ft. with a DVP= 3 sf/sec; thus no improvements are necessary to meet the 100 year collector street criteria. 10 year criteria is to maintain one driving lane free from runoff. In order to meet the 10 year street flow criteria, recommendation is to install inlets to collect approximately 10 cfs and connect them to the proposed 54" RCP on Anamosa.

If the option to reduce the DVP of Woodlawn is to be exercised, then the pipe size will need to be increased to a 60" RCP, however without installing improvements downstream to reduce the DVP on Racine St. south of Anamosa St., insufficient capacity will exist to facilitate increased pipe size. Excluding the cost of the recommended improvements, the system to reduce the DVP is estimated to cost $60,000. The cost of this storm sewer is included in the Design Plan Cost Estimate as an optional item.

In order to optimize the use of the recommended system at the intersection of Anamosa St. and Racine St. it is necessary to get the appropriate flow distribution to the existing 60" RCP and the proposed 42" RCP. It is recommended to install a RCP wye or manhole to acquire a split so that approximately 80 cfs flows into the proposed Racine St. storm sewer, and approximately 70 cfs into the existing 60" RCP. Additional flow into the existing 60" RCP will come from the improvements serving the area north of Anamosa St. and east of Racine St. These improvements are discussed in the Miscellaneous Improvements discussion.

Element 9

Element 9 is an existing open channel beginning at the Element 301 detention pond and ending at Element 302 detention pond. No improvements are recommended.

The typical channel for UDSWM2 routing used a 20 foot wide channel, side slopes of 50:1 , n value of 0.050, and an invert slope of 0.008 ft/ft. Peak routed flow is 309 cfs.

Element 10

Element 10 is an existing 48" dia RCP culvert under Interstate 90 beginning at the Element 302 detention pond and ending at Element 303 detention pond. No improvements are recommended.

The typical pipe for UDSWM2 routing used a 6.5 foot diameter RCP , n value of 0.016, and an invert slope of 0.002 ft/ft. Peak routed flow is 192 cfs.

The UDSWM2 routing used a larger diameter pipe than the existing. This was done to more accurately model the actual flow conditions since UDSWM2 calculates pipe flow as if it were a storm sewer and the existing pipe hydraulics were analyzed and determined to be operating under culvert conditions.

Element 11

Element 11 is an existing open channel across the Rushmore Mall parking lot beginning at the Element 303 detention pond and ending at Element 12. Improvements are recommended and, optional improvements are included for the Rushmore Mall area that are described under the miscellaneous improvements section of the report.

Recommendation is to grade the undeveloped area at the northwest corner of the Rushmore Mall site to drain along the west side of the mall building. Some ponding will occur here however; this ponding will be significantly less than if the runoff is allowed to flow east and become trapped on the north side of the mall.

The typical channel for UDSWM2 routing used a 100 foot wide channel, side slopes of 50:1 , n value of 0.016, and an invert slope of 0.018 ft/ft. Peak routed flow is 83 cfs, however, the flows across the Rushmore Mall parking lot will vary greatly.

Element 12

Element 12 is a proposed 42" RCP culvert crossing under Control Data Road beginning at Element 11 and ending at Element 111.

Under existing conditions, no storm sewer exists to convey flows across the road, thus runoff is being transferred east along the road ditch into the Boxelder drainage basin. During discussions with City staff it was decided to correct the basin transfer problem by conveying the flow south to the approximate historic flow path. It has been judged necessary to keep runoff from sub-basin 9 at its historical runoff rate due to the return of the previously diverted flow and since significant flow capacity deficiencies exist downstream in the basin.

The typical pipe for UDSWM2 routing used a 3.5 foot diameter RCP , n value of 0.016, and an invert slope of 0.009 ft/ft. Peak routed flow is 83 cfs .

The above pipe and its hydraulic characteristics were chosen based upon simulating the approximate historic flow from this sub-basin in an attempt to approximate downstream improvements assuming that flows from this basin will remain at the historic runoff rate.

The modeling technique used here allows UDSWM2 to calculate the storage required upstream of the culvert assuming the pipe will operate under the given hydraulic characteristics. Using this model the storage required upstream at peak runoff for Subbasin 9 fully developed conditions and attempting to limit flow to historic rates will be approximately 1.4 acre-feet.

Element 100

Element 100 is a direct flow element. It is used to summarize flows from sub-basin 1 and Element 20. The flow calculated at this element is the final discharge to Rapid Creek from the "Knollwood Tributary" with exception to flows diverted at Element 103. Peak discharge is 1,358 cfs.

Element 101

Element 101 is a direct flow element. It summarizes flows that are split at Element 103 and provides an inflow hydrograph to Element 20. Peak discharge is 1,189 cfs.

Element 102

Element 102 is a direct flow element. It summarizes flows that are split at Element 103 and provides an inflow hydrograph to Element 20. Peak discharge is 200 cfs.

Element 103

Element 103 is a direct flow/split flow element located at the intersection of the main channel (Element 2) and Centre Street.

Element 103 splits the flow with a maximum of 200 cfs being sent to Element 102 (then to pipe Element 1) and the balance of the flow is sent to Element 101. The 200 cfs sent to Element 102 matches the Element 1 storm sewer capacity. The remaining flow will be diverted to proposed Element 20 channel. Peak discharge at Element 103 is 1,389 cfs.

Element 104

Element 104 is a direct flow element. It provides an inflow hydrograph for the Highway 44 crossing. Peak discharge is 1,395 cfs.

Element 105

Element 105 is a direct flow element. It summarizes flows from sub-basin 3, and Element 5 to provide an inflow hydrograph to Element 4. The flow calculated at this element is the flow reaching the Cambell St. crossing. Peak discharge is 1,156 cfs.

Element 106

Element 106 is a direct flow element. It summarizes flows from sub-basin 4 and Element 7 to provide an inflow hydrograph to Element 6. Peak discharge is 980 cfs.

Element 107

Element 107 is a direct flow element. It summarizes flows from sub-basin 5 and Element 8 to provide an inflow hydrograph to detention pond Element 300. Peak discharge is 811 cfs.

Element 108

Element 108 is a direct flow element. It provides an inflow hydrograph for the detention pond Element 301. Peak discharge is 381 cfs.

Element 109

Element 109 is a direct flow element. It summarizes flows from sub-basin 7 and Element 10 to provide an inflow hydrograph to detention pond Element 302. Peak discharge is 374 cfs.

Element 110

Element 110 is a direct flow element. It summarizes flows from sub-basin 8 and Element 11 to provide an inflow hydrograph to detention pond Element 303. Peak discharge is 1014 cfs.

Element 111

Element 111 is a direct flow element located at the outlet of sub-basin 9 and Control Data Road. It provides an inflow hydrograph for Element 12, which in turn is used in sizing future detention needs for sub-basin 9 at full developement. Peak discharge is 194 cfs.

Element 300

Element 300 is an existing detention pond located just east of Lacrosse St. and just north of the existing railroad right of way. It is recommended that storage capacity be increased and that the outlet system be improved.

The existing riprapped berm in the middle of the pond should be removed and the bottom of the pond should be expanded as much as possible. At minimum, the pond should be excavated and lowered from approximate elevation 3253 to elevation 3245.

The existing 48" ductile iron pipe and 60" RCP discharge pipes must be removed and replaced with a new combination of pipes to optimize the use of the proposed storage increase and conform to the downstream storm sewer.

It is recommended that two RCP culverts be installed through the dam embankment to provide a staged discharge system. A 60" RCP and 66" RCP are recommended for the outlet. Flow line for both pipes is at elevation 3245.

Peak inflow is 811 cfs, peak outflow is 573 cfs, and required storage is 10.7 acre-feet. Proposed top of pool is at approximate elevation 3254. The top of pool elevation proposed is critical in the functioning of the proposed culvert under Lacrosse St.

Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 300		
ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3245	0.0	0
3249	4.0	205
3250	5.1	280
3254	10.7	573

Element 301

Element 301 is the existing Knollwood detention pond. Storage capacity in the pond is adequate, the design storm passes through the principal outlet works, and 1 foot of freeboard exists above the emergency spillway. No improvements are necessary.
Peak inflow is 381 cfs, peak outflow is 88 cfs, and required storage is 36.8 acre-feet. Top of pool is at approximate elevation 3280, top of existing embankment is at elevation 3281, and the emergency spillway elevation is at approximate elevation 3280. Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 301		
ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3269	0.0	0
3270	0.0	3
3275	10.2	37
3276	14.5	42
3277	19.3	47
3278	24.5	50
3279	30.3	55
3280	36.9	88
3281	44.2	192

Element 302

Element 302 is an existing detention pond located at the upstream end of the Knollwood detention pond. The outlet consists of a staged pipe/spillway system which discharges to the Element 301 detention pond. The outlet system is comprised of a 12" CMP at approximate elevation 3279.5 and two concrete spillways, one at approximate elevation 3284.5 and the other at approximate elevation 3285. Storage capacity in the pond is adequate, the design storm passes through the principal outlet works, however freeboard is inadequate, and no emergency spillway exists. Improvements to the pond are necessary. Improvements on Maple Ave. to capture sub-basin 7 flows are also necessary.

Recommended improvement consists of raising the pond embankment to obtain 1 ft. of freeboard above the high water elevation. The entire length of the pond embankment will not require raising since part of the embankment already has adequate freeboard.

In order to supply an emergency spillway for this pond it is recommended to install rip-rap at the existing spillways after freeboard is supplied. The rip-rap should be installed so that the flow area above the existing concrete spillway is protected for flows greater than the design storm. Rip-rap should also be placed so that downstream of the spillways, the embankment face and toe are also protected.

Peak inflow is 374 cfs, peak outflow is 324 cfs, and required storage is 10.0 acre-feet. Top of pool is at approximate elevation 3286, top of existing embankment varies between elevation 3286 and 3288. Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 302

ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3279.5	0.0	0
3280	0.0	1
3281	0.2	4
3282	0.8	5
3283	2.4	7
3284	4.6	8
3285	7.3	74
3286	10.4	365

Maple Ave.

A 48" RCP should be installed from the sag just south of I-90 to Knollwood Dr., and additional storm sewer and inlets are necessary to the south and west to collect approximately 163 cfs, which is the peak interpolated flow from this portion of Subbasin 7. Also the commercial developement along the south side of I-90 presently drains runoff north and adjacent to I-90.

Total runoff expected at the south side of I-90 is approximately 217 cfs. This runoff should be completely captured and conveyed east under Maple Ave. to Element 302 detention pond. An existing open channel from Maple Ave. to the detention pond will require enlarging to convey this flow to the pond.

These improvements in conjunction with recommendations for Element 303 detention pond are required to prevent additional flooding at the intersection of Maple Ave. and Disk Dr., and aid in routing subbasin flows to their correct destination, thus preventing basin transfer to the north from occurring.

Element 303

Element 303 is an existing detention pond located just north of Interstate 90 and just east of Maple Ave. Storage capacity in the pond is adequate, the principle outlet works have the capacity to pass the design storm, and no formal emergency spillway exists.

Another deficiency related to this facility is the inability of runoff to get into the detention pond. This is largely due to the lack of adequate storm sewer facilities at the Rushmore Mall to capture and convey the flow to the detention pond. This deficiency has caused flooding to occur at the intersection of Maple Ave. and Disk Dr. as well as in and around the Mall parking lots and adjacent streets.

Without constructing significant facilities at the Rushmore Mall to capture and convey the flow to the detention pond, the flooding of the Maple Ave and Disk Dr. intersection will continue to occur. It has been assumed that improvements are unlikely to occur on the Mall site due to the fact that the Mall site is a previously constructed private facility. Thus recommendations are to minimize the flooding situation at the Maple Ave and Disk Dr. intersection, and at the same time route all flows into the detention pond to optimize its use. Improvements are necessary.

Peak routed inflow to the pond is 1014 cfs. Existing storm sewer from the mall and adjacent streets into the detention pond has a capacity of approximately 110 cfs. The recommended improvement is to construct a concrete lined channel from the intersection east to the pond to convey the remaining 904 cfs.

The existing sag area at the intersection of Maple Ave. and Disk Dr. will operate as a weir with runoff flowing over the curb to the east. When ponding occurs here the expected maximum depth is approximately 2.3 ft. The channel capacity recommended will need to be such that the flow depth in the channel is at or below 2.3 ft. The reason for this is so that the ponding depth at the intersection is minimized and so that the minimum amount of runoff will overflow the curbline south of I-90 and be routed to Element 302. Because of the continued inundation of the Maple Ave. and Disk Dr. intersection, the improvement recommendation will be a design exception to the RCDCM criteria.

The recommended channel has a 20 ft wide bottom, 4 to 1 side slopes, and a slope of .01 ft/ft. the velocity expected in the channel is approximately 13 ft/sec and the flow will be

supercritical, so reinforced concrete shall be required. Flow depth expected is approximately 2.3 ft and per the RCDCM criteria 2.4 ft of freeboard are required.

As mentioned above no formal emergency spillway exists. This is again due to the inability to get runoff into the pond. Note that the top of the pond embankment is also the I-90 embankment. The elevation is approximately 3316 which is approximately 18 ft. above top of pool.

The existing outlet consists of a staged standpipe which discharges to a 48" RCP modeled as Element 10.

Peak inflow is 1014 cfs, peak outflow is 192 cfs, and required storage is 29.8 acre-feet. Top of pool is at approximate elevation 3297.9.

Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 303

ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3285	0.0	0
3286	1.0	5
3288	2.3	22
3290	5.0	31
3294	14.0	44
3295	17.0	91
3296	21.0	138
3297	25.0	163
3299	36.0	230
3300	42.0	341
3301	49.0	664
3302	57.0	1301

"Secondary Tributary Area"

Element 50

Element 50 represents a storm sewer system with street overflow beginning at Rapid Creek and following Lacrosse St. north to Omaha St. The existing system is undersized and severe street flooding occurs frequently during storm events.

Historically this element acts as the primary conveyance element for Subbasins 11,12,13 and 15. Design plan recommendations are to reroute the major flows away from this element and utilize this facility for serving a portion of Subbasin 15 only. The major design criteria used for determining improvement recommendations is that Omaha St. is an arterial street, and no overtopping will be allowed.

Peak routed flow in Element 50 is 61 cfs. It should be noted that this flow is significantly less than the peak flow from Subbasin 15 (81 cfs). This is due to UDSWM2 accounting for pipe storage versus the relatively small basin area. Thus the peak subbasin flow should be used to determine the improvements needed because the improvements begin at the upper end of the system where pipe storage has no beneficial effect.
Peak interpolated flow from Subbasin 15 is 81 cfs. However, the existing system capacity is only 35 cfs (assuming no street overtopping on Omaha St). The design plan recommendation is to collect the remaining 46 cfs using the proposed recommendations in Subbasin 20 (see Element 70).

Recommended improvements for Element 50 consist of extending storm sewer north on Lacrosse St. to collect 35 cfs prior to the Omaha St. intersection. Also an inlet and outlet pipe should be constructed to replace the existing improvement for draining the runoff from the trailer court west of Lacrosse St. These recommendations should be incorporated in the reconstruction of Lacrosse St.

The typical pipe for UDSWM2 routing is a 36" RCP with an n value of 0.016 and an invert slope of 0.0035 ft/ft. The typical overflow channel represents the street and used a 1 foot wide channel, side slopes of 20:1, n value of 0.020, and an invert slope of 0.0035 ft/ft.

Element 55

Element 55 is a proposed open channel beginning at Element 120 (Rapid Creek) and ending at Element 125 (Lacrosse St.). The proposed location for this channel is on City owned land, thus no easement acquisition is anticipated

The typical recommended channel has a 20 foot wide bottom, side slopes of 5:1, n value of 0.050, and an invert slope of 0.0035 ft/ft.

A culvert crossing is at Brennen Ave. Recommendation is for installation of a 4 ft by 7 ft RBC.

The typical channel for UDSWM2 routing used a 20 foot wide channel, side slopes of 5:1, n value of 0.063, and an invert slope of 0.0035 ft/ft. Peak routed flow is 339 cfs.

Element 56

Element 56 represents an existing open channel between Element 125 (Lacrosse St.) and Element 126. The channel is inadequate and improvements are necessary.

Presently this channel is non functional and no drainage system exists to serve the north portion of Subbasin 10. The south portion is served by an inadequate existing 18" CMP storm sewer that drains across the Pennington County Fairgrounds. However, until that south portion of Subbasin 10 develops, the existing 18" CMP can be of use in draining the low lying area here.

The abandoned railroad tracks here divide Subbasin 10 north-south, and since the proposed channel is located on the north side, it is recommended to provide a means for the south portion of the basin to drain north to the proposed channel. No specific recommendation is given here because this improvement should conform to developement needs. Another design consideration affecting these recommendation is the floodplain and floodway designation and the development requirements necessary to meet the ordinances. It is anticipated that elevation of this area will occur and this area can be drained to the north utilizing the proposed channel.

At Lacrosse St. a culvert crossing is required to convey flows to Element 55. Recommendation is for installation of a 4 ft by 7 ft RBC. The RCB will convey the entire peak flow to Element 55.
It is recommended that the Element 56 channel be regraded with a 20 foot wide bottom, 5:1 side slopes, an invert slope of 0.005 ft/ft, and an n value of 0.05. Normal depth of flow in the improved channel for 347 cfs is approximately 3.3 feet at a velocity of about 3 fps.

The typical channel for UDSWM2 routing used a 20 foot wide channel, 5:1 side slopes, n value 0.065, and an invert slope of 0.005 ft/ft. Peak routed flow is 347 cfs.

Element 57

Element 57 represents an existing open channel between Element 126 and Element 127 (Omaha St.). The channel is inadequate and improvements are necessary.

The major design criteria used for determining improvement recommendations is that Omaha St. is an arterial street, and that no overtopping is allowed; thus the Element 57 design recommendations are based upon the need to convey the 100 year peak flow from the subbasins to the north.

Another design consideration affecting this recommendation is the floodplain designation for the north portion of Sub-basin 10. The Rapid Creek base flood elevations shall be such as to require any new developement to be elevated in order to meet the ordinance requirements. The ground adjacent to Element 57 open channel is expected to be raised approximately 3-5 feet in order to meet this ordinance requirement, thus allowing for the recommended channel to be possible.

Although floodproofing is another option that could be used to develop this area, it is assumed that the elevation option would be used due to the cost of floodproofing a site and the physical access problem that would exist to this area, that being the elevation difference between Omaha St. and the proposed development area.

It is recommended that the Element 57 channel be regraded with a 20 foot wide bottom, 5:1 side slopes, an invert slope of 0.0025 ft/ft, and an n value of 0.065. Normal depth of flow in the improved channel for 252 cfs is approximately 3.4 feet at a velocity of about 2 fps.

Element 58

Element 58 is an existing parking lot area that acts as the channel for draining all runoff from Subbasins 12 and 13. Element 51 in the existing UDSWM2 routing element modeled for this channel and although physical channel parameters are given in the model, no actual channel exists and during storm events flooding of structures, parking lots, and overtopping of Omaha St. will occur. Element 58 begins at Omaha St. and ends at detention pond Element 310. Improvements are recommended.

At the south end of Element 58 is the modeled confluence of Element 58 and Subbasin 11. Peak flow expected here is reflected in Element 127 and is 258 cfs. In order to convey the peak flow under Omaha St. it is recommended to install double 7 ft by 3 ft RCB. Multiple RCB are recommended here rather than an single pipe in order to avoid conflict with the existing sanitary sewer main. Also the 24" water main on the north side of Omaha St. will require lowering at this crossing.

In order to convey the peak flow of 161 cfs, recommended improvements for Element 58 include installing a 54" RCP from Omaha St.(Element 127) north to Element 310 detention pond. The typical pipe for UDSWM2 routing is a 54" RCP with an n value of 0.016 and an invert slope of 0.005 ft/ft.

In order to maintain flow depths and prevent overtopping of Omaha St. additional collection of runoff will be required. In order to convey the entire peak flow of 132 cfs for Subbasin 11, recommended improvements include installing a storm sewer east along Omaha St. from Element 58 to Poplar St.. The storm sewer will be a 36" dia. RCP decreasing in size to the east. No specific recommendations are given for pipe sizing to the east due to the site specific drainage needs and the nature of the flow patterns for the properties to the north of Omaha St. For cost estimation purpose a 36" RCP was assumed for the entire length of storm sewer (approx. 1150 ft.).

West of the proposed 7 ft by 3 ft RCB crossing for Omaha St., existing storm sewer exists. It is recommended that these inlets and storm sewer be connected to the proposed RCB crossing.

Element 59

Element 59 is an existing open channel beginning at detention pond Element 310 and ending at Element 129 Flow capacity is adequate and no improvements to Element 59 channel are recommended. Small storm sewers are recommended on Lacrosse St. and E. North St. to collect runoff and route to Element 59.

The typical channel for UDSWM2 routing is a 20 foot wide channel, side slopes of 5:1, n value of 0.063, and an invert slope of 0.010 ft/ft. Peak routed flow is 209 cfs.

The upstream end of Element 59 is the intersection of the major flow path for Subbasin 13 and Lacrosse St. Storm sewer is recommended to maintain proper flow depths and eliminate overtopping of the arterial streets in this subbasin. Recommended storm sewer starts at the intersection of Lacrosse St. and E. New York St., follows north along Lacrosse St. to E. North St., then west along E. North St. to Herman St..

Lacrosse St.

Runoff has been known to cause severe street flooding along Lacrosse St. and significant traffic hazards exist. Recommended improvements along Lacrosse St. consist of installing a 48" RCP from E. New York St. to Philadelphia St., then a 42" RCP from Philadelphia St. to Denver St., then a 36 " RCP from Denver St. to E. North St.. Peak interpolated flows expected at E. New York St., Philadelphia St., Denver St., and E. North St. are 213 cfs, 169 cfs, 93 cfs, and 48 cfs respectively.

E. North St.

Recommended improvements along E. North St. consist of installing a 36" RCP along the north side of E. North St. from Lacrosse St. to Racine St. at a slope of approximately .005 ft/ft, then a 33" RCP from Racine St. to Waterloo St., then a 30" RCP decreasing to a 24" RCP from Waterloo St. to Milwaukee St., then a 18" RCP decreasing to a 12" RCP from Milwaukee St. to Herman St.. Peak interpolated flows expected at Lacrosse St., Racine St., Waterloo St., and Milwaukee St. are 48 cfs, 36 cfs, 24 cfs, and 7 cfs respectively.

Element 120

Element 120 is a direct flow element. It summarizes flows from Element 50 and Element 55. It provides the final hydrograph from the secondary tributary to Rapid Creek. Peak discharge is 383 cfs.

Element 125

Element 125 is a direct flow element. It provides an inflow hydrograph for the Lacrosse St. crossing. Peak discharge is 347 cfs.

Element 126

Element 126 is a direct flow element. It summarizes flows from sub-basin 10 and Element 57 to provide an inflow hydrograph to Element 56. Peak discharge is 356 cfs.

Element 127

Element 127 is a direct flow element. It summarizes flows from sub-basin 11 and Element 58 to provide an inflow hydrograph to Element 57. Peak discharge is 258 cfs.

Element 128

Element 128 is a direct flow element. It summarizes flows from sub-basin 12 and Element 59 to provide an inflow hydrograph to detention pond Element 310. Peak discharge is 315 cfs.

Element 129

Element 129 is a direct flow element. It provides an inflow hydrograph to Element 59, and provides a peak flow used in sizing improvements on Lacrosse St. Peak discharge is 213 cfs.

Element 310

Element 310 is an existing detention pond located just east of Lacrosse St. and approximately 400 ft. north of Omaha St.. The existing detention pond has an insignificant amount of storage and no outlet facilities. The pond is located on private land. Improvements are recommended, and easement acquisition will be necessary.

Construction of an embankment and discharge system are recommended to reduce the peak discharge. The discharge system shall be routed to connect to Element 58 storm sewer.

The existing top of pond elevation is approximately 3200, and bottom of pool elevation is approximately 3199. In order to provide for adequate storage and freeboard it is necessary to raise the top of embankment to elevation 3210.

The recommended outlet improvements consist of a staged discharge standpipe with an emergency spillway graded into the pond embankment with overflow to begin at approximate elevation 3209. The discharge standpipe should be designed to match the stage discharge of the proposed Element 58 storm sewer.

Peak inflow is 315 cfs, peak outflow is 160 cfs, and required storage is 5.4 acre-feet. Top of detention pool is at approximate elevation 3209.
Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 310		
ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3200	0.0	0
3202	0.3	30
3204	1.1	90
3206	2.5	145
3208	4.4	160
3209	5.6	160
3210	6.7	160

Element 70

Element 70 represents existing street flow on Omaha St and on Steele Ave. It flows from the intersection of Omaha St. and Waterloo St., along Omaha St. east to Steele Ave., then south along Steele Ave. to Rapid Creek. The section of Omaha St. from Rapid Creek to Lacrosse St. is a sag vertical with frequent flooding due to undersized storm sewer facilities. The runoff can not escape the sag area without first causing considerable inundation. Improvements are recommended.

The major design criteria used for determining improvement recommendations is that Omaha St. is an arterial street, and no overtopping is allowed; thus the Element 70 design recommendations are based upon the need to convey the 100 year peak flow from the subbasins to the north.

Subbasin 20 is the main runoff generator that needs to be considered; however as mentioned in the design recommendations for Element 50, and although not included in the UDSWM2 routing, a portion of the flow from Subbasin 15 is to be collected in the Element 70 storm sewer.

Peak routed flow for Element 70 is 121 cfs, however the peak interpolated flow expected is 170 cfs due to the additional flows from Subbasin 15.

Existing storm sewer that presently serves this area consists of a 24" RCP (approximate capacity = 20 cfs) on Steele Ave., that drains the low point of the vertical sag, and a 12" RCP (approximate capacity = 5 cfs) on Brennen Ave. that serves the Lacrosse St. and Omaha St intersection. The improvements recommended here include the continued

use of these existing storm sewers. Prior to final design of the recommended improvements it will be necessary to complete a detailed survey of the existing facilities to determine the actual capacity and compatibility with the proposed system.

In order to convey the peak interpolated flow of 170 cfs, recommended improvements include installing in addition to the existing system, a 54" RCP along Steele Ave. from Omaha St. to Rapid Creek. The typical pipe for UDSWM2 routing used a 54" RCP with an n value of 0.016 and an invert slope of 0.005 ft/ft.

Additional storm sewer recommended to collect the peak flow consist of installing a 48" RCP along Omaha St. from Waterloo St. to Steele Ave., then a 42" RCP decreasing to a 36" RCP from Steele Ave. to Brennen Ave., then a dual 24" RCP from Brennen Ave. to Lacrosse St.. Peak interpolated flows expected on Omaha St. at the intersections with Waterloo St., Steele Ave., Brennen Ave., and Lacrosse St. are 81 cfs, 166 cfs, 76 cfs, and 46 cfs respectively.
The majority of runoff from Subbasin 20 is routed to Waterloo St.. In order to collect the peak interpolated flow of approximately 65 cfs it is recommended to install a 36" RCP, for a distance of 550 north of the intersection of Omaha St. and Waterloo St.

In addition to the above recommended storm sewer, it will be necessary to install the proper amount of inlets to optimize the use of the recommended improvements.

Element 130

Element 130 is a direct flow element. It provides the final hydrograph from secondary tributary sub-basin 20 to Rapid Creek. Peak discharge is 121 cfs; however the peak interpolated flow expected is 170 cfs due to the additional flows from Subbasin 15.

Element 131

Element 131 is a direct flow element. It provides an inflow hydrograph to Element 70. Peak discharge is 122 cfs; however the peak interpolated flow expected is 170 cfs due to the additional flows from Subbasin 15.

Element 80

Element 80 is an existing 24" RCP beginning at Rapid Creek and ending at detention pond Element 320 (Roosevelt Pond). Pipe capacity is adequate and no improvements are necessary.

Pipe used in the UDSWM2 modeling is a 24" RCP with an n value of 0.016 and an invert slope of 0.010 ft/ft. Peak routed flow is 19 cfs.

Element 80 in conjunction with detention pond Element 320 is the main conveyance element for management of runoff from Subbasin 30. The modeling of these elements assumes that all flow from Subbasin 30 will flow into detention pond Element 320. Presently portions of the flows from the basin will not route to the pond, and instead the entrance road that serves the south portion of Roosevelt Park will become inundated. No structure inundation is anticipated; however, it will be desirable to route runoff from this basin into Element 320 to improve runoff quality prior to its discharge into Rapid Creek. The need to reduce flow depths on Maple Ave is also a factor in the routing of runoff to detention pond Element 320.

Runoff from Subbasin 30 that presently does not flow into detention pond Element 320 is from that portion of the basin that is west of Herman St. Recommended improvements to capture runoff from this area and route it to Element 320 consist of storm sewer on Maple Ave. and Herman St. along with the regrading of that portion of Iowa ditch between Maple Ave. and Herman St.

Maple Ave

Peak interpolated flow expected at the intersection of Maple Ave and the Iowa ditch is approximately 79 cfs. It is recommended to capture the entire 100 year peak flow and route it into the abandoned Iowa ditch.

Although street flow capacity on Maple Ave. north of the Iowa ditch is adequate for the interpolated 100 year discharge, and all runoff could feasibly be trapped at the Iowa ditch, the collector status of Maple Ave will require some storm sewer north of the Iowa ditch to reduce the street flow depths for the interpolated 10 year flow of 34 cfs

Recommended improvements include installing a 24" RCP decreasing to a 15" RCP from the Iowa ditch north to New York St.. Inlet capacity shall be necessary so that only 10 cfs will remain on the street in the 10 year event.

Herman St.

Peak interpolated flow expected at the intersection of Herman St. and the Iowa ditch is approximately 50 cfs. It is recommended to capture the entire 100 year peak flow and route it into the abandoned Iowa ditch.

At this location existing inlets are in place but are inadequate to capture the entire 50 cfs. It is recommended to install additional inlets to the north to intercept the remaining flow or provide for runoff to leave the street and flow east at the Iowa ditch, and provide for overland flow across the park to the pond. This improvement should be coordinated with the following recommendations for the Iowa Ditch.

Iowa Ditch

Iowa ditch is an existing open channel which flows east from Maple Ave. to Herman St. Flow capacity is adequate; however minor improvements are recommended.

Peak interpolated flow expected in Iowa ditch west of Herman St. is approximately 79 cfs.

The typical channel for calculations is a 10 foot wide channel, side slopes of 2:1, n value of 0.063, and an invert slope of 0.0025 ft/ft.

Recommended improvements include tree removal, cleaning and regrading in the bottom of the channel to provide acceptable flow conditions. Normal depth of flow in the improved channel for 79 cfs is approximately 2.8 feet at a velocity of about 2.4 fps.

At the east end of the channel the existing 24" RCP storm sewer from Herman St to Roosevelt Pond is inadequate to convey the peak flow from the west. Recommended improvement for this crossing and conveyance to Roosevelt Pond consists of installing at minimum, additional capacity to convey the entire peak flow of 79 cfs from the west. Any additional flow capacity required above the 79 cfs will be dependant upon final design at Herman St.

Element 140

Element 140 is a direct flow element. It summarizes flows from sub-basin 30 and provides an inflow hydrograph to detention pond Element 320. Peak discharge is 272 cfs.

Element 320

Element 320 is Roosevelt Pond, an existing detention pond located in Roosevelt Park. Storage capacity in the pond is adequate, the design storm passes through the principal outlet works, and 1 foot of freeboard exists above the high water elevation. No improvements are necessary.

Peak inflow is 272 cfs, peak outflow is 19 cfs, and required storage is 11.9 acre-feet. Top of pool is at approximate elevation 3193.5, top of existing embankment is at elevation 3194.5.

The discharge pipe is the 24" pipe modeled as Element 80. The low area between the swimming pool and Waterloo St. acts as the emergency spillway.

Stage/storage/discharge data for the pond is given below.

STAGE/STORAGE/DISCHARGE DATA - ELEMENT 320		
ELEV.	STORAGE (AC-FT)	DISCHARGE (CFS)
3190.5	0.0	0
3192	5.5	9
3194	14.0	22
3194.5	17.0	117

Element 90 and 91

Element 90 represents the existing grass lined open channel beginning at Rapid Creek and ending at Element 91 culvert crossing under Centre St. Due to topography in relation to the existing improvements and the undersized culvert at Centre St., considerable inundation (1.5 ft to 3 ft deep) of the area north of Centre St. will occur in both the initial and major storm events. Improvements are recommended.

Peak flow from Subbasin 40 is 233 cfs, and it is recommended that the entire peak flow be conveyed in order to eliminate inundation in the south east portion of the subbasin. In order to convey the peak flow of 233 cfs, recommended improvements for Element 90 include installing a 54" RCP from Rapid Creek north to approximately 100 ft. north of Centre St. The typical pipe for UDSWM2 routing is a 54" RCP with an n value of 0.016 and an invert slope of 0.007 ft/ft.

Additional improvements in this basin include constructing open channels along the abandoned railroad right of way along with the development of the adjacent properties in order to convey the runoff efficiently to the proposed storm sewer.

An existing 18" RCP storm sewer system along the north side of Centre St. presently serves the properties at the south west corner of Subbasin 40. The storm sewer system is inadequate and presently drains to the west into Subbasin 10 creating a minor basin transfer problem. It is recommended that at the time of reconstruction of Centre St., the existing system be abandoned and proper street drainage facilities be installed to convey flows east to the proposed storm sewer.

Element 150

Element 150 is a direct flow element. It summarizes flows from sub-basin 40 and provides an inflow hydrograph to Element 90. Peak discharge is 223 cfs.

MISCELLANEOUS AREA IMPROVEMENTS

Various drainage improvement projects will be necessary in the study area in addition to those recommended in the computer modeled areas. Following are recommendations for known or easily identifiable problem areas.

Cambell St.

On Cambell St. north of Element 105, storm sewer capacity should be increased to carry flows necessary to reduce the 10 year flow depths. Design recommendations assume runoff from sub-basin 2 will be contained to the east side of the street, and flow depths are to meet RCDCM criteria.

In addition to the existing 24" RCP, approximately 1100 feet of 30" RCP should be installed from Element 105 street crossing north. The pipe should have capacity for about 75 cfs. Additional inlet capacity will be necessary to optimize the use of the proposed storm sewer. This design recommendation will also convey 100 year flows required to meet RCDCM criteria for DVP.

Herman St

North of the intersection with Downing St., Herman St. dead ends at the embankment for Knollwood Pond. In this area street flooding, and some yard flooding north and south of the street occurs. During events where the high water elevation in the detention pond is above the low point elevation in the sag on Herman St., flow will cease from the existing outlet pipe serving the sag and ponding will occur.

Recommended improvement is to divert all runoff at the intersection of Herman St. and Downing St. onto Downing St. by construction of a cross pan to carry approximately 27 cfs south to Downing St.. This diversion will result in reducing the subbasin area that presently drains to this location by approximately half.
Ponding at the sag on Herman St. will still occur. However, depths will be such that ponding is restricted to the street only.

Rushmore Mall

On the north side of the Rushmore Mall, adjacent to the Target and Sears stores, runoff has been known to collect and cause parking lot flooding. Although no building flooding has been documented, the possibility exists.
Peak interpolated flow at this area is approximately 185 cfs. Existing CMP storm sewer serving these parking lots has an approximate capacity of 50 cfs. Recommended improvement would be to install a 54" RCP and inlet capacity to capture and convey the remaining peak interpolated flow. This storm sewer should be routed to the detention pond Element 303. A length of approximately 2,100 ft of RCP is anticipated.

Improvement recommendations for the Mall area are also outlined under recommendations for Element 11.

Anamosa St.

On the north side of Anamosa St. and east of Racine St. an existing 24" RCP collects runoff from a drainage swale that flows from north to south and intercepts runoff from the commercial properties that exist along the west side of Lacrosse St.. Improvements to the swale and the storm sewer are recommended. Peak interpolated flow expected from this area is 53 cfs(100 yr.) and 27 cfs(10 yr). Recommendations include regrading the swale to carry the 100 year flow, and to provide in addition to the existing storm sewer, capacity to collect and convey the entire 100 year flow into the existing 60" RCP on Anamosa St.

MULTIPLE USE

Multi-purpose use of drainage facilities was considered during the design plan process. Greenbelts, nature trails, bike trails, and similar facilities are suggested for incorporation into the plan.

Multi-purpose uses are considered secondary to drainage requirements and it is not mandatory they be incorporated. Hydraulic capacity of the drainage facilities will not be compromised if the multi-purpose improvements are designed properly. When channel improvements are made, it may be necessary to modify the conceptual channel grading shown on the multi-purpose plans to meet the flow requirements of this Design Plan.

Existing multi-purpose uses are very limited in the study area. Some existing multi-purpose uses are the permanent pool in Roosevelt park and wetlands in other detention ponds.

Additional multi-purpose opportunities exist in the basin. Suggestions given below are somewhat general in nature, however they provide basic concepts for multi-purpose use.

It is suggested that natural channels not recommended for hydraulic improvements remain natural and that vegetation be allowed to remain. Natural channels will provide areas for greenbelts, passive areas, wildlife, and other multiple uses. As a general rule heavily vegetated natural channels will not affect project hydraulics as channel roughness values used in UDSWM2 are generally indicative of natural vegetated conditions.

Where channel grading is recommended it is suggested that the grading be done in a manner to promote greenbelt type uses. Low flow and trickle channels should be incorporated so overbank areas can be utilized with infrequent disruption due to flooding. It may be possible to have the low flow channel be a wetlands type channel.

Detention facilities should be utilized for such uses as common open space, hiking trails, ballfields, wildlife areas, parks, etc. The use of wetland type bottoms in detention ponds could be considered for use as "make-up" for loss of wetlands in other areas or for enhancement of water quality.

A few examples where multipurpose use might be incorporated are:

Knollwood detention pond (Element 301) could be used for ballfields, ice-skating rink, or exercise trail.

The design plan incorporates the use of the existing abandoned railroad tracks south of Omaha St. as channelization for runoff. This abandoned track area from Lacrosse St. to Creek Dr. could be used as a hiking/biking trail and connection to the existing bike trail is feasible.

RECOMMENDATIONS

1. Implementation Schedule

It was beyond the scope of the project to determine a complete detailed improvement schedule for the entire basin, however a generalized discussion of improvement scheduling follows.

Flooding problems already exist in the basin; therefore, implementation of the design plan should begin immediately. Simple economics dictate that complete plan implementation will take many years, thus priority should be given to projects that provide immediate benefit.

Projects that can be completed in conjunction with street or utility projects should be given priority. This suggestion is made since concurrent projects will be more economical than separate projects.

In general the reach between Elements 1 and 7 should be given priority because of the potential for developement, current basin transfer problems as well as potential widespread flooding in these reaches. The improvements should start with providing outlet channel capacity downstream of proposed storm sewers and then construction of the storm sewers and inlets to trap and convey runoff to the channels. It should be noted that careful consideration of the sequencing of these improvements should be made to prevent the effect of pushing the problem downstream which could in turn allow for additional runoff in some reaches beyond the present flows. This potential problem exists because of the existing basin transfer potential (see Element 6).

It is suggested that improvements to detention pond Element 302, 303 and recommended improvements on Maple Ave. just south of I-90 be given high priority. With out these improvements runoff will not be properly controlled and the downstream detention ponds could be jeopardized. Detention pond 302 does not have an emergency

spillway, and currently no freeboard. If runoff was to top the earth embankment, erosion of the dam could occur, possibly breach and thus releasing approximately 10 ac-ft of runoff into detention pond Element 301. Element 301 has an existing emergency spillway, but an instantaneous increase of volume in the pond could exceed the spillway capacity.

Detention pond Element 310 provides an immediate benefit by significantly reducing flows. High priority is suggested for this project. Also since easement acquisition is necessary it is important to start this process as soon as possible.

Improvements to detention pond 300 provides multiple benefits by reducing downstream flows and along with the proposed crossing improvements for Lacrosse St., will aid in eliminating flooding upstream of the Lacrosse St. and Waterloo St. intersection.

Improvements at Element 70 provide relief from the severe flooding problem on Omaha St. just east of Rapid Creek, thus should be considered high priority.

2. Final Design Recommendations

As mentioned earlier it was beyond the scope of the project to provide final construction design plans and the recommendations given in the plan are conceptual in nature. It will be necessary to prepare final engineering plans for the improvements and the following recommendations are made for use during the final project design phase.

1. All improvements should be designed in accordance with proper engineering standards and in accordance with the Rapid City Drainage Criteria Manual.

2. Improvements should be designed in accordance with FEMA rules and regulations.

3. If final detention pond curves are not practically identical to the plan recommended curves, it is necessary to perform a new computer analysis of the actual design to review basinwide impacts.

4. During final design, the conceptual sections, sizes, grades, etc., recommended in the design plan shall be checked for applicability to actual project requirements. Final design should include flow carrying characteristics, constructability, economics, etc,.

5. There are numerous locations where removal of existing pipes and replacement with larger pipes is recommended. In some instances it may be more economical to leave the existing pipe in place and add another pipe. This option should be investigated during final design of the storm sewer systems.

6. HEC-2 should be used to calculate water surface profiles for all open channel and bridge designs.

7. Flow in the concrete channels is likely to be supercritical and all relevant factors relating to supercritical flow shall be considered during design.

8. All topography and elevation data should be confirmed with field surveys prior to plan implementation or final design of recommended improvements.

9. Project design should be done with future multiple-use improvements in mind even if the multi-use items are not included with construction of the drainage project.

3. Additional Recommendations

1. The design plan should be adopted as part of the City's comprehensive plan.

2. The design plan should be reviewed and updated on a regular basis as the basin develops.

TABLE 1
SUMMARY OF DESIGN PLAN
RECOMMENDED IMPROVEMENTS AND ESTIMATED COSTS

ELEMENT NUMBER	RECOMMENDED IMPROVEMENT	ESTIMATED COST
1	No improvements.	N.C.
2	Regrade and improve channel.	$40,000
3	Construct additional box culvert.	$270,000
4	No improvements.	N.C.
5	Construct additional box culvert at Cambell St. Construct additional box culvert at Chicago St. Channel grading and sewer main relocation	$390,000
6	Construct additional box culvert on Denver St. and Spruce St.,	$170,000
7*	Construct additional box culvert on Spruce St. and in alley between Spruce St. and Pine St.	$300,000
	Construct additional storm sewer on Lacrosse St. and Watertown St.	$110,000
	Construct storm sewer on Spruce St.	$190,000
	Construct storm sewer on E. North St.	$170,000
	Regrade and improve channel at trailer court.	$20,000
8*	Construct additional box culvert at Lacrosse St., extend existing 48" RCP on Lacrosse St., remove existing 72" RCP	$180,000
	Construct additional storm sewer on Waterloo St. and Racine St.,	$175,000
	Construct storm sewer on Anamosa St.	$60,000
	Construct storm sewer on Woodlawn Dr.	$135,000
	Grade swale, improve 24" RCP storm sewer.	$20,000
9	No improvements.	N.C.
10	No improvements.	N.C.
11	No improvements.	N.C.
12	Construct culvert under Control Data Rd.	$10,000
20	Grade channel south of Centre St. to Rapid Creek, construct box culvert at Centre St. crossing, construct diversion at Hawthorne Irrigation Ditch.	$335,000
50	Extend storm sewer north along Lacrosse St., construct inlets	$20,000

TABLE 1 - CONTINUED
SUMMARY OF DESIGN PLAN
RECOMMENDED IMPROVEMENTS AND ESTIMATED COSTS

55	Grade channel from Rapid Creek to Lacrosse St., construct box culvert at Brennen Ave.	$76,000
56	Grade channel from Lacrosse St. east to Element 57, construct box culvert at Lacrosse St.	$51,000
57	Grade channel from Element 56 north to Omaha St.,	$25,000
58	Construct 54" RCP storm sewer from Omaha St. to Element 310, construct twin box culvert at Omaha St., construct 36" RCP storm sewer east along Omaha St., relocate 24" water main on Omaha St.	$205,000
59	Construct 48" to 36" RCP storm sewer on Lacrosse St. from N.Y. St. to E. North St., Construct 36" to 12" RCP storm sewer on E. North St. from Lacrosse St. to Milwaukee St.	$225,000
70	Construct 54" to 24" RCP storm sewer on Omaha St. from Rapid Creek to Lacrosse St., Construct 36" RCP storm sewer Waterloo St. from Omaha St. north	$175,000
80	Construct Storm sewer and inlets on Maple Ave from Iowa ditch north to N.Y. St. Construct storm sewer and inlets on Herman, or diversion to route flow to Roosevelt Pond. Regrade and clean Iowa Ditch.	$30,000
90	Construct 54" RCP storm sewer from Centre St. to Rapid Creek.	$155,000
300	Install new RCP discharge pipes, excavate to increase storage.	$220,000
301	No improvements	N.C.
302	Raise embankment to provide freeboard, construct emergency spillway. Construct 48" RCP storm sewer and inlets along Maple Ave. south of I-90., and system to serve commercial developement.	$70,000
303	Construct concrete lined channel	$60,000
310	Construct embankment, outlet system, emergency spillway	$70,000
320	No improvements	N.C.
--	Miscellaneous Areas	
	Construct 30" RCP storm sewer along Cambell St.	$65,000
	Construct crosspan at intersection of Herman St. and Downing St.	$20,000
	Construct 54" RCP storm sewer at Rushmore Mall	N.C.

TABLE 1 - CONTINUED
SUMMARY OF DESIGN PLAN
RECOMMENDED IMPROVEMENTS AND ESTIMATED COSTS

Recommended Improvements Sub-Total	$4,042,000
5% Contingency	$202,000
25% Engineering/Administration	$1,011,000
TOTAL COST OF RECOMMENDED DESIGN PLAN IMPROVEMENTS	$5,255,000

*ADDITIONAL OPTIONAL IMPROVEMENTS ARE POSSIBLE - SEE TABLE 2

TABLE 2
SUMMARY OF DESIGN PLAN
OPTIONAL IMPROVEMENTS AND ESTIMATED COSTS

ELEMENT NUMBER	RECOMMENDED IMPROVEMENT	ESTIMATED COST
7	Install 72" to 66" RCP storm sewer and inlets on Pine St.	$525,000
8	Install 4'by 8' decreasing to a 4'by 6' RCB and inlets from Waterloo St and Racine St. in lieu of recommended improvements	$320,000
	Install 60" to 54" RCP and inlets on Woodlawn St. in lieu of recommended improvements.	$180,000
	Install 60" RCP in lieu of recommended 54" on Anamosa	$60,000
	Optional Improvements Sub-Total	$1,085,000
	5% Contingency	$54,000
	25% Engineering/Administration	$285,000
TOTAL COST OF OPTIONAL DESIGN PLAN IMPROVEMENTS		$1,424,000

TABLE 3
SUMMARY OF DESIGN PLAN
PEAK SUB-BASIN FLOWS WITH FUTURE LAND USE CONDITIONS

SUB-BASIN NUMBER	AREA (SQ MI)	10 YR (CFS)	100 YR (CFS)
01	0.105	158	291
02	0.093	165	280
03	0.118	198	347
04	0.248	442	818
05	0.302	425	804
06	0.084	91	184
07	0.116	121	241
08	0.264	548	950
09	0.038	112	194
10	0.038	66	121
11	0.041	72	132
12	0.039	60	114
13	0.083	118	213
15	0.016	45	81
20	0.047	58	122
30	0.115	127	272
40	0.067	139	233

TABLE 4 - SUMMARY OF DESIGN PLAN
HYDRAULIC ELEMENT PEAK FLOWS
FUTURE LAND USE AND DESIGN PLAN HYDRAULIC CONDITIONS

ELEMENT NUMBER	10 YR (CFS)	100 YR (CFS)
1	200	200
2*	707	1,389
3	714	1,395
4*	713	1.395
5*	431	899
6*	543	988
7*	275	559
8*	42	88
9*	119	309
10	91	192
11*	65	83
12	83	83
20*	464	1143
50*	35	61
55	191	339
56	196	347
57*	154	252
58	119	161
59	116	209
70*	59	121
80*	9	19
90*	130	221
100	557	1,359
101	507	1,189
102	200	200
103	707	1,389
104	713	1,395
105	582	1,157
106	525	980
107	429	811
108	134	381
109	158	374
110	599	1,014
111	112	194
120	201	383
125	196	347
126	197	356
127	156	258
128	169	315
129	118	213

TABLE 4 - CONTINUED
SUMMARY OF DESIGN PLAN
HYDRAULIC ELEMENT PEAK FLOWS
FUTURE LAND USE AND DESIGN PLAN HYDRAULIC CONDITIONS

ELEMENT NUMBER	10 YR (CFS)	100 YR (CFS)
130*	59	121
131*	58	122
140	127	272
150	139	233
300	297	575
301	42	88
302	126	324
303	91	192
310	120	160
320	9	19

*ROUTED FLOWS ONLY, SEE APPENDIX A OR HYDRAULICS CHAPTER FOR EXPLANATION.

HYDROLOGY

HYDROLOGY

METHODOLOGY

Before any drainage design can be performed it is necessary to determine runoff peaks and volumes from the various sub-basins. Numerous methods of making these determinations are available varying from the simple rational method to very complex statistical methods.

In accordance with the City of Rapid City Drainage Criteria Manual the method used for runoff determination in this design plan is a computerized version of the Colorado Urban Hydrograph Procedure (CUHPE/PC). This model allows the design plan to be easily updated should the conditions change from those assumed in this study.

It should be noted that a runoff/routing analysis is only an approximation since storms rarely follow ideal patterns and other factors such as ground cover, infiltration, and channel conditions may vary with time or from assumed conditions. The intent of a runoff/routing analysis is to provide a reasonably dependable and consistent approximation of rainfall-runoff characteristics.

INPUT PARAMETERS

1. Storm Recurrence Interval and Rainfall

In accordance with the City of Rapid City Drainage Criteria Manual, the design plan presented in this report is based on the 100 year one-hour storm with fully developed land use conditions. The 100 year storm has a one per cent chance of being equalled or exceeded in any one year. The 100 year one-hour storm is 2.95 inches per hour.

Ten year flows were also calculated to help in evaluation of problems and proposed improvements. The 10 year one-hour storm is 1.86 inches per hour.

2. Sub-basin Characteristics

As previously mentioned the design plan is based on the anticipated future land use of the basin.

Anticipated future development is discussed in the BASIN DESCRIPTION section of the report. If future development results in higher than assumed imperviousness it will be necessary to provide on site detention to reduce flows to the assumed imperviousness rate.

The CUHPE/PC program requires input of numerous parameters to represent sub-basin characteristics. The reader is referred to the program user's manual and the City of Rapid City Drainage Criteria Manual for a complete description of the input requirements. Input data was developed following guidelines in the manuals. Data sources included USGS topographic maps, 1"=200' aerial photos with 2 foot and 10

foot contours, SCS soil maps, field reconnaissance, engineering equations, and engineering judgement. Soils information is included as Figure 5.

A complete listing of all input data used for runoff analysis is included on the CUHPE/PC computer printouts.

SUB-BASIN FLOWS

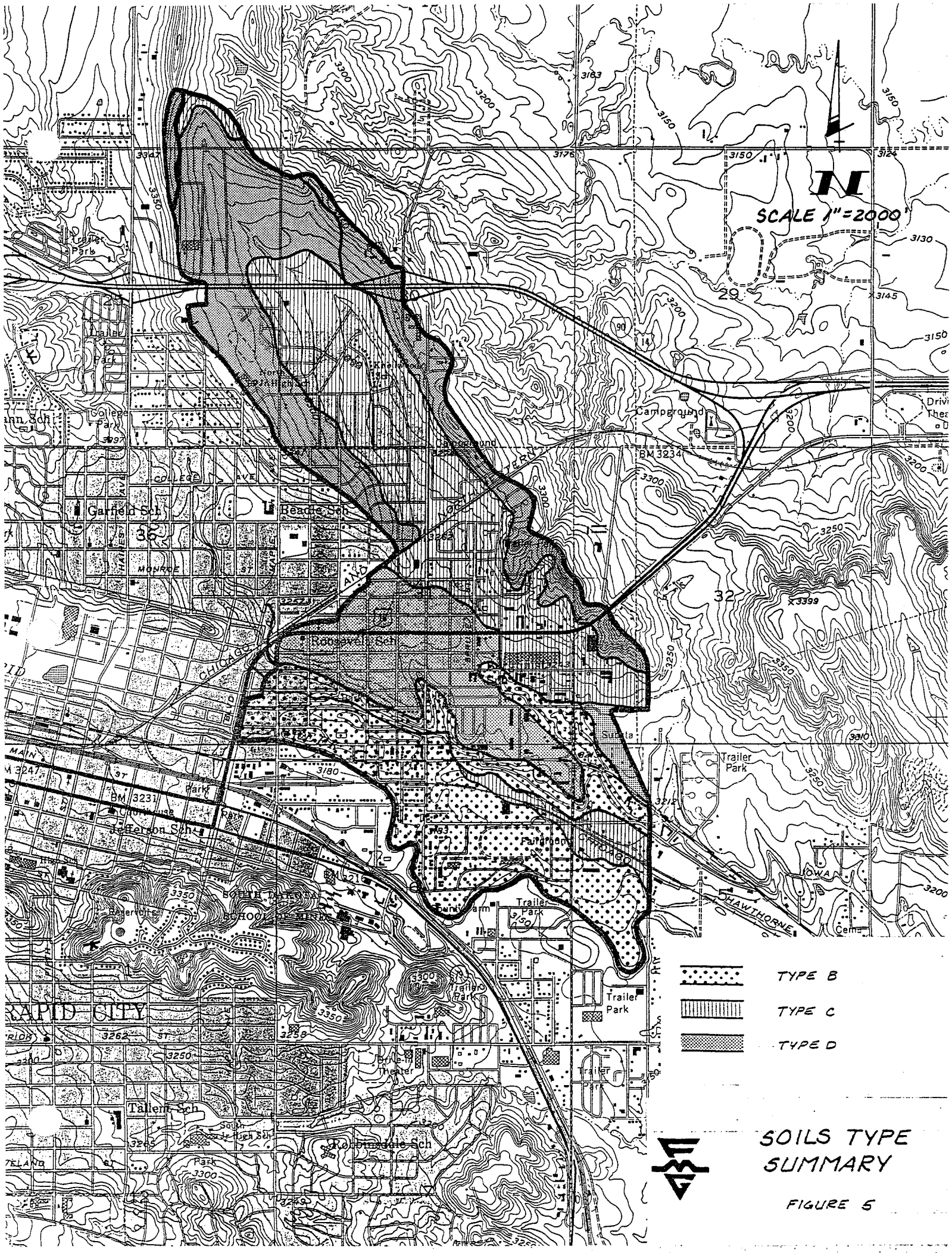
Peak sub-basin flows for both the 10 year and 100 year storms are given on Table 5 and hydrographs for the 100 year flows are located in Appendix A. Computer printouts of 10 year and 100 year CUHPE/PC models are located in Appendix B.

TABLE 5
PEAK SUB-BASIN FLOWS
EXISTING LAND USE CONDITIONS

SUB-BASIN NUMBER	AREA (SQ MI)	10 YR (CFS)	100 YR (CFS)
01	0.105	158	291
02	0.093	150	268
03	0.118	198	347
04	0.248	442	818
05	0.302	413	781
06	0.084	100	203
07	0.116	121	241
08	0.264	548	950
09	0.038	29	76
10	0.038	66	121
11	0.041	72	132
12	0.039	60	114
13	0.083	118	213
15	0.016	45	81
20	0.047	58	122
30	0.115	127	272
40	0.067	139	233

TABLE 6
PEAK SUB-BASIN FLOWS
FUTURE LAND USE CONDITIONS

SUB-BASIN NUMBER	AREA (SQ MI)	10 YR (CFS)	100 YR (CFS)
01	0.105	158	291
02	0.093	165	280
03	0.118	198	347
04	0.248	442	818
05	0.302	425	804
06	0.084	91	184
07	0.116	121	241
08	0.264	548	950
09	0.038	112	194
10	0.038	66	121
11	0.041	72	132
12	0.039	60	114
13	0.083	118	213
15	0.016	45	81
20	0.047	58	122
30	0.115	127	272
40	0.067	139	233



SOILS TYPE SUMMARY

FIGURE 5

HYDRAULICS

HYDRAULICS

METHODOLOGY

In order to use peak flows and hydrographs effectively and arrive at a realistic determination of time varied flows it is necessary to account for basin hydraulic characteristics. This process involves routing and combining hydrographs. This is a key step in the design process as it is where various design options are proposed and basinwide results investigated.

Numerous methods are available for performing these calculations ranging from simple hand approximations to complex computer modeling. In accordance with the City of Rapid City Drainage Criteria Manual the method used for the hydraulic routing is a computer model known as the Urban Drainage Storm Water Management Model (UDSWM2-PC). This model allows the design plan to be easily updated should conditions change from those assumed in the design.

HYDRAULIC ROUTING NETWORK

Prior to routing and calculating combined hydrographs it is necessary to conceptually represent the drainage system as a system of interconnected hydraulic elements. Hydraulic properties of each element are then characterized by various parameters and flows routed through the elements.

It should be noted that the drainage system subdivision could be taken to infinitesimal detail in theory, however computation and manpower requirements become prohibitive. No established rule is available for this subdivision and it is primarily based on engineering needs and judgement. The hydraulic subdivision used in this design provides a sufficient number of elements for suitable modeling. The network allows for sub-basin inflow at sub-basin design points and provides hydraulic flow elements between tributary junctions, between design points, at numerous road crossings, at detention ponds, and at other locations judged necessary.

As with sub-basin delineation the hydraulic routing system was established following major flow patterns and unaccounted for sub-basin transfer could occur.

The schematic of the hydraulic system network used with this design plan is included as Figure 6 (also a Figure 4 in DESIGN PLAN chapter.) The physical hydraulic routing elements are also shown on the aerial photos.

INPUT PARAMETERS

The UDSWM2-PC model requires input of numerous parameters to represent hydraulic element characteristics. The reader is referred to the program user's

manual and the City of Rapid City Drainage Criteria Manual for a detailed explanation of input requirements and methods.

Input parameters were determined following guidelines in the program user's manual and the Drainage Criteria Manual. Data sources included aerial contour maps, as-built drawings, field reconnaissance, engineering equations, and engineering judgement.

Input data used with the UDSWM2-PC model is included on the computer printouts in the appendices. An explanation of the various flow element types shown on the schematics and methods used for characterizing them follows. A description of each individual element is included in the DESIGN PLAN part of the report.

1. Direct Sub-basin Inflow

These are not hydraulic elements but rather denote inflow into the system from the various sub-basins. The computer model assumes that the inflow enters the hydraulic network at the sub-basin design point. It ignores the possibility that a portion of the sub-basin inflow may enter the adjacent hydraulic element above the sub-basin design point. Inflows used for these elements are the calculated hydrographs determined in the HYDROLOGY chapter of this report.

2. Detention Pond Elements

This element type allows the program to account for effects of storage at detention ponds. The flow calculated by the program for the referenced element is the outflow. The inflow to these elements is provided by other types of routing elements as shown on the schematic.

Input required for detention pond elements consists of a storage versus discharge data set. Storage data was determined from aerial contour maps, City of Rapid City topographic surveys, and as-built engineering drawings. If expansion of pond storage was determined necessary the design plan storage curves were developed using engineering judgement. Design plan storage curves were checked for reasonableness against existing ground contours.

Discharge curves were developed using appropriate culvert engineering techniques and standard engineering equations for orifices and weirs. Discharge curves were developed assuming unobstructed flow conditions.

Certain culverts and road crossings were not modeled as detention pond elements, rather they were assumed simply to be a portion of the adjacent routing element. Modeling limitations, insignificant backwater or storage effects, minor flow lengths, and/or overtopping characteristics warranted this assumption.

3. Direct Flow Elements

Direct flow elements are not true hydraulic conveyance elements, rather they serve to provide summarized hydrographs. They are included in this study to summarize upstream flows and to provide inflow hydrographs for other elements. No data input is necessary.

4. Flow Conveyance Elements

These elements are trapezoidal open channels, storm sewer pipes, or combinations thereof. Flow conveyance elements may have overflow sections.

Overflow conveyance elements are used at various locations. Overflow elements are the same as pipe or channel elements except that a larger trapezoidal channel is specified to accept flows exceeding the capacity of the initial channel section or pipe. Bottom width of the overflow section does not include the top width of the initial section and therefore may be zero. Depth data required by the program is depth of initial channel and combined depth of the initial channel and overflow section.

Input parameters consist of slope, roughness, and section geometry. Slopes were calculated from aerial contour maps, as-built plans, or in the case of new facilities, in accordance with the proposed design. Roughness coefficients were selected to represent conditions as they exist in the field or assumed design coefficients for new facilities. Roughness coefficients were then increased by 25% for use in UDSWM2 flow routing in accordance with the program user's manual. Unobstructed flow was assumed in all UDSWM2 elements unless otherwise reflected in the n value.

During input preparation it was assumed that channels would essentially remain in existing condition unless changed specifically by the design plan. Natural channels change shapes and slopes infinitely through the elements thus it was necessary to approximate a natural channel as a trapezoid and assume it as typical throughout the length of the element.

It should be noted that the program routes only flows entering the upstream end of the open channel or pipe and ignores the possibility that any adjacent sub-basin flow may be entering . Due to this program limitation the user should exercise caution when using channel or pipe peak flows and hydrographs for design. Flows for design should be increased appropriately using engineering judgement to reflect incoming sub-basin flows.

Additionally the user should not use conveyance element flow depths since flows are calculated as normal depth and effects of backwater, changing sections, etc., are not accounted for. The UDSWM2 calculations do not provide a flood boundary analysis.

5. Split Flow Elements

Split flow elements are used to split and divert routed flow. Outflow from these elements is routed to two downstream elements rather that the normal single element. Direct flow elements and flow conveyance elements may be used as flow diversion elements.

Input required for this element is a table of total flow in the element versus flow diverted to the specified split flow element. Flow not diverted to the specified split flow element is routed to the specified downstream element.

6. Flow Element Numbers

Each hydraulic element is identified with a unique number. Element numbers are separated into a set of ranges and values for specific identification of types. Numbers 1-90 are used to represent channel or pipe flow elements, 100 series numbers represent direct flow or flow diversion elements, 300 series numbers represent detention ponds, and numbers 20,55-59 and 310 represent recommended new design plan facilities.

HYDRAULIC ELEMENT FLOWS

Routed flows were calculated at all elements using methods and parameters presented above. Flows were calculated for both the 10 year and 100 year storms.

Flows were first calculated using the CUHPE/PC hydrographs for future projected land use and UDSWM2-PC flow routing with hydraulic conditions as they exist today. This scenario represents what would happen in the basin if complete land development occurs with no drainage improvements. Since the basin is already highly developed, this routing closely simulates today's conditions. This routing provides a basis for problem identification and as a starting point for design planning.

The design process then consisted of numerous flow calculations using fully developed land use conditions and UDSWM2-PC routing of various design proposals. The result is the KNOLLWOOD DRAINAGE BASIN DESIGN PLAN as presented in the DESIGN PLAN section of this report.

Peak flows for hydraulic routing elements are given on Table 6. Design plan flows are also given in the DESIGN PLAN chapter of this report. Hydrographs for routing elements are given in Appendix A. UDSWM2 printouts for recommended Design Plan hydraulic conditions are given in Appendix C and UDSWM2 printouts for existing hydraulic conditions are given in Appendix F.

STREET FLOW

Flow depth in streets was calculated in order to determine if flow depth requirements in the Rapid City Drainage Criteria Manual are met. Calculations for both the 10 year and 100 year discharges were made.

The flow used for calculations is surface flow only and does not include flow being conveyed by storm sewer at the referenced location. Street flow depths are discussed in the INDIVIDUAL ELEMENT DESIGN section of this report.

Depth was determined using normal depth calculations assuming a typical city street sections. Existing street widths and grades were used for the calculations. The area behind the curbs was assumed non-effective and was not included in calculations.

A copy of the RCDCM criteria for street flow is included at the rear of this chapter as Figure 7.

PROBLEM IDENTIFICATION

After flows were calculated and a floodplain approximated, it was possible to identify existing and potential future problems in the basin. Problem identification consisted of field reconnaissance, discussions with City staff, review of existing floodplain maps, analyzing effects of flow on roads, dams, and channels, and engineering judgement.

Under existing conditions numerous streets and areas adjacent to the streets will be inundated to depths that far exceed the Rapid City Drainage Criteria Manual requirements.

As explained in the previous section, it is expected that numerous structures are subject to flooding without implementation of drainage controls and improvement projects.

Other miscellaneous problems exist. Many channels, detention ponds, and pipes in the basin are inadequate and require improvement. Debris is located in channels and channel maintenance is poor. Numerous structures are in a state of disrepair and require cleaning.

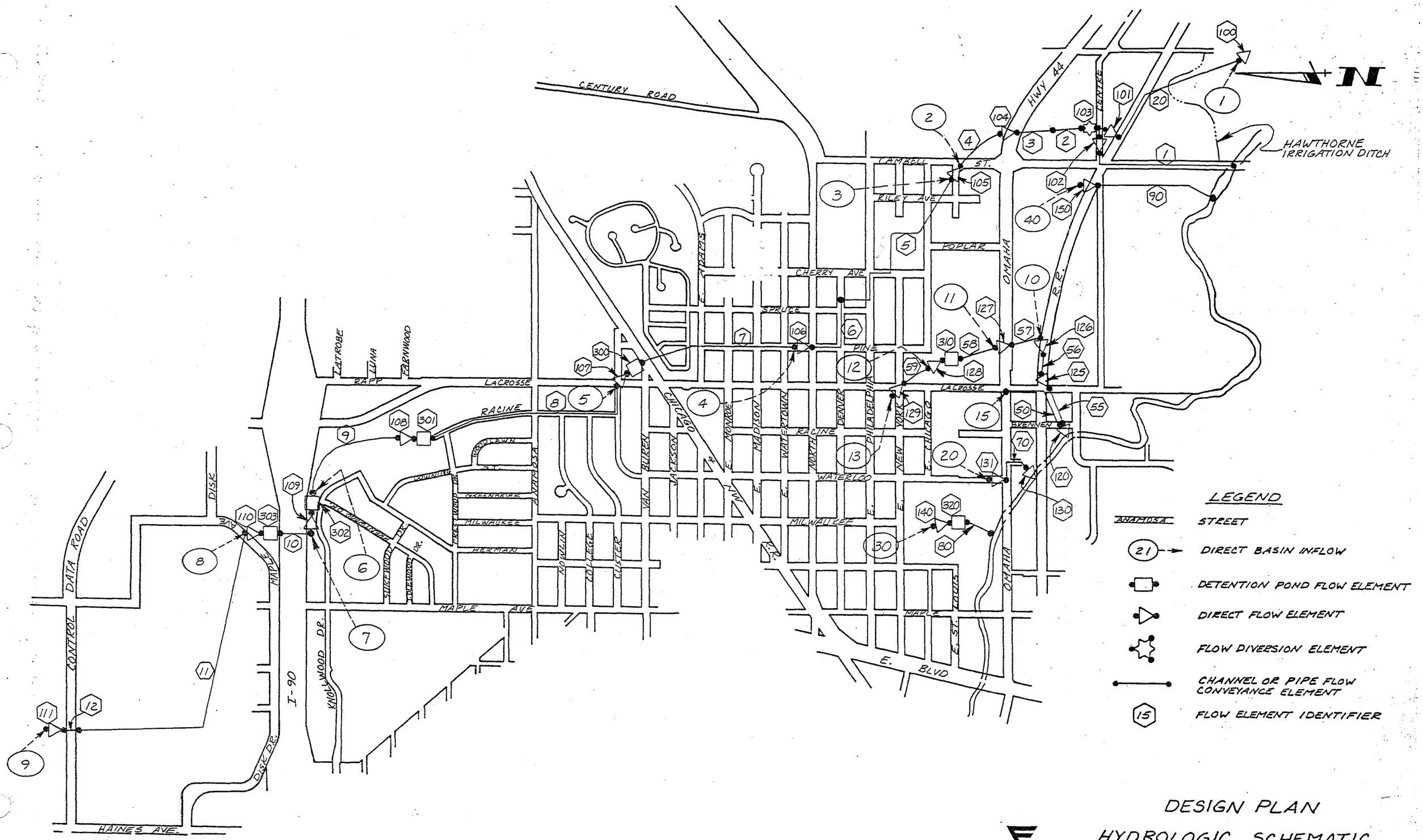
TABLE 7
HYDRAULIC ELEMENT PEAK FLOWS - FUTURE LAND USE

	EXISTING HYDRAULICS		DESIGN PLAN HYDRAULICS	
ELEMENT NUMBER	10 YR (CFS)	100 YR (CFS)	10 YR (CFS)	100 YR (CFS)
1*	653	1,277	200	200
2*	681	1,299	707	1,389
3	674	1,312	714	1,395
4*	686	1,322	713	1,395
5*	414	775	431	899
6*	531	945	543	988
7*	210	377	275	559
8*	42	87	42	88
9*	117	312	119	309
10	89	192	91	192
11*	63	131	65	83
12	--	--	83	83
20*	--	--	464	1143
50*	229	450	35	61
51*	165	309	--	--
52*	113	206	--	--
55	--	--	191	339
56	--	--	196	347
57*	--	--	154	252
58	--	--	119	161
59	--	--	116	209
70	55	117	59	121
80	9	19	9	19
90*	9	9	130	221
91	9	9	--	--
100	738	1,492	557	1,359
101	--	--	507	1,189
102	--	--	200	200
103	--	--	707	1,389
104	686	1322	713	1,395
105	560	1080	582	1,157
106	538	971	525	980
107	429	811	429	811
108	132	386	134	381
109	158	383	158	374
110	608	1081	599	1,014
111	112	194	112	194
120	285	557	201	383
121	243	464	--	--
122	167	312	--	--

TABLE 7 - CONTINUED
HYDRAULIC ELEMENT PEAK FLOWS - FUTURE LAND USE

	EXISTING HYDRAULICS		DESIGN PLAN HYDRAULICS	
ELEMENT NUMBER	10 YR (CFS)	100 YR (CFS)	10 YR (CFS)	100 YR (CFS)
123	118	213	--	--
125	--	--	196	347
126	--	--	197	356
127	--	--	156	258
128	--	--	169	315
129	--	--	118	213
130	55	117	59	121
131	58	122	58	122
140	127	272	127	272
150	139	233	139	233
300	217	382	297	575
301	42	87	42	88
302	125	328	126	324
303	89	192	91	192
310	--	--	120	160
320	9	19	9	19

*ROUTED FLOWS ONLY, SEE APPENDIX A OR HYDRAULICS CHAPTER FOR EXPLANATION.

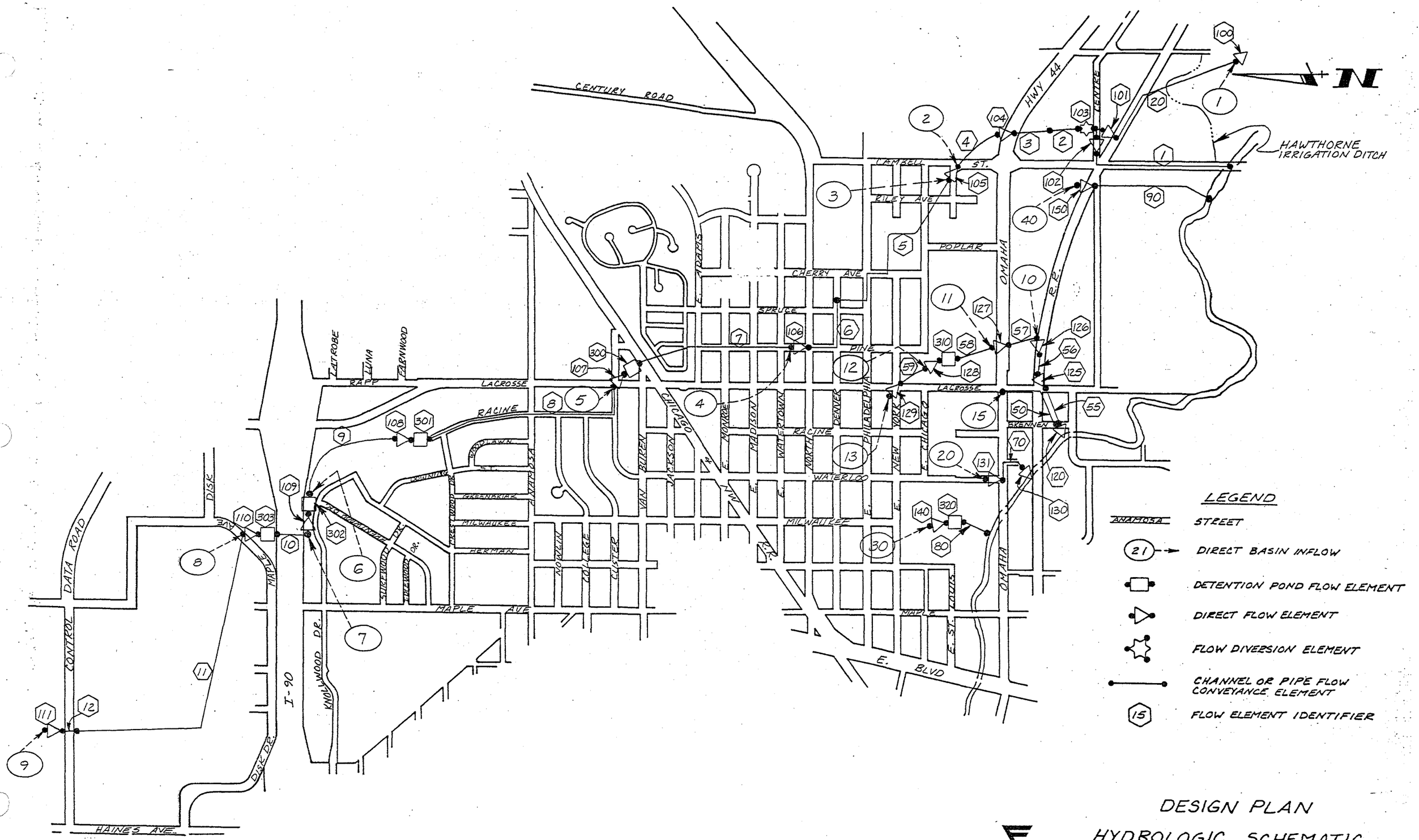


DESIGN PLAN

HYDROLOGIC SCHEMATIC

"KNOLLWOOD DRAINAGE BASIN"

FIGURE 4

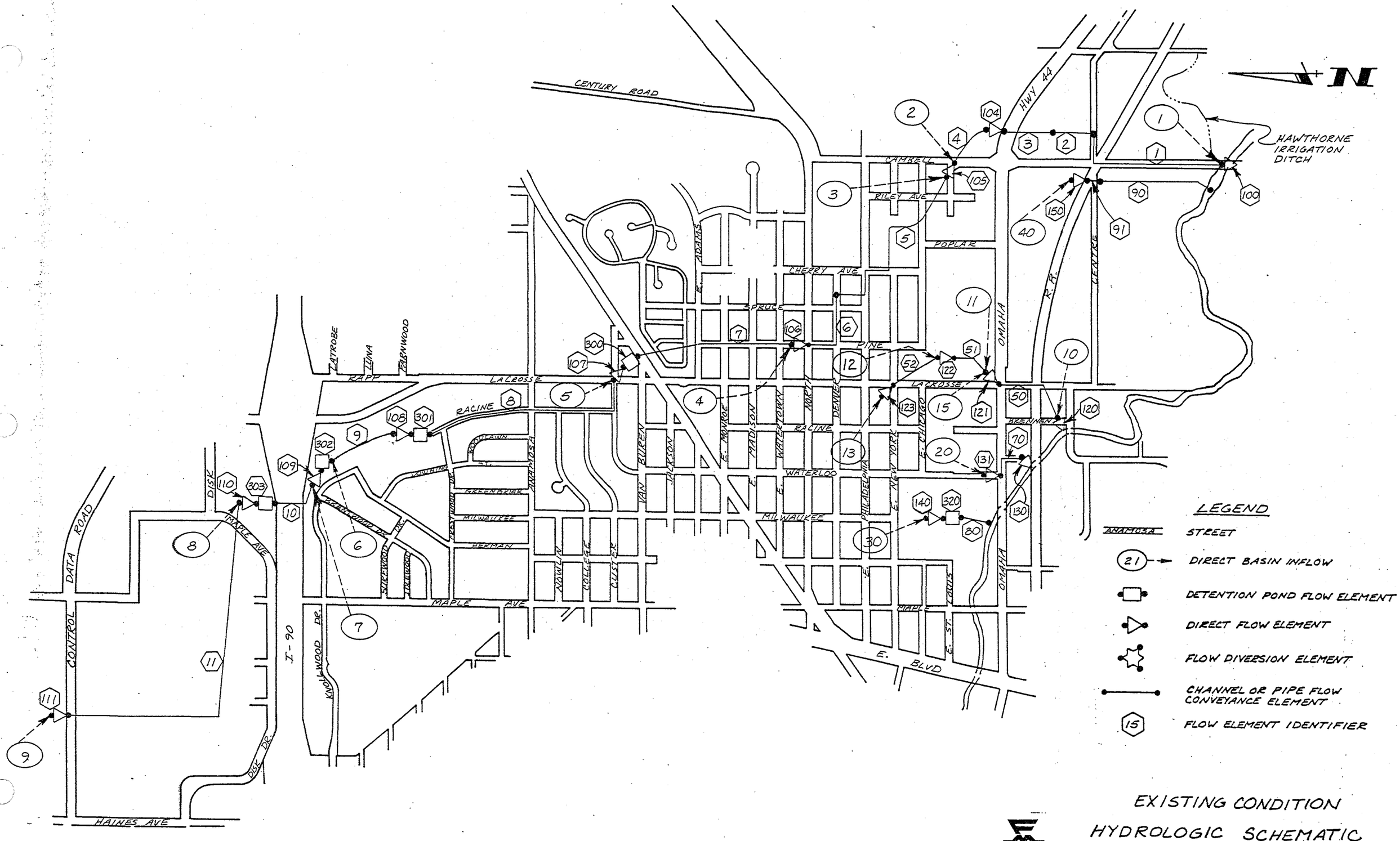


DESIGN PLAN

HYDROLOGIC SCHEMATIC

"KNOLLWOOD DRAINAGE BASIN"

FIGURE 6



EXISTING CONDITION
HYDROLOGIC SCHEMATIC
"KNOLLWOOD DRAINAGE BASIN"
FIGURE 7

FIGURE 8- RCDCM STREET FLOW CRITERIA

Allowable Initial Storm Runoff Encroachment

Street Classification	Initial Storm Frequency	Maximum Encroachment
Local	10-year	No curb over-topping.* Flow may cover crown of street.
Collector	10-year	No curb over-topping.* Flow spread must leave at least half of each lane** free of water for a two lane roadway and one lane free in each direction, for a four lane roadway.
Arterial	10-year	No curb over-topping.* Flow spread must leave all four lanes** free of water.

* Where no curb exists, encroachment shall not extend over property lines except at drainage easements.

** Standard 12 foot driving lane.

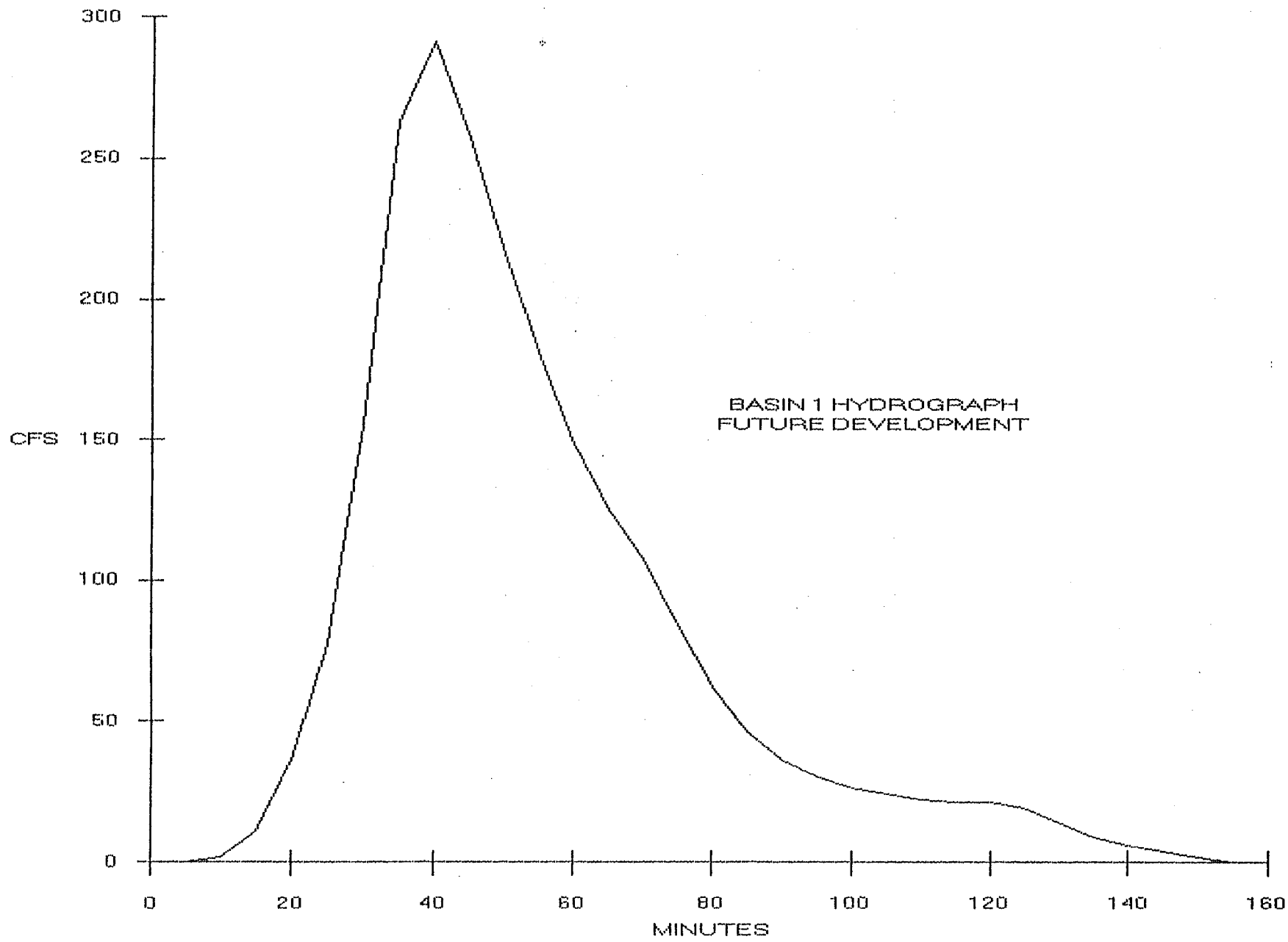
Allowable Major Storm Runoff Inundation

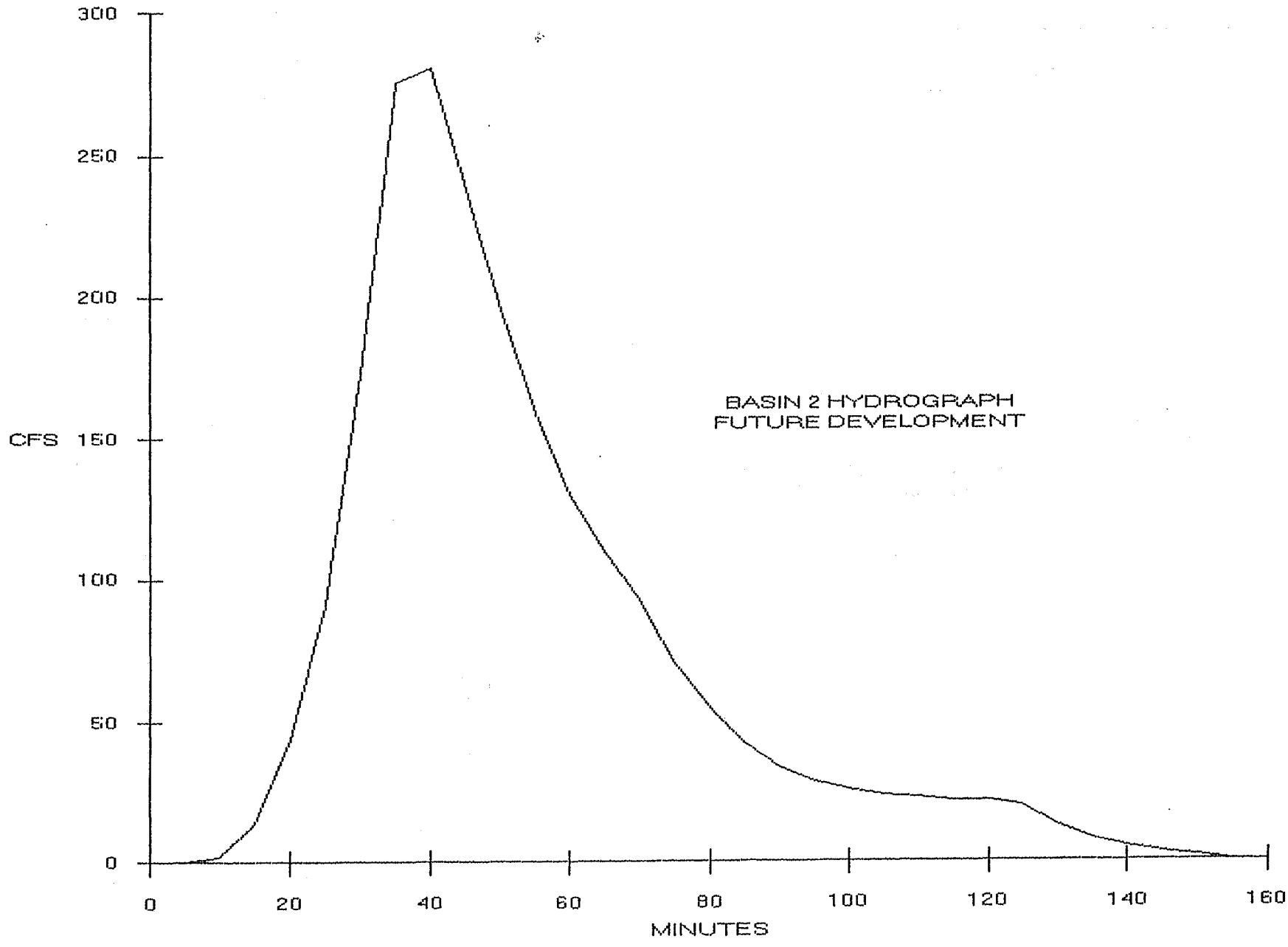
Street Classification	Major Storm Frequency	Allowable Depth and Inundated Areas
Local	100-year	Residential dwellings, public, commercial, and industrial buildings, shall not be inundated at the ground line, unless buildings are flood-proofed. The depth of water over the gutter flowline shall not exceed 18 inches and the product of the depth and the velocity shall not exceed a value of 5.0 square feet per second.
Collector	100-year	Residential dwellings, public, commercial, and industrial buildings, shall not be inundated at the ground line, unless buildings are flood-proofed. The depth of water over the gutter flowline shall not exceed 12 inches and the product of the depth and the velocity shall not exceed a value of 5.0 square feet per second.
Arterial	100-year	Residential dwellings, public, commercial, and industrial buildings, shall not be inundated at the ground line, unless buildings are flood-proofed. The street crown of a typical section should be free of water. The depth of water over the gutter flowline shall not exceed 6 inches and the product of the depth and the velocity shall not exceed a value of 4.0 square feet per second.

APPENDIX A

DESIGN PLAN HYDROGRAPHS

This appendix contains design plan hydrographs for sub-basins, direct flow elements and detention ponds. The hydrographs are for design plan conditions which are future land use and design plan hydraulic conditions. The hydrographs are in numerical order.


BASIN 1 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
MINUTES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FUTURE DEVELOPMENT
CFS
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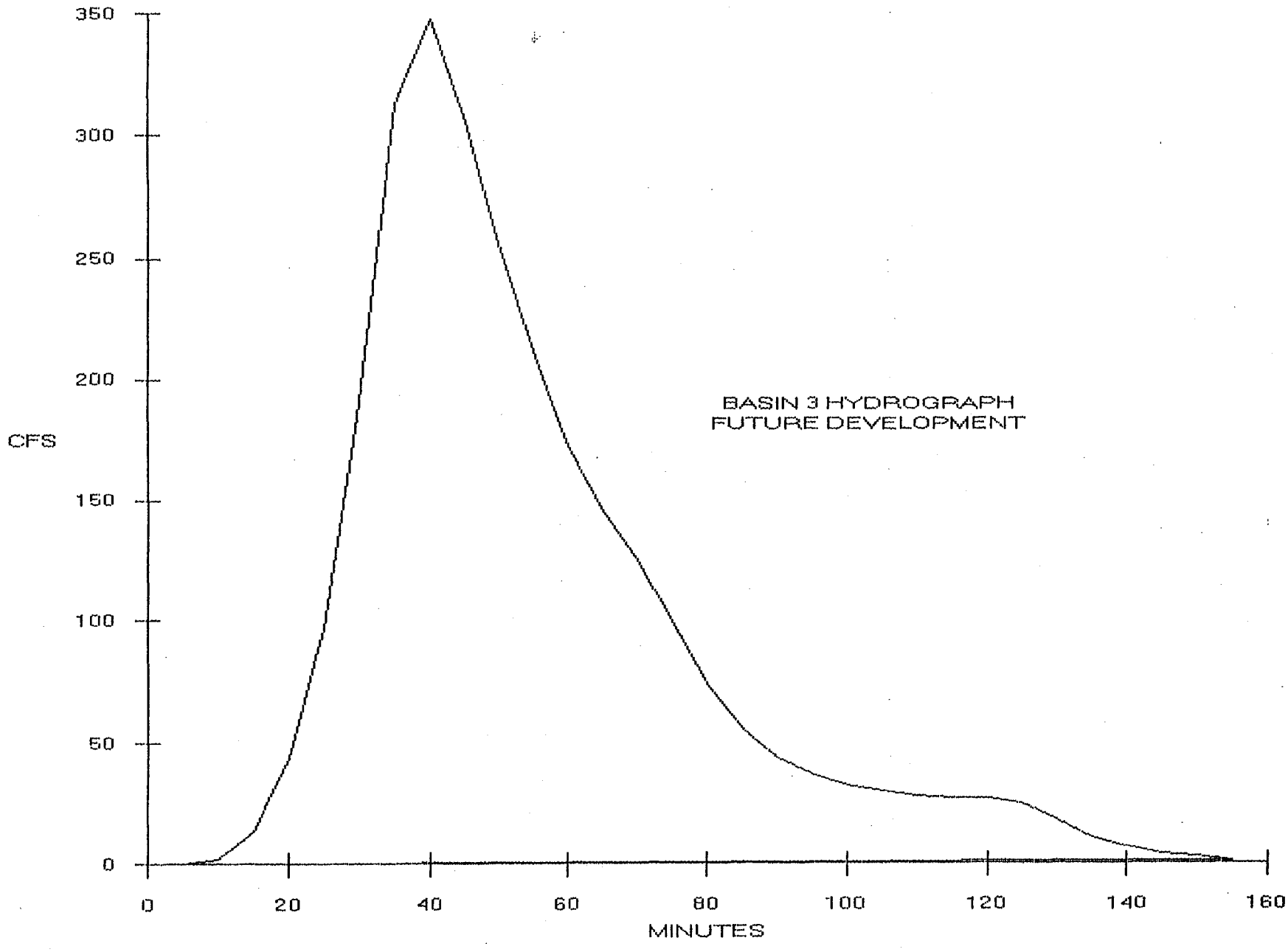
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
MINUTES


BASIN 3 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
350
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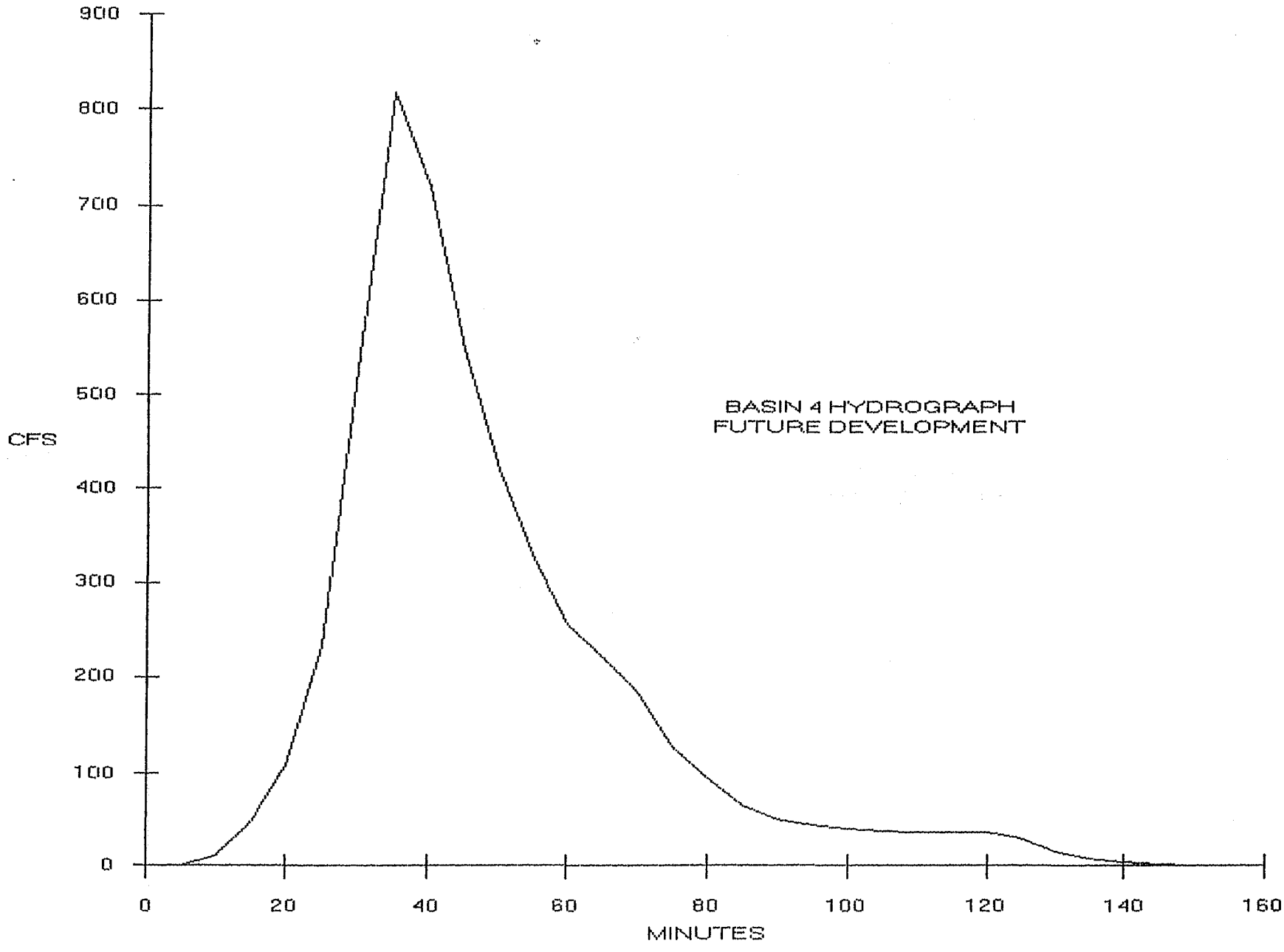
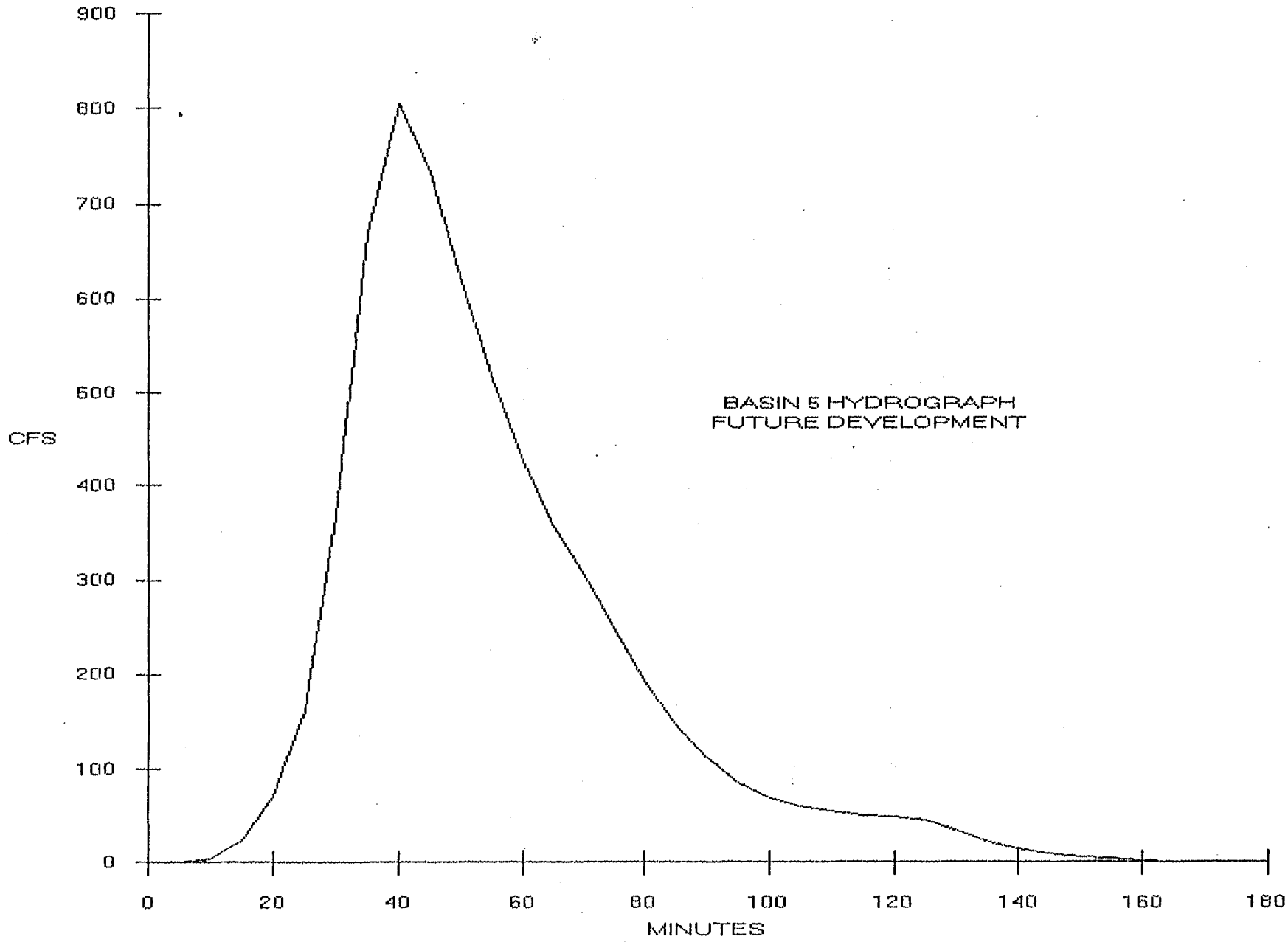
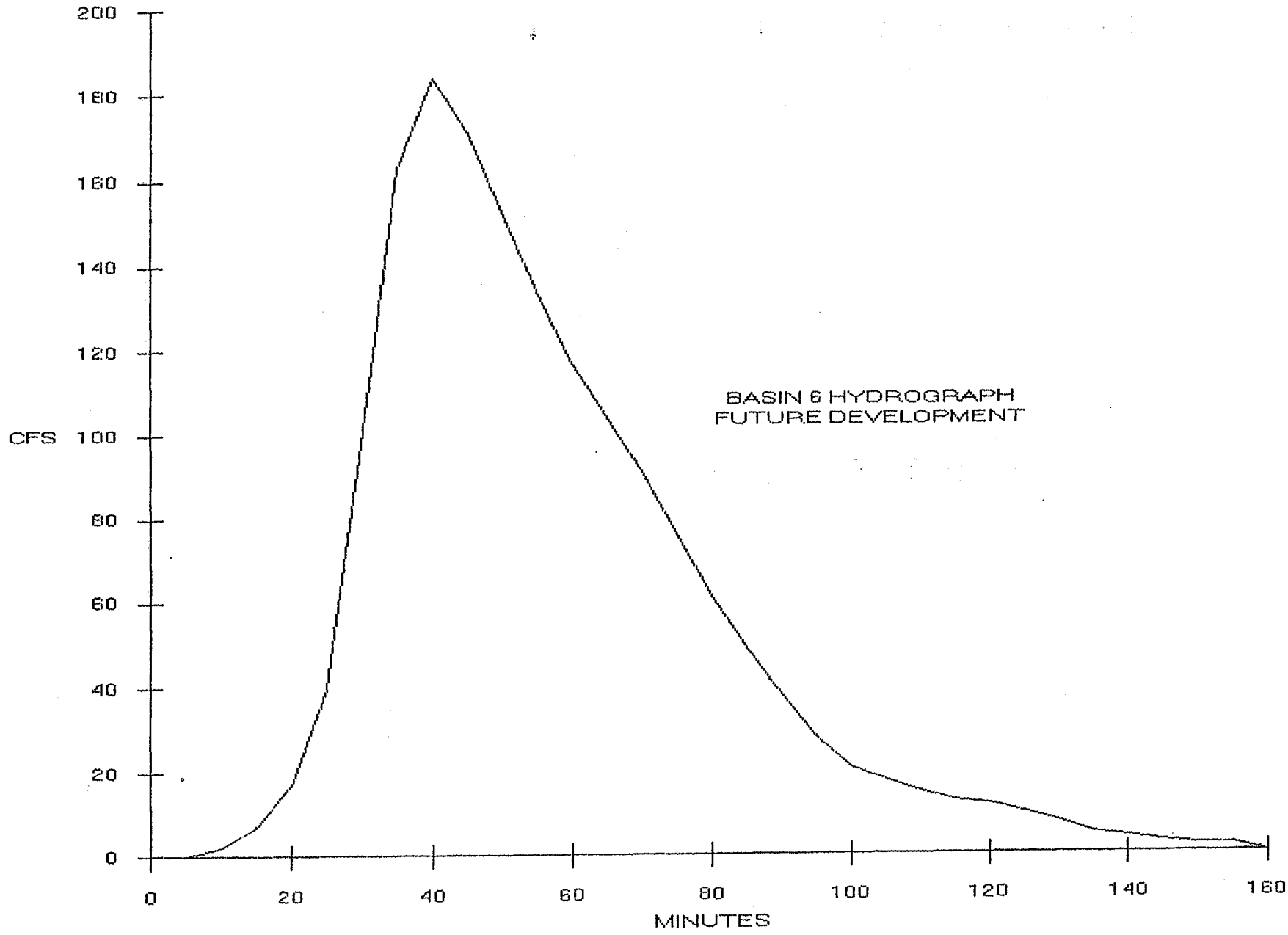
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
MINUTES


BASIN 4 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
900
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
MINUTES


BASIN 5 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
900
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
180
MINUTES


BASIN 6 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
200
180
160
140
120
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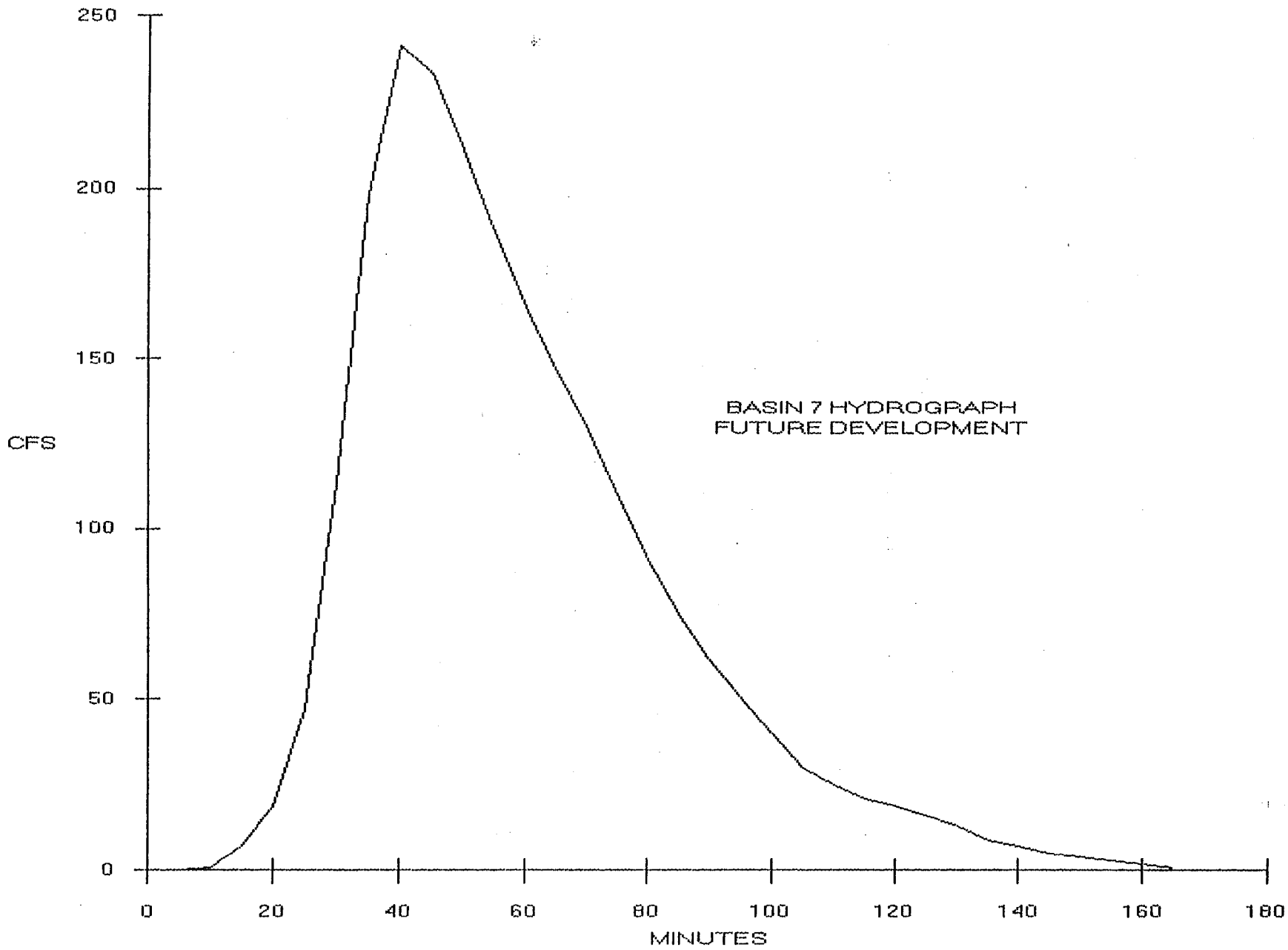
160
MINUTES


BASIN 7 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
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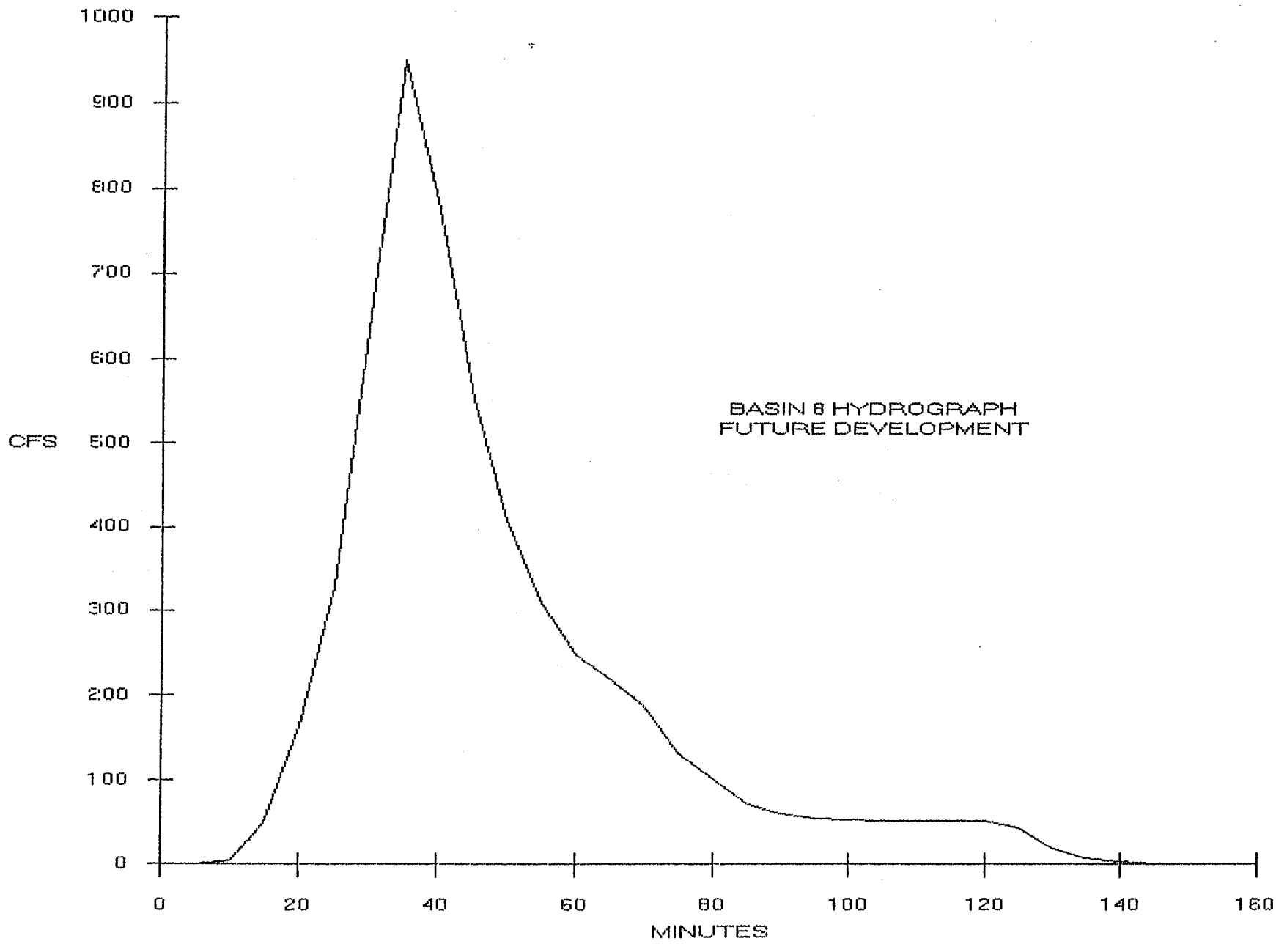
MINUTES


BASIN 8 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
1000
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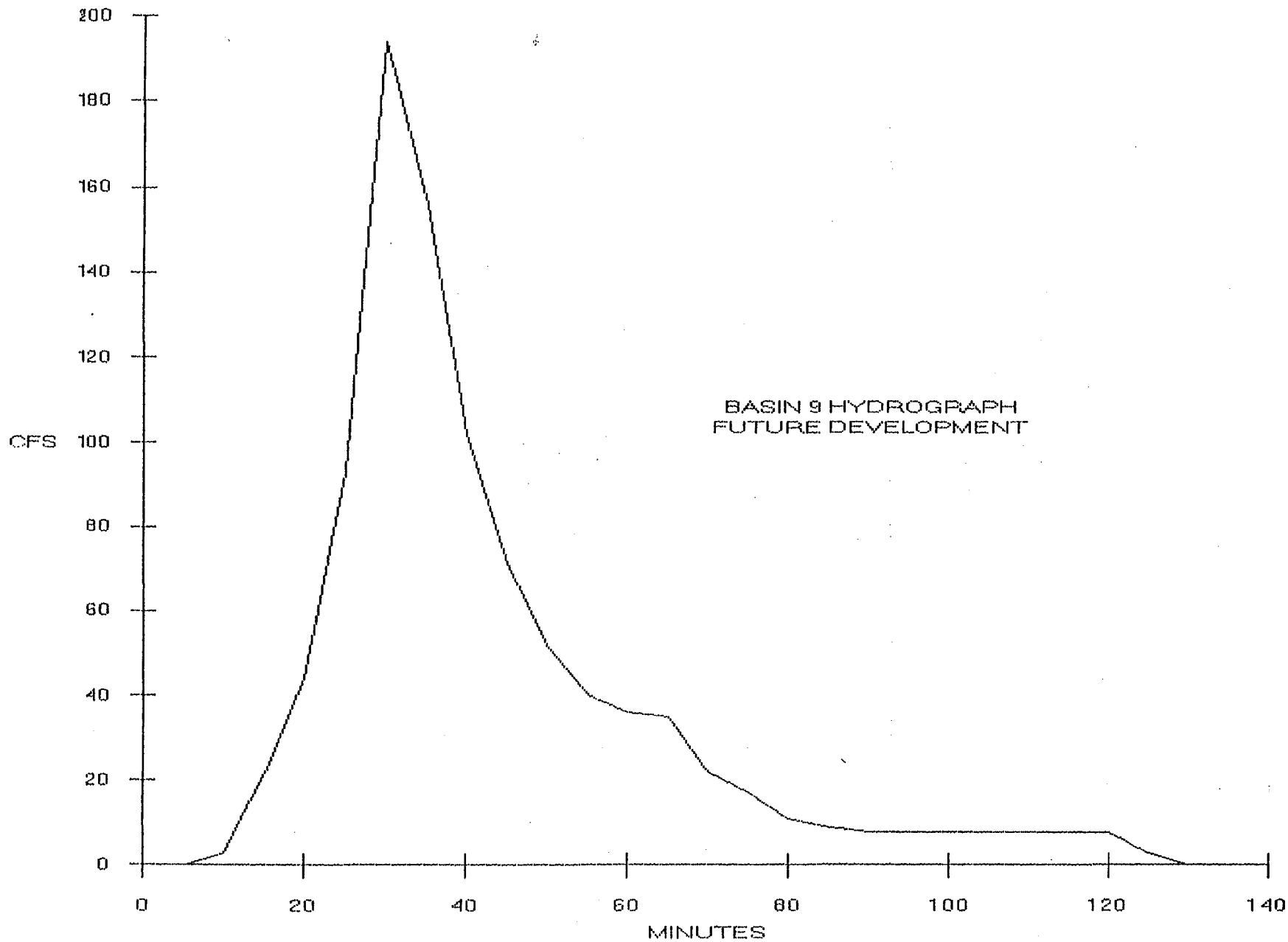
MINUTES


BASIN 9 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
200
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40
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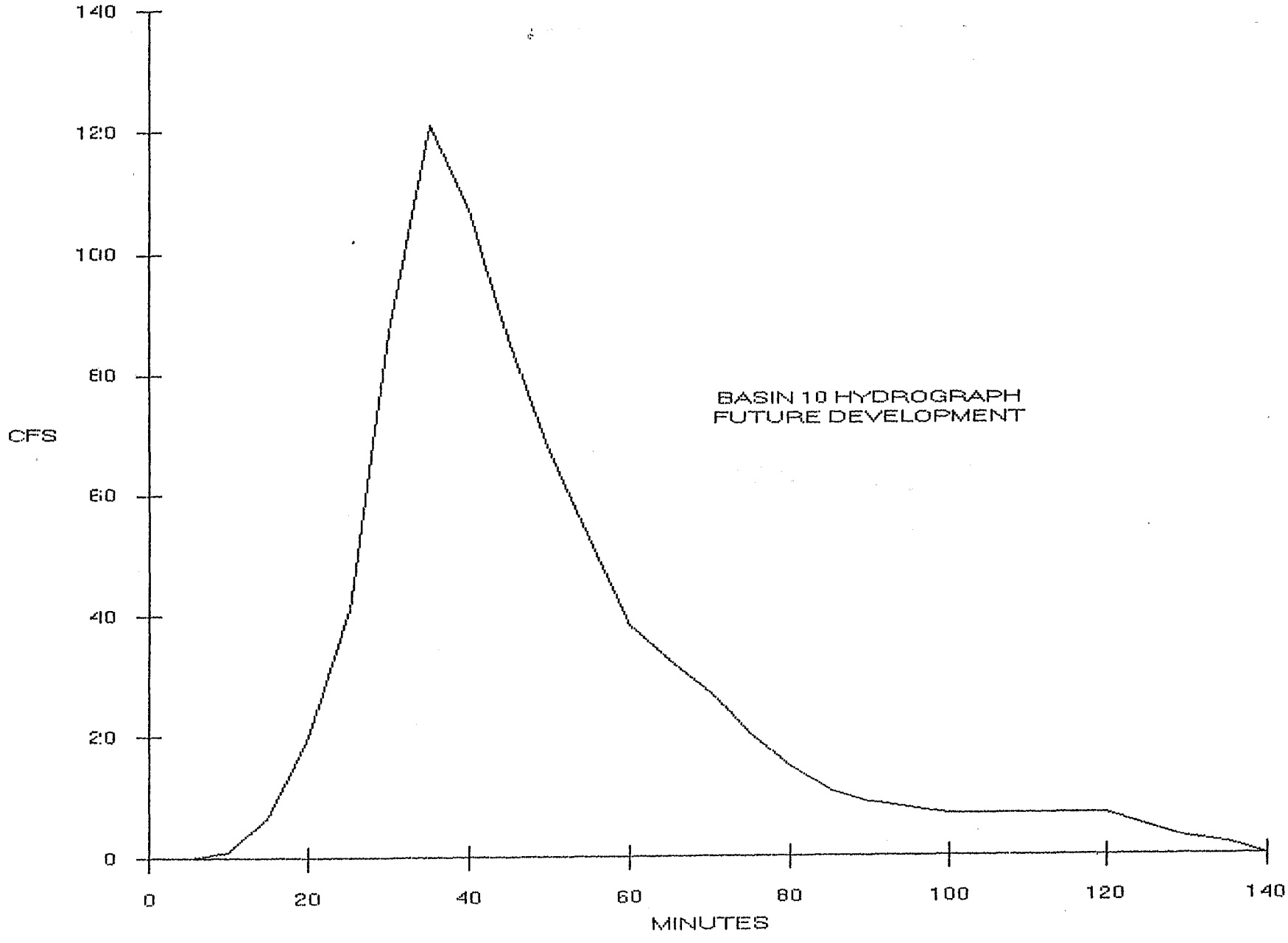
100
120
140
MINUTES


BASIN 10 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
140
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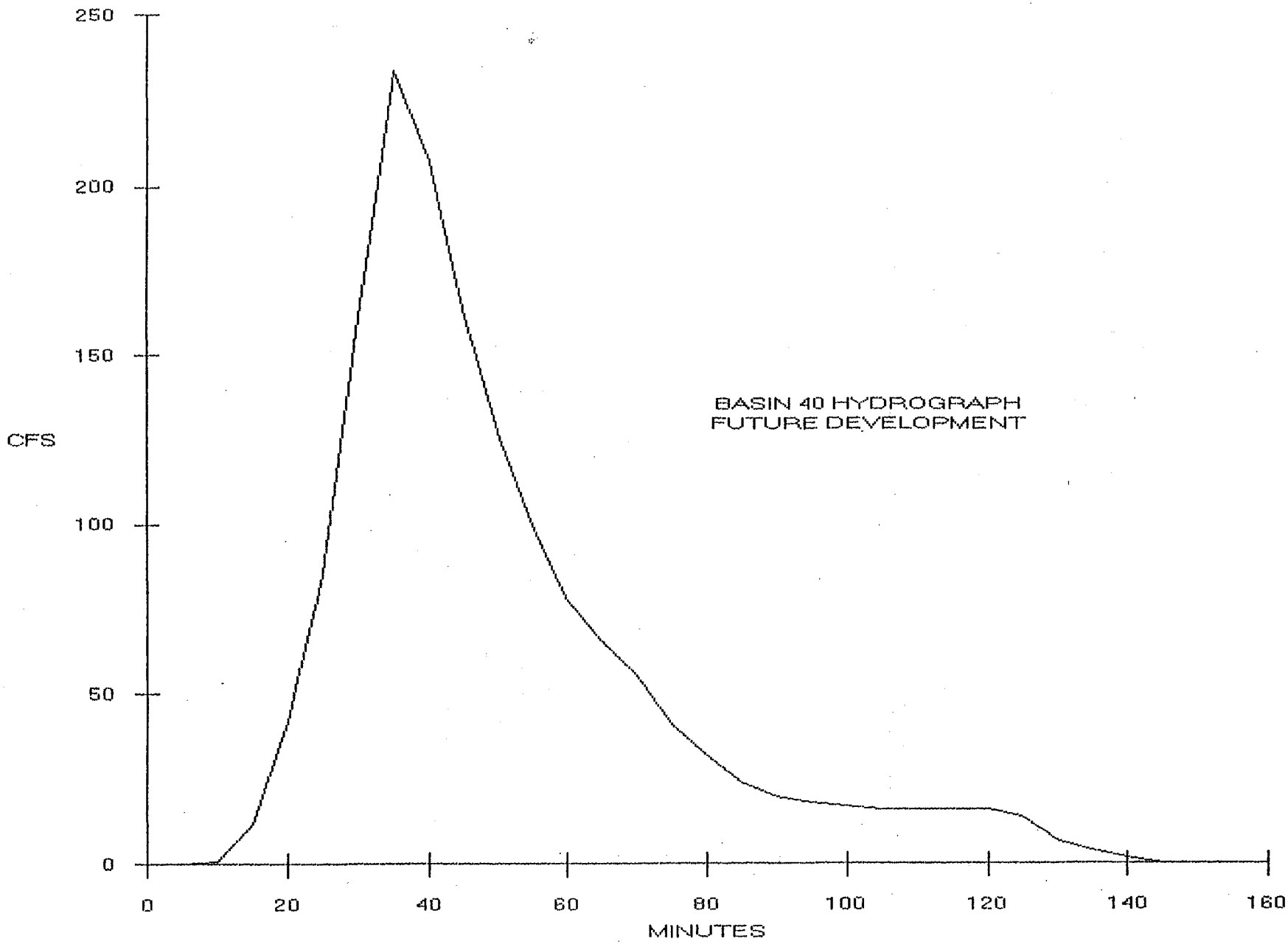
120
140
MINUTES


BASIN 40 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
250
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100
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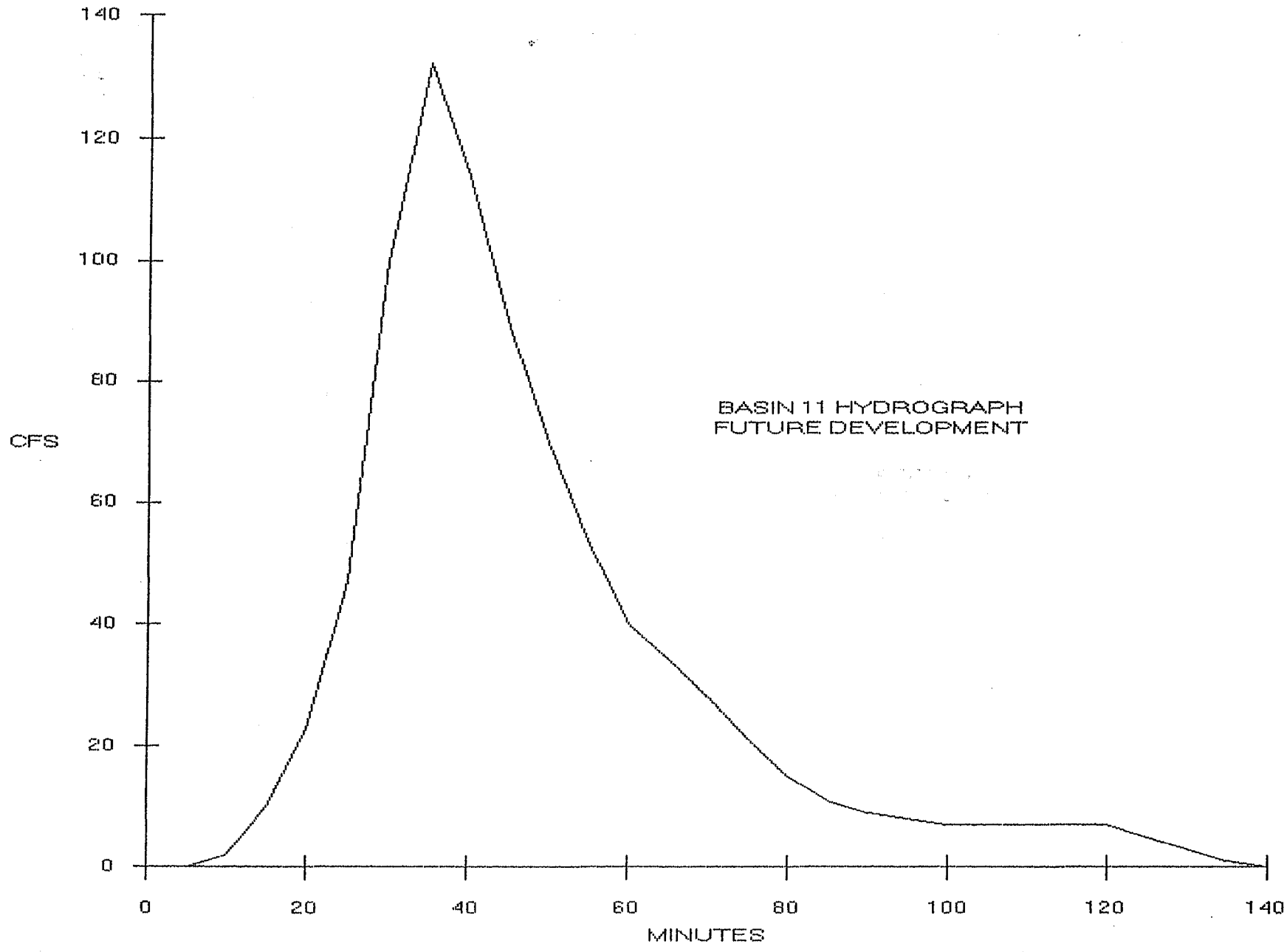
140
160
MINUTES


BASIN 11 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
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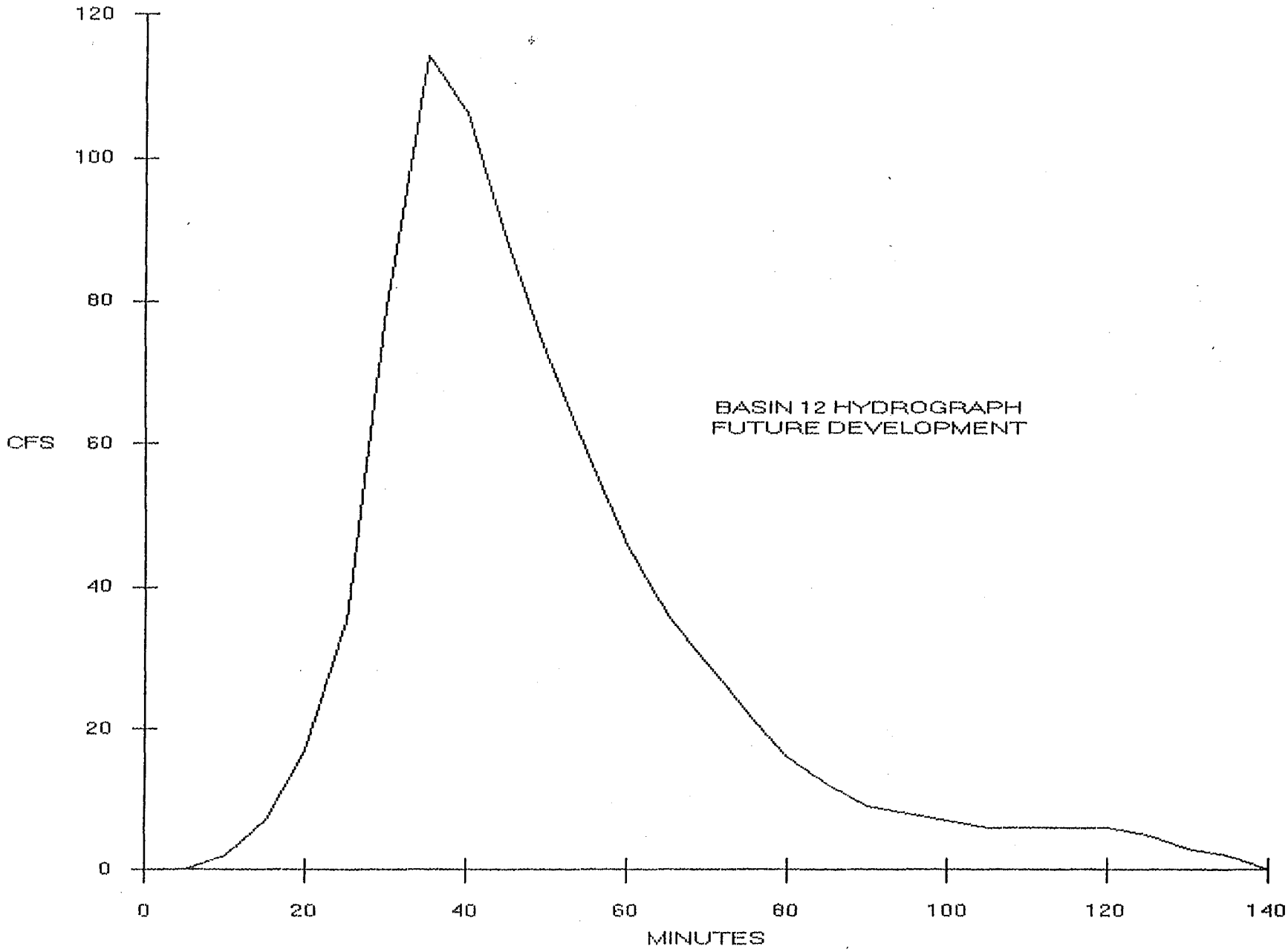
120
140
MINUTES


BASIN 12 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
120
100
80
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20
40
60
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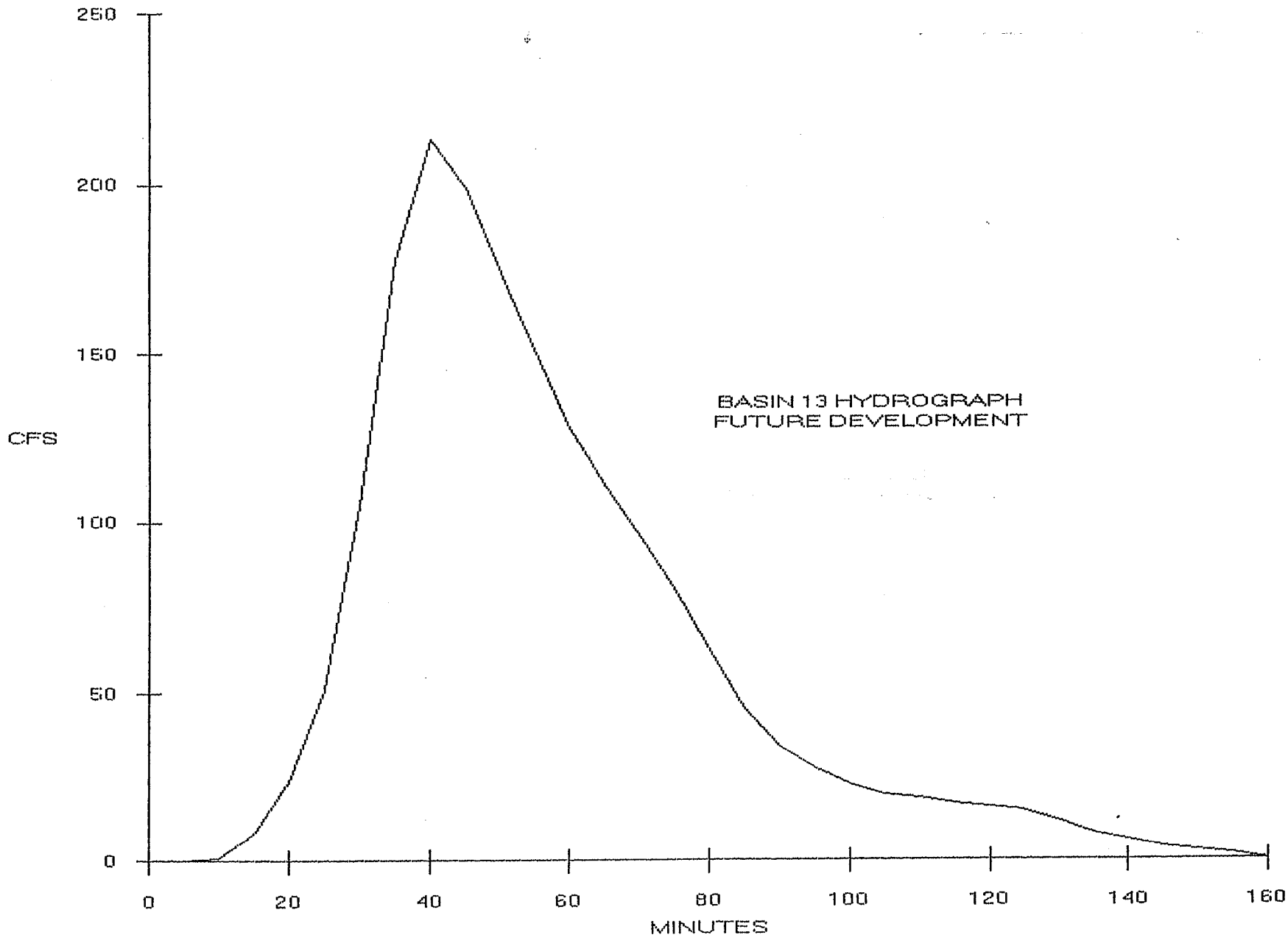
100
120
140
MINUTES


BASIN 13 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
250
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100
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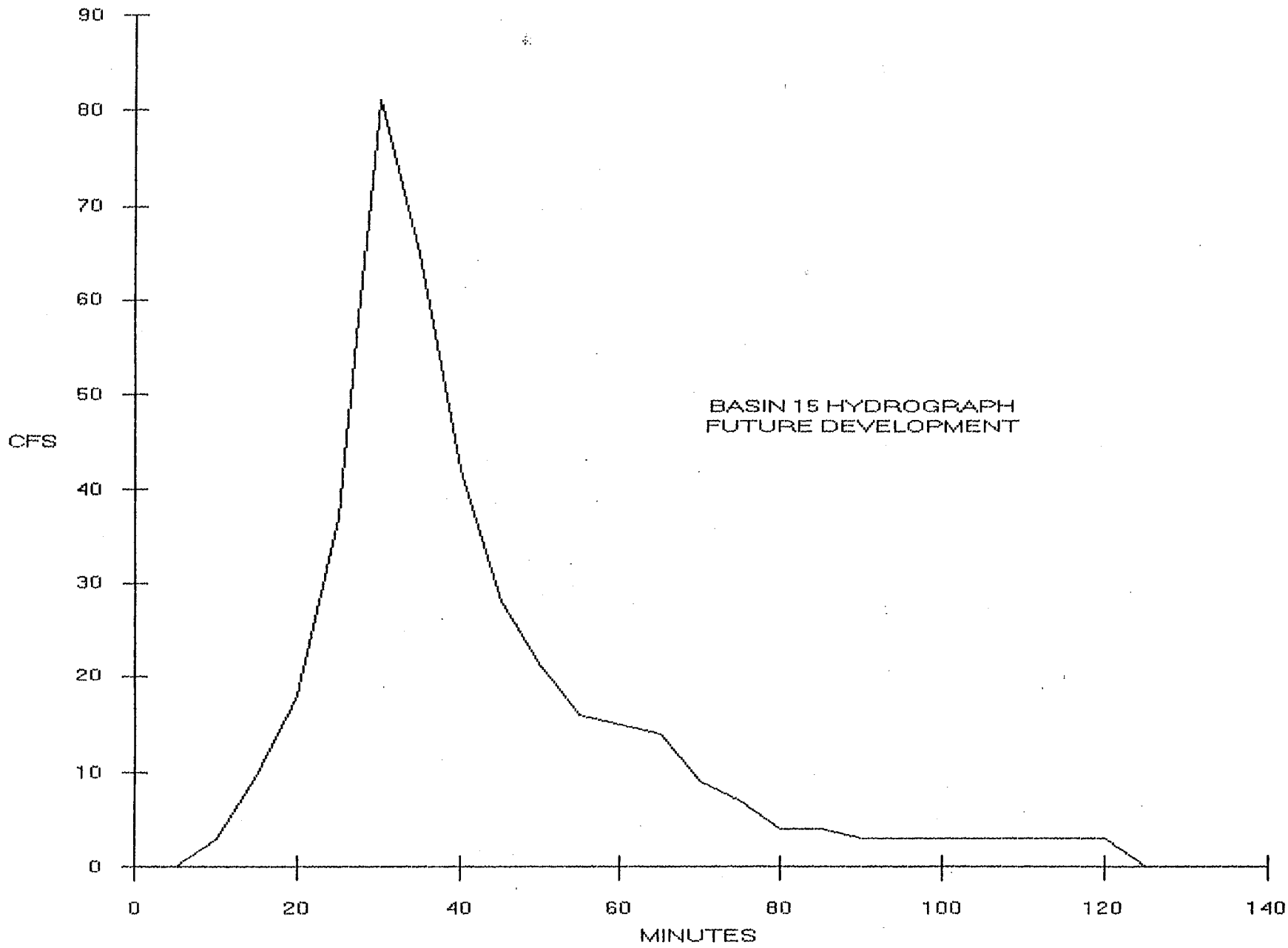
160
MINUTES


BASIN 15 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
90
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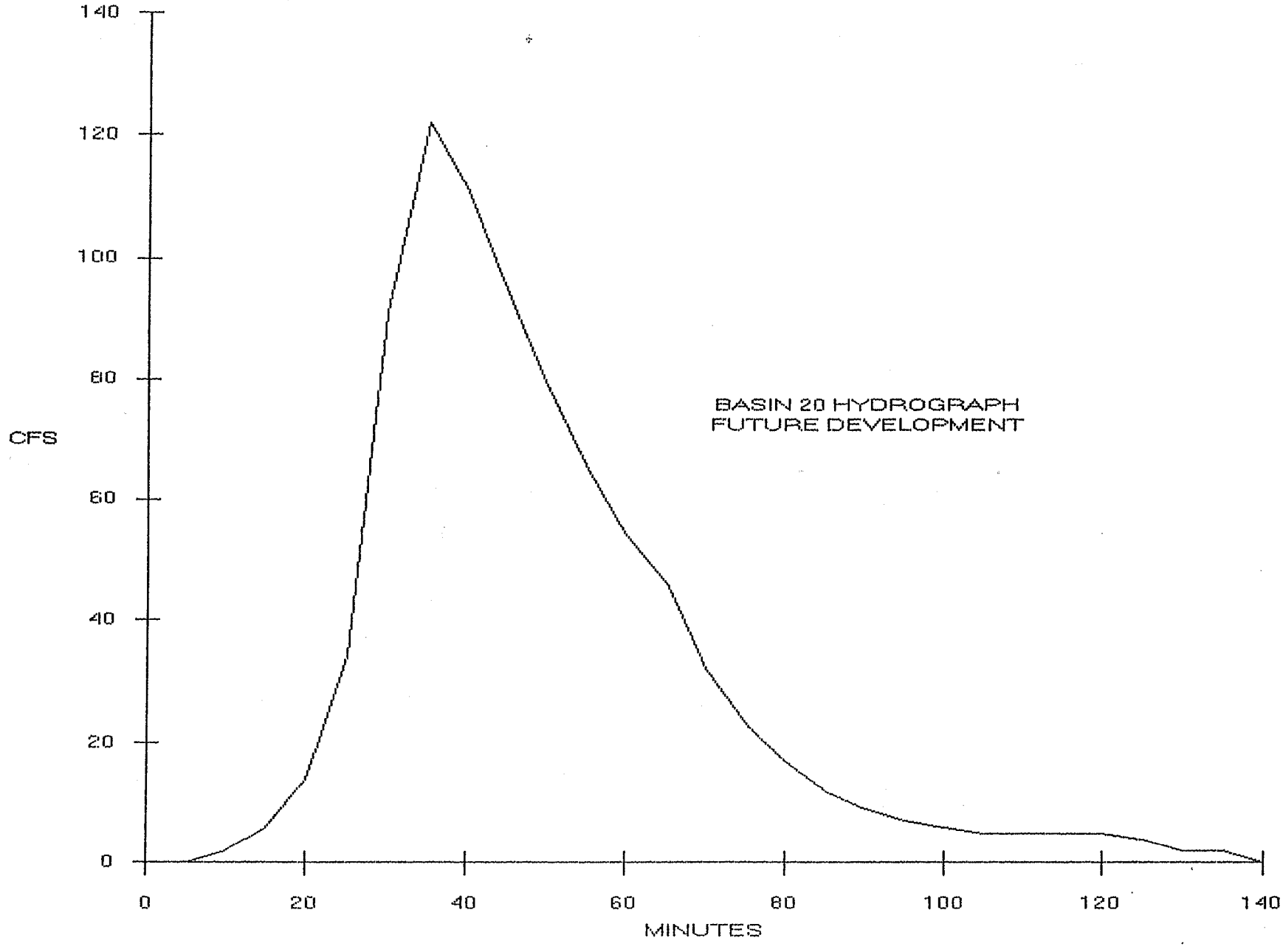
100
120
140
MINUTES


BASIN 20 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
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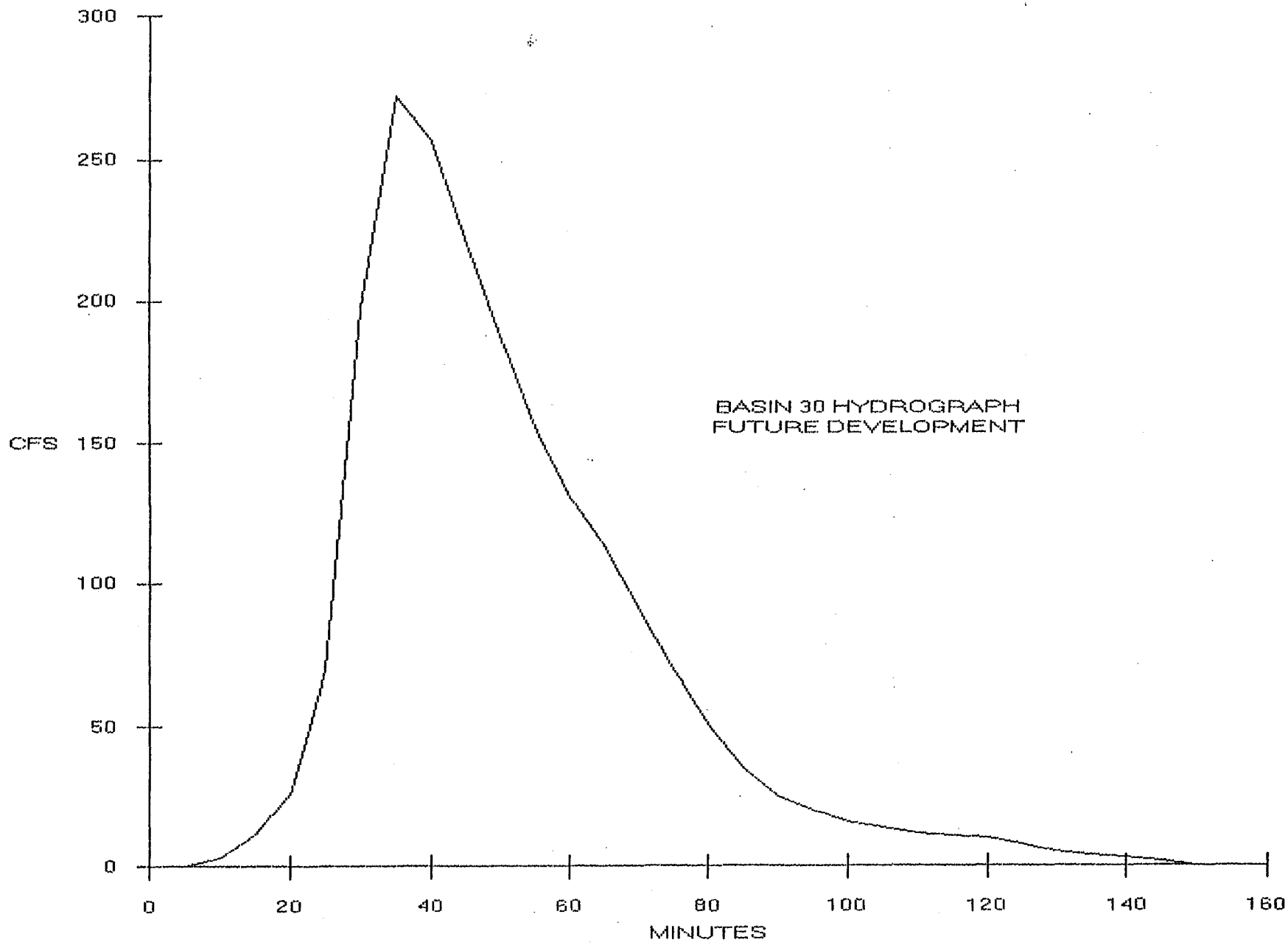
120
140
MINUTES


BASIN 30 HYDROGRAPH
FUTURE DEVELOPMENT
CFS
300
250
200
150
100
50
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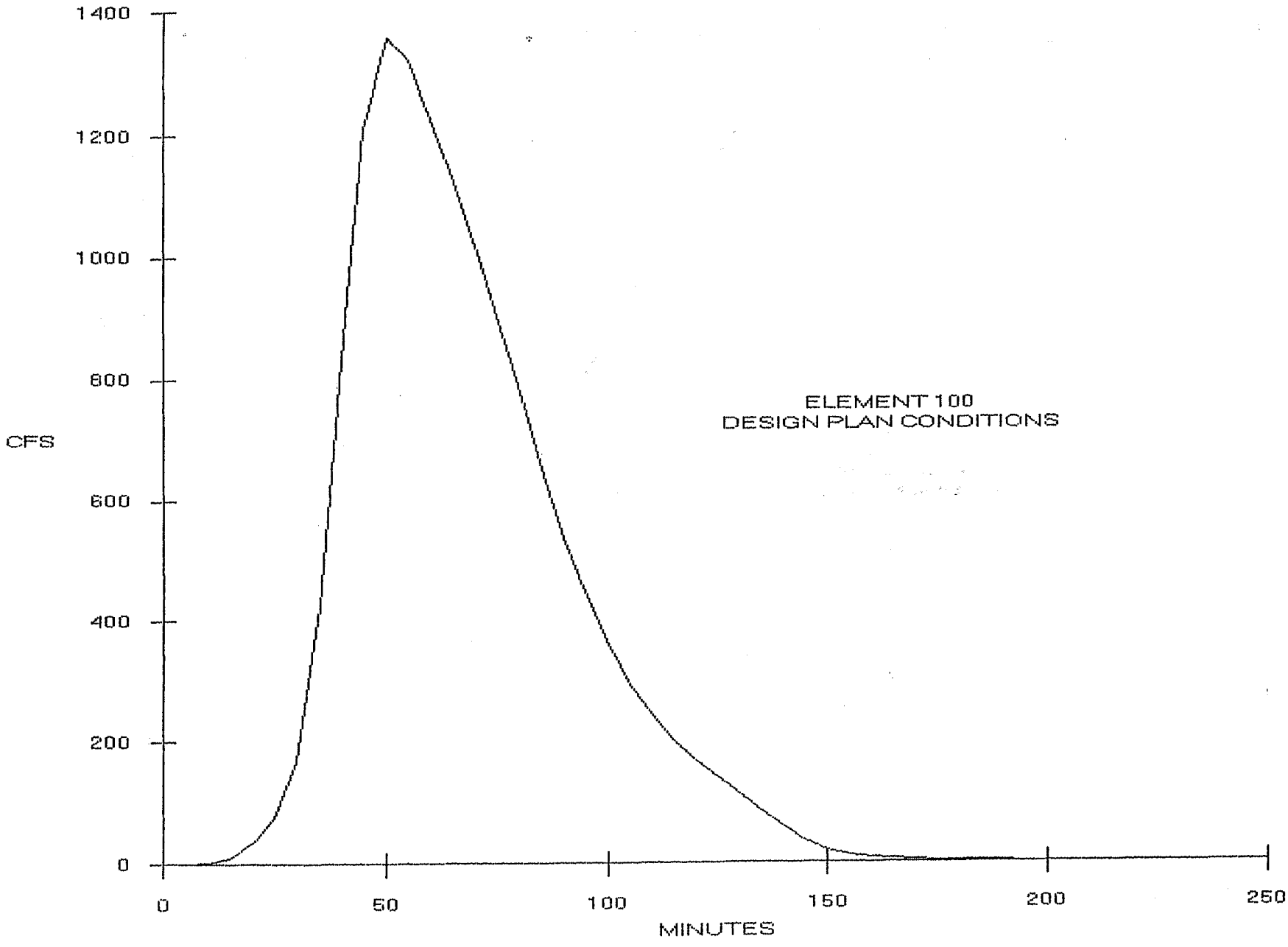
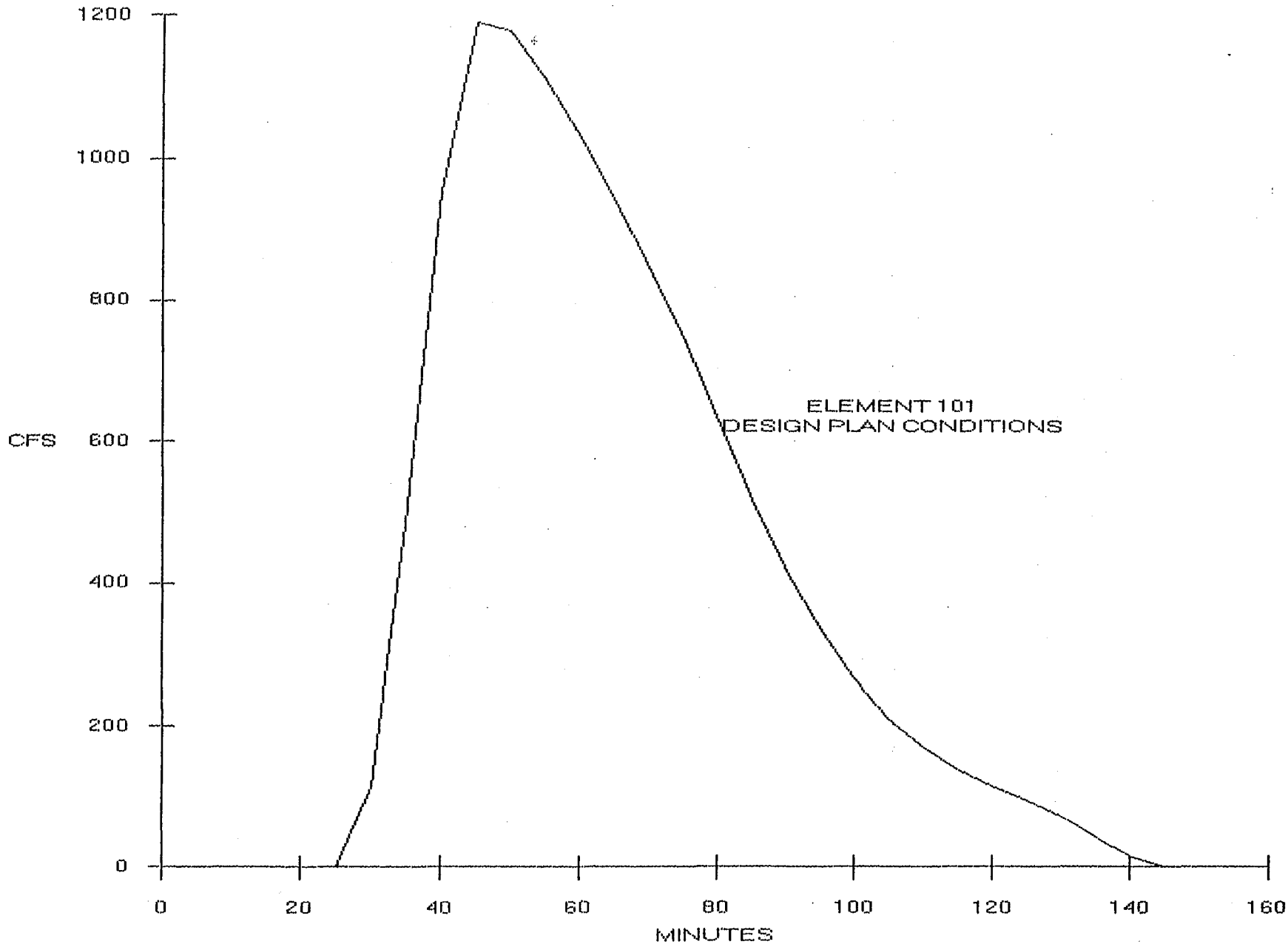
60
80
100
120
140
160
MINUTES


ELEMENT 100
DESIGN PLAN CONDITIONS
CFS
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
MINUTES


1200
1000
800
600
400
200
0
CFS
ELEMENT 101
DESIGN PLAN CONDITIONS
0
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60
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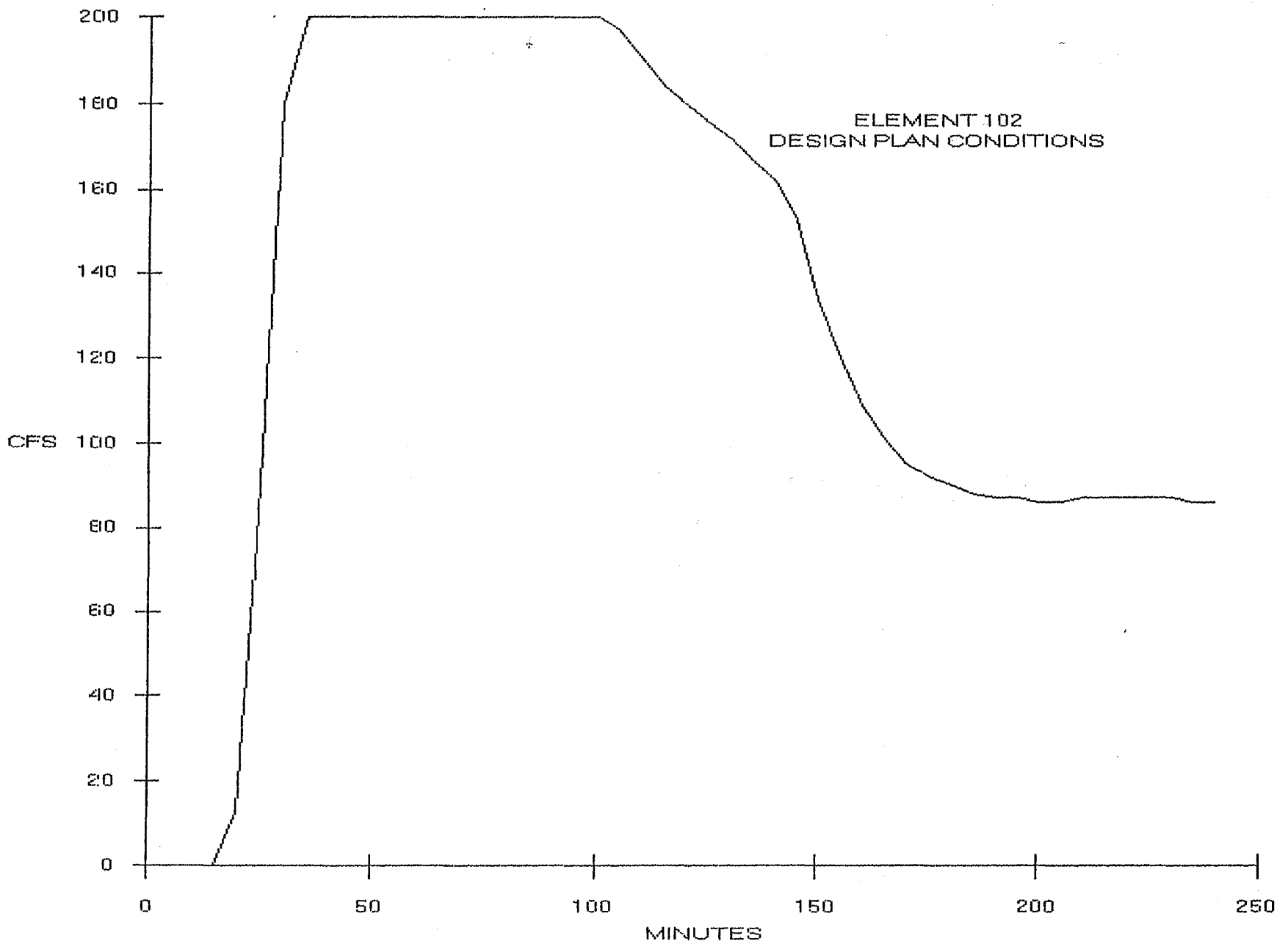
140
160
MINUTES


ELEMENT 102
DESIGN PLAN CONDITIONS
CFS
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60
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0
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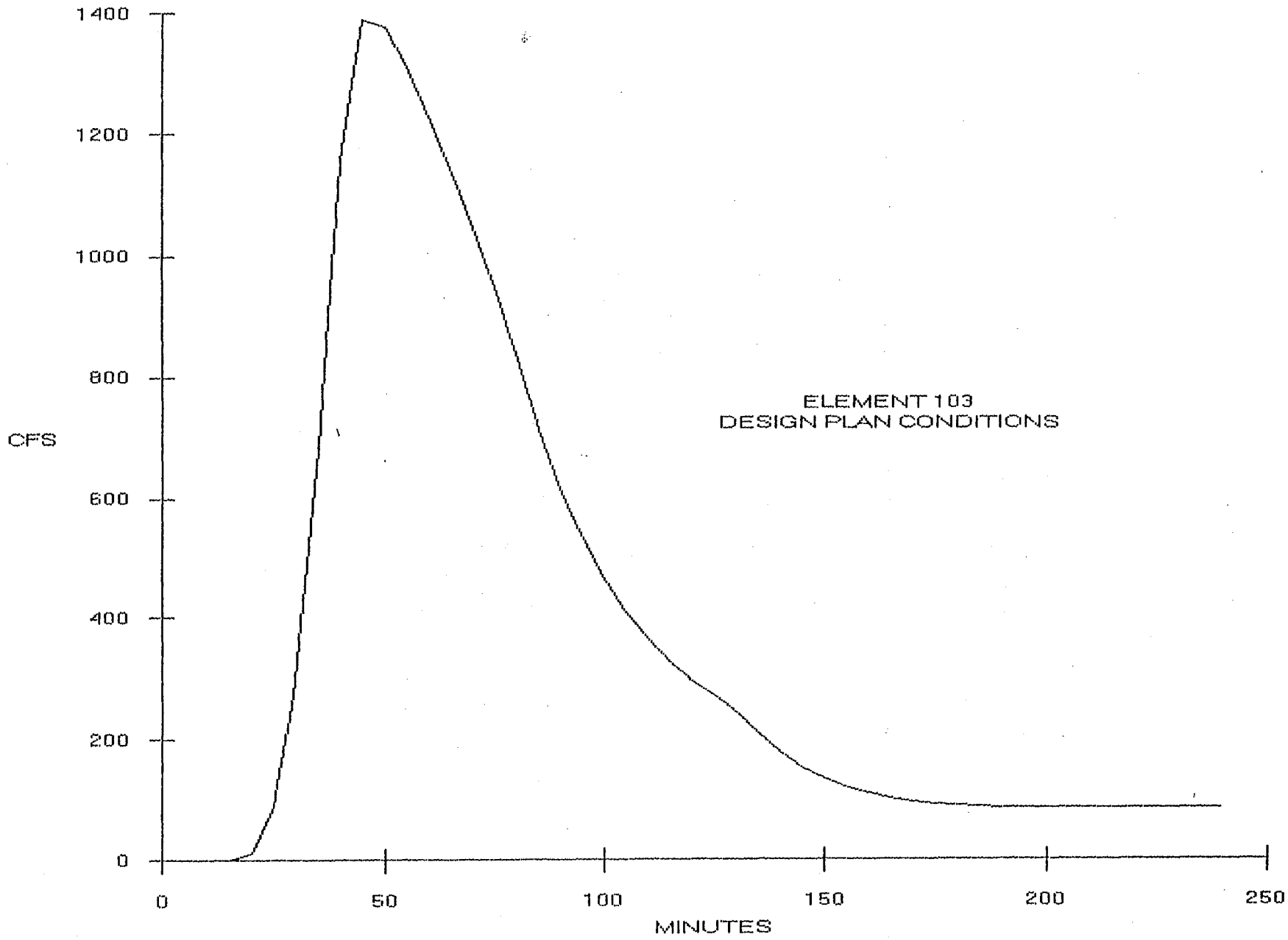
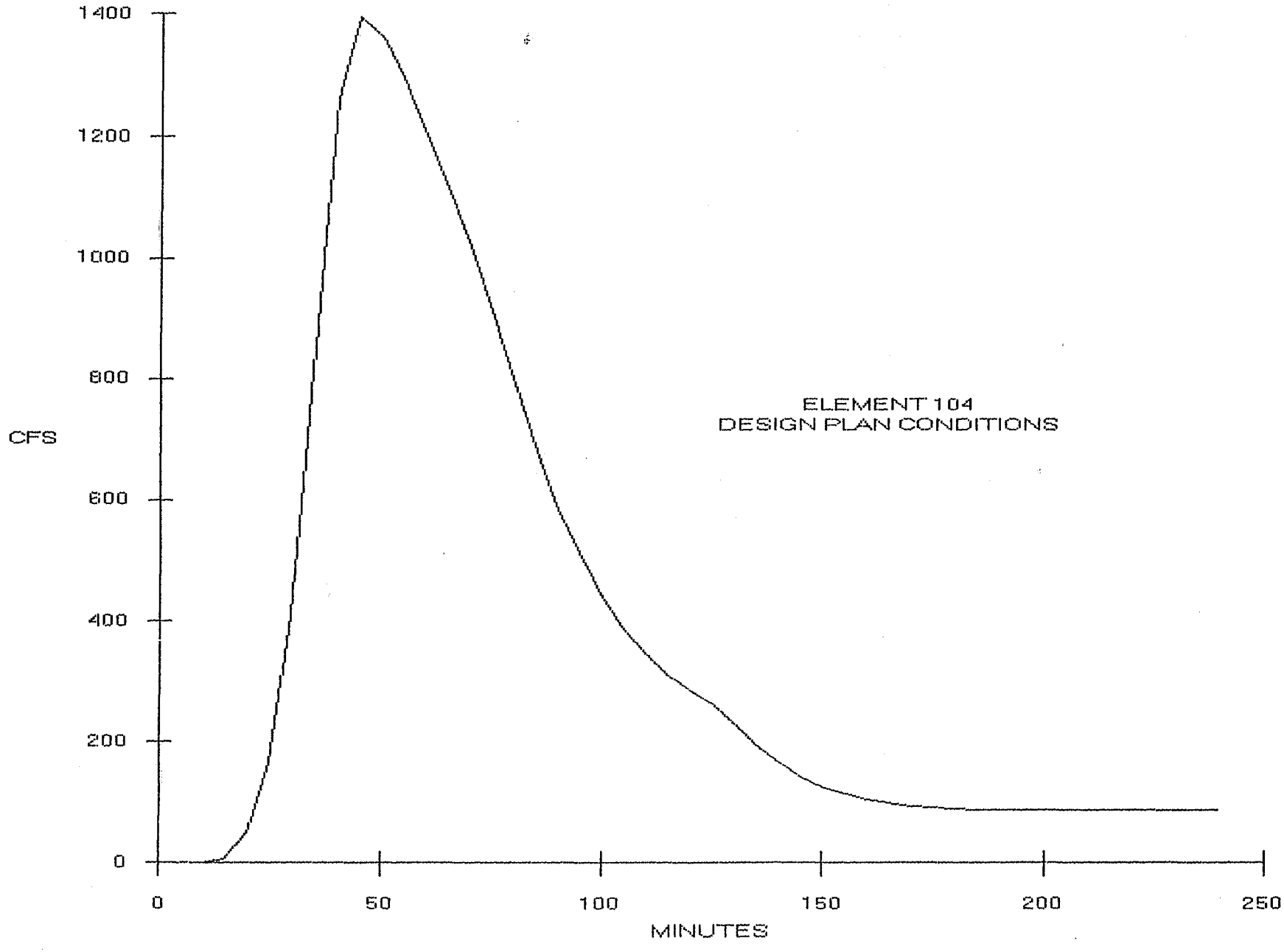
100
150
200
250
MINUTES


ELEMENT 103
DESIGN PLAN CONDITIONS
CFS
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
MINUTES


ELEMENT 104
DESIGN PLAN CONDITIONS
CFS
1400
1200
1000
800
600
400
200
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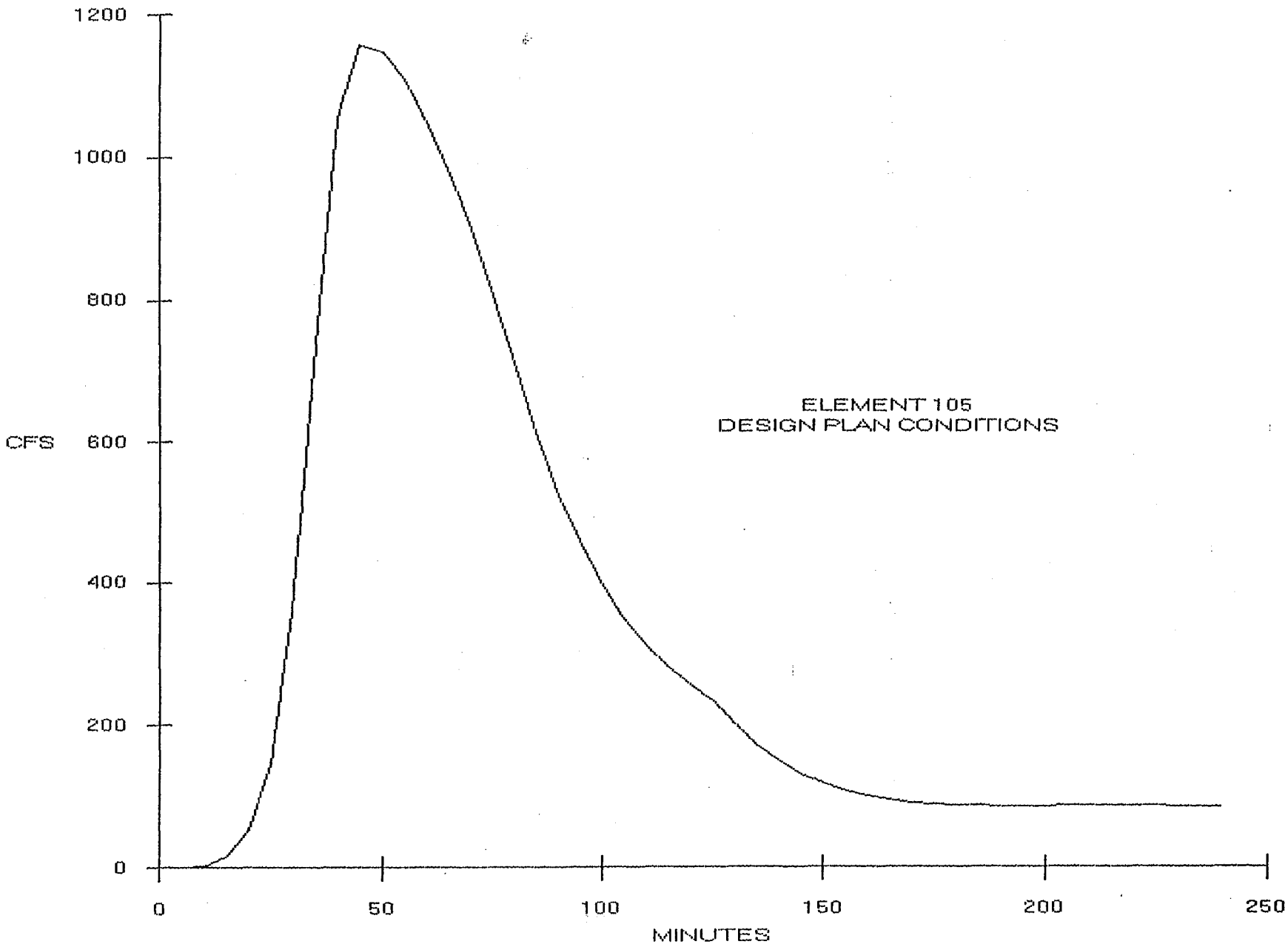
50
100
150
200
250
MINUTES


ELEMENT 105
DESIGN PLAN CONDITIONS
CFS
1200
1000
800
600
400
200
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0
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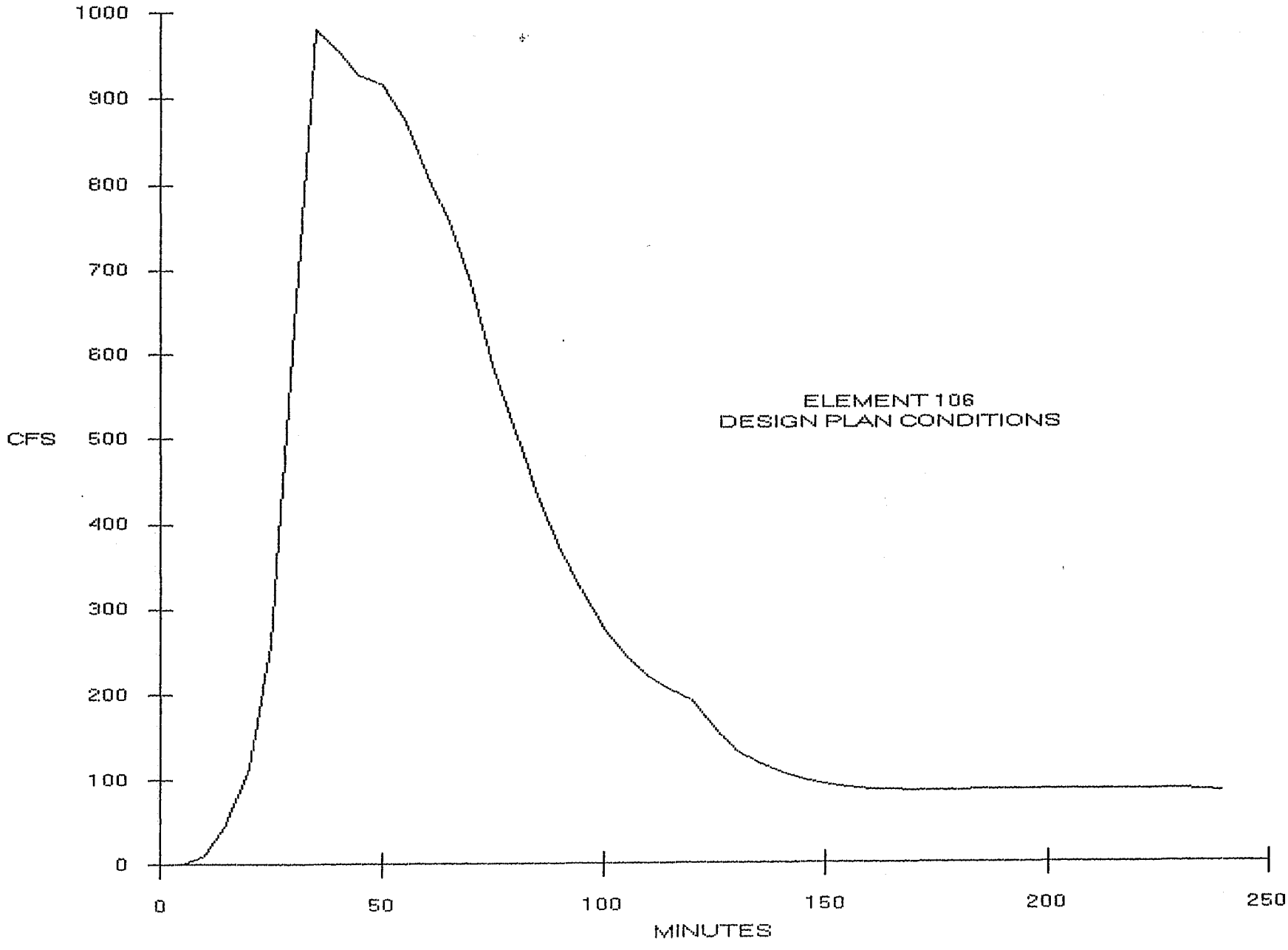
100
150
200
250
MINUTES


ELEMENT 106
DESIGN PLAN CONDITIONS
CFS
1000
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700
600
500
400
300
200
100
0
0
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100
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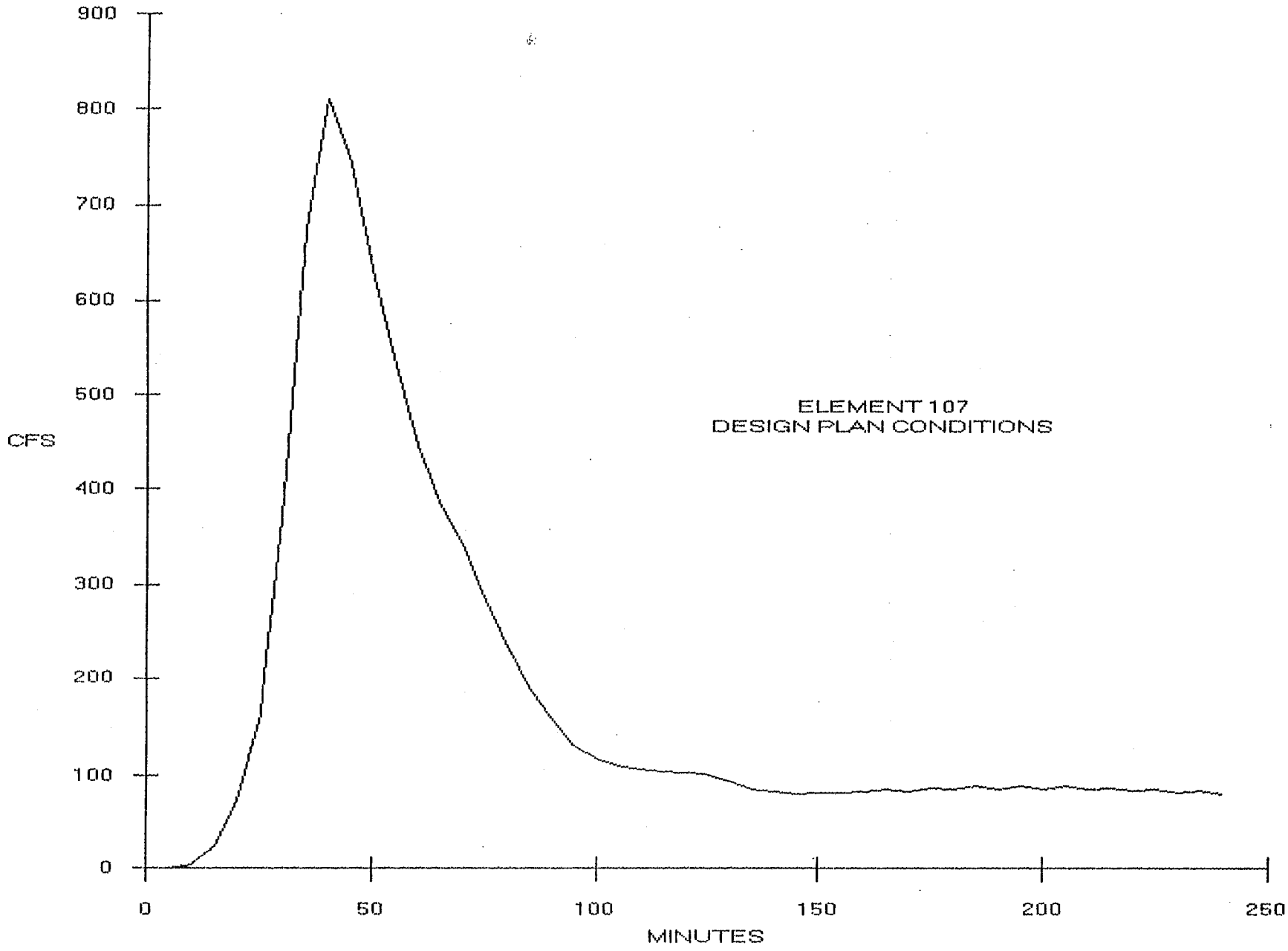
200
250
MINUTES


ELEMENT 107
DESIGN PLAN CONDITIONS
CFS
900
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600
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400
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200
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0
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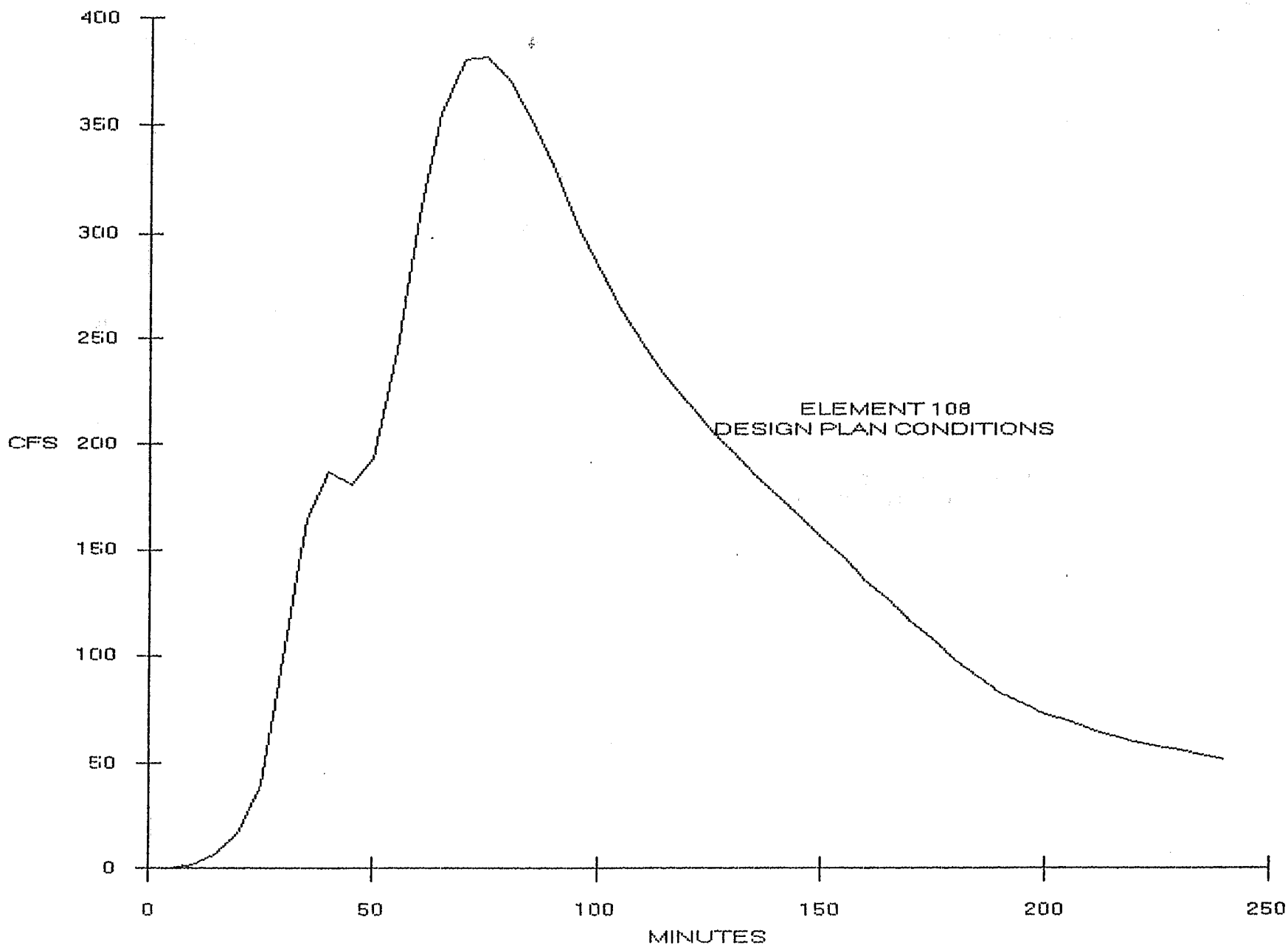
150
200
250
MINUTES


400
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CFS 200
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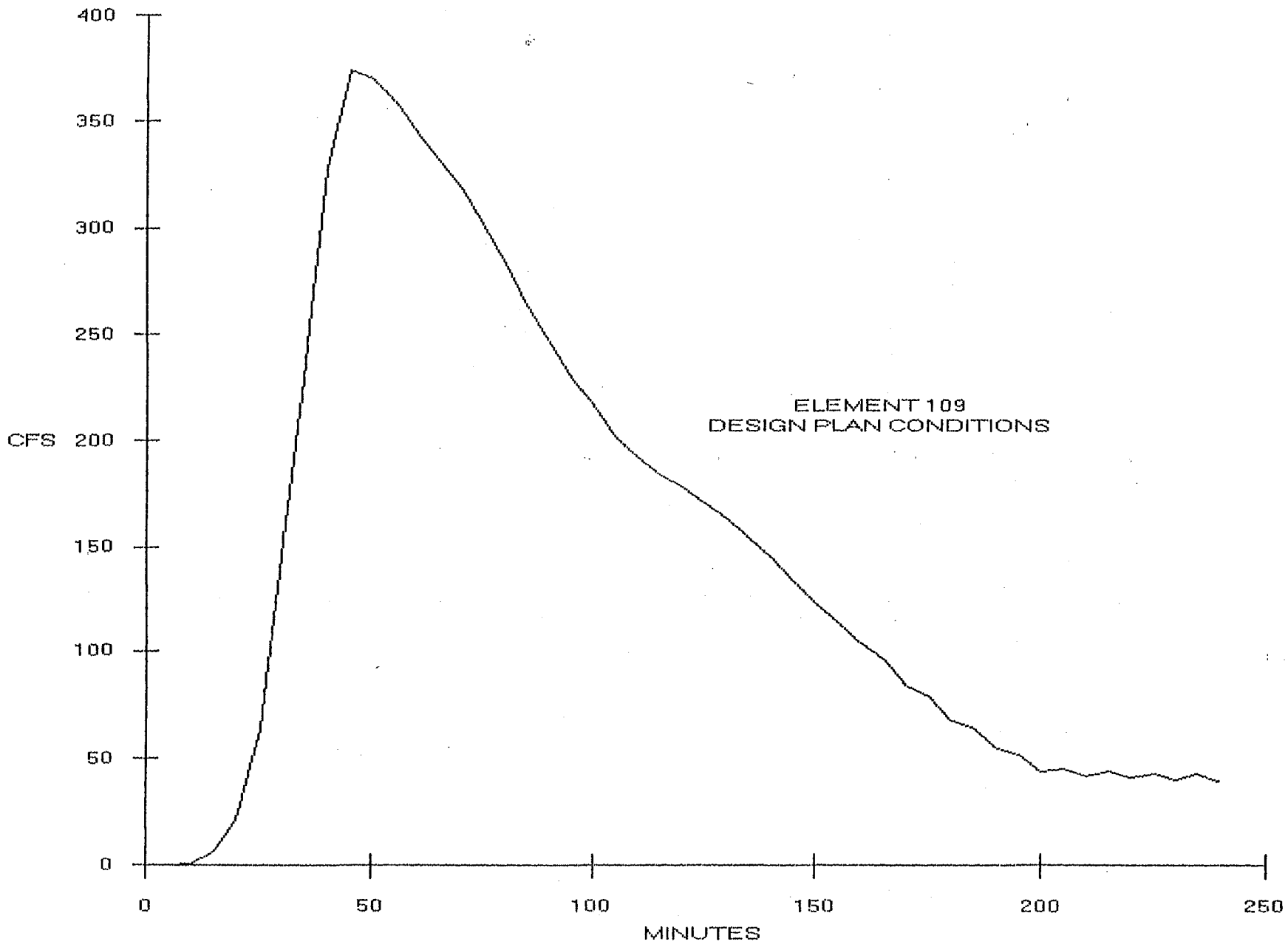
100
150
200
250
MINUTES
ELEMENT 108
DESIGN PLAN CONDITIONS


ELEMENT 109
DESIGN PLAN CONDITIONS
CFS
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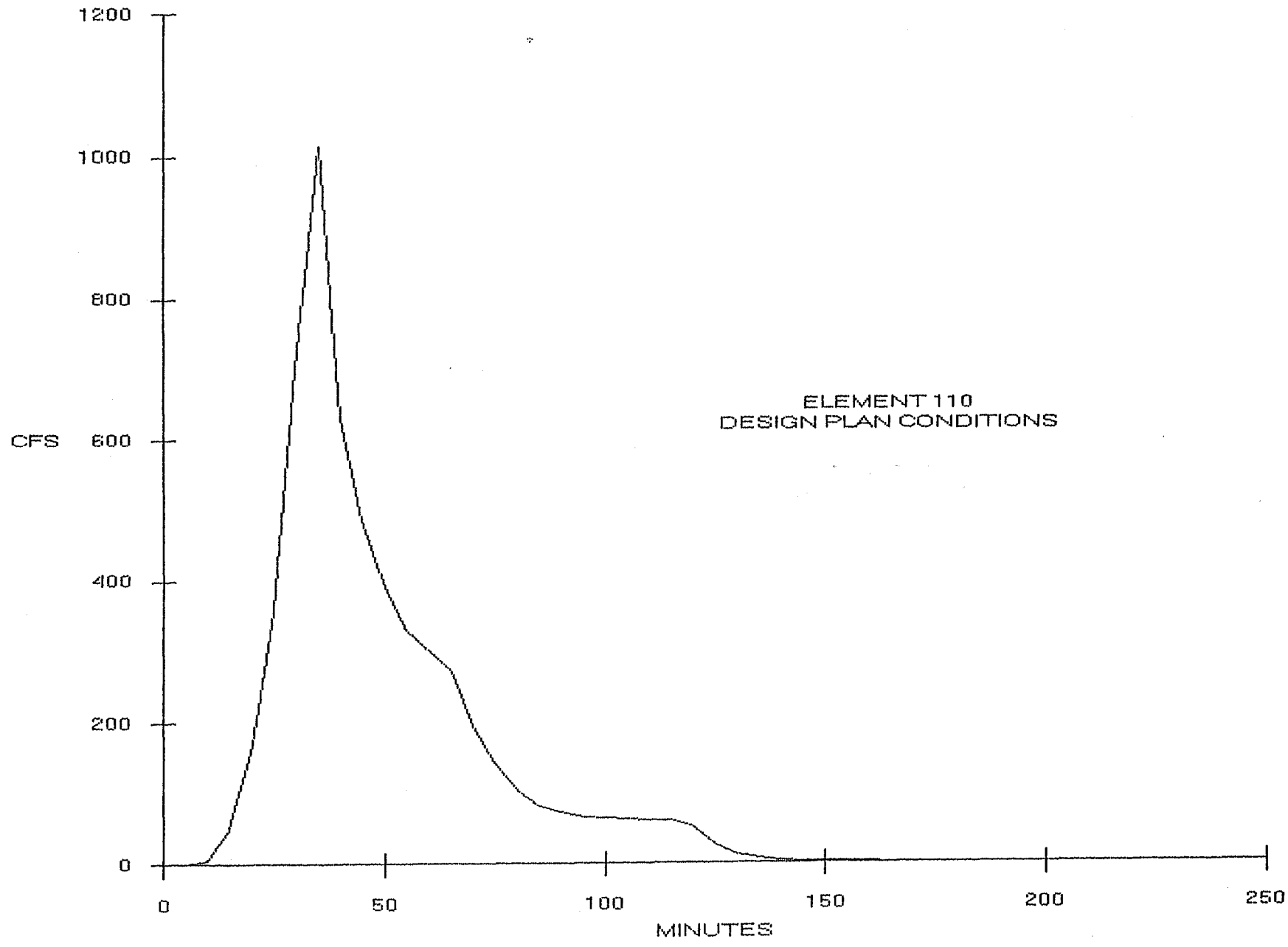
150
200
250
MINUTES


ELEMENT 110
DESIGN PLAN CONDITIONS
CFS
1200
1000
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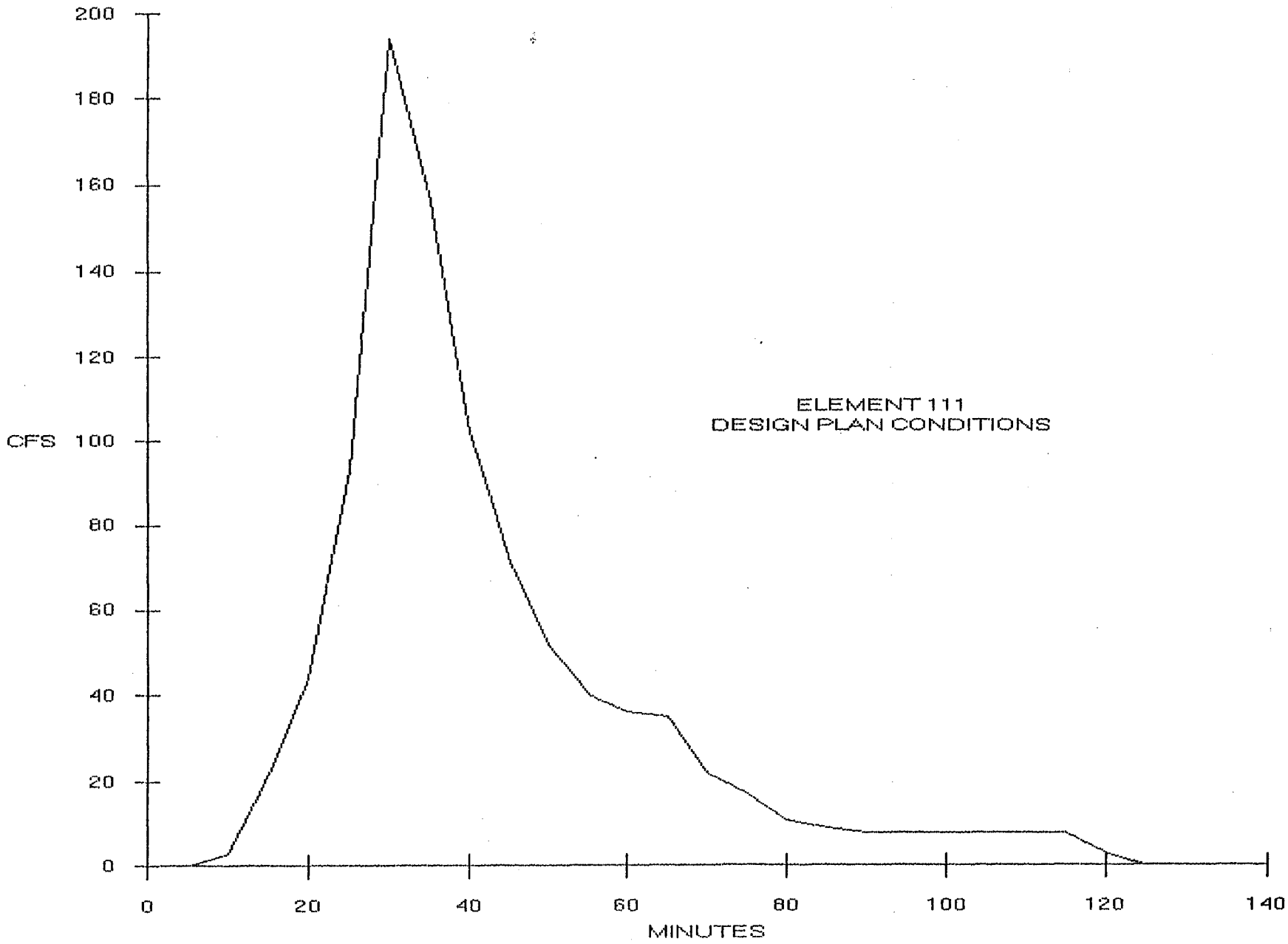
0
50
100
150
200
250
MINUTES


ELEMENT 111
DESIGN PLAN CONDITIONS
CFS
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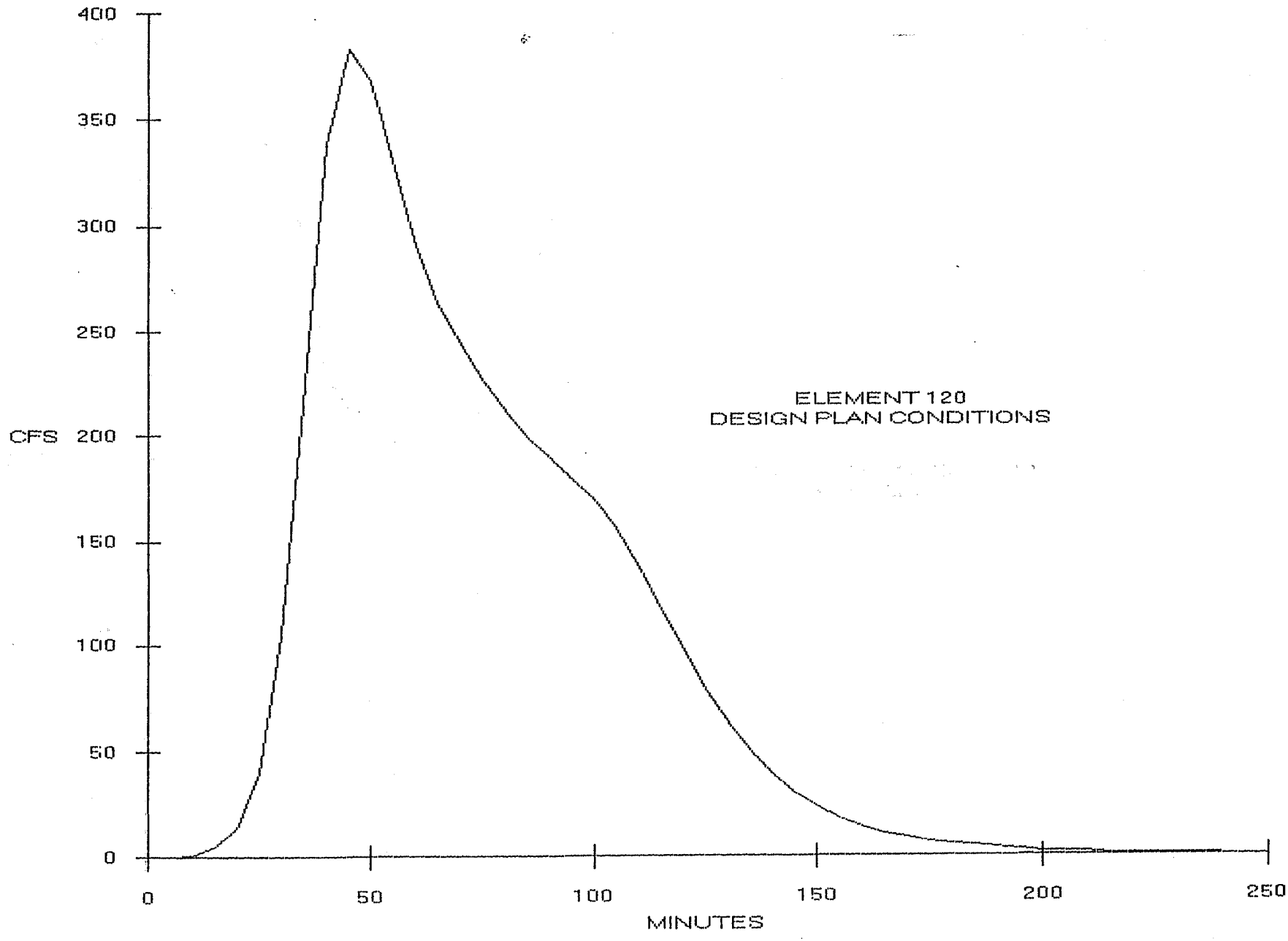
120
140
MINUTES


ELEMENT 120
DESIGN PLAN CONDITIONS
CFS
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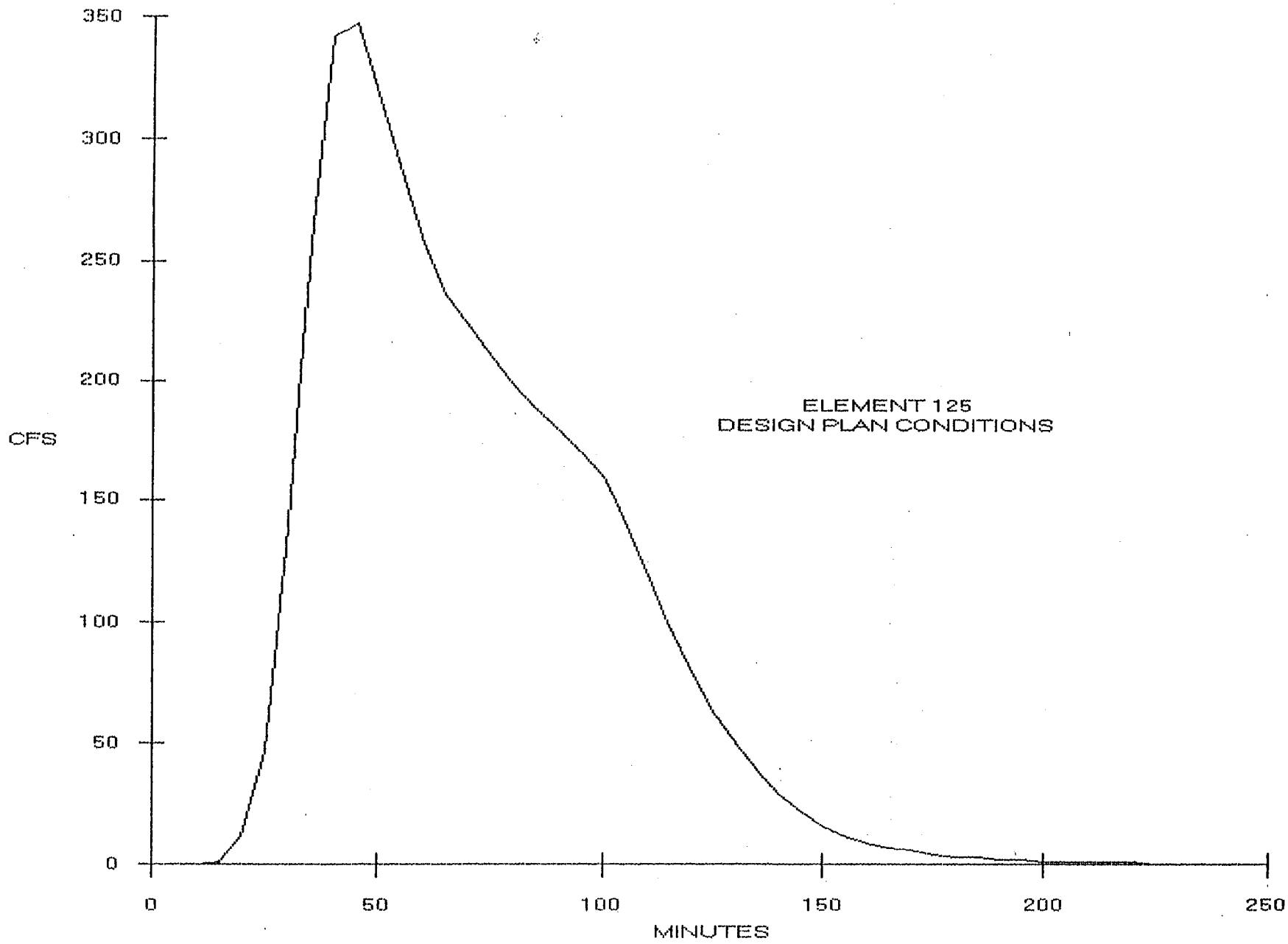
200
250
MINUTES


ELEMENT 125
DESIGN PLAN CONDITIONS
CFS
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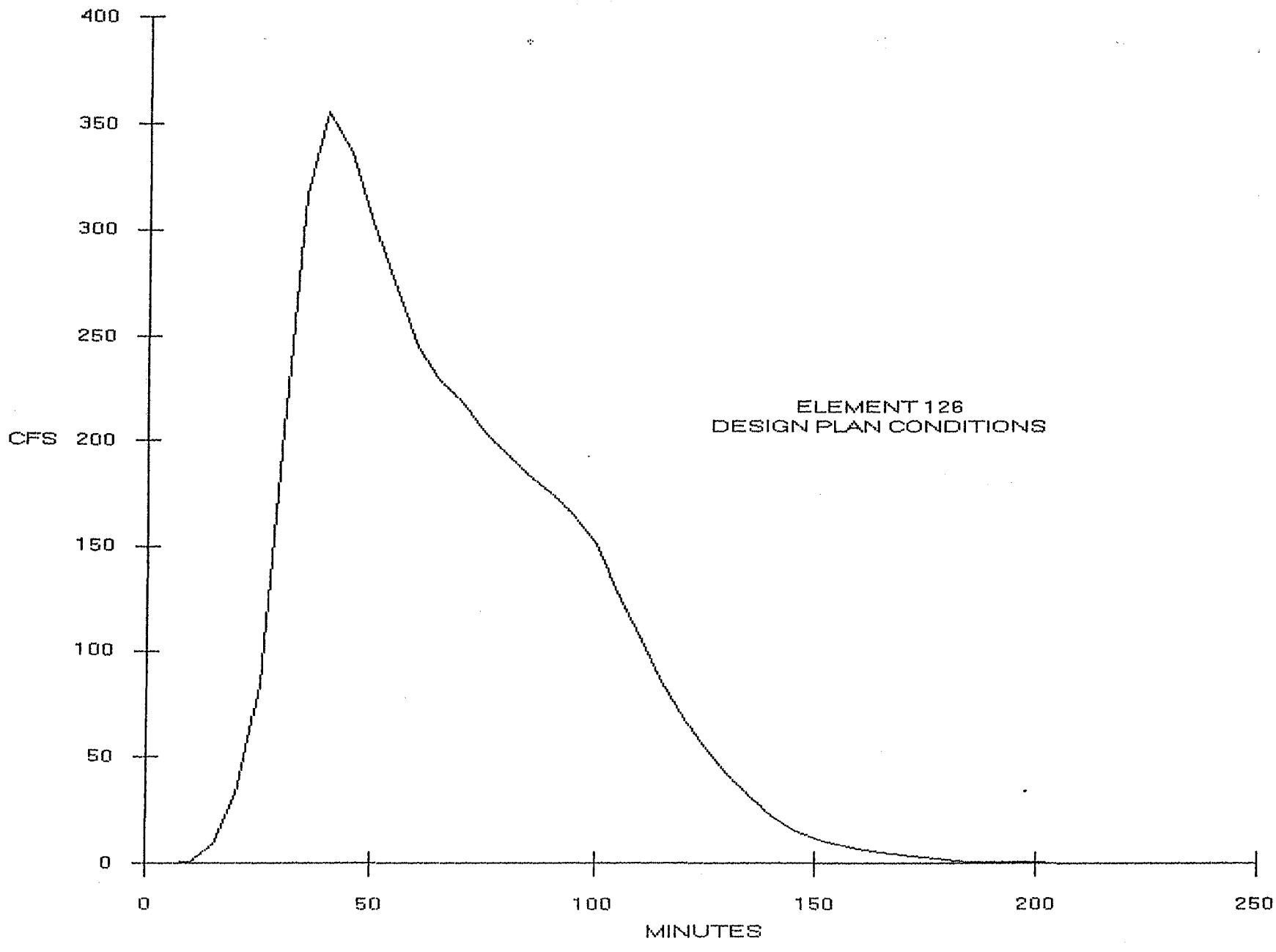
MINUTES


ELEMENT 126
DESIGN PLAN CONDITIONS
CFS
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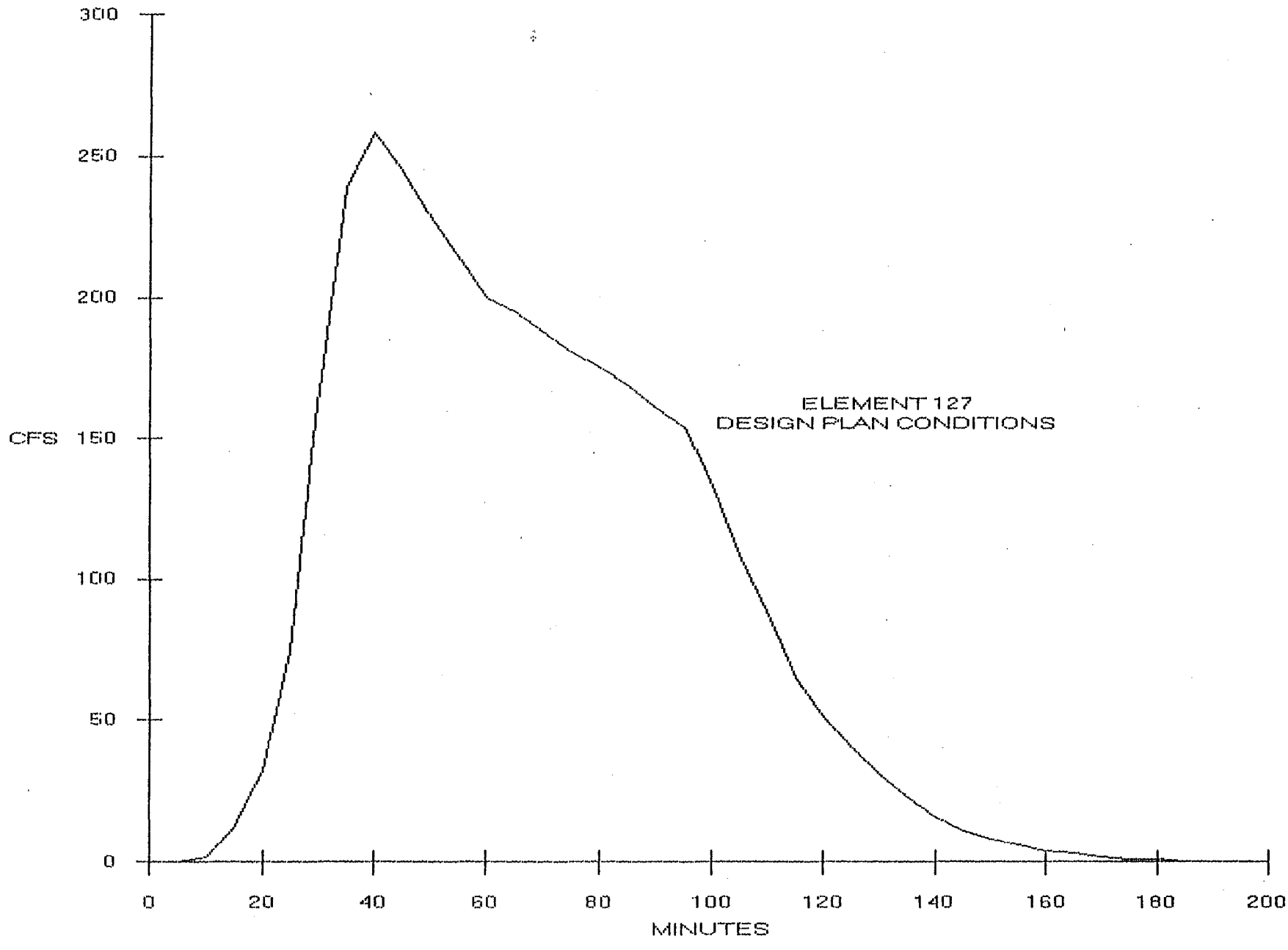
200
250
MINUTES


ELEMENT 127
DESIGN PLAN CONDITIONS
CFS
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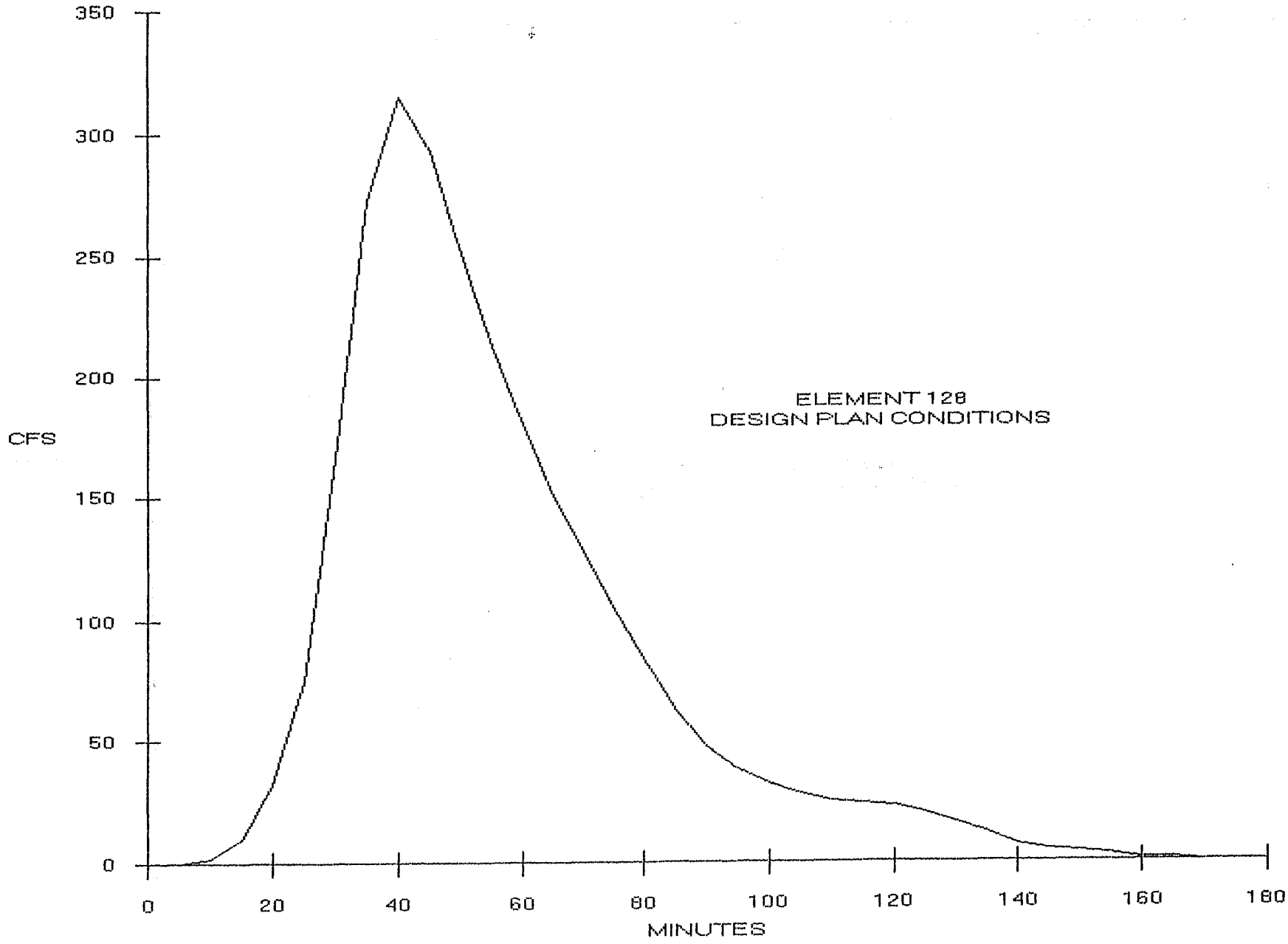
180
200
MINUTES


ELEMENT 128
DESIGN PLAN CONDITIONS
CFS
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100
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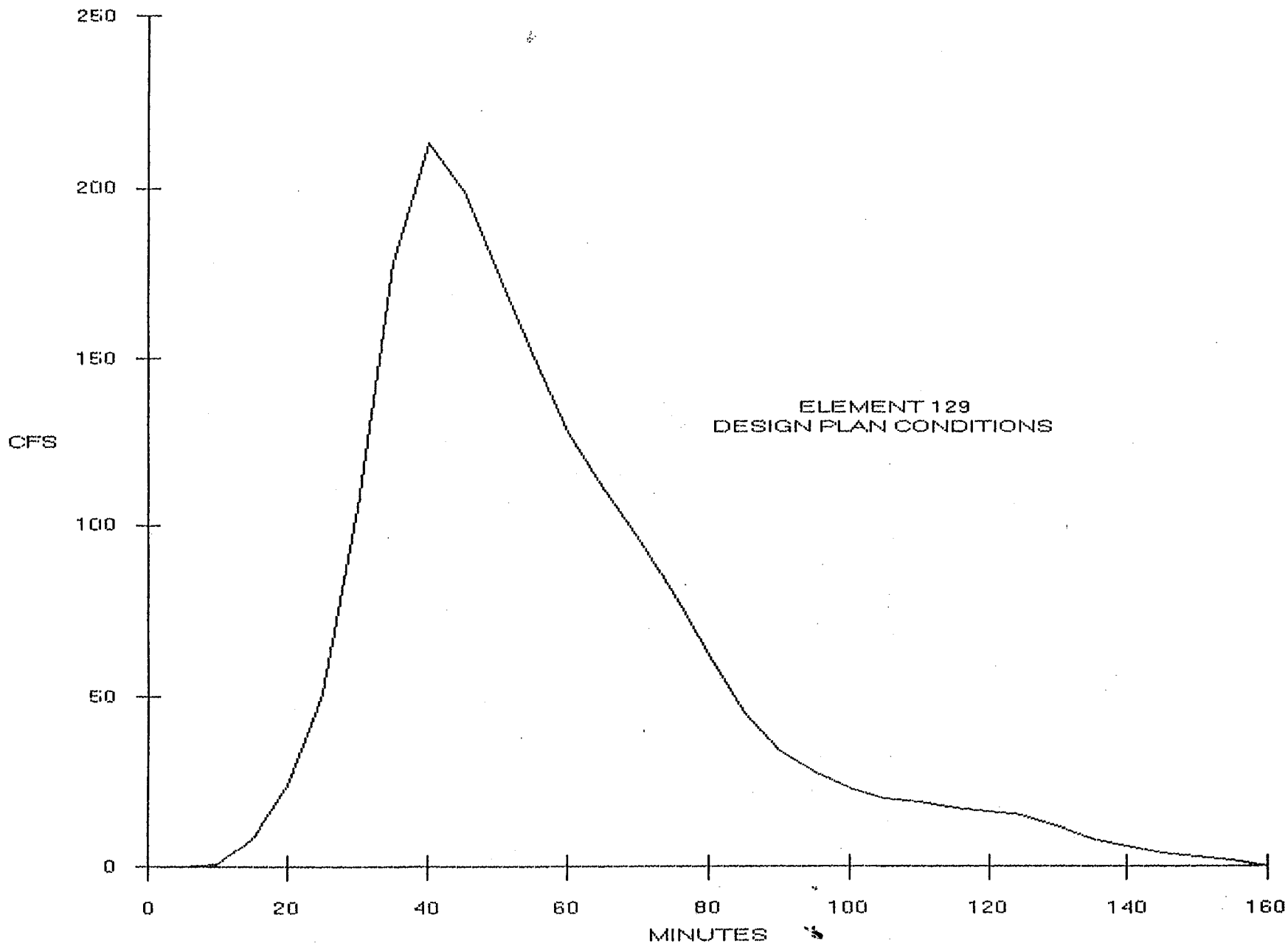
160
180
MINUTES


ELEMENT 129
DESIGN PLAN CONDITIONS
CFS
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60
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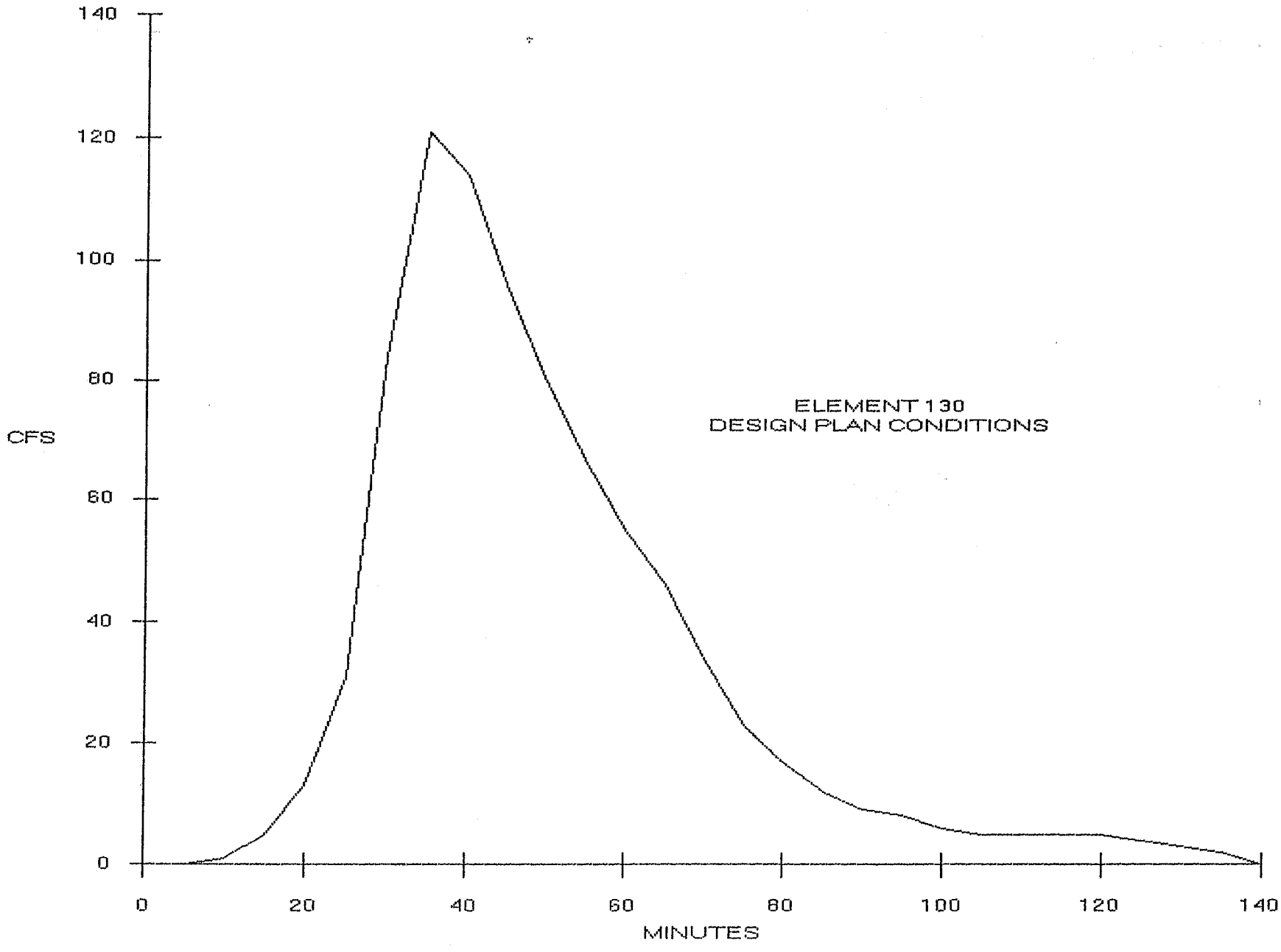
100
120
140
160
MINUTES


ELEMENT 130
DESIGN PLAN CONDITIONS
CFS
MINUTES
0
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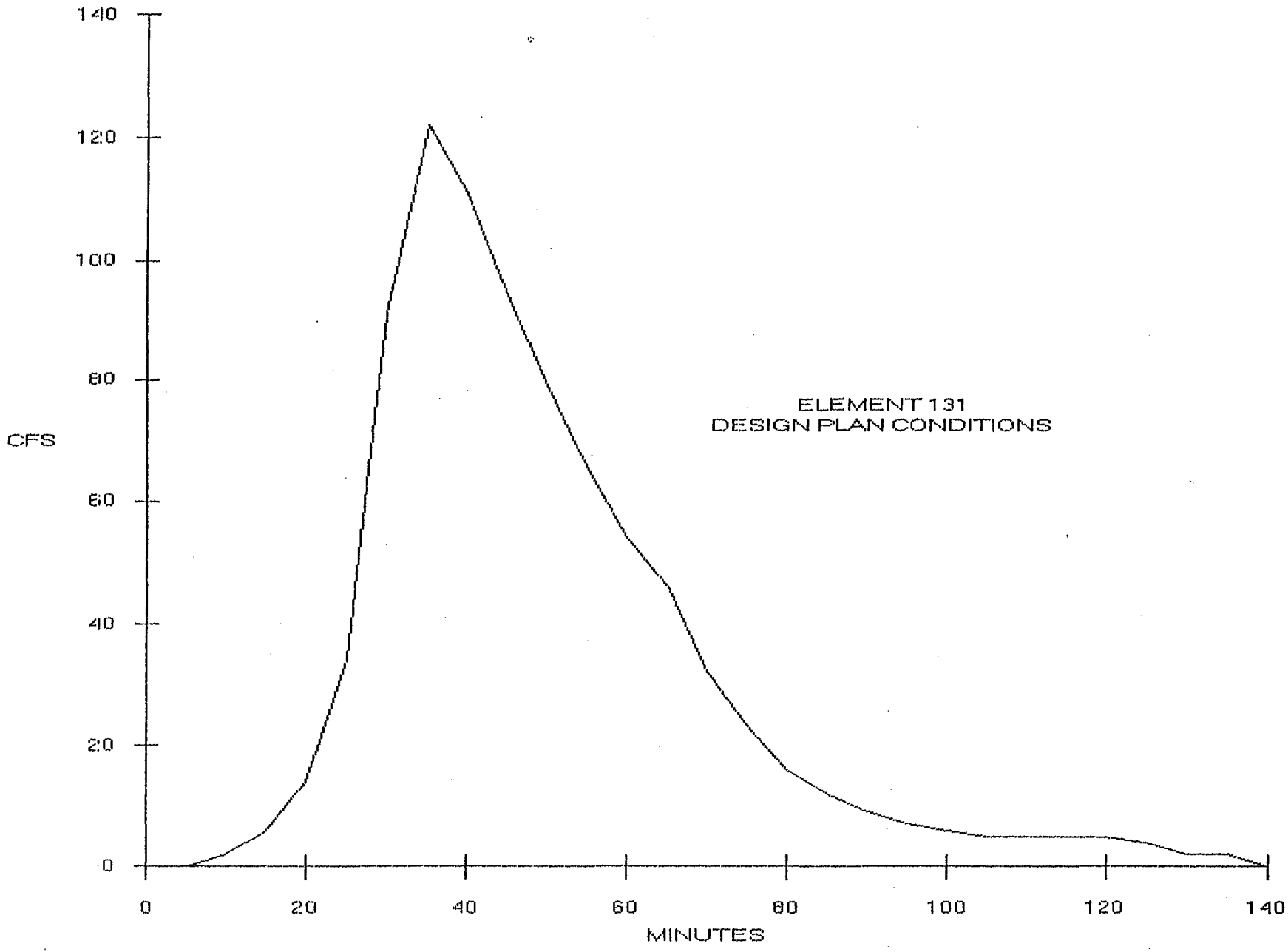
100
120
140


ELEMENT 131
DESIGN PLAN CONDITIONS
CFS
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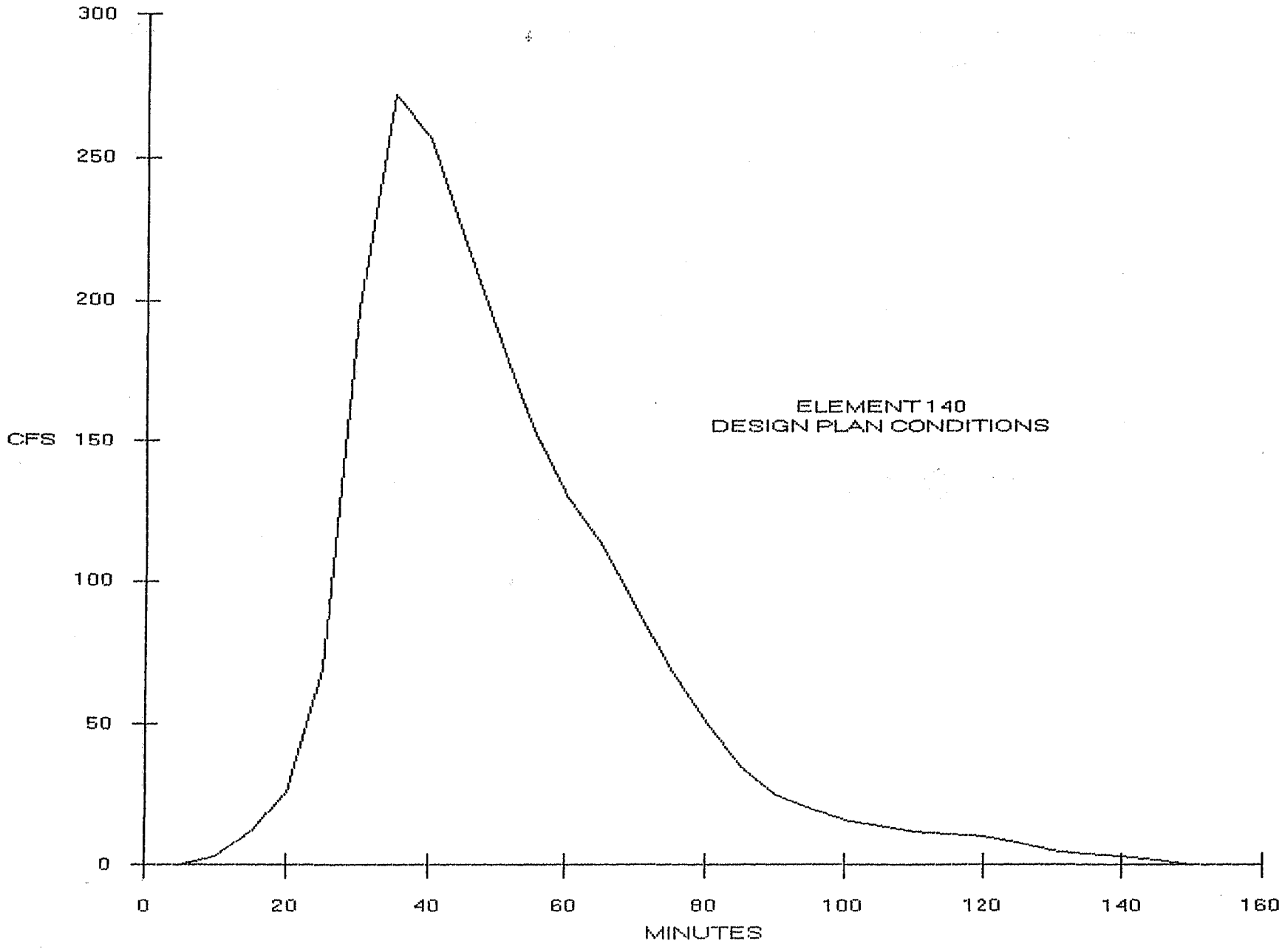
100
120
140
MINUTES


ELEMENT 140
DESIGN PLAN CONDITIONS
CFS
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200
150
100
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60
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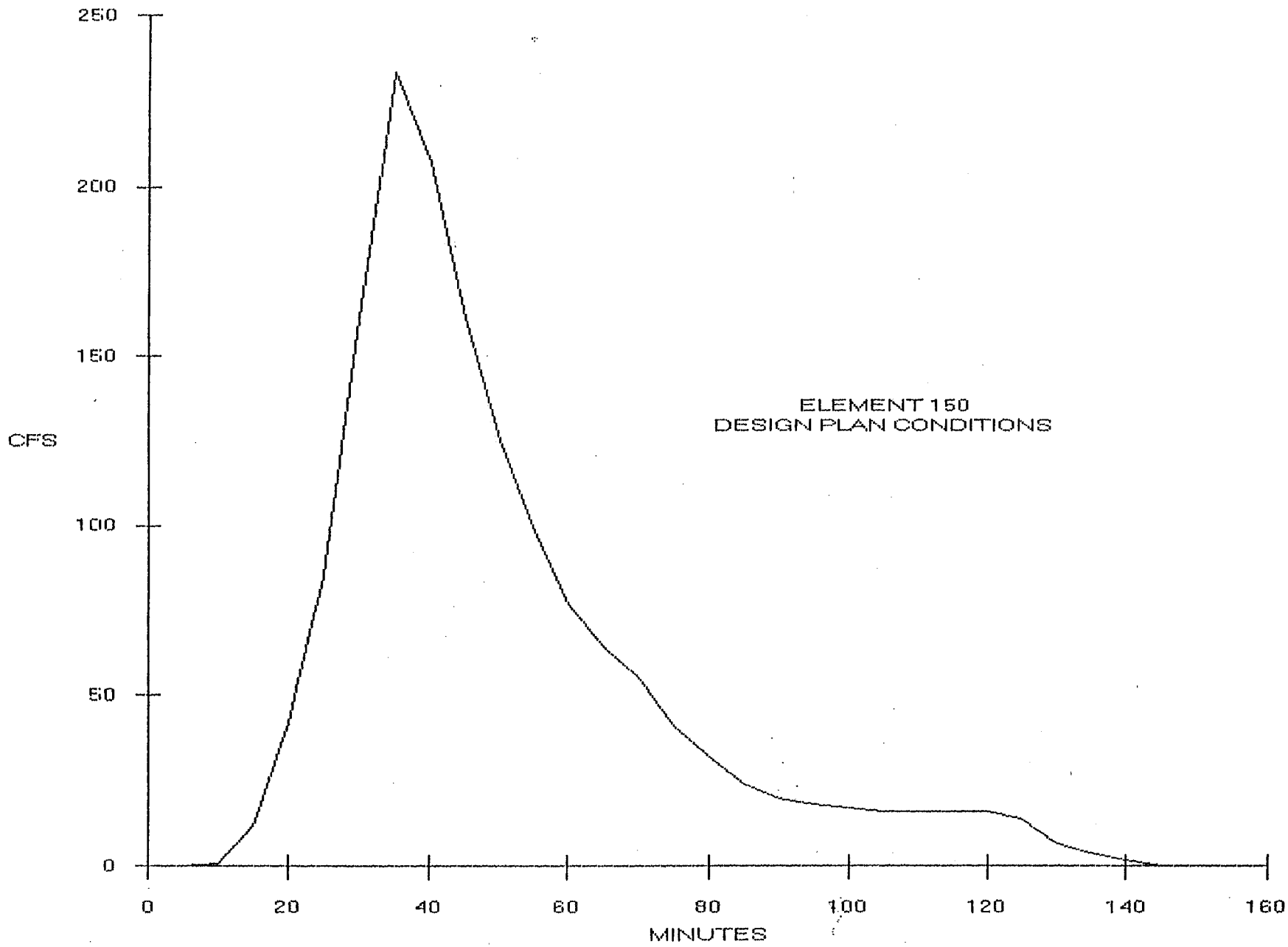
140
160
MINUTES


ELEMENT 150
DESIGN PLAN CONDITIONS
CFS
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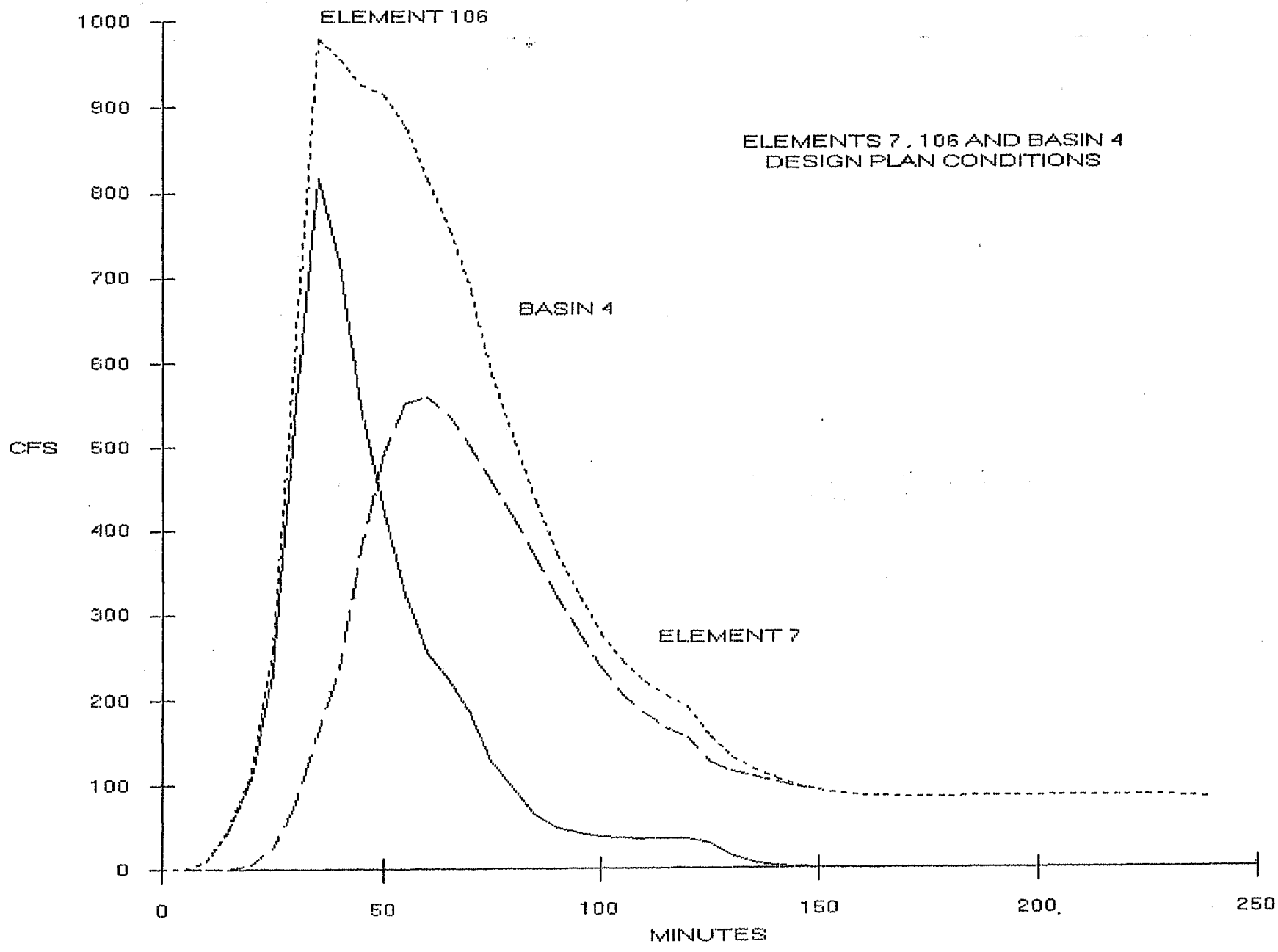
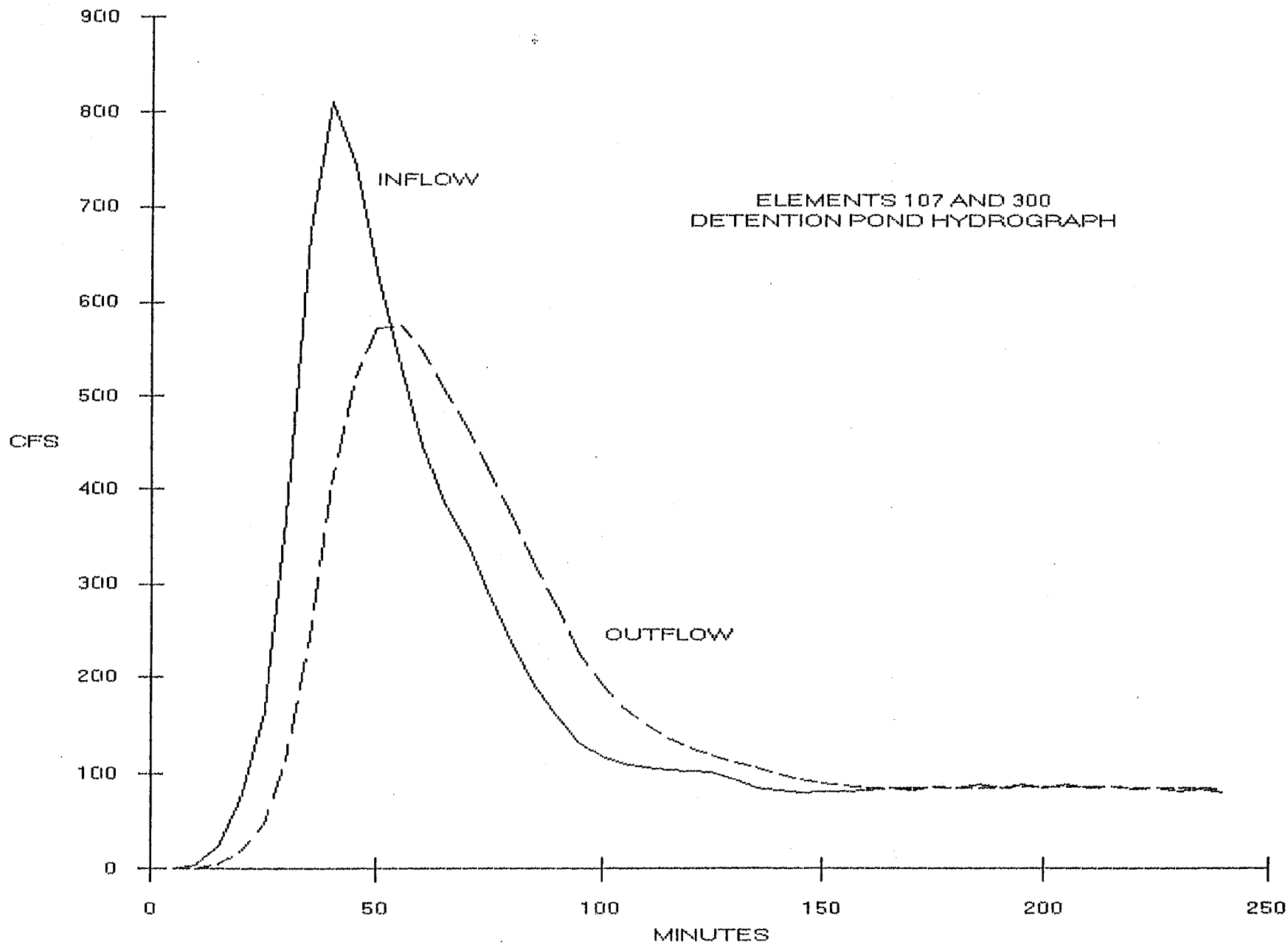
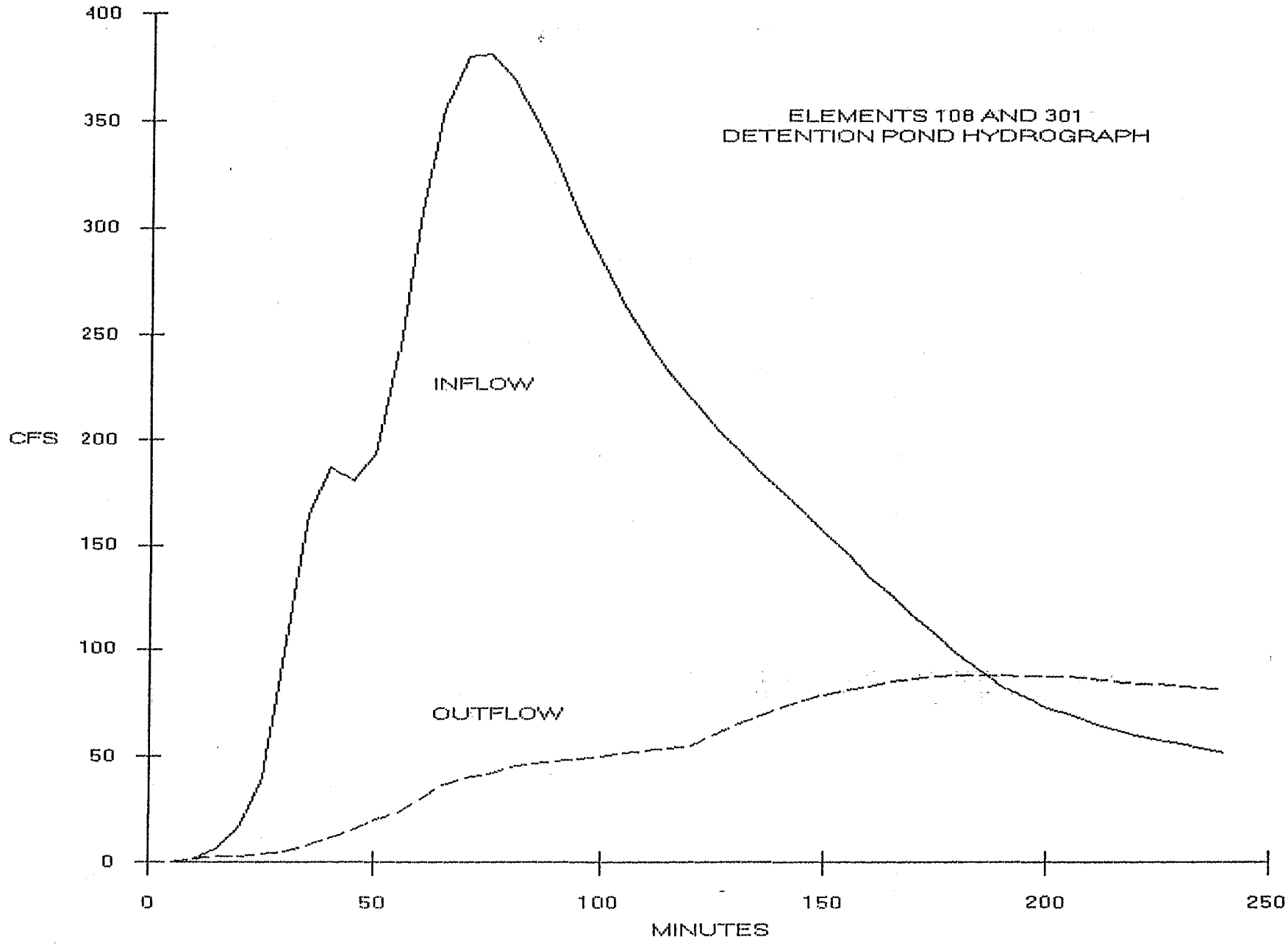
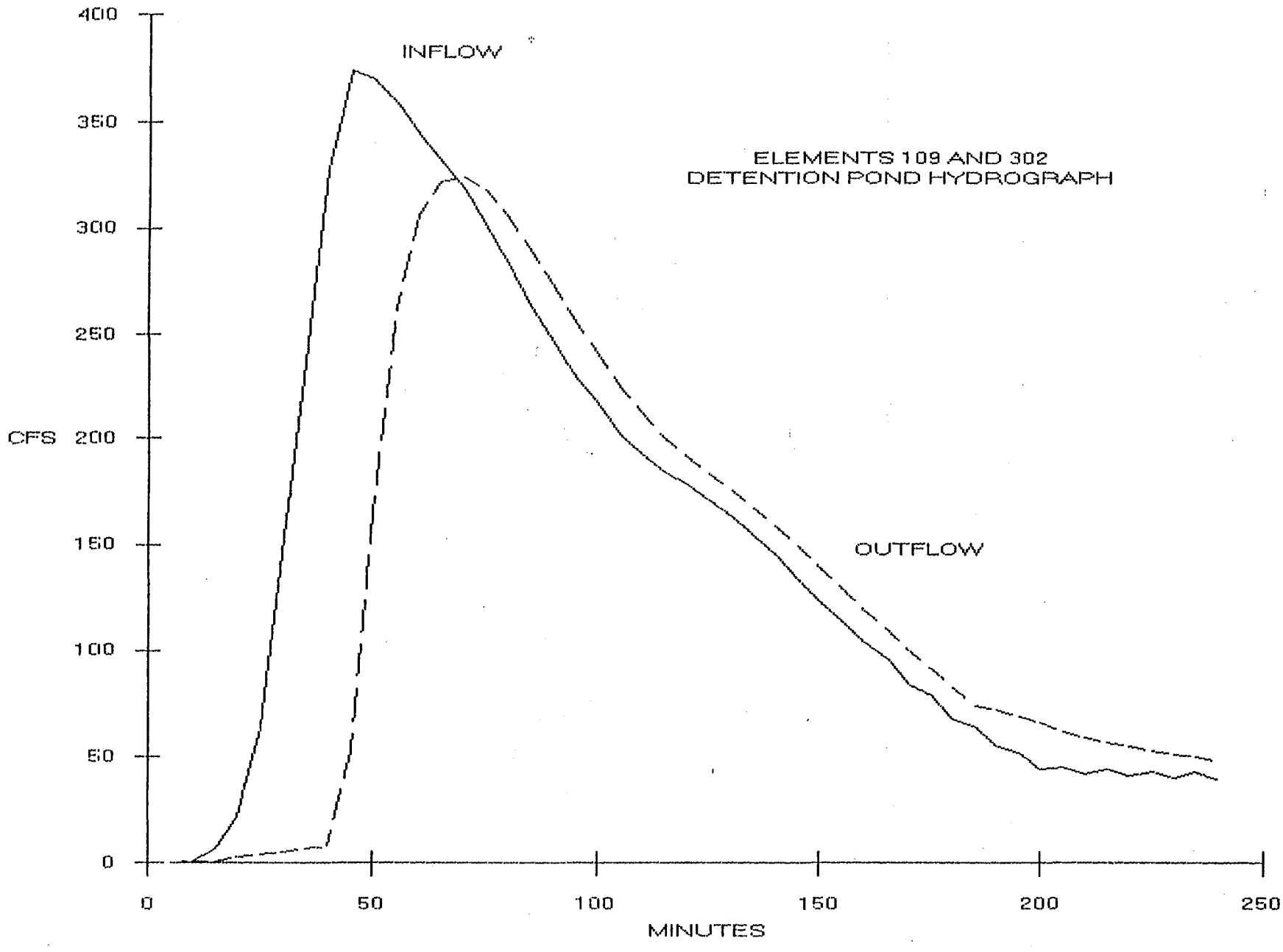
160
MINUTES


ELEMENTS 7 , 106 AND BASIN 4
DESIGN PLAN CONDITIONS
ELEMENT 106
BASIN 4
ELEMENT 7
CFS
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
MINUTES


ELEMENTS 107 AND 300
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
MINUTES


ELEMENTS 108 AND 301
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
MINUTES


ELEMENTS 109 AND 302
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
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350
300
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200
150
100
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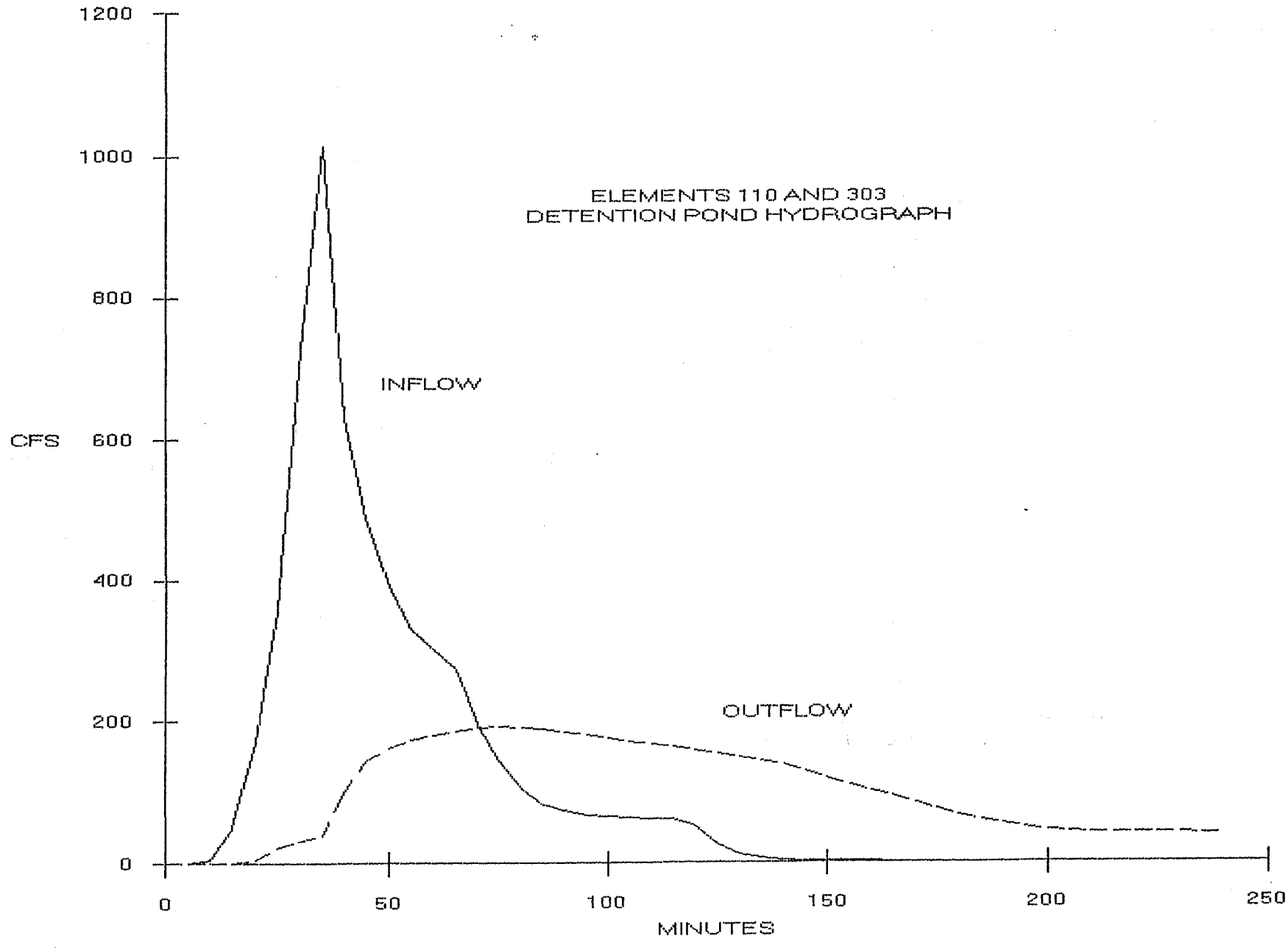
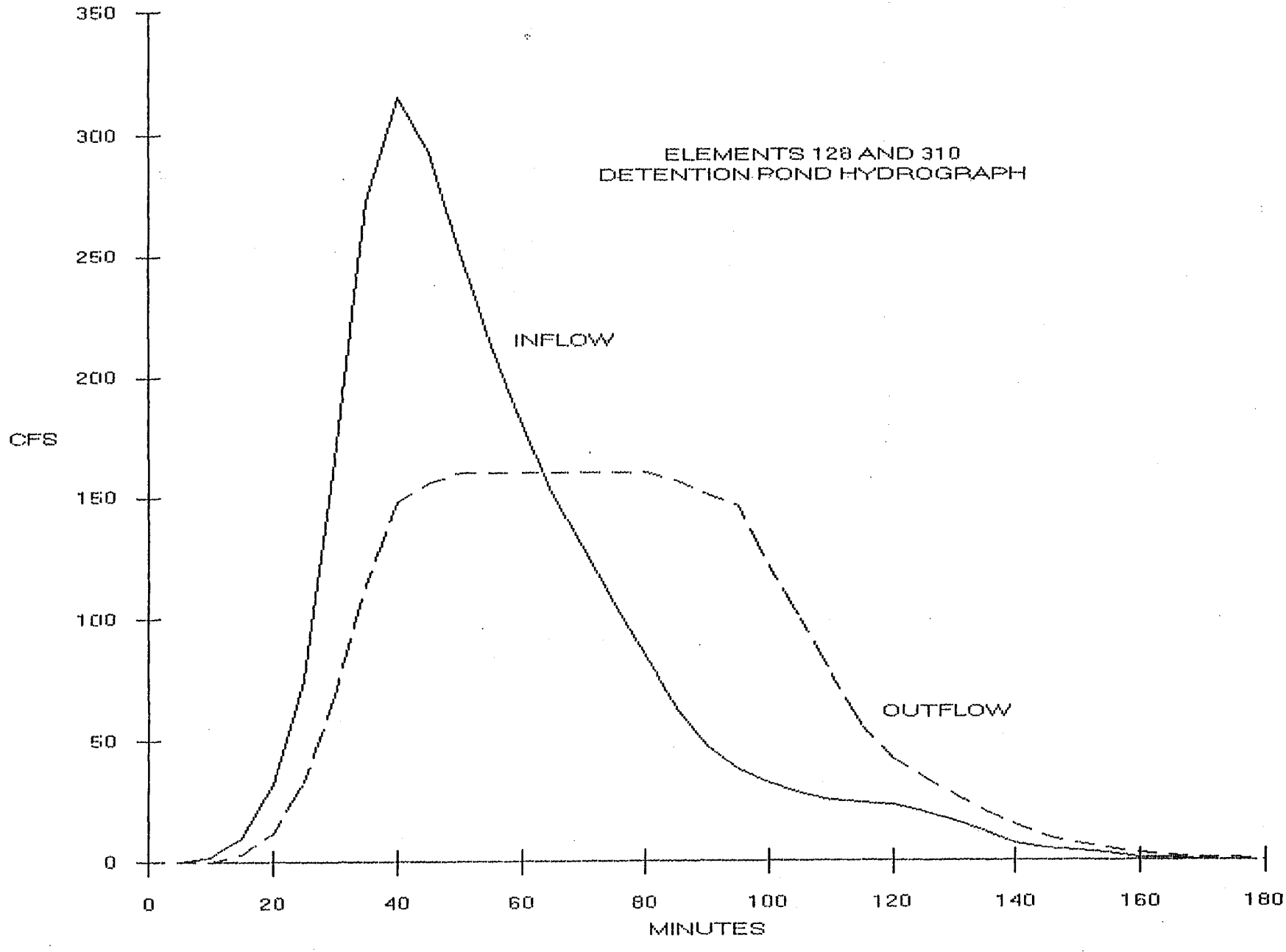
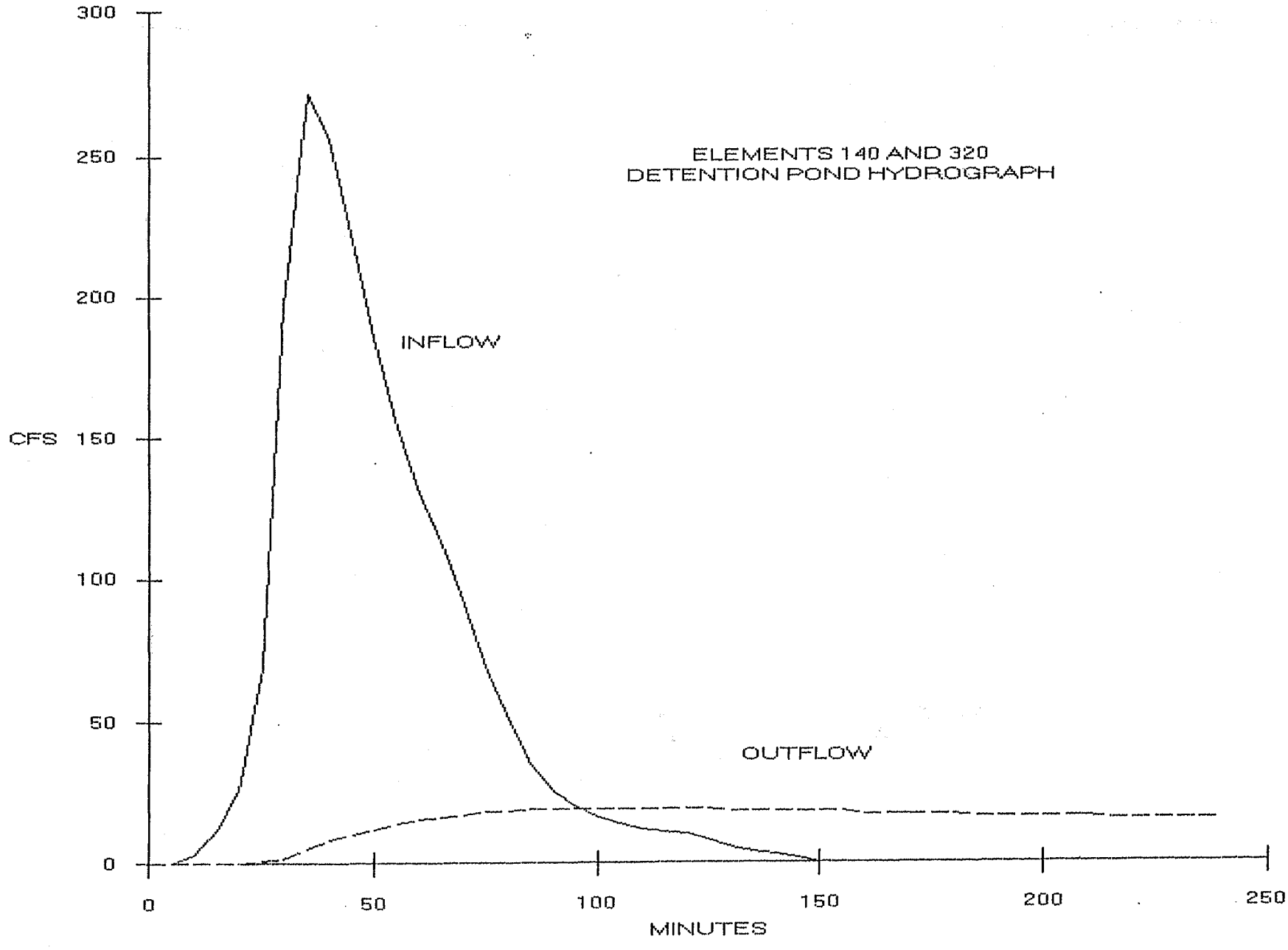
0
50
100
150
200
250
MINUTES


ELEMENTS 110 AND 303
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
1200
1000
800
600
400
200
0
0
50
100
150
200
250
MINUTES


ELEMENTS 120 AND 310
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
160
180
MINUTES


ELEMENTS 140 AND 320
DETENTION POND HYDROGRAPH
INFLOW
OUTFLOW
CFS
300
250
200
150
100
50
0
0
50
100
150
200
250
MINUTES

APPENDIX B

CUHPE/PC COMPUTER PRINTOUTS

This appendix contains CUHPE/PC printouts for future land use conditions. Printouts for both the 10 year and 100 years runs are included.

APPENDIX B - CUHPE/PC - 10 YR

FULLY DEVELOPED LAND USE CONDITIONS

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\2      KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993
01 10 YR     10 1.86                                          0.000.000.000.00

\71 1 15.0    01 01 BASIN #1 FUTURE CONDITIONS
 .105 .568 .341 75.0 .013 27.0  .40  .08  3.8.0018   .6     0
\71 1 15.0    02 02 BASIN #2 FUTURE CONDITIONS
 .093 .758 .360 91.0 .030 26.0  .40  .08  3.2.0018   .5     0
\71 1 15.0    03 03 BASIN #3 FUTURE CONDITIONS
 .118 .691 .252 85.0 .015 28.0  .35  .08  3.4.0018   .5     0
\70 1 15.0    04 04 BASIN #4 FUTURE CONDITIONS
 .248 .758 .284 57.0 .019  0.0  .35  .06  3.0.0018   .5     0
\70 1 15.0    05 05 BASIN #5 FUTURE CONDITIONS
 .302 .953 .419 58.0 .008  0.0  .35  .07  3.0.0018   .5     0
\71 1 15.0    06 06 BASIN #6 FUTURE CONDITIONS
 .084 .634 .417 46.0 .011 29.0  .38  .06  3.0.0018   .5     0
\71 1 15.0    07 07 BASIN #7 FUTURE CONDITIONS
 .116 .777 .445 47.0 .014 33.0  .35  .07  3.0.0018   .5     0
\70 1 15.0    08 08 BASIN #8 FUTURE CONDITIONS
 .264 .563 .379 80.0 .018  0.0  .40  .10  3.0.0018   .5     0
 71 1 15.0    09 09 BASIN #9 FUTURE CONDITIONS
 .038 .288 .138 70.0 .030 11.0  .35  .10  3.0.0018   .5     0
\71 1 15.0    10 10 BASIN #10 FUTURE CONDITIONS
 .038 .275 .104 71.0 .018 18.0  .40  .10  3.9.0018   .6     0
\71 1 15.0    40 40 BASIN #40 FUTURE CONDITIONS
 .067 .379 .180 92.0 .007 21.0  .40  .10  3.9.0018   .6     0
\71 1 15.0    11 11 BASIN #11 FUTURE CONDITIONS
 .041 .360 .095 68.0 .021 17.0  .40  .07  3.6.0018   .5     0
\71 1 15.0    12 12 BASIN #12 FUTURE CONDITIONS
 .039 .322 .142 60.0 .016 19.0  .38  .07  3.6.0018   .5     0
 71 1 15.0    13 13 BASIN #13 FUTURE CONDITIONS
 .083 .691 .218 72.0 .010 30.0  .35  .06  3.0.0018   .5     0
 71 1 15.0    15 15 BASIN #15 FUTURE CONDITIONS
 .016 .237 .114 68.0 .012 10.0  .40  .07  3.6.0018   .5     0
\71 1 15.0    20 20 BASIN #20 FUTURE CONDITIONS
 .047 .369 .199 41.0 .018 19.0  .35  .07  4.1.0018   .6     0
\71 1 15.0    30 30 BASIN #30 FUTURE CONDITIONS
 .115 .530 .242 34.0 .024 23.0  .35  .07  3.7.0018   .6     0
E
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□□

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 01 -- BASIN COMMENT: BASIN #1 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.10	.57	.34	75.00	.0130	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.078	.555

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.00	27.00	2245.77	235.81	5.60

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 8.57)

WIDTH AT 50 = 13. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .08 IN.
INFILTRATION = 3.80 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	126.	40.	24.
5.	57.	25.	82.	45.	16.
10.	213.	30.	54.	50.	10.
15.	197.	35.	36.	55.	0.

1 BASIN ID: 01 -- BASIN COMMENT: BASIN #1 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	75.	.06	.045	39.
5.	.04	.000	0.	80.	.05	.033	37.
10.	.07	.019	1.	85.	.04	.025	33.
15.	.15	.109	10.	90.	.04	.025	29.
20.	.28	.199	38.	95.	.04	.025	26.
25.	.47	.385	88.	100.	.04	.025	24.
30.	.22	.199	148.	105.	.04	.025	23.
35.	.10	.086	158.	110.	.04	.025	22.
40.	.08	.063	133.	115.	.03	.023	21.
45.	.07	.055	105.	120.	.02	.017	20.
50.	.06	.044	85.	125.	.00	.000	17.
55.	.06	.045	69.	130.	.00	.000	12.
60.	.06	.045	58.	135.	.00	.000	8.
65.	.06	.045	50.	140.	.00	.000	5.
70.	.06	.045	44.	145.	.00	.000	3.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.605 INCHES

```
VOLUME OF EXCESS PRECIP =     9.  ACRE-FEET
PEAK Q =  158. CFS      TIME OF PEAK =  35. MIN.
INFILT.= 3.80 IN/HR    DECAY = .00180    FNINF =  .60 IN/HR
MAX.PERV.RET.= .40 IN.     MAX.IMP.RET.= .08 IN.

RATIONAL FORMULA C =        .75
                 I =       3.1 INCHES/HOUR
                 A =      67.2 ACRES
                 Q =      155. CFS
```

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 02 -- BASIN COMMENT: BASIN #2 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.09	.76	.36	91.00	.0300	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.074	.581

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
11.25	26.00	2550.75	237.22	4.96

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 8.06)

WIDTH AT 50 = 12. MIN. WIDTH AT 75 = 6. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .08 IN.
INFILTRATION = 3.20 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	107.	40.	16.
5.	57.	25.	67.	45.	10.
10.	226.	30.	41.	50.	0.
15.	173.	35.	26.	0.	0.

1 BASIN ID: 02 -- BASIN COMMENT: BASIN #2 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	75.	.06	.053	39.
5.	.04	.000	0.	80.	.05	.041	38.
10.	.07	.022	1.	85.	.04	.031	34.
15.	.15	.132	13.	90.	.04	.031	30.
20.	.28	.241	47.	95.	.04	.031	27.
25.	.47	.425	104.	100.	.04	.031	25.
30.	.22	.208	165.	105.	.04	.031	24.
35.	.10	.095	161.	110.	.04	.031	23.
40.	.08	.072	129.	115.	.03	.027	22.

45.	.07	.064	101.	*	120.	.02	.021	21.	*
50.	.06	.053	80.	*	125.	.00	.000	18.	*
55.	.06	.053	65.	*	130.	.00	.000	11.	*
60.	.06	.053	54.	*	135.	.00	.000	7.	*
65.	.06	.053	47.	*	140.	.00	.000	4.	*
70.	.06	.053	41.	*	145.	.00	.000	2.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.850 INCHES
VOLUME OF EXCESS PRECIP = 9. ACRE-FEET
PEAK Q = 165. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.20 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .08 IN.

RATIONAL FORMULA C = .86
I = 3.2 INCHES/HOUR
A = 59.5 ACRES
Q = 162. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 03 -- BASIN COMMENT: BASIN #3 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.69	.25	85.00	.0150	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.076	.591

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.24	28.00	2328.67	274.78	6.29

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 7.88)

WIDTH AT 50 = 13. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .08 IN.
INFILTRATION = 3.40 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	146.	40.	25.
5.	57.	25.	93.	45.	16.
10.	238.	30.	60.	50.	10.
15.	234.	35.	39.	55.	0.

1 BASIN ID: 03 -- BASIN COMMENT: BASIN #3 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)

0.	.00	.000	0.	*	75.	.06	.051	50.	*
5.	.04	.000	0.	*	80.	.05	.038	47.	*
10.	.07	.021	1.	*	85.	.04	.029	43.	*
15.	.15	.123	12.	*	90.	.04	.029	37.	*
20.	.28	.225	47.	*	95.	.04	.029	33.	*
25.	.47	.421	110.	*	100.	.04	.029	30.	*
30.	.22	.206	185.	*	105.	.04	.029	29.	*
35.	.10	.092	198.	*	110.	.04	.029	28.	*
40.	.08	.070	165.	*	115.	.03	.026	27.	*
45.	.07	.061	130.	*	120.	.02	.020	25.	*
50.	.06	.051	104.	*	125.	.00	.000	22.	*
55.	.06	.051	85.	*	130.	.00	.000	15.	*
60.	.06	.051	71.	*	135.	.00	.000	10.	*
65.	.06	.051	62.	*	140.	.00	.000	6.	*
70.	.06	.051	55.	*	145.	.00	.000	4.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.777 INCHES
VOLUME OF EXCESS PRECIP = 11. ACRE-FEET
PEAK Q = 198. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.40 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .08 IN.

RATIONAL FORMULA C = .83
I = 3.0 INCHES/HOUR
A = 75.5 ACRES
Q = 189. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 04 -- BASIN COMMENT: BASIN #4 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.25	.76	.28	57.00	.0190	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.085	.551

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.82	3344.92	829.54	13.23

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	205.	40.	15.
5.	310.	25.	107.	45.	8.
10.	779.	30.	55.	50.	0.
15.	396.	35.	29.	0.	0.

1 BASIN ID: 04 -- BASIN COMMENT: BASIN #4 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME	INCREMENT RAINFALL	TOTAL EXCESS	STORM HYDROGRAPH	TIME	INCREMENT RAINFALL	TOTAL EXCESS	STORM HYDROGRAPH

(MIN.)	(IN) PRECIP	(CFS)	*	(MIN.)	(IN) PRECIP	(CFS)	*
0.	.00 .000	0.	*	75.	.06 .040	77.	*
5.	.04 .000	0.	*	80.	.05 .027	72.	*
10.	.07 .025	8.	*	85.	.04 .019	60.	*
15.	.15 .083	45.	*	90.	.04 .019	48.	*
20.	.28 .151	121.	*	95.	.04 .019	43.	*
25.	.47 .388	276.	*	100.	.04 .019	40.	*
30.	.22 .194	442.	*	105.	.04 .019	38.	*
35.	.10 .081	372.	*	110.	.04 .019	37.	*
40.	.08 .058	259.	*	115.	.03 .017	36.	*
45.	.07 .050	185.	*	120.	.02 .013	33.	*
50.	.06 .039	139.	*	125.	.00 .000	25.	*
55.	.06 .040	108.	*	130.	.00 .000	13.	*
60.	.06 .040	92.	*	135.	.00 .000	7.	*
65.	.06 .040	84.	*	140.	.00 .000	3.	*
70.	.06 .040	79.	*	145.	.00 .000	2.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.440 INCHES
VOLUME OF EXCESS PRECIP = 19. ACRE-FEET
PEAK Q = 442. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .06 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 05 -- BASIN COMMENT: BASIN #5 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.30	.95	.42	58.00	.0080	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.085	.573

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.91	2113.14	638.17	16.11

WIDTH AT 50 = 14. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*
0.	0.	*	25.	252.	*	50.	32.	*
5.	132.	*	30.	167.	*	55.	21.	*
10.	518.	*	35.	110.	*	60.	14.	*
15.	591.	*	40.	73.	*	65.	9.	*
20.	385.	*	45.	48.	*	70.	0.	*

1 BASIN ID: 05 -- BASIN COMMENT: BASIN #5 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*

0.	.00	.000	0.	80.	.05	.028	105.
5.	.04	.000	0.	85.	.04	.019	93.
10.	.07	.020	3.	90.	.04	.019	76.
15.	.15	.084	21.	95.	.04	.019	65.
20.	.28	.154	76.	100.	.04	.019	58.
25.	.47	.390	188.	105.	.04	.019	54.
30.	.22	.195	356.	110.	.04	.019	51.
35.	.10	.081	425.	115.	.03	.017	49.
40.	.08	.059	370.	120.	.02	.013	46.
45.	.07	.050	294.	125.	.00	.000	40.
50.	.06	.040	235.	130.	.00	.000	29.
55.	.06	.040	190.	135.	.00	.000	19.
60.	.06	.040	158.	140.	.00	.000	12.
65.	.06	.040	136.	145.	.00	.000	8.
70.	.06	.040	123.	150.	.00	.000	5.
75.	.06	.040	113.	155.	.00	.000	3.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.448 INCHES
VOLUME OF EXCESS PRECIP = 23. ACRE-FEET
PEAK Q = 425. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 06 -- BASIN COMMENT: BASIN #6 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.08	.63	.42	46.00	.0110	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.090	.404

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
11.91	29.00	1650.15	138.61	4.48

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 10.93)

WIDTH AT 50 = 18. MIN. WIDTH AT 75 = 9. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .38 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	25.	65.	50.	17.
5.	60.	30.	50.	55.	13.
10.	132.	35.	38.	60.	10.
15.	125.	40.	29.	65.	8.
20.	89.	45.	22.	70.	0.

1 BASIN ID: 06 -- BASIN COMMENT: BASIN #6 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*
0.	.00	.000	0.	*	75.	.06	.036	33.	*
5.	.04	.000	0.	*	80.	.05	.023	30.	*
10.	.07	.020	1.	*	85.	.04	.015	26.	*
15.	.15	.067	7.	*	90.	.04	.015	20.	*
20.	.28	.122	19.	*	95.	.04	.015	16.	*
25.	.47	.359	48.	*	100.	.04	.015	15.	*
30.	.22	.190	81.	*	105.	.04	.015	13.	*
35.	.10	.076	91.	*	110.	.04	.015	12.	*
40.	.08	.054	81.	*	115.	.03	.014	12.	*
45.	.07	.045	69.	*	120.	.02	.011	11.	*
50.	.06	.035	59.	*	125.	.00	.000	9.	*
55.	.06	.035	50.	*	130.	.00	.000	7.	*
60.	.06	.035	44.	*	135.	.00	.000	5.	*
65.	.06	.036	39.	*	140.	.00	.000	4.	*
70.	.06	.036	36.	*	145.	.00	.000	3.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.284 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 91. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .38 IN. MAX.IMP.RET.= .06 IN.

RATIONAL FORMULA C = .60
I = 3.0 INCHES/HOUR
A = 53.8 ACRES
Q = 95. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 07 -- BASIN COMMENT: BASIN #7 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.78	.44	47.00	.0140	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.090	.431

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
13.47	33.00	1509.84	175.14	6.19

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 11.50)

WIDTH AT 50 = 20. MIN. WIDTH AT 75 = 10. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*

0.	0.	*	30.	73.	*	60.	16.	*
5.	59.	*	35.	57.	*	65.	12.	*
10.	152.	*	40.	44.	*	70.	10.	*
15.	171.	*	45.	34.	*	75.	7.	*
20.	126.	*	50.	26.	*	80.	0.	*
25.	96.	*	55.	20.	*	0.	0.	*

1 BASIN ID: 07 -- BASIN COMMENT: BASIN #7 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*
0.	.00	.000	0.	*	80.	.05	.023	44.	*
5.	.04	.000	0.	*	85.	.04	.016	39.	*
10.	.07	.016	1.	*	90.	.04	.016	33.	*
15.	.15	.068	6.	*	95.	.04	.016	28.	*
20.	.28	.125	20.	*	100.	.04	.016	23.	*
25.	.47	.376	55.	*	105.	.04	.016	20.	*
30.	.22	.190	100.	*	110.	.04	.016	18.	*
35.	.10	.076	121.	*	115.	.03	.014	17.	*
40.	.08	.054	113.	*	120.	.02	.011	16.	*
45.	.07	.046	98.	*	125.	.00	.000	14.	*
50.	.06	.035	84.	*	130.	.00	.000	11.	*
55.	.06	.036	73.	*	135.	.00	.000	8.	*
60.	.06	.036	64.	*	140.	.00	.000	6.	*
65.	.06	.036	57.	*	145.	.00	.000	4.	*
70.	.06	.036	52.	*	150.	.00	.000	3.	*
75.	.06	.036	48.	*	155.	.00	.000	2.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.309 INCHES
VOLUME OF EXCESS PRECIP = 8. ACRE-FEET
PEAK Q = 121. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .61
I = 2.8 INCHES/HOUR
A = 74.2 ACRES
Q = 124. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 08 -- BASIN COMMENT: BASIN #8 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.26	.56	.38	80.00	.0180	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.077	.653

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.28	4343.97	1146.81	14.08

WIDTH AT 50 = 7. MIN. WIDTH AT 75 = 4. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	389.	30.	29.
5.	354.	20.	163.	35.	12.
10.	921.	25.	68.	40.	0.

1 BASIN ID: 08 -- BASIN COMMENT: BASIN #8 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.049	95.
5.	.04	.000	0.	75.	.06	.049	94.
10.	.07	.005	2.	80.	.05	.036	90.
15.	.15	.116	45.	85.	.04	.027	75.
20.	.28	.212	183.	90.	.04	.027	62.
25.	.47	.407	385.	95.	.04	.027	56.
30.	.22	.204	548.	100.	.04	.027	53.
35.	.10	.090	420.	105.	.04	.027	52.
40.	.08	.068	270.	110.	.04	.027	52.
45.	.07	.059	187.	115.	.03	.024	51.
50.	.06	.049	141.	120.	.02	.018	46.
55.	.06	.049	113.	125.	.00	.000	34.
60.	.06	.049	100.	130.	.00	.000	14.
65.	.06	.049	96.	135.	.00	.000	6.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.693 INCHES
VOLUME OF EXCESS PRECIP = 24. ACRE-FEET
PEAK Q = 548. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 09 -- BASIN COMMENT: BASIN #9 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.29	.14	70.00	.0300	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.080	.463

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
5.35	11.00	6247.51	237.41	2.03

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.87)

WIDTH AT 50 = 5. MIN. WIDTH AT 75 = 2. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	10.	82.	20.	8.
5.	232.	15.	25.	25.	0.

1 BASIN ID: 09 -- BASIN COMMENT: BASIN #9 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	65.	.06	.045	16.
5.	.04	.000	0.	70.	.06	.045	16.
10.	.07	.004	1.	75.	.06	.045	16.
15.	.15	.101	24.	80.	.05	.032	13.
20.	.28	.186	52.	85.	.04	.024	10.
25.	.47	.405	112.	90.	.04	.024	9.
30.	.22	.200	85.	95.	.04	.024	8.
35.	.10	.086	48.	100.	.04	.024	8.
40.	.08	.064	30.	105.	.04	.024	8.
45.	.07	.055	22.	110.	.04	.024	8.
50.	.06	.045	17.	115.	.03	.021	8.
55.	.06	.045	16.	120.	.02	.016	6.
60.	.06	.045	16.	125.	.00	.000	2.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.579 INCHES
VOLUME OF EXCESS PRECIP = 3. ACRE-FEET
PEAK Q = 112. CFS TIME OF PEAK = 25. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .73
I = 4.8 INCHES/HOUR
A = 24.3 ACRES
Q = 86. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 10 -- BASIN COMMENT: BASIN #10 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.28	.10	71.00	.0180	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.080	.466

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.26	18.00	3105.36	118.00	2.03

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.78)

WIDTH AT 50 = 10. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.90 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	56.	30.	12.
5.	62.	20.	34.	35.	0.
10.	105.	25.	20.	0.	0.

1 BASIN ID: 10 -- BASIN COMMENT: BASIN #10 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	65.	.06	.043	13.
5.	.04	.000	0.	70.	.06	.043	12.
10.	.07	.004	0.	75.	.06	.043	12.
15.	.15	.103	7.	80.	.05	.031	12.
20.	.28	.188	23.	85.	.04	.024	10.
25.	.47	.374	49.	90.	.04	.024	9.
30.	.22	.197	66.	95.	.04	.024	8.
35.	.10	.084	55.	100.	.04	.024	7.
40.	.08	.061	41.	105.	.04	.024	7.
45.	.07	.053	31.	110.	.04	.024	7.
50.	.06	.042	23.	115.	.03	.021	7.
55.	.06	.043	16.	120.	.02	.016	6.
60.	.06	.043	14.	125.	.00	.000	4.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.532 INCHES
VOLUME OF EXCESS PRECIP = 3. ACRE-FEET
PEAK Q = 66. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.90 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .71
I = 3.9 INCHES/HOUR
A = 24.3 ACRES
Q = 67. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 40 -- BASIN COMMENT: BASIN #40 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.07	.38	.18	92.00	.0070	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.074	.555

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
9.10	21.00	3230.93	216.47	3.57

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER,
REPLACING THE ONE COMPUTED BY CUHPD (TP= 6.54)

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.90 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	110.	30.	18.
5.	76.	20.	60.	35.	10.
10.	209.	25.	33.	40.	0.

1 BASIN ID: 40 -- BASIN COMMENT: BASIN #40 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.053	28.
5.	.04	.000	0.	75.	.06	.053	27.
10.	.07	.005	0.	80.	.05	.041	26.
15.	.15	.133	11.	85.	.04	.031	23.
20.	.28	.244	47.	90.	.04	.031	20.
25.	.47	.423	98.	95.	.04	.031	18.
30.	.22	.208	139.	100.	.04	.031	17.
35.	.10	.095	116.	105.	.04	.031	16.
40.	.08	.072	84.	110.	.04	.031	16.
45.	.07	.063	62.	115.	.03	.028	16.
50.	.06	.053	48.	120.	.02	.021	15.
55.	.06	.053	37.	125.	.00	.000	11.
60.	.06	.053	31.	130.	.00	.000	6.
65.	.06	.053	28.	135.	.00	.000	3.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.834 INCHES
VOLUME OF EXCESS PRECIP = 7. ACRE-FEET
PEAK Q = 139. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.90 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .85
I = 3.6 INCHES/HOUR
A = 42.9 ACRES
Q = 130. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 11 -- BASIN COMMENT: BASIN #11 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.36	.09	68.00	.0210	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.081	.462

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
7.88	17.00	3296.58	135.16	2.19

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.92)

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.60 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	59.	30.	11.
5.	76.	20.	33.	35.	0.
10.	112.	25.	19.	0.	0.

1 BASIN ID: 11 -- BASIN COMMENT: BASIN #11 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	65.	.06	.044	14.
5.	.04	.000	0.	70.	.06	.044	14.
10.	.07	.023	2.	75.	.06	.044	14.
15.	.15	.099	10.	80.	.05	.032	13.
20.	.28	.180	26.	85.	.04	.023	11.
25.	.47	.378	56.	90.	.04	.023	9.
30.	.22	.198	72.	95.	.04	.023	8.
35.	.10	.085	59.	100.	.04	.023	7.
40.	.08	.062	43.	105.	.04	.023	7.
45.	.07	.054	32.	110.	.04	.023	7.
50.	.06	.044	24.	115.	.03	.020	7.
55.	.06	.044	17.	120.	.02	.016	6.
60.	.06	.044	15.	125.	.00	.000	4.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.548 INCHES
VOLUME OF EXCESS PRECIP = 3. ACRE-FEET
PEAK Q = 72. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.60 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .72
I = 4.0 INCHES/HOUR
A = 26.2 ACRES
Q = 75. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 12 -- BASIN COMMENT: BASIN #12 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)

.04	.32	.14	60.00	.0160	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.084	.430

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.74	19.00	2645.95	103.19	2.08

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 5.59)

WIDTH AT 50 = 11. MIN. WIDTH AT 75 = 6. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .38 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.60 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	59.	30.	16.
5.	56.	20.	37.	35.	10.
10.	99.	25.	24.	40.	0.

1 BASIN ID: 12 -- BASIN COMMENT: BASIN #12 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.041	13.
5.	.04	.000	0.	75.	.06	.041	12.
10.	.07	.021	1.	80.	.05	.028	12.
15.	.15	.087	7.	85.	.04	.020	10.
20.	.28	.159	19.	90.	.04	.020	8.
25.	.47	.370	42.	95.	.04	.020	7.
30.	.22	.195	60.	100.	.04	.020	7.
35.	.10	.081	54.	105.	.04	.020	6.
40.	.08	.059	42.	110.	.04	.020	6.
45.	.07	.051	33.	115.	.03	.018	6.
50.	.06	.040	26.	120.	.02	.014	5.
55.	.06	.041	20.	125.	.00	.000	4.
60.	.06	.041	15.	130.	.00	.000	2.
65.	.06	.041	13.	135.	.00	.000	1.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.449 INCHES
VOLUME OF EXCESS PRECIP = 3. ACRE-FEET
PEAK Q = 60. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.60 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .38 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .67
I = 3.7 INCHES/HOUR
A = 25.0 ACRES
Q = 63. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 13 -- BASIN COMMENT: BASIN #13 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.08	.69	.22	72.00	.0100	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.079	.527

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
13.29	30.00	1876.08	155.71	4.43

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 8.30)

WIDTH AT 50 = 16. MIN. WIDTH AT 75 = 8. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	25.	71.	50.	14.
5.	37.	30.	52.	55.	10.
10.	126.	35.	37.	60.	0.
15.	149.	40.	27.	0.	0.
20.	102.	45.	19.	0.	0.

1 BASIN ID: 13 -- BASIN COMMENT: BASIN #13 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	80.	.05	.033	32.
5.	.04	.000	0.	85.	.04	.024	28.
10.	.07	.031	1.	90.	.04	.024	24.
15.	.15	.104	8.	95.	.04	.024	22.
20.	.28	.191	25.	100.	.04	.024	20.
25.	.47	.407	58.	105.	.04	.024	18.
30.	.22	.201	100.	110.	.04	.024	17.
35.	.10	.087	118.	115.	.03	.022	17.
40.	.08	.064	105.	120.	.02	.017	16.
45.	.07	.056	87.	125.	.00	.000	14.
50.	.06	.045	73.	130.	.00	.000	10.
55.	.06	.046	62.	135.	.00	.000	7.
60.	.06	.046	53.	140.	.00	.000	5.
65.	.06	.046	47.	145.	.00	.000	3.
70.	.06	.046	41.	150.	.00	.000	2.
75.	.06	.046	37.	155.	.00	.000	1.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.631 INCHES
VOLUME OF EXCESS PRECIP = 7. ACRE-FEET
PEAK Q = 118. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .06 IN.

RATIONAL FORMULA C = .76
I = 2.9 INCHES/HOUR
A = 53.1 ACRES
Q = 117. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 15 -- BASIN COMMENT: BASIN #15 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.02	.24	.11	68.00	.0120	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.081	.401

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
4.97	10.00	6247.48	99.96	.85

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.98)

WIDTH AT 50 = 5. MIN. WIDTH AT 75 = 2. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.60 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	10.	33.	20.	0.
5.	100.	15.	11.	0.	0.

1 BASIN ID: 15 -- BASIN COMMENT: BASIN #15 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	60.	.06	.044	6.
5.	.04	.000	0.	65.	.06	.044	6.
10.	.07	.023	2.	70.	.06	.044	6.
15.	.15	.099	11.	75.	.06	.044	6.
20.	.28	.180	22.	80.	.05	.032	5.
25.	.47	.378	45.	85.	.04	.023	4.
30.	.22	.198	34.	90.	.04	.023	3.
35.	.10	.085	19.	95.	.04	.023	3.
40.	.08	.062	11.	100.	.04	.023	3.
45.	.07	.054	8.	105.	.04	.023	3.
50.	.06	.044	7.	110.	.04	.023	3.
55.	.06	.044	6.	115.	.03	.020	3.

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.548 INCHES
VOLUME OF EXCESS PRECIP = 1. ACRE-FEET

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PEAK Q =   45. CFS      TIME OF PEAK =  25. MIN.
INFILT.= 3.60 IN/HR    DECAY = .00180    FNINF =  .50 IN/HR
MAX.PERV.RET.= .40 IN.     MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C =        .72
                 I =       5.0 INCHES/HOUR
                 A =      10.2 ACRES
                 Q =       37. CFS
1   U.D.F.C.D. CUHP RUNOFF ANALYSIS     EXECUTED ON DATE                AT TIME

    CUHPE/PC VERSION MODIFIED IN JANUARY 1985

    PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS  7

    KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993

    BASIN ID:      20  --  BASIN COMMENT:   BASIN #20 FUTURE CONDITIONS

      AREA OF BASIN  LENGTH OF BASIN  DIST TO CENTROID  IMPERVIOUS AREA  SLOPE  UNIT DURATION
         (SQMI)           (MI)             (MI)              (PCT)      (FT/FT)    (MIN)

          .05              .37              .20             41.00        .0180      5.00

                    COEFFICIENT                    COEFFICIENT
              (REFLECTING TIME TO PEAK)   (RELATED TO PEAK RATE OF RUNOFF)

                        .093                           .337

                          CALCULATED UNIT HYDROGRAPH

      TIME TO PEAK  TIME OF CONCENTRATION  PEAK RATE OF RUNOFF  UNIT HYDROGRAPH PEAK  VOLUME OF RUNOFF
         (MIN)              (MIN)             (CFS/SQMI)              (CFS)              (AF)

          7.95             19.00             2379.55                111.84             2.51


      *** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER,
                 REPLACING THE ONE COMPUTED BY CUHPD (TP=  6.67)

      WIDTH AT 50 =  13. MIN.   WIDTH AT 75 =   7. MIN.  K50 = .35  K75 = .45

              RAINFALL LOSSES INPUT W/ BASIN DATA

      MAX. PERVIOUS RET. = .35 IN.    MAX. IMPERVIOUS RET. = .07 IN.
      INFILTRATION = 4.10 IN./HR.     DECAY =  .00180/SECOND      FNINFL =  .60 IN./HR.


     TIME       UNIT      '     TIME       UNIT      '     TIME       UNIT      '
             HYDROGRAPH   *             HYDROGRAPH   *             HYDROGRAPH   *
                          *                          *
                          *                          *
      0.          0.      *     20.         42.      *     40.          9.      *
      5.         84.      *     25.         29.      *     45.          0.      *
     10.        102.      *     30.         20.      *      0.          0.      *
     15.         63.      *     35.         14.      *      0.          0.      *
1         BASIN ID:      20  --  BASIN COMMENT:   BASIN #20 FUTURE CONDITIONS

 **** STORM NO. =   1  ****      DATE OR RETURN PERIOD =  10 YR

          INCREMENT   TOTAL     STORM     *          INCREMENT   TOTAL     STORM     *
    TIME   RAINFALL   EXCESS  HYDROGRAPH  *    TIME   RAINFALL   EXCESS  HYDROGRAPH  *
   (MIN.)    (IN)     PRECIP    (CFS)     *   (MIN.)    (IN)     PRECIP    (CFS)     *
                                          *                                          *
                                          *                                          *
      0.      .00      .000       0.      *     65.      .06      .029       13.     *
      5.      .04      .000       0.      *     70.      .06      .029       11.     *
     10.      .07      .014       1.      *     75.      .06      .029       11.     *
     15.      .15      .059       6.      *     80.      .05      .018       10.     *
     20.      .28      .109      16.      *     85.      .04      .014        8.     *
     25.      .47      .329      43.      *     90.      .04      .014        7.     *
     30.      .22      .180      58.      *     95.      .04      .014        6.     *
     35.      .10      .067      51.      *    100.      .04      .014        6.     *
     40.      .08      .046      40.      *    105.      .04      .014        5.     *
     45.      .07      .038      32.      *    110.      .04      .014        5.     *
```

50.	.06	.028	26.	*	115.	.03	.012	5.	*
55.	.06	.028	21.	*	120.	.02	.009	4.	*
60.	.06	.028	17.	*	125.	.00	.000	3.	*

TOTAL PRECIP. = 2.15 (1-HOUR RAIN = 1.86) EXECESS PRECIP. = 1.136 INCHES
VOLUME OF EXCESS PRECIP = 3. ACRE-FEET
PEAK Q = 58. CFS TIME OF PEAK = 30. MIN.
INFILT.= 4.10 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .53
I = 3.7 INCHES/HOUR
A = 30.1 ACRES
Q = 60. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 30 -- BASIN COMMENT: BASIN #30 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.53	.24	34.00	.0240	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.096	.320

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.30	23.00	2114.07	243.12	6.13

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 7.78)

WIDTH AT 50 = 14. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.70 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH		TIME	UNIT HYDROGRAPH		TIME	UNIT HYDROGRAPH	
0.	0.	*	25.	71.	*	50.	12.	*
5.	183.	*	30.	50.	*	55.	8.	*
10.	231.	*	35.	35.	*	60.	0.	*
15.	151.	*	40.	25.	*	0.	0.	*
20.	102.	*	45.	17.	*	0.	0.	*

1 BASIN ID: 30 -- BASIN COMMENT: BASIN #30 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 10 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)		TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	
0.	.00	.000	0.	*	75.	.06	.025	28.	*
5.	.04	.000	0.	*	80.	.05	.015	23.	*

10.	.07	.012	2.	*	85.	.04	.011	18.	*
15.	.15	.049	12.	*	90.	.04	.011	15.	*
20.	.28	.090	30.	*	95.	.04	.011	14.	*
25.	.47	.327	89.	*	100.	.04	.011	12.	*
30.	.22	.178	127.	*	105.	.04	.011	12.	*
35.	.10	.064	116.	*	110.	.04	.011	11.	*
40.	.08	.043	92.	*	115.	.03	.010	11.	*
45.	.07	.035	74.	*	120.	.02	.008	10.	*
50.	.06	.024	59.	*	125.	.00	.000	7.	*
55.	.06	.025	48.	*	130.	.00	.000	5.	*
60.	.06	.025	40.	*	135.	.00	.000	3.	*
65.	.06	.025	35.	*	140.	.00	.000	2.	*
70.	.06	.025	31.	*	145.	.00	.000	1.	*

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TOTAL PRECIP. =  2.15 (1-HOUR RAIN =  1.86)     EXECESS PRECIP. = 1.050  INCHES
VOLUME OF EXCESS PRECIP =     6.  ACRE-FEET
PEAK Q =  127. CFS      TIME OF PEAK =  30. MIN.
INFILT.= 3.70 IN/HR    DECAY = .00180    FNINF =  .60 IN/HR
MAX.PERV.RET.= .35 IN.     MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C =        .49
                 I =       3.4 INCHES/HOUR
                 A =      73.6 ACRES
                 Q =      122. CFS
1   U.D.F.C.D. CUHPD RUNOFF ANALYSIS     EXECUTED ON DATE                AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985 TO WRITE OUTPUT FILE OF STORM HYDROGRAPHS FOR SUBSEQUENT
USE WITH MULTI-PLAN RIVER ROUTING ROUTINES OF HEC-1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993



NO HYDROGRAPH VALUES WERE WRITTEN TO AN OUTPUTFILE FOR THIS RUN OF CUHPD.
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APPENDIX B - CUHPE/PC - 100 YR

FULLY DEVELOPED LAND USE CONDITIONS

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\2      KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993
01100 YR    100 2.95                                          0.000.000.000.00

\71 1 15.0    01 01 BASIN #1 FUTURE CONDITIONS
 .105 .568 .341 75.0 .013 27.0  .40  .08  3.8.0018   .6     0
\71 1 15.0    02 02 BASIN #2 FUTURE CONDITIONS
 .093 .758 .360 91.0 .030 26.0  .40  .08  3.2.0018   .5     0
\71 1 15.0    03 03 BASIN #3 FUTURE CONDITIONS
 .118 .691 .252 85.0 .015 28.0  .35  .08  3.4.0018   .5     0
\70 1 15.0    04 04 BASIN #4 FUTURE CONDITIONS
 .248 .758 .284 57.0 .019  0.0  .35  .06  3.0.0018   .5     0
\70 1 15.0    05 05 BASIN #5 FUTURE CONDITIONS
 .302 .953 .419 58.0 .008  0.0  .35  .07  3.0.0018   .5     0
\71 1 15.0    06 06 BASIN #6 FUTURE CONDITIONS
 .084 .634 .417 46.0 .011 29.0  .38  .06  3.0.0018   .5     0
\71 1 15.0    07 07 BASIN #7 FUTURE CONDITIONS
 .116 .777 .445 47.0 .014 33.0  .35  .07  3.0.0018   .5     0
\70 1 15.0    08 08 BASIN #8 FUTURE CONDITIONS
 .264 .563 .379 80.0 .018  0.0  .40  .10  3.0.0018   .5     0
 71 1 15.0    09 09 BASIN #9 FUTURE CONDITIONS
 .038 .288 .138 70.0 .030 11.0  .35  .10  3.0.0018   .5     0
\71 1 15.0    10 10 BASIN #10 FUTURE CONDITIONS
 .038 .275 .104 71.0 .018 18.0  .40  .10  3.9.0018   .6     0
\71 1 15.0    40 40 BASIN #40 FUTURE CONDITIONS
 .067 .379 .180 92.0 .007 21.0  .40  .10  3.9.0018   .6     0
\71 1 15.0    11 11 BASIN #11 FUTURE CONDITIONS
 .041 .360 .095 68.0 .021 17.0  .40  .07  3.6.0018   .5     0
\71 1 15.0    12 12 BASIN #12 FUTURE CONDITIONS
 .039 .322 .142 60.0 .016 19.0  .38  .07  3.6.0018   .5     0
 71 1 15.0    13 13 BASIN #13 FUTURE CONDITIONS
 .083 .691 .218 72.0 .010 30.0  .35  .06  3.0.0018   .5     0
 71 1 15.0    15 15 BASIN #15 FUTURE CONDITIONS
 .016 .237 .114 68.0 .012 10.0  .40  .07  3.6.0018   .5     0
\71 1 15.0    20 20 BASIN #20 FUTURE CONDITIONS
 .047 .369 .199 41.0 .018 19.0  .35  .07  4.1.0018   .6     0
\71 1 15.0    30 30 BASIN #30 FUTURE CONDITIONS
 .115 .530 .242 34.0 .024 23.0  .35  .07  3.7.0018   .6     0
E
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1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 01 -- BASIN COMMENT: BASIN #1 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.10	.57	.34	75.00	.0130	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.078	.555

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.00	27.00	2245.77	235.81	5.60

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 8.57)

WIDTH AT 50 = 13. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .08 IN.
INFILTRATION = 3.80 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	126.	40.	24.
5.	57.	25.	82.	45.	16.
10.	213.	30.	54.	50.	10.
15.	197.	35.	36.	55.	0.

1 BASIN ID: 01 -- BASIN COMMENT: BASIN #1 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	75.	.06	.044	84.
5.	.03	.000	0.	80.	.04	.025	62.
10.	.09	.027	2.	85.	.04	.025	46.
15.	.14	.097	11.	90.	.04	.025	36.
20.	.24	.168	36.	95.	.04	.025	30.
25.	.41	.320	77.	100.	.04	.025	26.
30.	.74	.694	155.	105.	.04	.025	24.
35.	.41	.383	263.	110.	.04	.025	22.
40.	.24	.213	291.	115.	.04	.025	21.
45.	.18	.163	257.	120.	.04	.025	21.
50.	.15	.129	216.	125.	.00	.000	19.
55.	.12	.101	179.	130.	.00	.000	14.
60.	.12	.101	148.	135.	.00	.000	9.
65.	.12	.101	125.	140.	.00	.000	6.
70.	.06	.044	107.	145.	.00	.000	4.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.812 INCHES

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        VOLUME OF EXCESS PRECIP =    16.  ACRE-FEET
        PEAK Q =  291. CFS      TIME OF PEAK =  40. MIN.
        INFILT.= 3.80 IN/HR    DECAY = .00180    FNINF =  .60 IN/HR
        MAX.PERV.RET.= .40 IN.     MAX.IMP.RET.= .08 IN.

        RATIONAL FORMULA C =        .82
                         I =       4.9 INCHES/HOUR
                         A =      67.2 ACRES
                         Q =      272. CFS
1    U.D.F.C.D. CUHP RUNOFF ANALYSIS     EXECUTED ON DATE                AT TIME

     CUHPE/PC VERSION MODIFIED IN JANUARY 1985

     PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS  7

     KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993


     BASIN ID:      02  --  BASIN COMMENT:   BASIN #2 FUTURE CONDITIONS

       AREA OF BASIN  LENGTH OF BASIN  DIST TO CENTROID  IMPERVIOUS AREA  SLOPE  UNIT DURATION
          (SQMI)           (MI)             (MI)              (PCT)      (FT/FT)    (MIN)

           .09              .76              .36             91.00        .0300       5.00

                    COEFFICIENT                    COEFFICIENT
               (REFLECTING TIME TO PEAK)   (RELATED TO PEAK RATE OF RUNOFF)

                        .074                           .581

                           CALCULATED UNIT HYDROGRAPH

       TIME TO PEAK  TIME OF CONCENTRATION  PEAK RATE OF RUNOFF  UNIT HYDROGRAPH PEAK  VOLUME OF RUNOFF
          (MIN)              (MIN)             (CFS/SQMI)              (CFS)               (AF)

          11.25             26.00             2550.75                237.22              4.96


       *** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER,
                  REPLACING THE ONE COMPUTED BY CUHPD (TP=  8.06)


       WIDTH AT 50 =  12. MIN.   WIDTH AT 75 =   6. MIN.  K50 = .35  K75 = .45

              RAINFALL LOSSES INPUT W/ BASIN DATA

       MAX. PERVIOUS RET. = .40 IN.    MAX. IMPERVIOUS RET. = .08 IN.
       INFILTRATION = 3.20 IN./HR.     DECAY =  .00180/SECOND      FNINFL =  .50 IN./HR.



      TIME       UNIT      '     TIME       UNIT      '     TIME       UNIT      '
              HYDROGRAPH   *             HYDROGRAPH   *             HYDROGRAPH   *
                           *                          *
                           *                          *
       0.          0.      *     20.         107.     *     40.         16.      *
       5.         57.      *     25.          67.     *     45.         10.      *
      10.        226.      *     30.          41.     *     50.          0.      *
      15.        173.      *     35.          26.     *      0.          0.      *
1          BASIN ID:      02  --  BASIN COMMENT:   BASIN #2 FUTURE CONDITIONS


 **** STORM NO. =   1  ****      DATE OR RETURN PERIOD = 100 YR


             INCREMENT   TOTAL     STORM      *             INCREMENT   TOTAL     STORM      *
      TIME    RAINFALL   EXCESS   HYDROGRAPH   *      TIME    RAINFALL   EXCESS   HYDROGRAPH   *
     (MIN.)     (IN)     PRECIP     (CFS)      *     (MIN.)     (IN)     PRECIP     (CFS)      *
                                               *                                               *
                                               *                                               *
       0.       .00       .000        0.       *      75.       .06       .053       70.       *
       5.       .03       .000        0.       *      80.       .04       .031       55.       *
      10.       .09       .033        2.       *      85.       .04       .031       42.       *
      15.       .14       .117       14.       *      90.       .04       .031       34.       *
      20.       .24       .204       44.       *      95.       .04       .031       29.       *
      25.       .41       .370       91.       *     100.       .04       .031       26.       *
      30.       .74       .699      173.       *     105.       .04       .031       24.       *
      35.       .41       .390      275.       *     110.       .04       .031       23.       *
      40.       .24       .221      280.       *     115.       .04       .031       22.       *
```

45.	.18	.171	238.	*	120.	.04	.031	22.	*
50.	.15	.137	196.	*	125.	.00	.000	20.	*
55.	.12	.109	159.	*	130.	.00	.000	13.	*
60.	.12	.109	130.	*	135.	.00	.000	8.	*
65.	.12	.109	110.	*	140.	.00	.000	5.	*
70.	.06	.053	93.	*	145.	.00	.000	3.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 3.049 INCHES
VOLUME OF EXCESS PRECIP = 15. ACRE-FEET
PEAK Q = 280. CFS TIME OF PEAK = 40. MIN.
INFILT.= 3.20 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .08 IN.

RATIONAL FORMULA C = .89
I = 5.0 INCHES/HOUR
A = 59.5 ACRES
Q = 267. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 03 -- BASIN COMMENT: BASIN #3 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.69	.25	85.00	.0150	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.076	.591

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.24	28.00	2328.67	274.78	6.29

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 7.88)

WIDTH AT 50 = 13. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .08 IN.
INFILTRATION = 3.40 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH		TIME	UNIT HYDROGRAPH		TIME	UNIT HYDROGRAPH	
0.	0.	*	20.	146.	*	40.	25.	*
5.	57.	*	25.	93.	*	45.	16.	*
10.	238.	*	30.	60.	*	50.	10.	*
15.	234.	*	35.	39.	*	55.	0.	*

1 BASIN ID: 03 -- BASIN COMMENT: BASIN #3 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*

0.	.00	.000	0.	*	80.	.04	.029	74.	*
5.	.03	.000	0.	*	85.	.04	.029	56.	*
10.	.09	.031	2.	*	90.	.04	.029	44.	*
15.	.14	.110	14.	*	95.	.04	.029	37.	*
20.	.24	.191	44.	*	100.	.04	.029	32.	*
25.	.41	.362	96.	*	105.	.04	.029	30.	*
30.	.74	.698	190.	*	110.	.04	.029	28.	*
35.	.41	.388	313.	*	115.	.04	.029	27.	*
40.	.24	.219	347.	*	120.	.04	.029	26.	*
45.	.18	.169	305.	*	125.	.00	.000	25.	*
50.	.15	.135	253.	*	130.	.00	.000	18.	*
55.	.12	.107	209.	*	135.	.00	.000	11.	*
60.	.12	.107	172.	*	140.	.00	.000	7.	*
65.	.12	.107	145.	*	145.	.00	.000	4.	*
70.	.06	.050	125.	*	150.	.00	.000	3.	*
75.	.06	.050	99.	*	155.	.00	.000	1.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.979 INCHES
VOLUME OF EXCESS PRECIP = 19. ACRE-FEET
PEAK Q = 347. CFS TIME OF PEAK = 40. MIN.
INFILT.= 3.40 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .08 IN.

RATIONAL FORMULA C = .87
I = 4.8 INCHES/HOUR
A = 75.5 ACRES
Q = 317. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 04 -- BASIN COMMENT: BASIN #4 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.25	.76	.28	57.00	.0190	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.085	.551

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.82	3344.92	829.54	13.23

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	205.	40.	15.
5.	310.	25.	107.	45.	8.
10.	779.	30.	55.	50.	0.
15.	396.	35.	29.	0.	0.

1 BASIN ID: 04 -- BASIN COMMENT: BASIN #4 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

INCREMENT	TOTAL	STORM	*	INCREMENT	TOTAL	STORM	*

TIME (MIN.)	RAINFALL (IN)	EXCESS PRECIP	HYDROGRAPH (CFS)	*	TIME (MIN.)	RAINFALL (IN)	EXCESS PRECIP	HYDROGRAPH (CFS)	*
0.	.00	.000	0.	*	75.	.06	.039	129.	*
5.	.03	.000	0.	*	80.	.04	.019	95.	*
10.	.09	.031	10.	*	85.	.04	.019	66.	*
15.	.14	.073	47.	*	90.	.04	.019	51.	*
20.	.24	.128	109.	*	95.	.04	.019	44.	*
25.	.41	.312	232.	*	100.	.04	.019	40.	*
30.	.74	.694	528.	*	105.	.04	.019	38.	*
35.	.41	.381	818.	*	110.	.04	.019	37.	*
40.	.24	.210	719.	*	115.	.04	.019	37.	*
45.	.18	.159	549.	*	120.	.04	.019	37.	*
50.	.15	.125	420.	*	125.	.00	.000	31.	*
55.	.12	.096	324.	*	130.	.00	.000	16.	*
60.	.12	.097	256.	*	135.	.00	.000	8.	*
65.	.12	.097	221.	*	140.	.00	.000	4.	*
70.	.06	.039	185.	*	145.	.00	.000	2.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.654 INCHES
VOLUME OF EXCESS PRECIP = 35. ACRE-FEET
PEAK Q = 818. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .06 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 05 -- BASIN COMMENT: BASIN #5 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.30	.95	.42	58.00	.0080	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.085	.573

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
12.91	2113.14	638.17	16.11

WIDTH AT 50 = 14. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*
0.	0.	*	25.	252.	*	50.	32.	*
5.	132.	*	30.	167.	*	55.	21.	*
10.	518.	*	35.	110.	*	60.	14.	*
15.	591.	*	40.	73.	*	65.	9.	*
20.	385.	*	45.	48.	*	70.	0.	*

1 BASIN ID: 05 -- BASIN COMMENT: BASIN #5 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME	INCREMENT RAINFALL	TOTAL EXCESS	STORM HYDROGRAPH	*	TIME	INCREMENT RAINFALL	TOTAL EXCESS	STORM HYDROGRAPH	*

(MIN.)	(IN)	PRECIP	(CFS)	*	(MIN.)	(IN)	PRECIP	(CFS)	*
				*					*
				*					*
0.	.00	.000	0.	*	85.	.04	.020	147.	*
5.	.03	.000	0.	*	90.	.04	.020	111.	*
10.	.09	.026	4.	*	95.	.04	.020	85.	*
15.	.14	.075	24.	*	100.	.04	.020	69.	*
20.	.24	.130	72.	*	105.	.04	.020	60.	*
25.	.41	.314	163.	*	110.	.04	.020	55.	*
30.	.74	.694	367.	*	115.	.04	.020	51.	*
35.	.41	.381	669.	*	120.	.04	.020	49.	*
40.	.24	.210	804.	*	125.	.00	.000	45.	*
45.	.18	.159	733.	*	130.	.00	.000	34.	*
50.	.15	.125	618.	*	135.	.00	.000	22.	*
55.	.12	.097	513.	*	140.	.00	.000	14.	*
60.	.12	.097	424.	*	145.	.00	.000	9.	*
65.	.12	.097	358.	*	150.	.00	.000	6.	*
70.	.06	.040	307.	*	155.	.00	.000	4.	*
75.	.06	.040	248.	*	160.	.00	.000	2.	*
80.	.04	.020	193.	*	165.	.00	.000	1.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.661 INCHES
VOLUME OF EXCESS PRECIP = 43. ACRE-FEET
PEAK Q = 804. CFS TIME OF PEAK = 40. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 06 -- BASIN COMMENT: BASIN #6 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.08	.63	.42	46.00	.0110	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.090	.404

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
11.91	29.00	1650.15	138.61	4.48

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 10.93)

WIDTH AT 50 = 18. MIN. WIDTH AT 75 = 9. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .38 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	' *	TIME	UNIT HYDROGRAPH	' *	TIME	UNIT HYDROGRAPH	' *
		*			*			
		*			*			
0.	0.	*	25.	65.	*	50.	17.	*
5.	60.	*	30.	50.	*	55.	13.	*
10.	132.	*	35.	38.	*	60.	10.	*
15.	125.	*	40.	29.	*	65.	8.	*
20.	89.	*	45.	22.	*	70.	0.	*

1 BASIN ID: 06 -- BASIN COMMENT: BASIN #6 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*
0.	.00	.000	0.	*	80.	.04	.015	61.	*
5.	.03	.000	0.	*	85.	.04	.015	49.	*
10.	.09	.025	2.	*	90.	.04	.015	38.	*
15.	.14	.059	7.	*	95.	.04	.015	28.	*
20.	.24	.103	17.	*	100.	.04	.015	21.	*
25.	.41	.275	40.	*	105.	.04	.015	18.	*
30.	.74	.692	98.	*	110.	.04	.015	15.	*
35.	.41	.378	163.	*	115.	.04	.015	13.	*
40.	.24	.206	184.	*	120.	.04	.015	12.	*
45.	.18	.155	171.	*	125.	.00	.000	10.	*
50.	.15	.121	152.	*	130.	.00	.000	8.	*
55.	.12	.092	133.	*	135.	.00	.000	5.	*
60.	.12	.093	117.	*	140.	.00	.000	4.	*
65.	.12	.093	104.	*	145.	.00	.000	3.	*
70.	.06	.035	91.	*	150.	.00	.000	2.	*
75.	.06	.035	76.	*	155.	.00	.000	2.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.502 INCHES
VOLUME OF EXCESS PRECIP = 11. ACRE-FEET
PEAK Q = 184. CFS TIME OF PEAK = 40. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .38 IN. MAX.IMP.RET.= .06 IN.

RATIONAL FORMULA C = .73
I = 4.7 INCHES/HOUR
A = 53.8 ACRES
Q = 186. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 07 -- BASIN COMMENT: BASIN #7 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.78	.44	47.00	.0140	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.090	.431

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
13.47	33.00	1509.84	175.14	6.19

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 11.50)

WIDTH AT 50 = 20. MIN. WIDTH AT 75 = 10. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	30.	73.	60.	16.
5.	59.	35.	57.	65.	12.
10.	152.	40.	44.	70.	10.
15.	171.	45.	34.	75.	7.
20.	126.	50.	26.	80.	0.
25.	96.	55.	20.	0.	0.

1 BASIN ID: 07 -- BASIN COMMENT: BASIN #7 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	85.	.04	.016	75.
5.	.03	.000	0.	90.	.04	.016	61.
10.	.09	.021	1.	95.	.04	.016	50.
15.	.14	.061	7.	100.	.04	.016	40.
20.	.24	.105	19.	105.	.04	.016	30.
25.	.41	.294	47.	110.	.04	.016	25.
30.	.74	.692	113.	115.	.04	.016	21.
35.	.41	.378	198.	120.	.04	.016	19.
40.	.24	.206	241.	125.	.00	.000	16.
45.	.18	.155	233.	130.	.00	.000	13.
50.	.15	.121	211.	135.	.00	.000	9.
55.	.12	.093	187.	140.	.00	.000	7.
60.	.12	.093	165.	145.	.00	.000	5.
65.	.12	.093	147.	150.	.00	.000	4.
70.	.06	.035	130.	155.	.00	.000	3.
75.	.06	.035	110.	160.	.00	.000	2.
80.	.04	.016	91.	165.	.00	.000	1.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.526 INCHES
VOLUME OF EXCESS PRECIP = 16. ACRE-FEET
PEAK Q = 241. CFS TIME OF PEAK = 40. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .74
I = 4.4 INCHES/HOUR
A = 74.2 ACRES
Q = 240. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 08 -- BASIN COMMENT: BASIN #8 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.26	.56	.38	80.00	.0180	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.077	.653

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAP PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.28	4343.97	1146.81	14.08

WIDTH AT 50 = 7. MIN. WIDTH AT 75 = 4. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	389.	30.	29.
5.	354.	20.	163.	35.	12.
10.	921.	25.	68.	40.	0.

1 BASIN ID: 08 -- BASIN COMMENT: BASIN #8 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.048	188.
5.	.03	.000	0.	75.	.06	.048	132.
10.	.09	.014	5.	80.	.04	.027	102.
15.	.14	.103	49.	85.	.04	.027	72.
20.	.24	.179	164.	90.	.04	.027	60.
25.	.41	.345	329.	95.	.04	.027	55.
30.	.74	.698	652.	100.	.04	.027	53.
35.	.41	.387	950.	105.	.04	.027	52.
40.	.24	.218	776.	110.	.04	.027	52.
45.	.18	.167	553.	115.	.04	.027	52.
50.	.15	.133	408.	120.	.04	.027	52.
55.	.12	.105	310.	125.	.00	.000	43.
60.	.12	.105	247.	130.	.00	.000	18.
65.	.12	.105	218.	135.	.00	.000	7.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.896 INCHES
VOLUME OF EXCESS PRECIP = 41. ACRE-FEET
PEAK Q = 950. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 09 -- BASIN COMMENT: BASIN #9 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.29	.14	70.00	.0300	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.080	.463

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
5.35	11.00	6247.51	237.41	2.03

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.87)

WIDTH AT 50 = 5. MIN. WIDTH AT 75 = 2. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	10.	82.	20.	8.
5.	232.	15.	25.	25.	0.

1 BASIN ID: 09 -- BASIN COMMENT: BASIN #9 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	65.	.12	.101	35.
5.	.03	.000	0.	70.	.06	.044	22.
10.	.09	.012	3.	75.	.06	.044	17.
15.	.14	.090	22.	80.	.04	.024	11.
20.	.24	.157	44.	85.	.04	.024	9.
25.	.41	.336	93.	90.	.04	.024	8.
30.	.74	.696	194.	95.	.04	.024	8.
35.	.41	.384	156.	100.	.04	.024	8.
40.	.24	.214	102.	105.	.04	.024	8.
45.	.18	.163	71.	110.	.04	.024	8.
50.	.15	.129	52.	115.	.04	.024	8.
55.	.12	.101	40.	120.	.04	.024	8.
60.	.12	.101	36.	125.	.00	.000	3.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXCESS PRECIP. = 2.787 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 194. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.00 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .82
I = 7.7 INCHES/HOUR
A = 24.3 ACRES
Q = 152. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 10 -- BASIN COMMENT: BASIN #10 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.28	.10	71.00	.0180	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.080	.466

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.26	18.00	3105.36	118.00	2.03

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.78)

WIDTH AT 50 = 10. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.90 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	56.	30.	12.
5.	62.	20.	34.	35.	0.
10.	105.	25.	20.	0.	0.

1 BASIN ID: 10 -- BASIN COMMENT: BASIN #10 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.042	27.
5.	.03	.000	0.	75.	.06	.042	20.
10.	.09	.012	1.	80.	.04	.024	15.
15.	.14	.092	7.	85.	.04	.024	11.
20.	.24	.159	20.	90.	.04	.024	9.
25.	.41	.307	41.	95.	.04	.024	8.
30.	.74	.693	87.	100.	.04	.024	7.
35.	.41	.381	121.	105.	.04	.024	7.
40.	.24	.212	107.	110.	.04	.024	7.
45.	.18	.161	85.	115.	.04	.024	7.
50.	.15	.127	67.	120.	.04	.024	7.
55.	.12	.099	52.	125.	.00	.000	5.
60.	.12	.099	38.	130.	.00	.000	3.
65.	.12	.099	32.	135.	.00	.000	2.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.741 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 121. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.90 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .80
I = 6.1 INCHES/HOUR
A = 24.3 ACRES
Q = 119. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 40 -- BASIN COMMENT: BASIN #40 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.07	.38	.18	92.00	.0070	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.074	.555

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
9.10	21.00	3230.93	216.47	3.57

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 6.54)

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.
INFILTRATION = 3.90 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	110.	30.	18.
5.	76.	20.	60.	35.	10.
10.	209.	25.	33.	40.	0.

1 BASIN ID: 40 -- BASIN COMMENT: BASIN #40 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.052	55.
5.	.03	.000	0.	75.	.06	.052	41.
10.	.09	.016	1.	80.	.04	.031	32.
15.	.14	.119	12.	85.	.04	.031	24.
20.	.24	.206	42.	90.	.04	.031	20.
25.	.41	.369	85.	95.	.04	.031	18.
30.	.74	.698	161.	100.	.04	.031	17.
35.	.41	.389	233.	105.	.04	.031	16.
40.	.24	.221	207.	110.	.04	.031	16.
45.	.18	.170	161.	115.	.04	.031	16.
50.	.15	.137	125.	120.	.04	.031	16.
55.	.12	.108	98.	125.	.00	.000	14.
60.	.12	.109	77.	130.	.00	.000	7.
65.	.12	.109	65.	135.	.00	.000	4.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 3.033 INCHES
VOLUME OF EXCESS PRECIP = 11. ACRE-FEET
PEAK Q = 233. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.90 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .10 IN.

RATIONAL FORMULA C = .89
I = 5.6 INCHES/HOUR
A = 42.9 ACRES
Q = 215. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 11 -- BASIN COMMENT: BASIN #11 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.36	.09	68.00	.0210	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.081	.462

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
7.88	17.00	3296.58	135.16	2.19

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 4.92)

WIDTH AT 50 = 9. MIN. WIDTH AT 75 = 5. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.60 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	59.	30.	11.
5.	76.	20.	33.	35.	0.
10.	112.	25.	19.	0.	0.

1 BASIN ID: 11 -- BASIN COMMENT: BASIN #11 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.044	28.
5.	.03	.000	0.	75.	.06	.044	21.
10.	.09	.031	2.	80.	.04	.023	15.
15.	.14	.088	10.	85.	.04	.023	11.
20.	.24	.152	23.	90.	.04	.023	9.
25.	.41	.309	47.	95.	.04	.023	8.
30.	.74	.695	100.	100.	.04	.023	7.
35.	.41	.383	132.	105.	.04	.023	7.
40.	.24	.213	114.	110.	.04	.023	7.
45.	.18	.163	89.	115.	.04	.023	7.
50.	.15	.129	70.	120.	.04	.023	7.
55.	.12	.100	53.	125.	.00	.000	5.
60.	.12	.100	40.	130.	.00	.000	3.
65.	.12	.101	34.	135.	.00	.000	1.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.757 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 132. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.60 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .81
I = 6.3 INCHES/HOUR
A = 26.2 ACRES
Q = 133. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 12 -- BASIN COMMENT: BASIN #12 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.04	.32	.14	60.00	.0160	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.084	.430

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.74	19.00	2645.95	103.19	2.08

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 5.59)

WIDTH AT 50 = 11. MIN. WIDTH AT 75 = 6. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .38 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.60 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	15.	59.	30.	16.
5.	56.	20.	37.	35.	10.
10.	99.	25.	24.	40.	0.

1 BASIN ID: 12 -- BASIN COMMENT: BASIN #12 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.040	29.
5.	.03	.000	0.	75.	.06	.041	22.
10.	.09	.027	2.	80.	.04	.020	16.
15.	.14	.077	7.	85.	.04	.020	12.
20.	.24	.135	17.	90.	.04	.020	9.
25.	.41	.296	35.	95.	.04	.020	8.
30.	.74	.693	79.	100.	.04	.020	7.
35.	.41	.381	114.	105.	.04	.020	6.
40.	.24	.210	106.	110.	.04	.020	6.
45.	.18	.160	88.	115.	.04	.020	6.
50.	.15	.126	72.	120.	.04	.020	6.
55.	.12	.097	58.	125.	.00	.000	5.
60.	.12	.098	46.	130.	.00	.000	3.
65.	.12	.098	36.	135.	.00	.000	2.

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.661 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 114. CFS TIME OF PEAK = 35. MIN.
INFILT.= 3.60 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .38 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .78
I = 5.9 INCHES/HOUR
A = 25.0 ACRES
Q = 116. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 13 -- BASIN COMMENT: BASIN #13 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.08	.69	.22	72.00	.0100	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.079	.527

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
13.29	30.00	1876.08	155.71	4.43

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 8.30)

WIDTH AT 50 = 16. MIN. WIDTH AT 75 = 8. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .06 IN.
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	25.	71.	50.	14.
5.	37.	30.	52.	55.	10.
10.	126.	35.	37.	60.	0.
15.	149.	40.	27.	0.	0.
20.	102.	45.	19.	0.	0.

1 BASIN ID: 13 -- BASIN COMMENT: BASIN #13 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	80.	.04	.024	62.
5.	.03	.000	0.	85.	.04	.024	45.
10.	.09	.040	1.	90.	.04	.024	34.
15.	.14	.093	8.	95.	.04	.024	28.
20.	.24	.161	24.	100.	.04	.024	23.
25.	.41	.340	51.	105.	.04	.024	20.
30.	.74	.696	105.	110.	.04	.024	18.
35.	.41	.385	178.	115.	.04	.024	17.
40.	.24	.215	213.	120.	.04	.024	16.
45.	.18	.164	199.	125.	.00	.000	15.
50.	.15	.130	174.	130.	.00	.000	12.
55.	.12	.102	150.	135.	.00	.000	8.
60.	.12	.102	128.	140.	.00	.000	6.
65.	.12	.102	111.	145.	.00	.000	4.
70.	.06	.045	96.	150.	.00	.000	3.
75.	.06	.045	80.	155.	.00	.000	2.

```
TOTAL PRECIP. =  3.41 (1-HOUR RAIN =  2.95)     EXECESS PRECIP. = 2.838  INCHES
VOLUME OF EXCESS PRECIP =    13.  ACRE-FEET
PEAK Q =  213. CFS      TIME OF PEAK =  40. MIN.
INFILT.= 3.00 IN/HR    DECAY = .00180    FNINF =  .50 IN/HR
MAX.PERV.RET.= .35 IN.     MAX.IMP.RET.= .06 IN.

RATIONAL FORMULA C =        .83
                 I =       4.6 INCHES/HOUR
                 A =      53.1 ACRES
                 Q =      204. CFS
1    U.D.F.C.D. CUHP RUNOFF ANALYSIS     EXECUTED ON DATE                AT TIME

     CUHPE/PC VERSION MODIFIED IN JANUARY 1985

     PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS  7

     KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993


     BASIN ID:      15  --  BASIN COMMENT:   BASIN #15 FUTURE CONDITIONS

       AREA OF BASIN  LENGTH OF BASIN  DIST TO CENTROID  IMPERVIOUS AREA  SLOPE  UNIT DURATION
          (SQMI)           (MI)             (MI)              (PCT)      (FT/FT)    (MIN)

           .02              .24              .11             68.00        .0120       5.00

                    COEFFICIENT                    COEFFICIENT
               (REFLECTING TIME TO PEAK)   (RELATED TO PEAK RATE OF RUNOFF)

                        .081                           .401

                          CALCULATED UNIT HYDROGRAPH

       TIME TO PEAK  TIME OF CONCENTRATION  PEAK RATE OF RUNOFF  UNIT HYDROGRAPH PEAK  VOLUME OF RUNOFF
          (MIN)              (MIN)             (CFS/SQMI)              (CFS)               (AF)

           4.97              10.00             6247.48                 99.96               .85


       *** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER,
                  REPLACING THE ONE COMPUTED BY CUHPD (TP=  4.98)


       WIDTH AT 50 =   5. MIN.   WIDTH AT 75 =   2. MIN.  K50 = .35  K75 = .45

               RAINFALL LOSSES INPUT W/ BASIN DATA

       MAX. PERVIOUS RET. = .40 IN.    MAX. IMPERVIOUS RET. = .07 IN.
       INFILTRATION = 3.60 IN./HR.     DECAY =  .00180/SECOND      FNINFL =  .50 IN./HR.


      TIME       UNIT      '     TIME       UNIT      '     TIME       UNIT      '
              HYDROGRAPH   *             HYDROGRAPH   *             HYDROGRAPH   *
                           *                          *
                           *                          *
       0.          0.      *     10.         33.      *     20.          0.      *
       5.        100.      *     15.         11.      *      0.          0.      *
1          BASIN ID:      15  --  BASIN COMMENT:   BASIN #15 FUTURE CONDITIONS

 **** STORM NO. =   1  ****      DATE OR RETURN PERIOD = 100 YR

             INCREMENT   TOTAL     STORM      *             INCREMENT   TOTAL     STORM      *
      TIME    RAINFALL   EXCESS   HYDROGRAPH  *      TIME    RAINFALL   EXCESS   HYDROGRAPH  *
     (MIN.)     (IN)     PRECIP     (CFS)     *     (MIN.)     (IN)     PRECIP     (CFS)     *
                                              *                                              *
                                              *                                              *
       0.       .00       .000        0.      *      60.       .12       .100       15.      *
       5.       .03       .000        0.      *      65.       .12       .101       14.      *
      10.       .09       .031        3.      *      70.       .06       .044        9.      *
      15.       .14       .088       10.      *      75.       .06       .044        7.      *
      20.       .24       .152       18.      *      80.       .04       .023        4.      *
      25.       .41       .309       37.      *      85.       .04       .023        4.      *
      30.       .74       .695       81.      *      90.       .04       .023        3.      *
      35.       .41       .383       65.      *      95.       .04       .023        3.      *
      40.       .24       .213       42.      *     100.       .04       .023        3.      *
      45.       .18       .163       28.      *     105.       .04       .023        3.      *
```

50.	.15	.129	21.	*	110.	.04	.023	3.	*
55.	.12	.100	16.	*	115.	.04	.023	3.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.757 INCHES
VOLUME OF EXCESS PRECIP = 2. ACRE-FEET
PEAK Q = 81. CFS TIME OF PEAK = 30. MIN.
INFILT.= 3.60 IN/HR DECAY = .00180 FNINF = .50 IN/HR
MAX.PERV.RET.= .40 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .81
I = 8.0 INCHES/HOUR
A = 10.2 ACRES
Q = 66. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 20 -- BASIN COMMENT: BASIN #20 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.05	.37	.20	41.00	.0180	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.093	.337

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
7.95	19.00	2379.55	111.84	2.51

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 6.67)

WIDTH AT 50 = 13. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 4.10 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	20.	42.	40.	9.
5.	84.	25.	29.	45.	0.
10.	102.	30.	20.	0.	0.
15.	63.	35.	14.	0.	0.

1 BASIN ID: 20 -- BASIN COMMENT: BASIN #20 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)
0.	.00	.000	0.	70.	.06	.028	32.
5.	.03	.000	0.	75.	.06	.028	23.
10.	.09	.019	2.	80.	.04	.014	17.
15.	.14	.053	6.	85.	.04	.014	12.

20.	.24	.092	14.	*	90.	.04	.014	9.	*
25.	.41	.243	34.	*	95.	.04	.014	7.	*
30.	.74	.684	91.	*	100.	.04	.014	6.	*
35.	.41	.370	122.	*	105.	.04	.014	5.	*
40.	.24	.199	111.	*	110.	.04	.014	5.	*
45.	.18	.148	94.	*	115.	.04	.014	5.	*
50.	.15	.114	79.	*	120.	.04	.014	5.	*
55.	.12	.085	65.	*	125.	.00	.000	4.	*
60.	.12	.086	54.	*	130.	.00	.000	2.	*
65.	.12	.086	46.	*	135.	.00	.000	2.	*

TOTAL PRECIP. = 3.41 (1-HOUR RAIN = 2.95) EXECESS PRECIP. = 2.359 INCHES
VOLUME OF EXCESS PRECIP = 6. ACRE-FEET
PEAK Q = 122. CFS TIME OF PEAK = 35. MIN.
INFILT.= 4.10 IN/HR DECAY = .00180 FNINF = .60 IN/HR
MAX.PERV.RET.= .35 IN. MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C = .69
I = 5.9 INCHES/HOUR
A = 30.1 ACRES
Q = 124. CFS

1 U.D.F.C.D. CUHP RUNOFF ANALYSIS EXECUTED ON DATE AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985

PRINT OPTION NUMBER SELECTED FOR THIS BASIN IS 7

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993

BASIN ID: 30 -- BASIN COMMENT: BASIN #30 FUTURE CONDITIONS

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	SLOPE (FT/FT)	UNIT DURATION (MIN)
.12	.53	.24	34.00	.0240	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.096	.320

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	TIME OF CONCENTRATION (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
8.30	23.00	2114.07	243.12	6.13

*** NOTE : THE TIME TO PEAK IS CALCULATED BASED ON THE TIME OF CONCENTRATION PROVIDED BY THE USER, REPLACING THE ONE COMPUTED BY CUHPD (TP= 7.78)

WIDTH AT 50 = 14. MIN. WIDTH AT 75 = 7. MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .35 IN. MAX. IMPERVIOUS RET. = .07 IN.
INFILTRATION = 3.70 IN./HR. DECAY = .00180/SECOND FNINFL = .60 IN./HR.

TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH	TIME	UNIT HYDROGRAPH
0.	0.	25.	71.	50.	12.
5.	183.	30.	50.	55.	8.
10.	231.	35.	35.	60.	0.
15.	151.	40.	25.	0.	0.
20.	102.	45.	17.	0.	0.

1 BASIN ID: 30 -- BASIN COMMENT: BASIN #30 FUTURE CONDITIONS

**** STORM NO. = 1 **** DATE OR RETURN PERIOD = 100 YR

TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*	TIME (MIN.)	INCREMENT RAINFALL (IN)	TOTAL EXCESS PRECIP	STORM HYDROGRAPH (CFS)	*
0.	.00	.000	0.	*	75.	.06	.025	69.	*
5.	.03	.000	0.	*	80.	.04	.011	51.	*
10.	.09	.016	3.	*	85.	.04	.011	35.	*
15.	.14	.044	12.	*	90.	.04	.011	25.	*
20.	.24	.076	26.	*	95.	.04	.011	20.	*
25.	.41	.236	69.	*	100.	.04	.011	16.	*
30.	.74	.683	197.	*	105.	.04	.011	14.	*
35.	.41	.368	272.	*	110.	.04	.011	12.	*
40.	.24	.196	256.	*	115.	.04	.011	11.	*
45.	.18	.145	220.	*	120.	.04	.011	10.	*
50.	.15	.111	186.	*	125.	.00	.000	8.	*
55.	.12	.082	154.	*	130.	.00	.000	5.	*
60.	.12	.083	130.	*	135.	.00	.000	4.	*
65.	.12	.083	113.	*	140.	.00	.000	3.	*
70.	.06	.025	91.	*	145.	.00	.000	2.	*

```
TOTAL PRECIP. =  3.41 (1-HOUR RAIN =  2.95)    EXECESS PRECIP. = 2.276  INCHES
VOLUME OF EXCESS PRECIP =    14.  ACRE-FEET
PEAK Q =  272. CFS      TIME OF PEAK =  35. MIN.
INFILT.= 3.70 IN/HR    DECAY = .00180    FNINF =  .60 IN/HR
MAX.PERV.RET.= .35 IN.     MAX.IMP.RET.= .07 IN.

RATIONAL FORMULA C =        .67
                 I =       5.4 INCHES/HOUR
                 A =      73.6 ACRES
                 Q =      264. CFS
1   U.D.F.C.D. CUHPD RUNOFF ANALYSIS     EXECUTED ON DATE                AT TIME

CUHPE/PC VERSION MODIFIED IN JANUARY 1985 TO WRITE OUTPUT FILE OF STORM HYDROGRAPHS FOR SUBSEQUENT
USE WITH MULTI-PLAN RIVER ROUTING ROUTINES OF HEC-1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN  FMG INC.    MARCH 1993


NO HYDROGRAPH VALUES WERE WRITTEN TO AN OUTPUTFILE FOR THIS RUN OF CUHPD.
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APPENDIX C

UDSWM2-PC COMPUTER PRINTOUTS

DESIGN PLAN HYDRAULIC CONDITIONS

This appendix contains UDSWM2-PC printouts for recommended design plan hydraulic conditions with fully developed land use conditions. Printouts for both the 10 year and 100 years runs are included.

CAUTION STATEMENT

The user is advised to use caution when using flow conveyance element (channels and pipes) peak flows and hydrographs given in this report. The UDSWM2-PC model assumes that all adjacent sub-basin flow enters the flow conveyance element at the sub-basin design point or the downstream end of the element. The flow conveyance element is simply routing the upstream incoming flow and ignoring the possibility that additional flow may be entering from the adjacent sub-basin. Due to this model limitation flow used for channel or pipe design should be increased appropriately using engineering judgement to reflect incoming sub-basin flow.

APPENDIX C - UDSWM2-PC - 10 YR

DESIGN PLAN HYDRAULIC CONDITIONS

```
   2   1   1   2
   3   4
WATERSHED   1
KNOLLWOOD DRAINAGE BASIN DESIGN PLAN    FMG INC.  MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS   10 YR STORM
        50  0 0  5.0                                                          1
        01  100
        02    4
        03  105
        04  106
        05  107
        06  108
        07  109
        08  110
        09  111
        10  126
        11  127
        12  128
        13  129
        15   50
        20  131
        30  140
        40  150

    0  111   12    3              1.
    0   12   11    2     3.5     100    .009      0.      0.    .016     3.5
    0   11  110    1   100.0    2970    .018     50.     50.    .016     5.0
    0  110  303    3              1.
    0  303   10 12 2     0.1      1.
         0        0         1         5       2.3        22         5        31
        14       44        17        91        21       138        25       163
        36      230        42       341        49       664        57      1301
    0   10  109    2     6.5     320    .002      0.      0.    .016     4.0
    0  109  302    3              1.
    0  302    9  8 2     0.1      1.
         0        0         0         1        .2         4        .8         5
       2.4        7       4.6         8       7.3        74      10.4       365
    0    9  108    1    20.0    1280    .008     50.     50.    .050    10.0
    0  108  301    3              1.
    0  301    8  9 2     0.1      1.
         0        0         0         3      10.2        37      14.5        42
      19.3       47      24.5        50      30.3        55      36.9        88
      44.2      192
    0    8  107    5     5.0    2541    .003      .0      .0    .016     5.0
                         1.0    2541    .003     20.     20.    .020    10.0
    0  107  300    3              1.
    0  300    7  4 2     0.1      1.
         0        0       4.0       205       5.1       280      10.7       573
    0    7  106    5     5.0    1767    .005      .0      .0    .016     5.0
                         1.0    1767    .005     20.     20.    .020    10.0
    0  106    6    3              1.
    0    6    5    5    10.0    1100    .005      .0      .0    .016    10.0
                         1.0    1100    .005     20.     20.    .020    10.0
    0    5  105    1    20.0    2400    .011      5.      5.    .063    20.0
    0  105    4    3              1.
```

```
   0    4  104    1    20.0     700    .015      4.      4.    .063    20.0
   0  104    3    3              1.
   0    3    2    5    15.0     600    .015      .0      .0    .016    15.0
                        50.0     600    .015     25.     25.    .050    20.0
   0    2  103    1    20.0     450    .013      5.      5.    .063    10.0
 102  103  101  7 3      .0      1.    .001      .0      .0    .001    10.0
        0         0       159       159       427       200       795       200
     1203       200      1483       200      1512       200
   0  101   20    3              1.
   0   20  100    1    20.0    1400    .009      5.      5.    .063    10.0
   0  102    1    3              1.
   0    1    0    5     5.0    1766    .008      .0      .0    .016     5.0
                         1.0    1766    .008     20.     20.    .020    10.0
   0  100    0    3              1.
   0  150   90    3              1.
   0   90    0    5     5.5    1000    .007      .0      .0    .016     5.5
                        20.0    1000    .007     20.     20.    .050    10.0
   0  129   59    3              1.
   0   59  128    1    20.0     300    .010      5.      5.    .063    10.0
   0  128  310    3              1.
   0  310   58  7 2     0.1      1.
        0         0        .3        30       1.1        90       2.5       145
      4.4       160       5.6       160       6.7       160
   0   58  127    5     5.5     500    .005      .0      .0    .016     5.5
                        20.0     500    .005     20.     20.    .063    10.0
   0   50  120    5     3.0    1000   .0035      .0      .0    .016     3.0
                         1.0    1000   .0035     20.     20.    .020    10.0
   0  120    0    3              1.
   0  127   57    3              1.
   0   57  126    1    20.0     400   .0025      5.      5.    .063     5.0
   0  126   56    3              1.
   0   56  125    1    20.0     500    .005      5.      5.    .063     5.0
   0  125   55    3              1.
   0   55  120    1    20.0     600   .0035      5.      5.    .063     5.0
   0  131   70    3              1.
   0   70  130    5     4.5     250    .005      .0      .0    .016     4.5
                        10.0     250    .005     20.     20.    .020    10.0
   0  130    0    3              1.
   0  140  320    3              1.
   0  320   80  4 2     0.1      1.
        0         0       5.5         9        14        22        17       117
   0   80    0    2     2.0     450     .01      .0      .0    .016     2.0

   0
  50
   1    2    3    4    5    6    7    8    9   10   11   12   20   50   55   56
  57   58   59   70   80   90  100  101  102  103  104  105  106  107  108  109
 110  111  120  125  126  127  128  129  130  131  140  150  300  301  302  303
 310  320
ENDPROGRAM
□□
```

1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY METCALF + EDDY, INC.
UNIVERSITY OF FLORIDA
WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)

UPDATED BY UNIVERSITY OF FLORIDA (JUNE 1973)
HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

OTAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

ONUMBER OF TIME STEPS 50
OINTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 17 SUBCATCHMENTS

TIME(HR/MIN)	1	2	3	4	5	6	7	8	9	10
	40	11	12	13	15	20	30			
0 0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 10.	1.	1.	1.	8.	3.	1.	1.	2.	1.	0.
	0.	2.	1.	1.	2.	1.	2.			
0 15.	10.	13.	12.	45.	21.	7.	6.	45.	24.	7.
	11.	10.	7.	8.	11.	6.	12.			
0 20.	38.	47.	47.	121.	76.	19.	20.	183.	52.	23.
	47.	26.	19.	25.	22.	16.	30.			
0 25.	88.	104.	110.	276.	188.	48.	55.	385.	112.	49.
	98.	56.	42.	58.	45.	43.	89.			
0 30.	148.	165.	185.	442.	356.	81.	100.	548.	85.	66.
	139.	72.	60.	100.	34.	58.	127.			
0 35.	158.	161.	198.	372.	425.	91.	121.	420.	48.	55.
	116.	59.	54.	118.	19.	51.	116.			
0 40.	133.	129.	165.	259.	370.	81.	113.	270.	30.	41.
	84.	43.	42.	105.	11.	40.	92.			
0 45.	105.	101.	130.	185.	294.	69.	98.	187.	22.	31.

		62.	32.	33.	87.	8.	32.	74.			
0	50.	85.	80.	104.	139.	235.	59.	84.	141.	17.	23.
		48.	24.	26.	73.	7.	26.	59.			
0	55.	69.	65.	85.	108.	190.	50.	73.	113.	16.	16.
		37.	17.	20.	62.	6.	21.	48.			
1	0.	58.	54.	71.	92.	158.	44.	64.	100.	16.	14.
		31.	15.	15.	53.	6.	17.	40.			
1	5.	50.	47.	62.	84.	136.	39.	57.	96.	16.	13.
		28.	14.	13.	47.	6.	13.	35.			
1	10.	44.	41.	55.	79.	123.	36.	52.	95.	16.	13.
		28.	14.	13.	41.	6.	11.	31.			
1	15.	39.	39.	50.	77.	113.	33.	48.	94.	16.	12.
		27.	14.	12.	37.	6.	11.	28.			
1	20.	37.	38.	47.	72.	105.	30.	44.	90.	13.	12.
		26.	13.	12.	32.	5.	10.	23.			
1	25.	33.	34.	43.	60.	93.	26.	39.	75.	10.	10.
		23.	11.	10.	28.	4.	8.	18.			
1	30.	29.	30.	37.	48.	76.	20.	33.	62.	9.	9.
		20.	9.	8.	24.	3.	7.	15.			
1	35.	26.	27.	33.	43.	65.	16.	28.	56.	8.	8.
		18.	8.	7.	22.	3.	6.	14.			
1	40.	24.	25.	30.	40.	58.	15.	23.	53.	8.	7.
		17.	7.	7.	20.	3.	6.	12.			
1	45.	23.	24.	29.	38.	54.	13.	20.	52.	8.	7.
		16.	7.	6.	18.	3.	5.	12.			
1	50.	22.	23.	28.	37.	51.	12.	18.	52.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
1	55.	21.	22.	27.	36.	49.	12.	17.	51.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
2	0.	20.	21.	25.	33.	46.	11.	16.	46.	6.	6.
		15.	6.	5.	16.	2.	4.	10.			
2	5.	17.	18.	22.	25.	40.	9.	14.	34.	2.	4.
		11.	4.	4.	14.	0.	3.	7.			
2	10.	12.	11.	15.	13.	29.	7.	11.	14.	0.	2.
		6.	2.	2.	10.	0.	2.	5.			
2	15.	8.	7.	10.	7.	19.	5.	8.	6.	0.	0.
		3.	0.	1.	7.	0.	0.	3.			
2	20.	5.	4.	6.	3.	12.	4.	6.	2.	0.	0.
		1.	0.	0.	5.	0.	0.	2.			
2	25.	3.	2.	4.	2.	8.	3.	4.	0.	0.	0.
		0.	0.	0.	3.	0.	0.	1.			
2	30.	2.	0.	2.	0.	5.	2.	3.	0.	0.	0.
		0.	0.	0.	2.	0.	0.	0.			
2	35.	0.	0.	0.	0.	3.	0.	2.	0.	0.	0.
		0.	0.	0.	1.	0.	0.	0.			
2	40.	0.	0.	0.	0.	2.	0.	2.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)	JK
111	12	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
12	11	0	2	PIPE	3.5	100.	.0090	.0	.0	.016	3.50	0
11	110	0	1	CHANNEL	100.0	2970.	.0180	50.0	50.0	.016	5.00	0
110	303	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
303	10	12	2	PIPE	.1	1.	.0010	.0	.0	.001	.10	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	1.0 5.0	2.3	22.0	5.0	31.0	14.0	44.0	17.0 91.0	
		21.0	138.0	25.0 163.0	36.0	230.0	42.0	341.0	49.0	664.0	57.0 1301.0	
10	109	0	2	PIPE	6.5	320.	.0020	.0	.0	.016	6.50	0
109	302	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
302	9	8	2	PIPE	.1	1.	.0010	.0	.0	.001	.10	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										

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                    .0     .0       .0    1.0       .2     4.0       .8     5.0       2.4     7.0       4.6     8.0
                   7.3   74.0     10.4  365.0
  9       108       0        1     CHANNEL       20.0    1280.    .0080    50.0  50.0      .050     10.00       0
108       301       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
301         8       9        2     PIPE            .1       1.    .0010      .0    .0      .001       .10       0
                RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                    .0     .0       .0    3.0      10.2    37.0      14.5    42.0      19.3    47.0      24.5    50.0
                  30.3   55.0     36.9   88.0      44.2   192.0
  8       107       0        5     PIPE            5.0    2541.    .0030      .0    .0      .016      5.00       0
                                     OVERFLOW      1.0    2541.    .0030    20.0  20.0      .020     10.00
107       300       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
300         7       4        2     PIPE            .1       1.    .0010      .0    .0      .001       .10       0
                RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                    .0     .0       4.0  205.0      5.1   280.0      10.7   573.0
  7       106       0        5     PIPE            5.0    1767.    .0050      .0    .0      .016      5.00       0
                                     OVERFLOW      1.0    1767.    .0050    20.0  20.0      .020     10.00
106         6       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
  6         5       0        5     PIPE           10.0    1100.    .0050      .0    .0      .016     10.00       0
                                     OVERFLOW      1.0    1100.    .0050    20.0  20.0      .020     10.00
  5       105       0        1     CHANNEL        20.0    2400.    .0110     5.0   5.0      .063     20.00       0
105         4       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
  4       104       0        1     CHANNEL        20.0     700.    .0150     4.0   4.0      .063     20.00       0
104         3       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
  3         2       0        5     PIPE           15.0     600.    .0150      .0    .0      .016     15.00       0
                                     OVERFLOW     50.0     600.    .0150    25.0  25.0      .050     20.00
  2       103       0        1     CHANNEL        20.0     450.    .0130     5.0   5.0      .063     10.00       0
103       101       7        3                     .0       1.    .0010      .0    .0      .001     10.00     102
                DIVERSION TO GUTTER NUMBER 102 - TOTAL Q VS DIVERTED Q IN CFS
                    .0     .0     159.0  159.0     427.0   200.0     795.0   200.0    1203.0   200.0    1483.0   200.0
               1512.0  200.0
101        20       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 20       100       0        1     CHANNEL        20.0    1400.    .0090     5.0   5.0      .063     10.00       0
102         1       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
  1         0       0        5     PIPE            5.0    1766.    .0080      .0    .0      .016      5.00       0
                                     OVERFLOW      1.0    1766.    .0080    20.0  20.0      .020     10.00
100         0       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
150        90       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 90         0       0        5     PIPE            5.5    1000.    .0070      .0    .0      .016      5.50       0
                                     OVERFLOW     20.0    1000.    .0070    20.0  20.0      .050     10.00
129        59       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 59       128       0        1     CHANNEL        20.0     300.    .0100     5.0   5.0      .063     10.00       0
128       310       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
310        58       7        2     PIPE            .1       1.    .0010      .0    .0      .001       .10       0
                RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                    .0     .0       .3   30.0      1.1    90.0       2.5   145.0       4.4   160.0       5.6   160.0
                   6.7  160.0
 58       127       0        5     PIPE            5.5     500.    .0050      .0    .0      .016      5.50       0
                                     OVERFLOW     20.0     500.    .0050    20.0  20.0      .063     10.00
 50       120       0        5     PIPE            3.0    1000.    .0035      .0    .0      .016      3.00       0
                                     OVERFLOW      1.0    1000.    .0035    20.0  20.0      .020     10.00
120         0       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
127        57       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 57       126       0        1     CHANNEL        20.0     400.    .0025     5.0   5.0      .063      5.00       0
126        56       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 56       125       0        1     CHANNEL        20.0     500.    .0050     5.0   5.0      .063      5.00       0
125        55       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 55       120       0        1     CHANNEL        20.0     600.    .0035     5.0   5.0      .063      5.00       0
131        70       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
 70       130       0        5     PIPE            4.5     250.    .0050      .0    .0      .016      4.50       0
                                     OVERFLOW     10.0     250.    .0050    20.0  20.0      .020     10.00
130         0       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
140       320       0        3                     .0       1.    .0010      .0    .0      .001     10.00       0
320        80       4        2     PIPE            .1       1.    .0010      .0    .0      .001       .10       0
                RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                    .0     .0       5.5    9.0     14.0    22.0      17.0   117.0
 80         0       0        2     PIPE            2.0     450.    .0100      .0    .0      .016      2.00       0
OTOTAL NUMBER OF GUTTERS/PIPES,  50
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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A.(AC)
1	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
3	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
4	105	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	808.3
5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
6	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
7	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
8	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3

9	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
10	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
12	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
20	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
50	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	10.2
55	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
56	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
57	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104.3
58	310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
59	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
70	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
80	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6
90	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9
100	20	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	875.5
101	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
103	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
104	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
105	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	748.8
106	7	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	673.3
107	8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	514.6
108	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	321.3
109	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	267.5
110	11	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	193.3
111	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	24.3
120	50	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138.9
125	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
126	57	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	128.6
127	58	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	104.3
128	59	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	78.1
129	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	53.1
130	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
131	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	30.1
140	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	73.6
150	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	42.9
300	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
301	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
302	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
303	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
310	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
320	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 50 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS

THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)	1 11 80 108 130	2 12 90 109 131	3 20 100 110 140	4 50 101 111 150	5 55 102 120 300	6 56 103 125 301	7 57 104 126 302	8 58 105 127 303	9 59 106 128 310	10 70 107 129 320
0 5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(D)	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 10.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	2. .3( )	0. .1( )	0. .1( )	0. .0( )	0. .0( )
	0. .0( )	1. .2( )	0. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .2( )
	0. .0( )	0. .1( )	1. .0( )	0. .0( )	0. .0( )	0. .0(D)	0. .0( )	1. .0( )	8. .0( )	3. .0( )
	1. .0( )	1. .0( )	2. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	2. .0( )	1. .0( )	1. .0( )
	1. .0( )	1. .0( )	2. .0( )	0. .0( )	0. .0(S)	1. .0(S)	1. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 15.	0. .0( )	0. .0( )	3. .3( )	6. .2( )	1. .1( )	24. 1.1( )	1. .2( )	0. .2( )	0. .0( )	0. .2( )
	1. .0( )	22. 1.3( )	0. .0( )	5. .8( )	0. .0( )	1. .1( )	2. .2( )	1. .3( )	3. .2( )	5. .7( )
	0. .1( )	4. .5( )	10. .0( )	0. .0( )	0. .0( )	0. .3(D)	6. .0( )	13. .0( )	46. .0( )	22. .0( )
	7. .0( )	7. .0( )	46. .0( )	24. .0( )	5. .0( )	1. .0( )	9. .0( )	12. .0( )	9. .0( )	8. .0( )
	5. .0( )	6. .0( )	12. .0( )	11. .0( )	4. .1(S)	3. .0(S)	1. .0(S)	1. .2(S)	3. .0(S)	0. .1(S)
0 20.	4. .5( )	14. .4( )	38. .9( )	51. .9( )	10. .4( )	94. 2.1( )	6. .7( )	1. .3( )	0. .0( )	3. .6( )
	7. .0( )	51. 2.1( )	0. .0( )	15. 1.4( )	1. .2( )	12. .5( )	14. .7( )	9. .8( )	15. .5( )	15. 1.1( )
	0. .2( )	31. 1.4( )	38. .0( )	0. .0( )	14. .0( )	14. 14.2(D)	51. .0( )	57. .0( )	127. .0( )	77. .0( )
	19. .0( )	23. .0( )	190. .0( )	52. .0( )	16. .0( )	12. .0( )	36. .0( )	35. .0( )	34. .0( )	25. .0( )
	15. .0( )	16. .0( )	30. .0( )	47. .0( )	18. .3(S)	3. .1(S)	3. .1(S)	5. 1.0(S)	13. .1(S)	0. .2(S)
0 25.	53. 1.8( )	106. 1.4( )	165. 1.9( )	186. 1.8( )	56. 1.0( )	248. 3.5( )	27. 1.4( )	2. .4( )	1. .1( )	18. 1.4( )
	30. .1( )	83. .1(O)	0. .0( )	32. 2.5( )	15. .7( )	54. 1.2( )	48. 1.4( )	30. 1.5( )	45. .9( )	39. 1.8( )
	1. .3( )	83. 2.3( )	88. .0( )	0. .0( )	106. .0( )	106. 106.4(D)	186. .0( )	166. .0( )	303. .0( )	190. .0( )
	48. .0( )	73. .0( )	415. .0( )	112. .0( )	47. .0( )	54. .0( )	97. .0( )	85. .0( )	87. .0( )	58. .0( )
	39. .0( )	43. .0( )	89. .0( )	98. .0( )	52. 1.0(S)	4. .3(S)	4. .4(S)	24. 2.9(S)	36. .4(S)	1. .6(S)
0 30.	149. 3.3( )	324. 2.5( )	399. 2.9( )	423. 2.9( )	175. 1.9( )	470. 5.0( )	79. 2.6( )	3. .5( )	1. .1( )	33. 1.8( )
	51. .1( )	83. .2(O)	18. .6( )	35. 3.2( )	63. 1.5( )	125. 2.0( )	102. 2.1( )	63. 2.2( )	87. 1.3( )	59. 2.3( )
	2.	130.	166.	140.	184.	324.	423.	359.	521.	358.

		.4( )	3.0( )	.0( )	.0( )	.0( )	184.3(D)	.0( )	.0( )	.0( )	.0( )
		83.	133.	599.	85.	98.	125.	167.	135.	148.	100.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		59.	58.	127.	139.	119.	5.	5.	33.	69.	2.
		.0( )	.0( )	.0( )	.0( )	2.3(S)	.7(S)	1.1(S)	6.2(S)	.8(S)	1.3(S)
0	35.	193.	578.	630.	643.	329.	543.	153.	4.	2.	36.
		4.2( )	3.4( )	3.7( )	3.6( )	2.6( )	5.4( )	4.2( )	.6( )	.1( )	1.9( )
		65.	83.	141.	31.	132.	181.	141.	95.	116.	52.
		.2( )	.1(0)	1.8( )	2.4( )	2.2( )	2.4( )	2.5( )	2.7( )	1.6( )	2.1( )
		3.	127.	299.	378.	200.	578.	643.	528.	525.	429.
		.6( )	2.9( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		93.	158.	485.	48.	163.	181.	197.	154.	169.	118.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		52.	51.	116.	116.	201.	7.	7.	38.	99.	4.
		.0( )	.0( )	.0( )	.0( )	3.9(S)	1.3(S)	2.1(S)	9.7(S)	1.3(S)	2.2(S)
0	40.	199.	707.	714.	713.	417.	463.	186.	6.	3.	41.
		4.4( )	3.7( )	3.9( )	3.8( )	3.0( )	4.9( )	5.7( )	.8( )	.2( )	2.1( )
		64.	42.	335.	16.	179.	196.	154.	113.	110.	41.
		.2( )	1.8( )	2.8( )	1.5( )	2.6( )	2.5( )	2.6( )	3.0( )	1.5( )	1.9( )
		4.	92.	467.	507.	200.	707.	713.	582.	445.	375.
		.7( )	2.4( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		84.	154.	334.	30.	195.	196.	196.	156.	152.	105.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		41.	40.	92.	84.	277.	9.	7.	42.	114.	5.
		.0( )	.0( )	.0( )	.0( )	5.1(S)	1.8(S)	3.1(S)	12.3(S)	1.7(S)	2.8(S)
0	45.	200.	695.	684.	680.	431.	424.	238.	7.	4.	43.
		4.4( )	3.7( )	3.8( )	3.7( )	3.0( )	4.7( )	6.0( )	.9( )	.2( )	2.1( )
		48.	12.	452.	10.	191.	190.	153.	119.	92.	33.
		.1( )	.9( )	3.3( )	1.2( )	2.7( )	2.4( )	2.6( )	3.1( )	1.4( )	1.7( )
		5.	68.	557.	495.	200.	695.	680.	561.	423.	302.
		.7( )	2.1( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		72.	141.	235.	22.	201.	190.	184.	151.	125.	87.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		33.	32.	74.	62.	296.	11.	8.	44.	120.	6.
		.0( )	.0( )	.0( )	.0( )	5.4(S)	2.3(S)	4.0(S)	13.9(S)	1.9(S)	3.4(S)
0	50.	200.	642.	629.	625.	424.	413.	270.	9.	6.	56.
		4.4( )	3.5( )	3.6( )	3.5( )	3.0( )	4.6( )	6.2( )	1.0( )	.2( )	2.4( )
		37.	26.	464.	8.	184.	177.	147.	119.	77.	26.
		.1( )	1.4( )	3.3( )	1.0( )	2.6( )	2.3( )	2.6( )	3.1( )	1.2( )	1.5( )
		6.	52.	549.	442.	200.	642.	625.	528.	408.	244.
		.8( )	1.8( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		64.	140.	177.	17.	192.	177.	170.	143.	103.	73.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		26.	26.	59.	48.	289.	12.	16.	60.	118.	6.
		.0( )	.0( )	.0( )	.0( )	5.3(S)	2.7(S)	4.9(S)	15.0(S)	1.8(S)	3.8(S)
0	55.	200.	591.	580.	576.	412.	389.	275.	11.	11.	69.
		4.4( )	3.4( )	3.5( )	3.4( )	3.0( )	4.5( )	6.2( )	1.0( )	.3( )	2.7( )
		29.	8.	430.	7.	172.	162.	137.	114.	65.	21.
		.1( )	.8( )	3.2( )	.9( )	2.5( )	2.2( )	2.5( )	3.0( )	1.1( )	1.3( )
		7.	40.	499.	391.	200.	591.	576.	497.	383.	201.
		.8( )	1.6( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		61.	142.	142.	16.	179.	162.	153.	131.	85.	62.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		21.	21.	48.	37.	266.	13.	36.	70.	113.	7.
		.0( )	.0( )	.0( )	.0( )	4.9(S)	3.0(S)	5.7(S)	15.7(S)	1.7(S)	4.1(S)
1	0.	200.	546.	536.	533.	393.	360.	260.	12.	20.	75.
		4.4( )	3.3( )	3.4( )	3.2( )	2.9( )	4.3( )	6.1( )	1.1( )	.4( )	2.8( )
		24.	22.	386.	6.	157.	147.	126.	106.	56.	17.
		.1( )	1.3( )	3.0( )	.9( )	2.4( )	2.1( )	2.4( )	2.9( )	1.0( )	1.2( )
		7.	33.	444.	346.	200.	546.	533.	464.	353.	170.
		.9( )	1.4( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		65.	139.	125.	16.	164.	147.	140.	120.	71.	53.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )

		17.	17.	40.	31.	235.	14.	52.	76.	104.	7.
		.0( )	.0( )	.0( )	.0( )	4.4(S)	3.4(S)	6.4(S)	16.1(S)	1.5(S)	4.4(S)
1	5.	200.	504.	494.	491.	368.	329.	238.	13.	33.	81.
		4.4( )	3.1( )	3.2( )	3.1( )	2.8( )	4.1( )	6.0( )	1.2( )	.5( )	3.0( )
		22.	10.	344.	6.	144.	135.	116.	97.	49.	13.
		.1( )	.8( )	2.8( )	.9( )	2.3( )	2.0( )	2.3( )	2.8( )	1.0( )	1.0( )
		7.	29.	394.	304.	200.	504.	491.	430.	322.	150.
		.9( )	1.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		72.	138.	118.	16.	150.	135.	129.	111.	62.	47.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		13.	13.	35.	28.	207.	15.	65.	81.	95.	8.
		.0( )	.0( )	.0( )	.0( )	4.0(S)	3.7(S)	6.9(S)	16.4(S)	1.2(S)	4.6(S)
1	10.	200.	465.	455.	452.	342.	301.	216.	15.	47.	84.
		4.4( )	3.0( )	3.1( )	3.0( )	2.7( )	3.9( )	5.9( )	1.2( )	.6( )	3.0( )
		20.	20.	303.	6.	132.	124.	106.	86.	43.	11.
		.1( )	1.2( )	2.7( )	.9( )	2.2( )	2.0( )	2.2( )	2.6( )	.9( )	1.0( )
		8.	28.	348.	265.	200.	465.	452.	397.	294.	137.
		.9( )	1.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		83.	136.	114.	16.	139.	124.	119.	100.	56.	41.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		11.	11.	31.	28.	187.	17.	81.	85.	84.	8.
		.0( )	.0( )	.0( )	.0( )	3.7(S)	4.2(S)	7.4(S)	16.6(S)	1.0(S)	4.8(S)
1	15.	200.	428.	419.	417.	316.	279.	197.	16.	65.	87.
		4.4( )	2.9( )	3.0( )	2.8( )	2.6( )	3.7( )	5.8( )	1.3( )	.7( )	3.1( )
		18.	11.	265.	6.	121.	113.	95.	73.	38.	11.
		.1( )	.9( )	2.5( )	.9( )	2.1( )	1.9( )	2.0( )	2.4( )	.8( )	.9( )
		8.	27.	305.	228.	200.	428.	417.	366.	274.	130.
		.9( )	1.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		98.	135.	113.	16.	128.	113.	107.	87.	51.	37.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		11.	11.	28.	27.	171.	19.	108.	88.	71.	8.
		.0( )	.0( )	.0( )	.0( )	3.3(S)	4.7(S)	7.7(S)	16.8(S)	.9(S)	4.9(S)
1	20.	198.	397.	390.	387.	293.	259.	182.	18.	85.	90.
		4.3( )	2.8( )	2.9( )	2.7( )	2.5( )	3.6( )	5.6( )	1.3( )	.8( )	3.1( )
		17.	16.	232.	6.	110.	102.	83.	63.	34.	10.
		.1( )	1.1( )	2.3( )	.9( )	2.0( )	1.8( )	1.9( )	2.2( )	.8( )	.9( )
		8.	27.	269.	201.	195.	397.	387.	340.	254.	123.
		.9( )	1.3( )	.0( )	.0( )	.0( )	195.4(D)	.0( )	.0( )	.0( )	.0( )
		115.	133.	107.	13.	116.	102.	95.	76.	45.	32.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		10.	10.	23.	26.	158.	21.	120.	90.	62.	8.
		.0( )	.0( )	.0( )	.0( )	3.1(S)	5.3(S)	7.8(S)	16.9(S)	.7(S)	5.0(S)
1	25.	194.	369.	362.	360.	272.	236.	170.	20.	101.	91.
		4.2( )	2.7( )	2.8( )	2.6( )	2.4( )	3.4( )	5.4( )	1.4( )	.9( )	3.2( )
		15.	7.	205.	5.	99.	90.	72.	55.	29.	8.
		.1( )	.7( )	2.2( )	.8( )	1.9( )	1.6( )	1.8( )	2.0( )	.7( )	.8( )
		8.	24.	238.	178.	191.	369.	360.	314.	229.	113.
		.9( )	1.2( )	.0( )	.0( )	.0( )	191.2(D)	.0( )	.0( )	.0( )	.0( )
		127.	129.	91.	10.	104.	90.	82.	66.	39.	28.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		8.	8.	18.	23.	146.	23.	126.	91.	54.	8.
		.0( )	.0( )	.0( )	.0( )	2.8(S)	5.9(S)	7.9(S)	17.0(S)	.6(S)	5.1(S)
1	30.	189.	340.	332.	329.	250.	214.	161.	22.	112.	90.
		4.1( )	2.6( )	2.7( )	2.5( )	2.3( )	3.2( )	5.0( )	1.5( )	.9( )	3.1( )
		14.	11.	181.	4.	87.	78.	63.	48.	26.	7.
		.1( )	.9( )	2.0( )	.7( )	1.8( )	1.5( )	1.6( )	1.9( )	.7( )	.8( )
		8.	21.	210.	153.	187.	340.	329.	287.	209.	99.
		1.0( )	1.1( )	.0( )	.0( )	.0( )	186.7(D)	.0( )	.0( )	.0( )	.0( )
		132.	123.	75.	9.	91.	78.	71.	57.	34.	24.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		7.	7.	15.	20.	134.	25.	126.	90.	47.	8.
		.0( )	.0( )	.0( )	.0( )	2.6(S)	6.7(S)	7.9(S)	16.9(S)	.5(S)	5.2(S)
1	35.	184.	309.	301.	299.	228.	189.	138.	25.	118.	88.
		4.0( )	2.5( )	2.5( )	2.4( )	2.2( )	3.0( )	3.8( )	1.6( )	1.0( )	3.1( )

		12.	6.	156.	3.	77.	68.	55.	42.	23.	6.
		.1( )	.7( )	1.9( )	.7( )	1.7( )	1.4( )	1.5( )	1.7( )	.6( )	.7( )
		9.	19.	182.	127.	182.	309.	299.	261.	181.	89.
		1.0( )	1.1( )	.0( )	.0( )	.0( )	182.0(D)	.0( )	.0( )	.0( )	.0( )
		134.	117.	68.	8.	80.	68.	63.	50.	30.	22.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	6.	14.	18.	122.	28.	123.	88.	41.	9.
		.0( )	.0( )	.0( )	.0( )	2.4(S)	7.4(S)	7.8(S)	16.8(S)	.4(S)	5.2(S)
1	40.	180.	281.	273.	271.	204.	164.	118.	27.	119.	86.
		3.9( )	2.3( )	2.4( )	2.3( )	2.1( )	2.8( )	3.4( )	1.6( )	1.0( )	3.1( )
		11.	10.	132.	3.	68.	60.	48.	37.	20.	6.
		.1( )	.8( )	1.7( )	.7( )	1.5( )	1.3( )	1.4( )	1.6( )	.6( )	.7( )
		9.	17.	156.	103.	178.	281.	271.	235.	158.	85.
		1.0( )	1.0( )	.0( )	.0( )	.0( )	177.6(D)	.0( )	.0( )	.0( )	.0( )
		133.	109.	65.	8.	71.	60.	56.	44.	27.	20.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	6.	12.	17.	111.	30.	118.	86.	36.	9.
		.0( )	.0( )	.0( )	.0( )	2.2(S)	8.1(S)	7.8(S)	16.7(S)	.4(S)	5.2(S)
1	45.	176.	255.	248.	245.	183.	149.	108.	29.	117.	84.
		3.8( )	2.2( )	2.3( )	2.1( )	1.9( )	2.7( )	3.1( )	1.7( )	1.0( )	3.0( )
		10.	7.	109.	3.	60.	54.	43.	33.	19.	5.
		.1( )	.7( )	1.6( )	.6( )	1.5( )	1.2( )	1.3( )	1.5( )	.6( )	.7( )
		9.	17.	132.	81.	174.	255.	245.	212.	146.	83.
		1.0( )	1.0( )	.0( )	.0( )	.0( )	173.7(D)	.0( )	.0( )	.0( )	.0( )
		131.	104.	63.	8.	64.	54.	50.	40.	25.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	12.	16.	103.	32.	112.	84.	32.	9.
		.0( )	.0( )	.0( )	.0( )	2.0(S)	8.8(S)	7.7(S)	16.5(S)	.3(S)	5.3(S)
1	50.	172.	232.	226.	225.	166.	140.	101.	32.	114.	82.
		3.7( )	2.1( )	2.2( )	2.0( )	1.8( )	2.6( )	3.0( )	1.8( )	.9( )	3.0( )
		10.	9.	89.	3.	54.	49.	39.	29.	18.	5.
		.1( )	.8( )	1.4( )	.6( )	1.4( )	1.2( )	1.3( )	1.4( )	.5( )	.7( )
		9.	16.	110.	62.	170.	232.	225.	194.	138.	83.
		1.0( )	1.0( )	.0( )	.0( )	.0( )	170.2(D)	.0( )	.0( )	.0( )	.0( )
		126.	100.	62.	8.	57.	49.	46.	36.	24.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	11.	16.	97.	35.	107.	81.	29.	9.
		.0( )	.0( )	.0( )	.0( )	1.9(S)	9.5(S)	7.7(S)	16.4(S)	.3(S)	5.3(S)
1	55.	169.	215.	210.	209.	154.	133.	95.	34.	110.	80.
		3.7( )	2.0( )	2.1( )	2.0( )	1.8( )	2.5( )	2.9( )	1.9( )	.9( )	2.9( )
		9.	7.	71.	3.	49.	45.	36.	27.	17.	5.
		.1( )	.7( )	1.2( )	.6( )	1.3( )	1.1( )	1.2( )	1.4( )	.5( )	.6( )
		9.	16.	92.	47.	168.	215.	209.	181.	131.	83.
		1.0( )	1.0( )	.0( )	.0( )	.0( )	167.5(D)	.0( )	.0( )	.0( )	.0( )
		122.	97.	60.	8.	52.	45.	43.	33.	23.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	11.	16.	93.	37.	103.	79.	26.	9.
		.0( )	.0( )	.0( )	.0( )	1.8(S)	10.1(S)	7.6(S)	16.3(S)	.3(S)	5.3(S)
2	0.	166.	201.	197.	196.	144.	127.	91.	36.	106.	77.
		3.6( )	2.0( )	2.1( )	1.9( )	1.7( )	2.5( )	2.8( )	1.9( )	.9( )	2.9( )
		9.	7.	56.	3.	45.	42.	33.	24.	16.	5.
		.1( )	.7( )	1.1( )	.6( )	1.2( )	1.1( )	1.1( )	1.3( )	.5( )	.6( )
		9.	15.	76.	35.	165.	201.	196.	169.	125.	82.
		1.0( )	1.0( )	.0( )	.0( )	.0( )	165.4(D)	.0( )	.0( )	.0( )	.0( )
		117.	93.	55.	6.	48.	42.	39.	31.	22.	16.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	4.	10.	15.	90.	38.	99.	77.	24.	9.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	10.6(S)	7.6(S)	16.1(S)	.2(S)	5.3(S)
2	5.	164.	187.	183.	181.	135.	117.	88.	37.	102.	75.
		3.6( )	1.9( )	2.0( )	1.8( )	1.6( )	2.4( )	2.8( )	1.9( )	.9( )	2.8( )
		8.	2.	43.	2.	42.	38.	30.	23.	15.	4.
		.0( )	.4( )	.9( )	.5( )	1.2( )	1.0( )	1.1( )	1.3( )	.5( )	.5( )
		9.	13.	60.	24.	163.	187.	181.	157.	113.	77.

		1.0( )	.9( )	.0( )	.0( )	.0( )	163.3(D)	.0( )	.0( )	.0( )	.0( )
		111. .0( )	88. .0( )	41. .0( )	2. .0( )	43. .0( )	38. .0( )	34. .0( )	27. .0( )	19. .0( )	14. .0( )
		4. .0( )	3. .0( )	7. .0( )	11. .0( )	87. 1.7(S)	38. 11.2(S)	95. 7.5(S)	74. 15.9(S)	22. .2(S)	9. 5.3(S)
2	10.	162. 3.6( )	170. 1.8( )	164. 1.9( )	162. 1.7( )	125. 1.6( )	103. 2.2( )	85. 2.7( )	38. 2.0( )	98. .9( )	70. 2.7( )
		6. .0( )	1. .2( )	31. .8( )	1. .3( )	37. 1.1( )	33. .9( )	26. 1.0( )	20. 1.2( )	12. .4( )	2. .4( )
		9. 1.0( )	8. .7( )	43. .0( )	10. .0( )	161. .0( )	170. 160.7(D)	162. .0( )	140. .0( )	97. .0( )	67. .0( )
		105. .0( )	81. .0( )	20. .0( )	0. .0( )	38. .0( )	33. .0( )	28. .0( )	22. .0( )	15. .0( )	10. .0( )
		2. .0( )	2. .0( )	5. .0( )	6. .0( )	82. 1.6(S)	39. 11.7(S)	90. 7.5(S)	70. 15.6(S)	19. .2(S)	9. 5.3(S)
2	15.	155. 3.4( )	150. 1.7( )	142. 1.8( )	140. 1.6( )	113. 1.5( )	90. 2.1( )	80. 2.6( )	39. 2.0( )	93. .9( )	65. 2.6( )
		5. .0( )	0. .0( )	21. .6( )	0. .2( )	32. 1.0( )	27. .8( )	21. .9( )	17. 1.1( )	9. .4( )	1. .2( )
		9. 1.0( )	5. .5( )	28. .0( )	0. .0( )	150. .0( )	150. 149.6(D)	140. .0( )	123. .0( )	86. .0( )	58. .0( )
		98. .0( )	73. .0( )	11. .0( )	0. .0( )	33. .0( )	27. .0( )	21. .0( )	17. .0( )	10. .0( )	7. .0( )
		1. .0( )	0. .0( )	3. .0( )	3. .0( )	76. 1.5(S)	39. 12.1(S)	84. 7.4(S)	64. 15.3(S)	16. .2(S)	9. 5.3(S)
2	20.	139. 3.2( )	129. 1.5( )	123. 1.6( )	121. 1.5( )	102. 1.4( )	80. 2.0( )	74. 2.5( )	39. 2.0( )	88. .8( )	59. 2.5( )
		4. .0( )	0. .0( )	13. .5( )	0. .2( )	27. .9( )	21. .7( )	17. .8( )	13. 1.0( )	6. .3( )	0. .0( )
		9. 1.0( )	3. .4( )	18. .0( )	0. .0( )	129. .0( )	129. 129.2(D)	121. .0( )	108. .0( )	77. .0( )	51. .0( )
		91. .0( )	65. .0( )	6. .0( )	0. .0( )	27. .0( )	21. .0( )	17. .0( )	13. .0( )	6. .0( )	5. .0( )
		0. .0( )	0. .0( )	2. .0( )	1. .0( )	70. 1.4(S)	40. 12.5(S)	77. 7.3(S)	58. 14.9(S)	12. .1(S)	9. 5.2(S)
2	25.	120. 2.9( )	112. 1.4( )	107. 1.5( )	105. 1.3( )	92. 1.3( )	72. 1.9( )	67. 2.3( )	40. 2.0( )	82. .8( )	54. 2.4( )
		3. .0( )	0. .0( )	9. .4( )	0. .1( )	22. .8( )	17. .6( )	13. .7( )	9. .8( )	4. .2( )	0. .0( )
		9. 1.0( )	1. .3( )	12. .0( )	0. .0( )	112. .0( )	112. 112.3(D)	105. .0( )	96. .0( )	69. .0( )	48. .0( )
		85. .0( )	58. .0( )	3. .0( )	0. .0( )	22. .0( )	17. .0( )	13. .0( )	9. .0( )	4. .0( )	3. .0( )
		0. .0( )	0. .0( )	1. .0( )	0. .0( )	64. 1.2(S)	40. 12.8(S)	73. 7.2(S)	53. 14.6(S)	9. .1(S)	8. 5.2(S)
2	30.	105. 2.7( )	98. 1.3( )	94. 1.4( )	92. 1.2( )	83. 1.3( )	64. 1.8( )	62. 2.2( )	40. 2.0( )	78. .8( )	49. 2.2( )
		3. .0( )	0. .0( )	6. .3( )	0. .1( )	18. .7( )	13. .6( )	10. .6( )	7. .7( )	3. .2( )	0. .0( )
		8. 1.0( )	0. .2( )	8. .0( )	0. .0( )	98. .0( )	98. 98.4(D)	92. .0( )	85. .0( )	62. .0( )	45. .0( )
		80. .0( )	52. .0( )	3. .0( )	0. .0( )	18. .0( )	13. .0( )	10. .0( )	7. .0( )	3. .0( )	2. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	58. 1.1(S)	40. 13.1(S)	70. 7.1(S)	48. 14.2(S)	6. .1(S)	8. 5.1(S)
2	35.	92. 2.5( )	86. 1.2( )	82. 1.4( )	81. 1.2( )	75. 1.2( )	59. 1.7( )	57. 2.1( )	40. 2.0( )	74. .8( )	45. 2.1( )
		2. .0( )	0. .0( )	5. .2( )	0. .1( )	15. .7( )	10. .5( )	8. .5( )	5. .6( )	2. .2( )	0. .0( )
		8. .9( )	0. .1( )	5. .0( )	0. .0( )	86. .0( )	86. 86.4(D)	81. .0( )	75. .0( )	57. .0( )	44. .0( )
		74. .0( )	47. .0( )	2. .0( )	0. .0( )	15. .0( )	10. .0( )	8. .0( )	5. .0( )	2. .0( )	1. .0( )

		0.	0.	0.	0.	54.	41.	67.	44.	4.	8.
		.0( )	.0( )	.0( )	.0( )	1.1(S)	13.3(S)	7.0(S)	13.9(S)	.0(S)	5.1(S)
2	40.	81.	77.	73.	72.	68.	54.	53.	41.	70.	43.
		2.3( )	1.2( )	1.3( )	1.1( )	1.1( )	1.6( )	2.1( )	2.0( )	.8( )	2.1( )
		2.	0.	3.	0.	12.	8.	6.	3.	1.	0.
		.0( )	.0( )	.2( )	.1( )	.6( )	.4( )	.4( )	.5( )	.1( )	.0( )
		8.	0.	3.	0.	77.	77.	72.	68.	53.	43.
		.9( )	.1( )	.0( )	.0( )	.0( )	76.7(D)	.0( )	.0( )	.0( )	.0( )
		70.	45.	2.	0.	12.	8.	6.	3.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	51.	41.	63.	44.	3.	8.
		.0( )	.0( )	.0( )	.0( )	1.0(S)	13.6(S)	6.9(S)	13.7(S)	.0(S)	5.0(S)
2	45.	73.	69.	67.	66.	63.	51.	50.	41.	67.	43.
		2.2( )	1.1( )	1.2( )	1.0( )	1.1( )	1.6( )	2.0( )	2.1( )	.7( )	2.1( )
		2.	0.	3.	0.	10.	6.	4.	2.	1.	0.
		.0( )	.0( )	.2( )	.1( )	.5( )	.4( )	.4( )	.4( )	.1( )	.0( )
		8.	0.	3.	0.	69.	69.	66.	63.	50.	39.
		.9( )	.1( )	.0( )	.0( )	.0( )	69.5(D)	.0( )	.0( )	.0( )	.0( )
		67.	42.	2.	0.	10.	6.	4.	2.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	48.	41.	60.	43.	2.	8.
		.0( )	.0( )	.0( )	.0( )	.9(S)	13.7(S)	6.7(S)	13.4(S)	.0(S)	4.9(S)
2	50.	67.	64.	62.	61.	58.	48.	47.	41.	64.	43.
		2.0( )	1.0( )	1.2( )	1.0( )	1.0( )	1.5( )	1.9( )	2.1( )	.7( )	2.1( )
		1.	0.	2.	0.	8.	5.	3.	1.	0.	0.
		.0( )	.0( )	.2( )	.1( )	.5( )	.3( )	.3( )	.3( )	.0( )	.0( )
		8.	0.	2.	0.	64.	64.	61.	58.	47.	43.
		.9( )	.1( )	.0( )	.0( )	.0( )	64.0(D)	.0( )	.0( )	.0( )	.0( )
		64.	45.	1.	0.	8.	5.	3.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	46.	41.	58.	43.	1.	8.
		.0( )	.0( )	.0( )	.0( )	.9(S)	13.9(S)	6.6(S)	13.1(S)	.0(S)	4.9(S)
2	55.	62.	59.	58.	57.	55.	46.	45.	41.	61.	42.
		2.0( )	1.0( )	1.1( )	1.0( )	1.0( )	1.5( )	1.9( )	2.1( )	.7( )	2.1( )
		1.	0.	2.	0.	6.	4.	2.	1.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.4( )	.3( )	.2( )	.3( )	.0( )	.0( )
		8.	0.	2.	0.	59.	59.	57.	55.	45.	39.
		.9( )	.1( )	.0( )	.0( )	.0( )	59.3(D)	.0( )	.0( )	.0( )	.0( )
		61.	41.	1.	0.	6.	4.	2.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	44.	42.	55.	42.	1.	8.
		.0( )	.0( )	.0( )	.0( )	.9(S)	14.1(S)	6.5(S)	12.8(S)	.0(S)	4.8(S)
3	0.	57.	55.	54.	53.	52.	45.	44.	41.	58.	42.
		1.9( )	1.0( )	1.1( )	.9( )	1.0( )	1.5( )	1.9( )	2.1( )	.7( )	2.1( )
		1.	0.	1.	0.	5.	3.	2.	1.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.4( )	.2( )	.2( )	.2( )	.0( )	.0( )
		8.	0.	1.	0.	55.	55.	53.	52.	44.	44.
		.9( )	.0( )	.0( )	.0( )	.0( )	55.5(D)	.0( )	.0( )	.0( )	.0( )
		58.	44.	1.	0.	5.	3.	2.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	44.	42.	53.	42.	0.	8.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.2(S)	6.5(S)	12.5(S)	.0(S)	4.8(S)
3	5.	54.	52.	51.	51.	49.	44.	43.	42.	56.	42.
		1.8( )	.9( )	1.1( )	.9( )	.9( )	1.5( )	1.8( )	2.1( )	.7( )	2.1( )
		1.	0.	1.	0.	4.	2.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.3( )	.2( )	.2( )	.2( )	.0( )	.0( )
		8.	0.	1.	0.	52.	52.	51.	49.	43.	40.
		.9( )	.0( )	.0( )	.0( )	.0( )	52.3(D)	.0( )	.0( )	.0( )	.0( )
		56.	40.	1.	0.	4.	2.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	43.	42.	51.	41.	0.	8.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.3(S)	6.4(S)	12.2(S)	.0(S)	4.7(S)
3	10.	51.	50.	49.	48.	47.	43.	43.	42.	54.	41.
		1.8( )	.9( )	1.1( )	.9( )	.9( )	1.4( )	1.8( )	2.1( )	.7( )	2.1( )

		1.	0.	1.	0.	3.	2.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.3( )	.2( )	.1( )	.1( )	.0( )	.0( )
		8.	0.	1.	0.	50.	50.	48.	47.	43.	44.
		.9( )	.0( )	.0( )	.0( )	.0( )	49.8(D)	.0( )	.0( )	.0( )	.0( )
		54.	43.	1.	0.	3.	2.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	43.	42.	50.	41.	0.	8.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.4(S)	6.3(S)	12.0(S)	.0(S)	4.7(S)
3	15.	49.	48.	47.	47.	46.	43.	42.	42.	52.	41.
		1.7( )	.9( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.7( )	2.0( )
		1.	0.	1.	0.	3.	1.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.2( )	.1( )	.1( )	.0( )	.0( )
		8.	0.	1.	0.	48.	48.	47.	46.	42.	40.
		.9( )	.0( )	.0( )	.0( )	.0( )	47.8(D)	.0( )	.0( )	.0( )	.0( )
		52.	39.	1.	0.	3.	1.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	42.	42.	49.	41.	0.	8.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.5(S)	6.3(S)	11.7(S)	.0(S)	4.6(S)
3	20.	47.	46.	46.	45.	45.	42.	42.	42.	51.	40.
		1.7( )	.9( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.7( )	2.0( )
		1.	0.	1.	0.	2.	1.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		8.	0.	1.	0.	46.	46.	45.	45.	42.	44.
		.9( )	.0( )	.0( )	.0( )	.0( )	46.3(D)	.0( )	.0( )	.0( )	.0( )
		51.	42.	1.	0.	2.	1.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	42.	42.	47.	40.	0.	8.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.5(S)	6.2(S)	11.4(S)	.0(S)	4.6(S)
3	25.	46.	45.	45.	45.	44.	42.	42.	42.	49.	40.
		1.7( )	.9( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.6( )	2.0( )
		1.	0.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		7.	0.	1.	0.	45.	45.	45.	44.	42.	40.
		.9( )	.0( )	.0( )	.0( )	.0( )	45.1(D)	.0( )	.0( )	.0( )	.0( )
		49.	38.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	42.	42.	46.	40.	0.	7.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.6(S)	6.2(S)	11.1(S)	.0(S)	4.5(S)
3	30.	45.	44.	44.	44.	43.	42.	42.	42.	48.	40.
		1.7( )	.8( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.6( )	2.0( )
		1.	0.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		7.	0.	1.	0.	44.	44.	44.	43.	42.	44.
		.9( )	.0( )	.0( )	.0( )	.0( )	44.2(D)	.0( )	.0( )	.0( )	.0( )
		48.	41.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	42.	42.	45.	40.	0.	7.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.6(S)	6.1(S)	10.9(S)	.0(S)	4.5(S)
3	35.	44.	44.	43.	43.	43.	42.	42.	42.	47.	39.
		1.6( )	.8( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.6( )	2.0( )
		1.	0.	0.	0.	1.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		7.	0.	0.	0.	44.	44.	43.	43.	42.	40.
		.9( )	.0( )	.0( )	.0( )	.0( )	43.6(D)	.0( )	.0( )	.0( )	.0( )
		47.	37.	1.	0.	1.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	42.	42.	44.	39.	0.	7.
		.0( )	.0( )	.0( )	.0( )	.8(S)	14.7(S)	6.1(S)	10.6(S)	.0(S)	4.4(S)
3	40.	43.	43.	43.	43.	43.	42.	42.	42.	46.	39.
		1.6( )	.8( )	1.0( )	.8( )	.9( )	1.4( )	1.8( )	2.1( )	.6( )	2.0( )
		0.	0.	0.	0.	1.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.1( )	.1( )	.1( )	.1( )	.0( )	.0( )
		7.	0.	0.	0.	43.	43.	43.	43.	42.	44.

		.9( )	.0( )	.0( )	.0( )	.0( )	43.2(D)	.0( )	.0( )	.0( )	.0( )
		46. .0( )	41. .0( )	0. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	43. 6.0(S)	39. 10.3(S)	0. .0(S)	7. 4.4(S)
3	45.	43. 1.6( )	43. .8( )	43. 1.0( )	43. .8( )	43. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	45. .6( )	38. 2.0( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .1( )	0. .1( )	0. .0( )	0. .0( )
		7. .9( )	0. .0( )	0. .0( )	0. .0( )	43. .0( )	43. 42.8(D)	43. .0( )	43. .0( )	42. .0( )	40. .0( )
		45. .0( )	37. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	43. 6.0(S)	38. 10.1(S)	0. .0(S)	7. 4.3(S)
3	50.	43. 1.6( )	43. .8( )	43. 1.0( )	43. .8( )	42. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	44. .6( )	38. 2.0( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		7. .9( )	0. .0( )	0. .0( )	0. .0( )	43. .0( )	43. 42.6(D)	43. .0( )	42. .0( )	42. .0( )	44. .0( )
		44. .0( )	40. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	42. 6.0(S)	38. 9.8(S)	0. .0(S)	7. 4.3(S)
3	55.	43. 1.6( )	42. .8( )	42. 1.0( )	42. .8( )	42. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	43. .6( )	38. 2.0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		7. .9( )	0. .0( )	0. .0( )	0. .0( )	42. .0( )	42. 42.5(D)	42. .0( )	42. .0( )	42. .0( )	40. .0( )
		43. .0( )	36. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	41. 6.0(S)	38. 9.6(S)	0. .0(S)	7. 4.2(S)
4	0.	42. 1.6( )	42. .8( )	42. 1.0( )	42. .8( )	42. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	42. .6( )	37. 2.0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		7. .8( )	0. .0( )	0. .0( )	0. .0( )	42. .0( )	42. 42.4(D)	42. .0( )	42. .0( )	42. .0( )	44. .0( )
		42. .0( )	39. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	41. 5.9(S)	37. 9.3(S)	0. .0(S)	7. 4.2(S)
4	5.	42. 1.6( )	42. .8( )	42. 1.0( )	42. .8( )	42. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	42. .6( )	37. 1.9( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		7. .8( )	0. .0( )	0. .0( )	0. .0( )	42. .0( )	42. 42.3(D)	42. .0( )	42. .0( )	42. .0( )	40. .0( )
		42. .0( )	35. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .8(S)	42. 14.7(S)	40. 5.9(S)	37. 9.1(S)	0. .0(S)	7. 4.1(S)
4	10.	42. 1.6( )	42. .8( )	42. 1.0( )	42. .8( )	42. .9( )	42. 1.4( )	42. 1.8( )	42. 2.1( )	41. .6( )	37. 1.9( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		7. .8( )	0. .0( )	0. .0( )	0. .0( )	42. .0( )	42. 42.3(D)	42. .0( )	42. .0( )	42. .0( )	44. .0( )
		41. .0( )	38. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )

0.	0.	0.	0.	42.	42.	40.	37.	0.	7.
.0( )	.0( )	.0( )	.0( )	.8(S)	14.7(S)	5.9(S)	8.8(S)	.0(S)	4.1(S)

1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 10 YR STORM

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
111	112.	(DIRECT FLOW)		0 25.
12	83.	3.5	.2	0 30.
11	65.	.2		0 35.
110	599.	(DIRECT FLOW)		0 30.
303	91.	.1	17.0	1 25.
10	91.	3.2		1 25.
109	158.	(DIRECT FLOW)		0 35.
302	126.	.1	7.9	1 30.
9	119.	1.0		1 40.
108	134.	(DIRECT FLOW)		1 35.
301	42.	.1	14.7	4 0.
8	42.	2.1		4 5.
107	429.	(DIRECT FLOW)		0 35.
300	296.	.1	5.4	0 45.
7	275.	6.2		0 55.
129	118.	(DIRECT FLOW)		0 35.
106	525.	(DIRECT FLOW)		0 35.
59	116.	1.6		0 35.
6	543.	5.4		0 35.
128	169.	(DIRECT FLOW)		0 35.
5	431.	3.0		0 45.
310	120.	.1	1.9	0 45.
105	582.	(DIRECT FLOW)		0 40.
58	119.	3.1		0 50.
4	713.	3.8		0 40.
127	156.	(DIRECT FLOW)		0 40.
104	713.	(DIRECT FLOW)		0 40.
57	154.	2.6		0 40.
3	714.	3.9		0 40.
126	197.	(DIRECT FLOW)		0 35.
2	707.	3.7		0 40.
56	196.	2.5		0 40.
103	707.	(DIRECT FLOW)		0 40.
140	127.	(DIRECT FLOW)		0 30.
131	58.	(DIRECT FLOW)		0 30.
125	196.	(DIRECT FLOW)		0 40.
101	507.	(DIRECT FLOW)		0 40.
320	9.	.1	5.3	2 0.
70	59.	2.3		0 30.
55	191.	2.7		0 45.
50	35.	3.2		0 30.
150	139.	(DIRECT FLOW)		0 30.
20	464.	3.3		0 50.
102	200.	(DIRECT FLOW)		0 40.
80	9.	1.0		2 5.
130	59.	(DIRECT FLOW)		0 30.
120	201.	(DIRECT FLOW)		0 45.
90	130.	3.0		0 30.
100	557.	(DIRECT FLOW)		0 45.
1	200.	4.4		1 15.

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ENDPROGRAM PROGRAM CALLED

□

APPENDIX C - UDSWM2-PC - 100 YR

DESIGN PLAN HYDRAULIC CONDITIONS

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   2   1   1   2
   3   4
WATERSHED   1
KNOLLWOOD DRAINAGE BASIN DESIGN PLAN    FMG INC.  MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS   100 YR STORM
        50  0 0  5.0                                                                  1
        01  100
        02    4
        03  105
        04  106
        05  107
        06  108
        07  109
        08  110
        09  111
        10  126
        11  127
        12  128
        13  129
        15   50
        20  131
        30  140
        40  150

    0  111   12    3              1.
    0   12   11    2     3.5     100    .009      0.      0.    .016     3.5
    0   11  110    1   100.0    2970    .018     50.     50.    .016     5.0
    0  110  303    3              1.
    0  303   10 12 2     0.1      1.
         0         0         1         5       2.3        22         5        31
        14        44        17        91        21       138        25       163
        36       230        42       341        49       664        57      1301
    0   10  109    2     6.5     320    .002      0.      0.    .016     4.0
    0  109  302    3              1.
    0  302    9  8 2     0.1      1.
         0         0         0         1        .2         4        .8         5
       2.4         7       4.6         8       7.3        74      10.4       365
    0    9  108    1    20.0    1280    .008     50.     50.    .050     10.0
    0  108  301    3              1.
    0  301    8  9 2     0.1      1.
         0         0         0         3      10.2        37      14.5        42
      19.3        47      24.5        50      30.3        55      36.9        88
      44.2       192
    0    8  107    5     5.0    2541    .003      .0      .0    .016     5.0
                          1.0    2541    .003     20.     20.    .020    10.0
    0  107  300    3              1.
    0  300    7  4 2     0.1      1.
         0         0       4.0       205       5.1       280      10.7       573
    0    7  106    5     5.0    1767    .005      .0      .0    .016     5.0
                          1.0    1767    .005     20.     20.    .020    10.0
    0  106    6    3              1.
    0    6    5    5    10.0    1100    .005      .0      .0    .016    10.0
                          1.0    1100    .005     20.     20.    .020    10.0
    0    5  105    1    20.0    2400    .011      5.      5.    .063    20.0
    0  105    4    3              1.
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   0    4  104    1    20.0     700    .015      4.      4.    .063    20.0
   0  104    3    3              1.
   0    3    2    5    15.0     600    .015      .0      .0    .016    15.0
                        50.0     600    .015     25.     25.    .050    20.0
   0    2  103    1    20.0     450    .013      5.      5.    .063    10.0
 102  103  101  7 3      .0      1.    .001      .0      .0    .001    10.0
        0         0       159       159       427       200       795       200
     1203       200      1483       200      1512       200
   0  101   20    3              1.
   0   20  100    1    20.0    1400    .009      5.      5.    .063    10.0
   0  102    1    3              1.
   0    1    0    5     5.0    1766    .008      .0      .0    .016     5.0
                         1.0    1766    .008     20.     20.    .020    10.0
   0  100    0    3              1.
   0  150   90    3              1.
   0   90    0    5     5.5    1000    .007      .0      .0    .016     5.5
                        20.0    1000    .007     20.     20.    .050    10.0
   0  129   59    3              1.
   0   59  128    1    20.0     300    .010      5.      5.    .063    10.0
   0  128  310    3              1.
   0  310   58  7 2     0.1      1.
        0         0        .3        30       1.1        90       2.5       145
      4.4       160       5.6       160       6.7       160
   0   58  127    5     5.5     500    .005      .0      .0    .016     5.5
                        20.0     500    .005     20.     20.    .063    10.0
   0   50  120    5     3.0    1000   .0035      .0      .0    .016     3.0
                         1.0    1000   .0035     20.     20.    .020    10.0
   0  120    0    3              1.
   0  127   57    3              1.
   0   57  126    1    20.0     400   .0025      5.      5.    .063     5.0
   0  126   56    3              1.
   0   56  125    1    20.0     500    .005      5.      5.    .063     5.0
   0  125   55    3              1.
   0   55  120    1    20.0     600   .0035      5.      5.    .063     5.0
   0  131   70    3              1.
   0   70  130    5     4.5     250    .005      .0      .0    .016     4.5
                        10.0     250    .005     20.     20.    .020    10.0
   0  130    0    3              1.
   0  140  320    3              1.
   0  320   80  4 2     0.1      1.
        0         0       5.5         9        14        22        17       117
   0   80    0    2     2.0     450     .01      .0      .0    .016     2.0

   0
  50
   1    2    3    4    5    6    7    8    9   10   11   12   20   50   55   56
  57   58   59   70   80   90  100  101  102  103  104  105  106  107  108  109
 110  111  120  125  126  127  128  129  130  131  140  150  300  301  302  303
 310  320
ENDPROGRAM
□□
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1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY METCALF + EDDY, INC.
UNIVERSITY OF FLORIDA
WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)

UPDATED BY UNIVERSITY OF FLORIDA (JUNE 1973)
HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

OTAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

ONUMBER OF TIME STEPS 50
OINTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 17 SUBCATCHMENTS

TIME(HR/MIN)	1	2	3	4	5	6	7	8	9	10
	40	11	12	13	15	20	30			
0 0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 10.	2.	2.	2.	10.	4.	2.	1.	5.	3.	1.
	1.	2.	2.	1.	3.	2.	3.			
0 15.	11.	14.	14.	47.	24.	7.	7.	49.	22.	7.
	12.	10.	7.	8.	10.	6.	12.			
0 20.	36.	44.	44.	109.	72.	17.	19.	164.	44.	20.
	42.	23.	17.	24.	18.	14.	26.			
0 25.	77.	91.	96.	232.	163.	40.	47.	329.	93.	41.
	85.	47.	35.	51.	37.	34.	69.			
0 30.	155.	173.	190.	528.	367.	98.	113.	652.	194.	87.
	161.	100.	79.	105.	81.	91.	197.			
0 35.	263.	275.	313.	818.	669.	163.	198.	950.	156.	121.
	233.	132.	114.	178.	65.	122.	272.			
0 40.	291.	280.	347.	719.	804.	184.	241.	776.	102.	107.
	207.	114.	106.	213.	42.	111.	256.			
0 45.	257.	238.	305.	549.	733.	171.	233.	553.	71.	85.

		161.	89.	88.	199.	28.	94.	220.			
0	50.	216.	196.	253.	420.	618.	152.	211.	408.	52.	67.
		125.	70.	72.	174.	21.	79.	186.			
0	55.	179.	159.	209.	324.	513.	133.	187.	310.	40.	52.
		98.	53.	58.	150.	16.	65.	154.			
1	0.	148.	130.	172.	256.	424.	117.	165.	247.	36.	38.
		77.	40.	46.	128.	15.	54.	130.			
1	5.	125.	110.	145.	221.	358.	104.	147.	218.	35.	32.
		65.	34.	36.	111.	14.	46.	113.			
1	10.	107.	93.	125.	185.	307.	91.	130.	188.	22.	27.
		55.	28.	29.	96.	9.	32.	91.			
1	15.	84.	70.	99.	129.	248.	76.	110.	132.	17.	20.
		41.	21.	22.	80.	7.	23.	69.			
1	20.	62.	55.	74.	95.	193.	61.	91.	102.	11.	15.
		32.	15.	16.	62.	4.	17.	51.			
1	25.	46.	42.	56.	66.	147.	49.	75.	72.	9.	11.
		24.	11.	12.	45.	4.	12.	35.			
1	30.	36.	34.	44.	51.	111.	38.	61.	60.	8.	9.
		20.	9.	9.	34.	3.	9.	25.			
1	35.	30.	29.	37.	44.	85.	28.	50.	55.	8.	8.
		18.	8.	8.	28.	3.	7.	20.			
1	40.	26.	26.	32.	40.	69.	21.	40.	53.	8.	7.
		17.	7.	7.	23.	3.	6.	16.			
1	45.	24.	24.	30.	38.	60.	18.	30.	52.	8.	7.
		16.	7.	6.	20.	3.	5.	14.			
1	50.	22.	23.	28.	37.	55.	15.	25.	52.	8.	7.
		16.	7.	6.	19.	3.	5.	12.			
1	55.	21.	22.	27.	37.	51.	13.	21.	52.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
2	0.	21.	22.	27.	37.	49.	12.	19.	52.	8.	7.
		16.	7.	6.	16.	3.	5.	10.			
2	5.	19.	20.	25.	31.	45.	10.	16.	43.	3.	5.
		14.	5.	5.	15.	0.	4.	8.			
2	10.	14.	13.	18.	16.	34.	8.	13.	18.	0.	3.
		7.	3.	3.	12.	0.	2.	5.			
2	15.	9.	8.	11.	8.	22.	5.	9.	7.	0.	2.
		4.	1.	2.	8.	0.	2.	4.			
2	20.	6.	5.	7.	4.	14.	4.	7.	3.	0.	0.
		2.	0.	0.	6.	0.	0.	3.			
2	25.	4.	3.	4.	2.	9.	3.	5.	0.	0.	0.
		0.	0.	0.	4.	0.	0.	2.			
2	30.	2.	2.	3.	0.	6.	2.	4.	0.	0.	0.
		0.	0.	0.	3.	0.	0.	0.			
2	35.	0.	0.	1.	0.	4.	2.	3.	0.	0.	0.
		0.	0.	0.	2.	0.	0.	0.			
2	40.	0.	0.	0.	0.	2.	0.	2.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			
2	45.	0.	0.	0.	0.	1.	0.	1.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
111	12	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
12	11	0	2	PIPE	3.5	100.	.0090	.0	.0	.016	3.50	0
11	110	0	1	CHANNEL	100.0	2970.	.0180	50.0	50.0	.016	5.00	0
110	303	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
303	10	12	2	PIPE	.1	1.	.0010	.0	.0	.001	.10	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	1.0 5.0	2.3	22.0	5.0	31.0	14.0	44.0	17.0 91.0	
		21.0	138.0	25.0 163.0	36.0	230.0	42.0	341.0	49.0	664.0	57.0 1301.0	
10	109	0	2	PIPE	6.5	320.	.0020	.0	.0	.016	6.50	0

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 109        302        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 302          9        8        2      PIPE         .1       1.    .0010      .0    .0      .001        .10       0
                  RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                      .0      .0       .0     1.0      .2     4.0      .8     5.0     2.4     7.0       4.6     8.0
                     7.3    74.0     10.4   365.0
   9        108        0        1      CHANNEL     20.0     1280.    .0080     50.0   50.0     .050      10.00       0
 108        301        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 301          8        9        2      PIPE         .1       1.    .0010      .0    .0      .001        .10       0
                  RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                      .0      .0       .0     3.0     10.2    37.0     14.5    42.0    19.3    47.0      24.5    50.0
                    30.3    55.0     36.9    88.0     44.2   192.0
   8        107        0        5      PIPE         5.0     2541.    .0030      .0    .0      .016       5.00       0
                                        OVERFLOW    1.0     2541.    .0030     20.0   20.0     .020      10.00
 107        300        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 300          7        4        2      PIPE         .1       1.    .0010      .0    .0      .001        .10       0
                  RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                      .0      .0      4.0   205.0     5.1   280.0     10.7   573.0
   7        106        0        5      PIPE         5.0     1767.    .0050      .0    .0      .016       5.00       0
                                        OVERFLOW    1.0     1767.    .0050     20.0   20.0     .020      10.00
 106          6        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
   6          5        0        5      PIPE        10.0     1100.    .0050      .0    .0      .016      10.00       0
                                        OVERFLOW    1.0     1100.    .0050     20.0   20.0     .020      10.00
   5        105        0        1      CHANNEL     20.0     2400.    .0110      5.0    5.0     .063      20.00       0
 105          4        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
   4        104        0        1      CHANNEL     20.0      700.    .0150      4.0    4.0     .063      20.00       0
 104          3        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
   3          2        0        5      PIPE        15.0      600.    .0150      .0    .0      .016      15.00       0
                                        OVERFLOW   50.0      600.    .0150     25.0   25.0     .050      20.00
   2        103        0        1      CHANNEL     20.0      450.    .0130      5.0    5.0     .063      10.00       0
 103        101        7        3                    .0       1.    .0010      .0    .0      .001      10.00     102
                  DIVERSION TO GUTTER NUMBER 102 - TOTAL Q VS DIVERTED Q IN CFS
                      .0      .0    159.0   159.0    427.0   200.0    795.0   200.0   1203.0   200.0   1483.0   200.0
                 1512.0   200.0
 101         20        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  20        100        0        1      CHANNEL     20.0     1400.    .0090      5.0    5.0     .063      10.00       0
 102          1        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
   1          0        0        5      PIPE         5.0     1766.    .0080      .0    .0      .016       5.00       0
                                        OVERFLOW    1.0     1766.    .0080     20.0   20.0     .020      10.00
 100          0        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 150         90        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  90          0        0        5      PIPE         5.5     1000.    .0070      .0    .0      .016       5.50       0
                                        OVERFLOW   20.0     1000.    .0070     20.0   20.0     .050      10.00
 129         59        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  59        128        0        1      CHANNEL     20.0      300.    .0100      5.0    5.0     .063      10.00       0
 128        310        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 310         58        7        2      PIPE         .1       1.    .0010      .0    .0      .001        .10       0
                  RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                      .0      .0       .3    30.0     1.1    90.0      2.5   145.0     4.4   160.0       5.6   160.0
                     6.7   160.0
  58        127        0        5      PIPE         5.5      500.    .0050      .0    .0      .016       5.50       0
                                        OVERFLOW   20.0      500.    .0050     20.0   20.0     .063      10.00
  50        120        0        5      PIPE         3.0     1000.    .0035      .0    .0      .016       3.00       0
                                        OVERFLOW    1.0     1000.    .0035     20.0   20.0     .020      10.00
 120          0        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 127         57        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  57        126        0        1      CHANNEL     20.0      400.    .0025      5.0    5.0     .063       5.00       0
 126         56        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  56        125        0        1      CHANNEL     20.0      500.    .0050      5.0    5.0     .063       5.00       0
 125         55        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  55        120        0        1      CHANNEL     20.0      600.    .0035      5.0    5.0     .063       5.00       0
 131         70        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
  70        130        0        5      PIPE         4.5      250.    .0050      .0    .0      .016       4.50       0
                                        OVERFLOW   10.0      250.    .0050     20.0   20.0     .020      10.00
 130          0        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 140        320        0        3                    .0       1.    .0010      .0    .0      .001      10.00       0
 320         80        4        2      PIPE         .1       1.    .0010      .0    .0      .001        .10       0
                  RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                      .0      .0       5.5     9.0    14.0    22.0     17.0   117.0
  80          0        0        2      PIPE         2.0      450.    .0100      .0    .0      .016       2.00       0
0TOTAL NUMBER OF CUTTERS/PIPES,  50
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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMC INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A.(AC)
1	102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
3	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
4	105	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	808.3
5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
6	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
7	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6

8	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
9	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
10	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
11	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
12	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
20	101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
50	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	10.2
55	125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
56	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
57	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104.3
58	310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
59	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
70	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
80	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6
90	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9
100	20	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	875.5
101	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.0
103	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
104	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
105	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	748.8
106	7	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	673.3
107	8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	514.6
108	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	321.3
109	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	267.5
110	11	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	193.3
111	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	24.3
120	50	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138.9
125	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128.6
126	57	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	128.6
127	58	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	104.3
128	59	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	78.1
129	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	53.1
130	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
131	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	30.1
140	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	73.6
150	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	42.9
300	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
301	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
302	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
303	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
310	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
320	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 50 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)	1 11 80 108 130	2 12 90 109 131	3 20 100 110 140	4 50 101 111 150	5 55 102 120 300	6 56 103 125 301	7 57 104 126 302	8 58 105 127 303	9 59 106 128 310	10 70 107 129 320
0 5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(D)	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 10.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	3. .4( )	0. .1( )	0. .1( )	0. .0( )	0. .1( )
	0. .0( )	2. .4( )	0. .0( )	1. .3( )	0. .0( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .3( )
	0. .0( )	0. .1( )	2. .0( )	0. .0( )	0. .0( )	0. .0(D)	0. .0( )	2. .0( )	10. .0( )	4. .0( )
	2. .0( )	1. .0( )	5. .0( )	3. .0( )	1. .0( )	0. .0( )	1. .0( )	2. .0( )	2. .0( )	1. .0( )
	1. .0( )	2. .0( )	3. .0( )	1. .0( )	1. .0(S)	2. .0(S)	1. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 15.	0. .1( )	0. .1( )	4. .3( )	7. .3( )	1. .1( )	26. 1.1( )	1. .3( )	0. .2( )	0. .0( )	0. .2( )
	1. .0( )	21. 1.2( )	0. .0( )	5. .8( )	0. .0( )	1. .1( )	2. .2( )	2. .4( )	3. .2( )	5. .7( )
	0. .1( )	5. .6( )	11. .0( )	0. .0( )	0. .0( )	0. .5(D)	7. .0( )	15. .0( )	48. .0( )	24. .0( )
	7. .0( )	7. .0( )	50. .0( )	22. .0( )	5. .0( )	1. .0( )	9. .0( )	12. .0( )	10. .0( )	8. .0( )
	5. .0( )	6. .0( )	12. .0( )	12. .0( )	5. .1(S)	3. .0(S)	1. .0(S)	1. .2(S)	3. .0(S)	0. .1(S)
0 20.	4. .5( )	15. .5( )	39. 1.0( )	50. .9( )	10. .4( )	88. 2.1( )	6. .7( )	1. .4( )	0. .0( )	3. .6( )
	6. .0( )	44. 1.9( )	0. .0( )	13. 1.3( )	1. .2( )	12. .5( )	13. .7( )	9. .8( )	15. .5( )	13. 1.0( )
	0. .2( )	29. 1.3( )	36. .0( )	0. .0( )	15. .0( )	15. 15.1(D)	50. .0( )	54. .0( )	116. .0( )	73. .0( )
	17. .0( )	22. .0( )	170. .0( )	44. .0( )	14. .0( )	12. .0( )	33. .0( )	32. .0( )	32. .0( )	24. .0( )
	13. .0( )	14. .0( )	26. .0( )	42. .0( )	18. .3(S)	3. .1(S)	3. .1(S)	5. .9(S)	12. .1(S)	0. .2(S)
0 25.	49. 1.7( )	97. 1.3( )	147. 1.8( )	165. 1.7( )	49. .9( )	211. 3.2( )	26. 1.4( )	2. .4( )	1. .1( )	18. 1.3( )
	29. .1( )	83. .0(O)	0. .0( )	27. 2.1( )	13. .6( )	47. 1.1( )	42. 1.3( )	27. 1.4( )	40. .9( )	31. 1.6( )
	1. .3( )	72. 2.1( )	77. .0( )	0. .0( )	97. .0( )	97. 96.7(D)	165. .0( )	146. .0( )	258. .0( )	165. .0( )
	40. .0( )	64. .0( )	358. .0( )	93. .0( )	40. .0( )	47. .0( )	84. .0( )	74. .0( )	75. .0( )	51. .0( )
	31. .0( )	34. .0( )	69. .0( )	85. .0( )	48. .9(S)	4. .3(S)	4. .4(S)	23. 2.7(S)	33. .3(S)	1. .5(S)
0 30.	142. 3.2( )	303. 2.4( )	381. 2.8( )	409. 2.8( )	169. 1.9( )	506. 5.2( )	74. 2.5( )	3. .5( )	1. .1( )	33. 1.8( )
	50.	83.	15.	44.	61.	130.	108.	62.	87.	84.

		.1( )	.5(0)	.5( )	3.5( )	1.5( )	2.0( )	2.2( )	2.1( )	1.3( )	2.9( )
		2.	139.	170.	122.	181.	303.	409.	358.	602.	369.
		.4( )	3.1( )	.0( )	.0( )	.0( )	181.0(D)	.0( )	.0( )	.0( )	.0( )
		99.	146.	702.	194.	105.	130.	195.	162.	166.	105.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		84.	91.	197.	161.	114.	5.	5.	33.	69.	2.
		.0( )	.0( )	.0( )	.0( )	2.2(S)	.7(S)	1.1(S)	6.1(S)	.8(S)	1.4(S)
0	35.	192.	697.	812.	850.	424.	899.	161.	4.	2.	39.
		4.2( )	3.7( )	4.2( )	4.1( )	3.0( )	7.8( )	5.1( )	.7( )	.1( )	2.0( )
		64.	83.	168.	61.	164.	257.	196.	107.	159.	121.
		.2( )	1.1(0)	2.0( )	3.7( )	2.5( )	2.8( )	3.0( )	2.9( )	1.8( )	4.1( )
		4.	215.	431.	497.	200.	697.	850.	737.	980.	673.
		.7( )	4.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		165.	237.	1014.	156.	225.	257.	317.	239.	273.	178.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		121.	122.	272.	233.	244.	8.	7.	41.	114.	5.
		.0( )	.0( )	.0( )	.0( )	4.6(S)	1.6(S)	2.3(S)	11.8(S)	1.7(S)	3.0(S)
0	40.	199.	1164.	1244.	1263.	707.	987.	235.	7.	3.	87.
		4.4( )	4.7( )	5.2( )	5.0( )	3.9( )	8.6( )	6.0( )	.8( )	.2( )	3.1( )
		73.	83.	554.	56.	282.	342.	249.	144.	209.	114.
		.2( )	1.4(0)	3.6( )	3.7( )	3.3( )	3.3( )	3.3( )	3.5( )	2.1( )	3.7( )
		7.	221.	845.	964.	200.	1164.	1263.	1053.	955.	811.
		.9( )	4.4( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		187.	328.	849.	102.	338.	342.	356.	258.	315.	213.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		114.	111.	256.	207.	403.	12.	8.	99.	148.	8.
		.0( )	.0( )	.0( )	.0( )	7.5(S)	2.7(S)	4.2(S)	17.7(S)	2.8(S)	4.8(S)
0	45.	200.	1389.	1395.	1395.	851.	926.	375.	10.	10.	142.
		4.4( )	5.1( )	5.5( )	5.2( )	4.2( )	8.0( )	6.5( )	1.0( )	.3( )	4.2( )
		78.	83.	962.	44.	339.	347.	252.	156.	205.	95.
		.2( )	1.4(0)	4.7( )	3.5( )	3.6( )	3.3( )	3.4( )	3.8( )	2.1( )	3.2( )
		10.	172.	1219.	1189.	200.	1389.	1395.	1156.	924.	743.
		1.0( )	3.6( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		181.	374.	631.	71.	383.	347.	337.	245.	293.	199.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		95.	94.	220.	161.	517.	16.	53.	144.	156.	10.
		.0( )	.0( )	.0( )	.0( )	9.6(S)	3.9(S)	6.5(S)	22.0(S)	3.9(S)	6.4(S)
0	50.	200.	1375.	1363.	1359.	892.	915.	492.	14.	41.	159.
		4.4( )	5.1( )	5.4( )	5.2( )	4.3( )	7.9( )	6.8( )	1.2( )	.6( )	4.5( )
		80.	83.	1142.	35.	333.	318.	237.	159.	179.	80.
		.2( )	1.3(0)	5.1( )	3.2( )	3.5( )	3.2( )	3.3( )	3.8( )	2.0( )	2.8( )
		12.	134.	1358.	1175.	200.	1375.	1359.	1145.	912.	632.
		1.2( )	3.0( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		193.	370.	488.	52.	368.	318.	304.	228.	251.	174.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		80.	79.	186.	125.	569.	20.	165.	162.	160.	12.
		.0( )	.0( )	.0( )	.0( )	10.6(S)	5.0(S)	8.3(S)	24.8(S)	4.7(S)	7.7(S)
0	55.	200.	1305.	1291.	1286.	897.	885.	549.	18.	111.	172.
		4.4( )	5.0( )	5.3( )	5.0( )	4.3( )	7.6( )	6.9( )	1.3( )	.9( )	4.8( )
		82.	83.	1140.	23.	305.	286.	221.	161.	155.	66.
		.2( )	1.0(0)	5.1( )	1.9( )	3.4( )	3.0( )	3.1( )	3.8( )	1.8( )	2.5( )
		14.	105.	1319.	1105.	200.	1305.	1286.	1105.	873.	531.
		1.3( )	2.6( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		244.	359.	392.	40.	327.	286.	273.	214.	213.	150.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		66.	65.	154.	98.	573.	24.	262.	173.	160.	14.
		.0( )	.0( )	.0( )	.0( )	10.7(S)	6.4(S)	9.3(S)	26.6(S)	5.2(S)	8.8(S)
1	0.	200.	1222.	1205.	1200.	873.	828.	557.	23.	191.	180.
		4.4( )	4.8( )	5.1( )	4.9( )	4.3( )	7.2( )	6.9( )	1.5( )	1.2( )	5.0( )
		83.	83.	1077.	16.	275.	257.	207.	160.	133.	55.
		.2( )	.7(0)	5.0( )	1.5( )	3.2( )	2.8( )	3.0( )	3.8( )	1.7( )	2.2( )
		15.	82.	1225.	1022.	200.	1222.	1200.	1045.	813.	446.
		1.4( )	2.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )

		308.	345.	329.	36.	291.	257.	245.	200.	180.	128.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		55.	54.	130.	77.	547.	30.	306.	181.	160.	15.
		.0( )	.0( )	.0( )	.0( )	10.2(S)	8.1(S)	9.8(S)	27.9(S)	5.4(S)	9.6(S)
1	5.	200.	1133.	1115.	1109.	829.	769.	535.	29.	253.	186.
		4.4( )	4.7( )	4.9( )	4.7( )	4.2( )	6.8( )	6.9( )	1.7( )	1.3( )	5.2( )
		83.	83.	996.	15.	250.	236.	197.	160.	115.	46.
		.2( )	.4(0)	4.8( )	1.4( )	3.1( )	2.7( )	3.0( )	3.8( )	1.6( )	2.0( )
		16.	68.	1121.	933.	200.	1133.	1109.	975.	756.	386.
		1.5( )	2.1( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		356.	332.	301.	35.	264.	236.	229.	195.	152.	111.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		46.	46.	113.	64.	507.	37.	322.	186.	160.	16.
		.0( )	.0( )	.0( )	.0( )	9.4(S)	10.2(S)	9.9(S)	28.8(S)	5.4(S)	10.4(S)
1	10.	200.	1042.	1024.	1019.	774.	701.	499.	34.	289.	190.
		4.4( )	4.5( )	4.7( )	4.5( )	4.1( )	6.4( )	6.8( )	1.9( )	1.4( )	5.3( )
		83.	81.	908.	12.	232.	223.	191.	160.	100.	34.
		.2( )	3.1( )	4.6( )	1.3( )	3.0( )	2.6( )	2.9( )	3.8( )	1.4( )	1.7( )
		17.	58.	1015.	842.	200.	1042.	1019.	899.	684.	341.
		1.5( )	1.9( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		380.	319.	271.	22.	244.	223.	218.	188.	129.	96.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		34.	32.	91.	55.	463.	40.	324.	190.	160.	17.
		.0( )	.0( )	.0( )	.0( )	8.6(S)	12.4(S)	10.0(S)	29.5(S)	5.3(S)	11.0(S)
1	15.	200.	942.	919.	911.	706.	609.	457.	38.	306.	192.
		4.4( )	4.3( )	4.4( )	4.2( )	3.9( )	5.8( )	6.7( )	2.0( )	1.4( )	5.4( )
		63.	0.	816.	8.	219.	211.	184.	160.	85.	23.
		.2( )	.0( )	4.4( )	1.0( )	2.9( )	2.6( )	2.9( )	3.8( )	1.3( )	1.4( )
		18.	46.	900.	742.	200.	942.	911.	805.	586.	287.
		1.6( )	1.7( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		381.	302.	196.	17.	227.	211.	204.	181.	106.	80.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		23.	23.	69.	41.	418.	42.	318.	192.	160.	18.
		.0( )	.0( )	.0( )	.0( )	7.7(S)	14.8(S)	9.9(S)	29.8(S)	5.0(S)	11.4(S)
1	20.	200.	826.	800.	792.	628.	523.	413.	41.	309.	191.
		4.4( )	4.0( )	4.1( )	4.0( )	3.7( )	5.3( )	6.6( )	2.1( )	1.4( )	5.4( )
		42.	26.	713.	6.	206.	198.	178.	160.	67.	17.
		.1( )	1.4( )	4.1( )	.9( )	2.8( )	2.5( )	2.8( )	3.8( )	1.2( )	1.2( )
		18.	35.	774.	626.	200.	826.	792.	702.	508.	234.
		1.6( )	1.5( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		370.	283.	144.	11.	212.	198.	193.	175.	84.	62.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		17.	16.	51.	32.	370.	45.	305.	191.	160.	18.
		.0( )	.0( )	.0( )	.0( )	6.8(S)	17.1(S)	9.8(S)	29.6(S)	4.6(S)	11.7(S)
1	25.	200.	712.	689.	681.	551.	451.	368.	44.	303.	189.
		4.4( )	3.7( )	3.8( )	3.7( )	3.4( )	4.9( )	6.5( )	2.1( )	1.4( )	5.3( )
		31.	0.	603.	4.	195.	188.	172.	158.	51.	12.
		.1( )	.0( )	3.8( )	.7( )	2.7( )	2.4( )	2.8( )	3.8( )	1.0( )	1.0( )
		19.	27.	649.	512.	200.	712.	681.	607.	434.	191.
		1.7( )	1.3( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		352.	264.	103.	9.	199.	188.	183.	169.	63.	45.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		12.	12.	35.	24.	322.	47.	290.	188.	157.	19.
		.0( )	.0( )	.0( )	.0( )	5.9(S)	19.2(S)	9.6(S)	29.2(S)	4.0(S)	11.8(S)
1	30.	200.	614.	593.	586.	480.	387.	323.	46.	291.	185.
		4.4( )	3.5( )	3.5( )	3.4( )	3.2( )	4.4( )	6.4( )	2.2( )	1.4( )	5.2( )
		23.	16.	499.	4.	185.	179.	165.	152.	38.	9.
		.1( )	1.1( )	3.4( )	.7( )	2.6( )	2.4( )	2.7( )	3.7( )	.8( )	.9( )
		19.	22.	535.	414.	200.	614.	586.	524.	374.	157.
		1.7( )	1.1( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		330.	246.	83.	8.	189.	179.	174.	161.	47.	34.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		9.	9.	25.	20.	276.	48.	273.	184.	151.	19.
		.0( )	.0( )	.0( )	.0( )	5.0(S)	21.2(S)	9.4(S)	28.5(S)	3.3(S)	11.9(S)

1	35.	200.	531.	513.	507.	418.	334.	278.	48.	277.	181.
		4.4( )	3.2( )	3.3( )	3.2( )	3.0( )	4.1( )	6.2( )	2.2( )	1.4( )	5.1( )
		18.	2.	408.	3.	176.	170.	158.	146.	30.	8.
		.1( )	.4( )	3.1( )	.7( )	2.6( )	2.3( )	2.6( )	3.6( )	.7( )	.8( )
		19.	19.	438.	331.	200.	531.	507.	454.	322.	132.
		1.7( )	1.1( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		305.	230.	74.	8.	179.	170.	165.	154.	38.	28.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		8.	7.	20.	18.	226.	49.	256.	180.	146.	19.
		.0( )	.0( )	.0( )	.0( )	4.3(S)	23.1(S)	9.2(S)	27.8(S)	2.6(S)	11.9(S)
1	40.	200.	462.	447.	442.	363.	288.	238.	49.	262.	176.
		4.4( )	3.0( )	3.1( )	2.9( )	2.8( )	3.8( )	6.0( )	2.3( )	1.3( )	4.9( )
		15.	13.	330.	3.	166.	159.	144.	126.	25.	6.
		.1( )	1.0( )	2.8( )	.7( )	2.5( )	2.2( )	2.5( )	3.2( )	.7( )	.7( )
		19.	17.	356.	262.	200.	462.	442.	396.	278.	118.
		1.7( )	1.0( )	.0( )	.0( )	.0( )	200.0(D)	.0( )	.0( )	.0( )	.0( )
		283.	216.	68.	8.	169.	159.	151.	133.	32.	23.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	6.	16.	17.	191.	50.	240.	176.	121.	19.
		.0( )	.0( )	.0( )	.0( )	3.7(S)	24.8(S)	9.1(S)	27.1(S)	1.9(S)	11.9(S)
1	45.	199.	406.	393.	388.	317.	252.	207.	50.	247.	172.
		4.4( )	2.8( )	2.9( )	2.7( )	2.6( )	3.5( )	5.8( )	2.3( )	1.3( )	4.8( )
		13.	4.	267.	3.	152.	141.	122.	101.	22.	5.
		.1( )	.5( )	2.5( )	.6( )	2.4( )	2.1( )	2.3( )	2.8( )	.6( )	.7( )
		19.	16.	290.	209.	197.	406.	388.	347.	245.	110.
		1.7( )	1.0( )	.0( )	.0( )	.0( )	196.8(D)	.0( )	.0( )	.0( )	.0( )
		264.	202.	66.	8.	156.	141.	129.	108.	28.	20.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	14.	16.	168.	52.	225.	171.	99.	19.
		.0( )	.0( )	.0( )	.0( )	3.3(S)	26.3(S)	8.9(S)	26.3(S)	1.3(S)	11.9(S)
1	50.	194.	359.	348.	345.	280.	227.	184.	51.	232.	167.
		4.2( )	2.6( )	2.7( )	2.6( )	2.4( )	3.3( )	5.6( )	2.3( )	1.3( )	4.7( )
		12.	12.	217.	3.	134.	119.	100.	80.	19.	5.
		.1( )	.9( )	2.2( )	.6( )	2.2( )	1.9( )	2.1( )	2.5( )	.6( )	.7( )
		19.	16.	239.	170.	190.	359.	345.	308.	221.	106.
		1.7( )	1.0( )	.0( )	.0( )	.0( )	189.6(D)	.0( )	.0( )	.0( )	.0( )
		247.	192.	64.	8.	137.	119.	107.	87.	25.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	12.	16.	150.	53.	211.	167.	76.	19.
		.0( )	.0( )	.0( )	.0( )	2.9(S)	27.7(S)	8.8(S)	25.6(S)	.9(S)	11.9(S)
1	55.	187.	322.	314.	311.	250.	208.	168.	53.	219.	163.
		4.0( )	2.5( )	2.6( )	2.4( )	2.3( )	3.2( )	5.4( )	2.4( )	1.3( )	4.6( )
		11.	5.	177.	3.	113.	98.	79.	58.	18.	5.
		.1( )	.6( )	2.0( )	.6( )	2.0( )	1.7( )	1.8( )	2.1( )	.5( )	.6( )
		19.	16.	198.	138.	184.	322.	311.	277.	204.	104.
		1.7( )	1.0( )	.0( )	.0( )	.0( )	184.0(D)	.0( )	.0( )	.0( )	.0( )
		232.	184.	63.	8.	117.	98.	86.	65.	24.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	11.	16.	137.	54.	200.	163.	55.	19.
		.0( )	.0( )	.0( )	.0( )	2.7(S)	29.0(S)	8.6(S)	24.9(S)	.6(S)	11.8(S)
2	0.	182.	294.	287.	285.	228.	196.	156.	54.	207.	159.
		3.9( )	2.4( )	2.5( )	2.3( )	2.2( )	3.1( )	4.3( )	2.4( )	1.2( )	4.5( )
		10.	11.	147.	3.	94.	79.	61.	44.	17.	5.
		.1( )	.9( )	1.8( )	.6( )	1.8( )	1.5( )	1.6( )	1.8( )	.5( )	.6( )
		19.	16.	167.	114.	180.	294.	285.	254.	193.	103.
		1.7( )	1.0( )	.0( )	.0( )	.0( )	179.7(D)	.0( )	.0( )	.0( )	.0( )
		219.	178.	62.	8.	97.	79.	68.	51.	23.	16.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	5.	10.	16.	127.	55.	191.	158.	42.	19.
		.0( )	.0( )	.0( )	.0( )	2.5(S)	30.2(S)	8.5(S)	24.2(S)	.5(S)	11.8(S)
2	5.	178.	271.	264.	262.	207.	170.	127.	56.	197.	155.
		3.9( )	2.3( )	2.4( )	2.2( )	2.1( )	2.9( )	3.5( )	2.5( )	1.2( )	4.4( )
		9.	1.	122.	2.	76.	63.	48.	35.	16.	4.

		.1( )	.3( )	1.7( )	.5( )	1.7( )	1.3( )	1.4( )	1.6( )	.5( )	.6( )
		19. 1.7( )	15. .9( )	141. .0( )	95. .0( )	176. .0( )	271. 176.1(D)	262. .0( )	232. .0( )	158. .0( )	101. .0( )
		207. .0( )	171. .0( )	52. .0( )	3. .0( )	79. .0( )	63. .0( )	54. .0( )	40. .0( )	20. .0( )	15. .0( )
		4. .0( )	4. .0( )	8. .0( )	14. .0( )	119. 2.3(S)	60. 31.3(S)	183. 8.5(S)	154. 23.6(S)	34. .3(S)	19. 11.7(S)
2	10.	174. 3.8( )	244. 2.2( )	234. 2.2( )	231. 2.1( )	184. 1.9( )	139. 2.6( )	117. 3.3( )	60. 2.6( )	188. 1.2( )	150. 4.3( )
		7. .0( )	1. .3( )	100. 1.5( )	1. .3( )	62. 1.5( )	50. 1.2( )	38. 1.2( )	28. 1.4( )	13. .5( )	3. .5( )
		18. 1.6( )	10. .8( )	114. .0( )	72. .0( )	172. .0( )	244. 171.9(D)	231. .0( )	202. .0( )	132. .0( )	94. .0( )
		196. .0( )	163. .0( )	25. .0( )	0. .0( )	63. .0( )	50. .0( )	41. .0( )	31. .0( )	16. .0( )	12. .0( )
		3. .0( )	2. .0( )	5. .0( )	7. .0( )	113. 2.2(S)	65. 32.2(S)	175. 8.4(S)	149. 22.8(S)	27. .3(S)	18. 11.6(S)
2	15.	169. 3.7( )	210. 2.0( )	198. 2.1( )	195. 1.9( )	161. 1.8( )	122. 2.4( )	110. 3.2( )	64. 2.7( )	180. 1.2( )	144. 4.2( )
		6. .0( )	0. .0( )	77. 1.3( )	0. .2( )	49. 1.3( )	39. 1.0( )	29. 1.1( )	22. 1.2( )	10. .4( )	2. .4( )
		18. 1.6( )	6. .6( )	86. .0( )	43. .0( )	167. .0( )	210. 166.7(D)	195. .0( )	172. .0( )	118. .0( )	86. .0( )
		185. .0( )	154. .0( )	13. .0( )	0. .0( )	50. .0( )	39. .0( )	31. .0( )	23. .0( )	12. .0( )	8. .0( )
		2. .0( )	2. .0( )	4. .0( )	4. .0( )	106. 2.1(S)	69. 33.1(S)	167. 8.3(S)	144. 21.9(S)	20. .2(S)	18. 11.5(S)
2	20.	164. 3.6( )	177. 1.8( )	168. 1.9( )	165. 1.7( )	142. 1.7( )	110. 2.3( )	103. 3.0( )	68. 2.8( )	172. 1.1( )	139. 4.1( )
		5. .0( )	0. .0( )	53. 1.0( )	0. .2( )	39. 1.1( )	29. .9( )	22. .9( )	16. 1.1( )	7. .3( )	0. .2( )
		18. 1.6( )	3. .4( )	58. .0( )	15. .0( )	162. .0( )	177. 161.7(D)	165. .0( )	149. .0( )	107. .0( )	83. .0( )
		175. .0( )	145. .0( )	8. .0( )	0. .0( )	39. .0( )	29. .0( )	22. .0( )	16. .0( )	7. .0( )	6. .0( )
		0. .0( )	0. .0( )	3. .0( )	2. .0( )	99. 1.9(S)	73. 33.8(S)	158. 8.2(S)	138. 21.0(S)	15. .1(S)	18. 11.4(S)
2	25.	157. 3.5( )	152. 1.7( )	145. 1.8( )	143. 1.6( )	127. 1.6( )	102. 2.2( )	97. 2.9( )	72. 2.9( )	163. 1.1( )	130. 3.9( )
		4. .0( )	0. .0( )	32. .8( )	0. .1( )	30. 1.0( )	22. .7( )	16. .8( )	11. .9( )	5. .3( )	0. .0( )
		18. 1.6( )	1. .3( )	36. .0( )	0. .0( )	152. .0( )	152. 152.2(D)	143. .0( )	131. .0( )	99. .0( )	81. .0( )
		166. .0( )	134. .0( )	4. .0( )	0. .0( )	30. .0( )	22. .0( )	16. .0( )	11. .0( )	5. .0( )	4. .0( )
		0. .0( )	0. .0( )	2. .0( )	0. .0( )	94. 1.8(S)	76. 34.5(S)	149. 8.1(S)	128. 20.1(S)	10. .1(S)	18. 11.3(S)
2	30.	142. 3.2( )	134. 1.6( )	128. 1.7( )	127. 1.5( )	115. 1.5( )	95. 2.1( )	93. 2.8( )	76. 2.9( )	154. 1.1( )	119. 3.7( )
		3. .0( )	0. .0( )	19. .6( )	0. .1( )	24. .9( )	16. .6( )	12. .6( )	8. .8( )	4. .2( )	0. .0( )
		18. 1.6( )	0. .2( )	21. .0( )	0. .0( )	134. .0( )	134. 133.8(D)	127. .0( )	118. .0( )	93. .0( )	82. .0( )
		156. .0( )	123. .0( )	3. .0( )	0. .0( )	24. .0( )	16. .0( )	12. .0( )	8. .0( )	4. .0( )	3. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	90. 1.8(S)	79. 35.1(S)	139. 8.0(S)	118. 19.3(S)	7. .1(S)	18. 11.2(S)
2	35.	126. 3.0( )	120. 1.5( )	115. 1.6( )	114. 1.4( )	106. 1.4( )	90. 2.1( )	89. 2.8( )	78. 3.0( )	145. 1.0( )	110. 3.6( )
		3. .0( )	0. .0( )	12. .4( )	0. .1( )	18. .7( )	12. .5( )	9. .5( )	6. .6( )	3. .2( )	0. .0( )
		18. 1.6( )	0. .1( )	12. .0( )	0. .0( )	120. .0( )	120. 119.5(D)	114. .0( )	108. .0( )	89. .0( )	82. .0( )

		146.	113.	3.	0.	18.	12.	9.	6.	3.	2.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	88.	81.	129.	109.	5.	18.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	35.6(S)	7.9(S)	18.5(S)	.1(S)	11.1(S)
2	40.	113.	108.	105.	104.	100.	88.	87.	81.	135.	102.
		2.8( )	1.4( )	1.5( )	1.3( )	1.4( )	2.1( )	2.7( )	3.1( )	1.0( )	3.4( )
		2.	0.	8.	0.	14.	9.	7.	4.	1.	0.
		.0( )	.0( )	.4( )	.1( )	.6( )	.5( )	.5( )	.5( )	.1( )	.0( )
		17.	0.	8.	0.	108.	108.	104.	100.	87.	83.
		1.6( )	.1( )	.0( )	.0( )	.0( )	108.4(D)	.0( )	.0( )	.0( )	.0( )
		135.	104.	2.	0.	14.	9.	7.	4.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	86.	83.	119.	101.	3.	17.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.0(S)	7.8(S)	17.8(S)	.0(S)	10.9(S)
2	45.	104.	100.	98.	97.	95.	86.	86.	83.	126.	94.
		2.6( )	1.3( )	1.5( )	1.3( )	1.4( )	2.0( )	2.7( )	3.1( )	1.0( )	3.2( )
		2.	0.	6.	0.	11.	7.	5.	3.	1.	0.
		.0( )	.0( )	.3( )	.1( )	.6( )	.4( )	.4( )	.5( )	.1( )	.0( )
		17.	0.	6.	0.	100.	100.	97.	95.	86.	85.
		1.5( )	.1( )	.0( )	.0( )	.0( )	100.4(D)	.0( )	.0( )	.0( )	.0( )
		126.	96.	2.	0.	11.	7.	5.	3.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	86.	85.	110.	93.	2.	17.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.3(S)	7.7(S)	17.2(S)	.0(S)	10.8(S)
2	50.	98.	95.	94.	93.	92.	86.	85.	85.	116.	86.
		2.5( )	1.3( )	1.4( )	1.3( )	1.3( )	2.0( )	2.7( )	3.2( )	1.0( )	3.1( )
		2.	0.	4.	0.	9.	6.	4.	2.	0.	0.
		.0( )	.0( )	.2( )	.1( )	.5( )	.3( )	.3( )	.4( )	.1( )	.0( )
		17.	0.	4.	0.	95.	95.	93.	92.	85.	83.
		1.5( )	.1( )	.0( )	.0( )	.0( )	95.3(D)	.0( )	.0( )	.0( )	.0( )
		116.	84.	2.	0.	9.	6.	4.	2.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	85.	86.	100.	84.	1.	17.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.5(S)	7.6(S)	16.6(S)	.0(S)	10.7(S)
2	55.	93.	92.	91.	90.	89.	85.	85.	86.	107.	77.
		2.5( )	1.3( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.9( )	2.9( )
		1.	0.	3.	0.	7.	4.	3.	1.	0.	0.
		.0( )	.0( )	.2( )	.1( )	.4( )	.3( )	.3( )	.3( )	.0( )	.0( )
		17.	0.	3.	0.	92.	92.	90.	89.	85.	87.
		1.5( )	.1( )	.0( )	.0( )	.0( )	91.9(D)	.0( )	.0( )	.0( )	.0( )
		107.	79.	1.	0.	7.	4.	3.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	85.	87.	91.	76.	1.	17.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.7(S)	7.5(S)	16.0(S)	.0(S)	10.6(S)
3	0.	91.	89.	89.	89.	88.	85.	85.	87.	98.	69.
		2.4( )	1.3( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.9( )	2.7( )
		1.	0.	3.	0.	6.	3.	2.	1.	0.	0.
		.0( )	.0( )	.2( )	.0( )	.4( )	.2( )	.2( )	.2( )	.0( )	.0( )
		17.	0.	3.	0.	89.	89.	89.	88.	85.	85.
		1.5( )	.0( )	.0( )	.0( )	.0( )	89.5(D)	.0( )	.0( )	.0( )	.0( )
		98.	68.	1.	0.	6.	3.	2.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	86.	88.	82.	68.	0.	17.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.8(S)	7.4(S)	15.6(S)	.0(S)	10.5(S)
3	5.	89.	88.	87.	87.	87.	86.	86.	87.	90.	62.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.9( )	2.6( )
		1.	0.	2.	0.	4.	3.	1.	0.	0.	0.
		.0( )	.0( )	.2( )	.0( )	.3( )	.2( )	.2( )	.2( )	.0( )	.0( )
		17.	0.	2.	0.	88.	88.	87.	87.	86.	89.
		1.5( )	.0( )	.0( )	.0( )	.0( )	87.9(D)	.0( )	.0( )	.0( )	.0( )
		90.	64.	1.	0.	5.	3.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	86.	88.	74.	61.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.8(S)	7.3(S)	15.1(S)	.0(S)	10.4(S)

3	10.	87.	87.	87.	87.	86.	86.	86.	88.	83.	56.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.8( )	2.4( )
		1.	0.	2.	0.	4.	2.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.3( )	.2( )	.1( )	.2( )	.0( )	.0( )
		16.	0.	2.	0.	87.	87.	87.	86.	86.	86.
		1.5( )	.0( )	.0( )	.0( )	.0( )	87.0(D)	.0( )	.0( )	.0( )	.0( )
		83.	55.	1.	0.	4.	2.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	86.	88.	72.	55.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.8(S)	7.2(S)	14.7(S)	.0(S)	10.3(S)
3	15.	87.	87.	86.	86.	86.	86.	87.	88.	78.	51.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.8( )	2.3( )
		1.	0.	1.	0.	3.	2.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.3( )	.2( )	.1( )	.1( )	.0( )	.0( )
		16.	0.	1.	0.	87.	87.	86.	86.	87.	89.
		1.5( )	.0( )	.0( )	.0( )	.0( )	86.5(D)	.0( )	.0( )	.0( )	.0( )
		78.	52.	1.	0.	3.	2.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	87.	87.	69.	50.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.8(S)	7.1(S)	14.4(S)	.0(S)	10.1(S)
3	20.	86.	86.	86.	86.	86.	87.	87.	87.	73.	45.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.8( )	2.2( )
		1.	0.	1.	0.	2.	1.	1.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		16.	0.	1.	0.	86.	86.	86.	86.	87.	86.
		1.4( )	.0( )	.0( )	.0( )	.0( )	86.4(D)	.0( )	.0( )	.0( )	.0( )
		73.	44.	1.	0.	2.	1.	1.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	87.	87.	66.	45.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.7(S)	7.0(S)	14.0(S)	.0(S)	10.0(S)
3	25.	86.	86.	87.	87.	87.	87.	87.	87.	70.	44.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.8( )	2.1( )
		1.	0.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		16.	0.	1.	0.	86.	86.	87.	87.	87.	89.
		1.4( )	.0( )	.0( )	.0( )	.0( )	86.5(D)	.0( )	.0( )	.0( )	.0( )
		70.	45.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	87.	87.	62.	44.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.6(S)	6.8(S)	13.7(S)	.0(S)	9.9(S)
3	30.	87.	87.	87.	87.	87.	87.	87.	87.	66.	43.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.7( )	2.1( )
		1.	0.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		16.	0.	1.	0.	87.	87.	87.	87.	87.	85.
		1.4( )	.0( )	.0( )	.0( )	.0( )	86.6(D)	.0( )	.0( )	.0( )	.0( )
		66.	42.	1.	0.	2.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	87.	86.	59.	43.	0.	16.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.5(S)	6.7(S)	13.4(S)	.0(S)	9.8(S)
3	35.	87.	87.	87.	87.	87.	87.	87.	86.	63.	43.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.7( )	2.1( )
		1.	0.	1.	0.	1.	1.	0.	0.	0.	0.
		.0( )	.0( )	.1( )	.0( )	.2( )	.1( )	.1( )	.1( )	.0( )	.0( )
		15.	0.	1.	0.	87.	87.	87.	87.	87.	87.
		1.4( )	.0( )	.0( )	.0( )	.0( )	86.7(D)	.0( )	.0( )	.0( )	.0( )
		63.	44.	1.	0.	1.	1.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	87.	85.	57.	43.	0.	15.
		.0( )	.0( )	.0( )	.0( )	1.7(S)	36.3(S)	6.6(S)	13.2(S)	.0(S)	9.7(S)
3	40.	87.	87.	87.	87.	87.	87.	87.	85.	60.	42.
		2.4( )	1.2( )	1.4( )	1.2( )	1.3( )	2.0( )	2.7( )	3.2( )	.7( )	2.1( )
		1.	0.	1.	0.	1.	1.	0.	0.	0.	0.

		.0( )	.0( )	.1( )	.0( )	.1( )	.1( )	.1( )	.1( )	.0( )	.0( )
		15. 1.4( )	0. .0( )	1. .0( )	0. .0( )	87. .0( )	87. 86.8(D)	87. .0( )	87. .0( )	87. .0( )	84. .0( )
		60. .0( )	41. .0( )	1. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	86. 1.7(S)	84. 36.2(S)	55. 6.5(S)	42. 12.9(S)	0. .0(S)	15. 9.6(S)
3	45.	87. 2.4( )	87. 1.2( )	87. 1.4( )	87. 1.2( )	87. 1.3( )	86. 2.0( )	86. 2.7( )	84. 3.2( )	58. .7( )	42. 2.1( )
		0. .0( )	0. .0( )	1. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .1( )	0. .1( )	0. .0( )	0. .0( )
		15. 1.4( )	0. .0( )	1. .0( )	0. .0( )	87. .0( )	87. 86.8(D)	87. .0( )	87. .0( )	86. .0( )	86. .0( )
		58. .0( )	43. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	86. 1.7(S)	84. 36.0(S)	53. 6.4(S)	42. 12.6(S)	0. .0(S)	15. 9.5(S)
3	50.	87. 2.4( )	87. 1.2( )	87. 1.4( )	87. 1.2( )	86. 1.3( )	86. 2.0( )	86. 2.7( )	84. 3.1( )	56. .7( )	42. 2.1( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )
		15. 1.4( )	0. .0( )	0. .0( )	0. .0( )	87. .0( )	87. 86.7(D)	87. .0( )	86. .0( )	86. .0( )	82. .0( )
		56. .0( )	40. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	85. 1.7(S)	83. 35.8(S)	51. 6.4(S)	42. 12.3(S)	0. .0(S)	15. 9.4(S)
3	55.	87. 2.4( )	86. 1.2( )	86. 1.4( )	86. 1.2( )	86. 1.3( )	85. 2.0( )	85. 2.7( )	83. 3.1( )	54. .7( )	41. 2.1( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		15. 1.4( )	0. .0( )	0. .0( )	0. .0( )	86. .0( )	86. 86.5(D)	86. .0( )	86. .0( )	85. .0( )	84. .0( )
		54. .0( )	43. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	85. 1.7(S)	82. 35.6(S)	50. 6.3(S)	41. 12.0(S)	0. .0(S)	15. 9.3(S)
4	0.	86. 2.4( )	86. 1.2( )	86. 1.4( )	86. 1.2( )	86. 1.3( )	85. 2.0( )	84. 2.7( )	82. 3.1( )	52. .7( )	41. 2.0( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		15. 1.4( )	0. .0( )	0. .0( )	0. .0( )	86. .0( )	86. 86.1(D)	86. .0( )	86. .0( )	84. .0( )	80. .0( )
		52. .0( )	39. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	84. 1.6(S)	81. 35.4(S)	48. 6.2(S)	41. 11.7(S)	0. .0(S)	15. 9.2(S)
4	5.	86. 2.4( )	86. 1.2( )	85. 1.4( )	85. 1.2( )	85. 1.3( )	84. 2.0( )	84. 2.7( )	81. 3.1( )	50. .7( )	40. 2.0( )
		0. .0( )	0. .0( )	0. .1( )	0. .0( )	1. .1( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		15. 1.3( )	0. .0( )	0. .0( )	0. .0( )	86. .0( )	86. 85.7(D)	85. .0( )	85. .0( )	84. .0( )	82. .0( )
		50. .0( )	42. .0( )	0. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	83. 1.6(S)	80. 35.2(S)	47. 6.2(S)	40. 11.5(S)	0. .0(S)	15. 9.1(S)
4	10.	85. 2.4( )	85. 1.2( )	85. 1.4( )	85. 1.2( )	84. 1.3( )	83. 2.0( )	83. 2.7( )	80. 3.0( )	49. .6( )	40. 2.0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		14. 1.3( )	0. .0( )	0. .0( )	0. .0( )	85. .0( )	85. 85.1(D)	85. .0( )	84. .0( )	83. .0( )	78. .0( )

49.	39.	0.	0.	0.	0.	0.	0.	0.	0.
.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
0.	0.	0.	0.	82.	79.	46.	40.	0.	14.
.0( )	.0( )	.0( )	.0( )	1.6(S)	35.0(S)	6.2(S)	11.2(S)	.0(S)	9.0(S)

1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FUTURE HYDROLOGIC AND DESIGN PLAN HYDRAULIC CONDITIONS 100 YR STORM

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
111	194.	(DIRECT FLOW)		0 30.
12	83.	3.5	1.4	0 45.
11	83.	.2		1 5.
110	1014.	(DIRECT FLOW)		0 35.
303	192.	.1	29.8	1 15.
10	192.	5.4		1 15.
109	374.	(DIRECT FLOW)		0 45.
302	324.	.1	10.0	1 10.
9	309.	1.4		1 20.
108	381.	(DIRECT FLOW)		1 15.
301	88.	.1	36.8	3 5.
8	88.	3.2		3 10.
107	811.	(DIRECT FLOW)		0 40.
300	573.	.1	10.7	0 55.
7	557.	6.9		1 0.
129	213.	(DIRECT FLOW)		0 40.
106	980.	(DIRECT FLOW)		0 35.
59	209.	2.1		0 40.
6	987.	8.6		0 40.
128	315.	(DIRECT FLOW)		0 40.
5	897.	4.3		0 55.
310	160.	.1	5.4	1 5.
105	1156.	(DIRECT FLOW)		0 45.
58	161.	3.8		0 55.
4	1395.	5.2		0 45.
127	258.	(DIRECT FLOW)		0 40.
104	1395.	(DIRECT FLOW)		0 45.
57	252.	3.4		0 45.
3	1395.	5.5		0 45.
126	356.	(DIRECT FLOW)		0 40.
2	1389.	5.1		0 45.
56	347.	3.3		0 45.
103	1389.	(DIRECT FLOW)		0 45.
140	272.	(DIRECT FLOW)		0 35.
131	122.	(DIRECT FLOW)		0 35.
125	347.	(DIRECT FLOW)		0 45.
101	1189.	(DIRECT FLOW)		0 45.
320	19.	.1	11.9	1 35.
70	121.	4.1		0 35.
55	339.	3.6		0 45.
50	61.	3.7		0 35.
150	233.	(DIRECT FLOW)		0 35.
20	1142.	5.1		0 50.
102	200.	(DIRECT FLOW)		0 35.
80	19.	1.7		1 35.
130	121.	(DIRECT FLOW)		0 35.
120	383.	(DIRECT FLOW)		0 45.
90	221.	4.4		0 40.
100	1358.	(DIRECT FLOW)		0 50.
1	200.	4.4		1 15.

1

ENDPROGRAM PROGRAM CALLED

APPENDIX D

UDSWM2-PC COMPUTER PRINTOUTS

EXISTING HYDRAULIC CONDITIONS

This appendix contains UDSWM2-PC printouts for existing hydraulic conditions with fully developed land use conditions. Printouts for both the 10 year and 100 years runs are included.

CAUTION STATEMENT

The user is advised to use caution when using flow conveyance element (channels and pipes) peak flows and hydrographs given in this report. The UDSWM2-PC model assumes that all adjacent sub-basin flow enters the flow conveyance element at the sub-basin design point or the downstream end of the element. The flow conveyance element is simply routing the upstream incoming flow and ignoring the possibility that additional flow may be entering from the adjacent sub-basin. Due to this model limitation flow used for channel or pipe design should be increased appropriately using engineering judgement to reflect incoming sub-basin flow.

APPENDIX D - UDSWM2-PC - 10 YR

EXISTING HYDRAULIC CONDITIONS

```
   2   1   1   2
   3   4
WATERSHED   1
KNOLLWOOD DRAINAGE BASIN DESIGN PLAN    FMG INC.  MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS    10 YR STORM
        50  0 0  5.0                                                                    1
        01  100
        02    4
        03  105
        04  106
        05  107
        06  108
        07  109
        08  110
        09  111
        10  120
        11  121
        12  122
        13  123
        15  121
        20  131
        30  140
        40  150

    0  111   11    3              1.
    0   11  110    1   100.0    2970    .018      4.      4.    .016     5.0
    0  110  303    3              1.
    0  303   10 12 2     0.1      1.
        0         0         1         5       2.3        22         5        31
       14        44        17        91        21       138        25       163
       36       230        42       341        49       664        57      1301
    0   10  109    2     6.5     320    .002      0.      0.    .016     4.0
    0  109  302    3              1.
    0  302    9  8 2     0.1      1.
        0         0         0         1        .2         4        .8         5
      2.4         7       4.6         8       7.3        74      10.4       365
    0    9  108    1    20.0    1280    .008     50.     50.    .050    10.0
    0  108  301    3              1.
    0  301    8  9 2     0.1      1.
        0         0         0         3      10.2        37      14.5        42
     19.3        47      24.5        50      30.3        55      36.9        88
     44.2       192
    0    8  107    5     5.0    2541    .003      .0      .0    .016     5.0
                      1.0    2541    .003     20.     20.    .020    10.0
    0  107  300    3              1.
    0  300    7  3 2     0.1      1.
        0         0       1.9       140      17.9       400
    0    7  106    5     5.0    1922    .005      .0      .0    .016     5.0
                      1.0    1922    .005     20.     20.    .020    10.0
    0  106    6    3              1.
    0    6    5    5     5.0     945    .005      .0      .0    .016     5.0
                      1.0     945    .005     20.     20.    .020    10.0
    0    5  105    1    20.0    2400    .011      5.      5.    .063    20.0
    0  105    4    3              1.
    0    4  104    1    20.0     700    .015      3.      3.    .063    20.0
```

```
   0  104    3    3              1.
   0    3    2    5     4.0     600    .027      .0      .0    .016     4.0
                        50.0     600    .027     25.     25.    .050    10.0
   0    2    1    1    50.0     450    .015     20.      8.    .063    10.0
   0    1  100    5     5.0    1766    .008      .0      .0    .016     5.0
                         1.0    1766    .008     20.     20.    .020    10.0
   0  100    0    3              1.
   0  150   91    3              1.
   0   91   90    2     1.5      50    .010      .0      .0    .016     1.5
   0   90    0    1   100.0    1000    .005     50.     50.    .050    10.0
   0  123   52    3              1.
   0   52  122    1    30.0     600    .033      4.      4.    .063    10.0
   0  122   51    3              1.
   0   51  121    1    20.0     500    .018      4.      4.    .044    10.0
   0  121   50    3              1.
   0   50  120    5     3.0     983    .004      .0      .0    .016     3.0
                         1.0     983    .004     20.     20.    .020    10.0
   0  120    0    3              1.
   0  131   70    3              1.
   0   70  130    4      .5     500    .005     12.     12.    .016      .5
                        10.0     500    .005     20.     20.    .020    10.0
   0  130    0    3              1.
   0  140  320    3              1.
   0  320   80  4 2     0.1      1.
        0         0       5.5         9        14        22        17        117
   0   80    0    2     2.0     450     .01      .0      .0    .016     2.0

   0
  40
   1    2    3    4    5    6    7    8    9   10   11   50   51   52   70   80
  90   91  105  106  107  108  109  110  111  120  121  122  123  130  131  140
 131  140  150  300  301  302  303  320
ENDPROGRAM
□□
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1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY METCALF + EDDY, INC.
UNIVERSITY OF FLORIDA
WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)

UPDATED BY UNIVERSITY OF FLORIDA (JUNE 1973)
HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

OTAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

ONUMBER OF TIME STEPS 50
OINTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 17 SUBCATCHMENTS

TIME(HR/MIN)	1	2	3	4	5	6	7	8	9	10
	40	11	12	13	15	20	30			
0 0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 10.	1.	1.	1.	8.	3.	1.	1.	2.	1.	0.
	0.	2.	1.	1.	2.	1.	2.			
0 15.	10.	13.	12.	45.	21.	7.	6.	45.	24.	7.
	11.	10.	7.	8.	11.	6.	12.			
0 20.	38.	47.	47.	121.	76.	19.	20.	183.	52.	23.
	47.	26.	19.	25.	22.	16.	30.			
0 25.	88.	104.	110.	276.	188.	48.	55.	385.	112.	49.
	98.	56.	42.	58.	45.	43.	89.			
0 30.	148.	165.	185.	442.	356.	81.	100.	548.	85.	66.
	139.	72.	60.	100.	34.	58.	127.			
0 35.	158.	161.	198.	372.	425.	91.	121.	420.	48.	55.
	116.	59.	54.	118.	19.	51.	116.			
0 40.	133.	129.	165.	259.	370.	81.	113.	270.	30.	41.
	84.	43.	42.	105.	11.	40.	92.			
0 45.	105.	101.	130.	185.	294.	69.	98.	187.	22.	31.

		62.	32.	33.	87.	8.	32.	74.			
0	50.	85.	80.	104.	139.	235.	59.	84.	141.	17.	23.
		48.	24.	26.	73.	7.	26.	59.			
0	55.	69.	65.	85.	108.	190.	50.	73.	113.	16.	16.
		37.	17.	20.	62.	6.	21.	48.			
1	0.	58.	54.	71.	92.	158.	44.	64.	100.	16.	14.
		31.	15.	15.	53.	6.	17.	40.			
1	5.	50.	47.	62.	84.	136.	39.	57.	96.	16.	13.
		28.	14.	13.	47.	6.	13.	35.			
1	10.	44.	41.	55.	79.	123.	36.	52.	95.	16.	13.
		28.	14.	13.	41.	6.	11.	31.			
1	15.	39.	39.	50.	77.	113.	33.	48.	94.	16.	12.
		27.	14.	12.	37.	6.	11.	28.			
1	20.	37.	38.	47.	72.	105.	30.	44.	90.	13.	12.
		26.	13.	12.	32.	5.	10.	23.			
1	25.	33.	34.	43.	60.	93.	26.	39.	75.	10.	10.
		23.	11.	10.	28.	4.	8.	18.			
1	30.	29.	30.	37.	48.	76.	20.	33.	62.	9.	9.
		20.	9.	8.	24.	3.	7.	15.			
1	35.	26.	27.	33.	43.	65.	16.	28.	56.	8.	8.
		18.	8.	7.	22.	3.	6.	14.			
1	40.	24.	25.	30.	40.	58.	15.	23.	53.	8.	7.
		17.	7.	7.	20.	3.	6.	12.			
1	45.	23.	24.	29.	38.	54.	13.	20.	52.	8.	7.
		16.	7.	6.	18.	3.	5.	12.			
1	50.	22.	23.	28.	37.	51.	12.	18.	52.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
1	55.	21.	22.	27.	36.	49.	12.	17.	51.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
2	0.	20.	21.	25.	33.	46.	11.	16.	46.	6.	6.
		15.	6.	5.	16.	2.	4.	10.			
2	5.	17.	18.	22.	25.	40.	9.	14.	34.	2.	4.
		11.	4.	4.	14.	0.	3.	7.			
2	10.	12.	11.	15.	13.	29.	7.	11.	14.	0.	2.
		6.	2.	2.	10.	0.	2.	5.			
2	15.	8.	7.	10.	7.	19.	5.	8.	6.	0.	0.
		3.	0.	1.	7.	0.	0.	3.			
2	20.	5.	4.	6.	3.	12.	4.	6.	2.	0.	0.
		1.	0.	0.	5.	0.	0.	2.			
2	25.	3.	2.	4.	2.	8.	3.	4.	0.	0.	0.
		0.	0.	0.	3.	0.	0.	1.			
2	30.	2.	0.	2.	0.	5.	2.	3.	0.	0.	0.
		0.	0.	0.	2.	0.	0.	0.			
2	35.	0.	0.	0.	0.	3.	0.	2.	0.	0.	0.
		0.	0.	0.	1.	0.	0.	0.			
2	40.	0.	0.	0.	0.	2.	0.	2.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	MANNING N	OVERBANK/SURCHARGE DEPTH (FT)		JK
111	11	0	3		.0	1.	.0010	.0	.0	.001	10.00		0
11	110	0	1	CHANNEL	100.0	2970.	.0180	4.0	4.0	.016	5.00		0
110	303	0	3		.0	1.	.0010	.0	.0	.001	10.00		0
303	10	12	2	PIPE	.1	1.	.0010	.0	.0	.001	.10		0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	1.0 5.0	2.3	22.0	5.0	31.0	14.0	44.0	17.0	91.0	
		21.0	138.0	25.0 163.0	36.0	230.0	42.0	341.0	49.0	664.0	57.0	1301.0	
10	109	0	2	PIPE	6.5	320.	.0020	.0	.0	.016	6.50		0
109	302	0	3		.0	1.	.0010	.0	.0	.001	10.00		0
302	9	8	2	PIPE	.1	1.	.0010	.0	.0	.001	.10		0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	.0 1.0	.2	4.0	.8	5.0	2.4	7.0	4.6	8.0	

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                        7.3    74.0      10.4   365.0
  9        108          0          1      CHANNEL        20.0     1280.     .0080     50.0  50.0      .050      10.00        0
108        301          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
301          8          9          2      PIPE            .1        1.       .0010      .0    .0      .001        .10        0
                   RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                        .0      .0       .0     3.0      10.2     37.0      14.5    42.0    19.3     47.0      24.5    50.0
                      30.3    55.0      36.9    88.0      44.2    192.0
  8        107          0          5      PIPE            5.0     2541.     .0030      .0    .0      .016       5.00        0
                                            OVERFLOW       1.0     2541.     .0030     20.0  20.0      .020      10.00
107        300          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
300          7          3          2      PIPE            .1        1.       .0010      .0    .0      .001        .10        0
                   RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                        .0      .0       1.9   140.0      17.9    400.0
  7        106          0          5      PIPE            5.0     1922.     .0050      .0    .0      .016       5.00        0
                                            OVERFLOW       1.0     1922.     .0050     20.0  20.0      .020      10.00
106          6          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
  6          5          0          5      PIPE            5.0      945.     .0050      .0    .0      .016       5.00        0
                                            OVERFLOW       1.0      945.     .0050     20.0  20.0      .020      10.00
  5        105          0          1      CHANNEL        20.0     2400.     .0110      5.0   5.0      .063      20.00        0
105          4          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
  4        104          0          1      CHANNEL        20.0      700.     .0150      3.0   3.0      .063      20.00        0
104          3          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
  3          2          0          5      PIPE            4.0      600.     .0270      .0    .0      .016       4.00        0
                                            OVERFLOW      50.0      600.     .0270     25.0  25.0      .050      10.00
  2          1          0          1      CHANNEL        50.0      450.     .0150     20.0   8.0      .063      10.00        0
  1        100          0          5      PIPE            5.0     1766.     .0080      .0    .0      .016       5.00        0
                                            OVERFLOW       1.0     1766.     .0080     20.0  20.0      .020      10.00
100          0          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
150         91          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
 91         90          0          2      PIPE            1.5       50.     .0100      .0    .0      .016       1.50        0
 90          0          0          1      CHANNEL       100.0     1000.     .0050     50.0  50.0      .050      10.00        0
123         52          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
 52        122          0          1      CHANNEL        30.0      600.     .0330      4.0   4.0      .063      10.00        0
122         51          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
 51        121          0          1      CHANNEL        20.0      500.     .0180      4.0   4.0      .044      10.00        0
121         50          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
 50        120          0          5      PIPE            3.0      983.     .0040      .0    .0      .016       3.00        0
                                            OVERFLOW       1.0      983.     .0040     20.0  20.0      .020      10.00
120          0          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
131         70          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
 70        130          0          4      CHANNEL         .5      500.     .0050     12.0  12.0      .016        .50        0
                                            OVERFLOW      10.0      500.     .0050     20.0  20.0      .020      10.00
130          0          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
140        320          0          3                      .0        1.       .0010      .0    .0      .001      10.00        0
320         80          4          2      PIPE            .1        1.       .0010      .0    .0      .001        .10        0
                   RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                        .0      .0       5.5     9.0      14.0     22.0      17.0   117.0
 80          0          0          2      PIPE            2.0      450.     .0100      .0    .0      .016       2.00        0
OTOTAL NUMBER OF GUTTERS/PIPES,  40
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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A.(AC)
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
3	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
4	105	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	808.3
5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
6	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
7	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
8	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
9	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
10	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
11	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
50	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114.6
51	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
52	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
70	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
80	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6
90	91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9

91	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9
100	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	875.5
104	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
105	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	748.8
106	7	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	673.3
107	8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	514.6
108	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	321.3
109	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	267.5
110	11	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	193.3
111	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	24.3
120	50	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	138.9
121	51	0	0	0	0	0	0	0	0	0	11	15	0	0	0	0	0	0	0	0	0	114.6
122	52	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	78.1
123	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	53.1
130	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
131	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	30.1
140	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	73.6
150	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	42.9
300	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
301	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
302	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
303	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
320	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 40 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)	1 11 107 131	2 50 108 140	3 51 109 131	4 52 110 140	5 70 111 150	6 80 120 300	7 90 121 301	8 91 122 302	9 105 123 303	10 106 130 320
0 5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 10.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	2. .4( )	0. .1( )	0. .1( )	0. .0( )	0. .0( )
	0. .0( )	1. .4( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	0. .0( )	0. .2( )	1. .0( )	8. .0( )
	3. .0( )	1. .0( )	1. .0( )	2. .0( )	1. .0( )	1. .0( )	4. .0( )	1. .0( )	1. .0( )	0. .0( )
	1. .0( )	2. .0( )	1. .0( )	2. .0( )	0. .0( )	1. .0(S)	1. .0(S)	1. .0(S)	0. .0(S)	0. .0(S)
0 15.	0. .0( )	0. .0( )	4. .4( )	6. .3( )	1. .1( )	27. 1.4( )	1. .3( )	0. .2( )	0. .0( )	0. .2( )

		1.	12.	3.	2.	3.	0.	1.	9.	13.	46.
		.0( )	1.2( )	.1( )	.1( )	.3( )	.1( )	.0( )	.0(0)	.0( )	.0( )
		22.	7.	7.	46.	24.	19.	23.	8.	8.	3.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	12.	6.	12.	11.	5.	3.	1.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.1(S)	.0(S)	.0(S)	.2(S)	.1(S)
0	20.	3.	13.	43.	53.	12.	100.	8.	1.	0.	3.
		.5( )	.2( )	1.3( )	.9( )	.4( )	3.0( )	.8( )	.3( )	.0( )	.6( )
		7.	39.	17.	11.	11.	0.	1.	9.	59.	129.
		.0( )	3.2( )	.4( )	.2( )	.5( )	.2( )	.1( )	.1(0)	.0( )	.0( )
		77.	19.	23.	191.	52.	61.	65.	30.	25.	11.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		16.	30.	16.	30.	47.	23.	3.	3.	5.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.3(S)	.1(S)	.1(S)	1.0(S)	.2(S)
0	25.	49.	100.	171.	188.	52.	203.	35.	2.	1.	18.
		1.7( )	.8( )	2.9( )	1.9( )	1.0( )	5.8( )	1.7( )	.4( )	.1( )	1.4( )
		31.	85.	61.	39.	30.	1.	3.	9.	161.	311.
		.1( )	3.9( )	.8( )	.5( )	.7( )	.3( )	.1( )	.6(0)	.0( )	.0( )
		190.	48.	73.	416.	112.	134.	161.	81.	58.	30.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		43.	89.	43.	89.	98.	68.	4.	4.	24.	1.
		.0( )	.0( )	.0( )	.0( )	.0( )	.9(S)	.3(S)	.4(S)	3.0(S)	.6(S)
0	30.	177.	246.	291.	410.	147.	403.	96.	3.	1.	33.
		3.8( )	1.3( )	4.5( )	2.9( )	1.7( )	6.6( )	2.9( )	.5( )	.1( )	1.8( )
		60.	174.	126.	82.	54.	2.	4.	9.	332.	538.
		.2( )	4.3( )	1.2( )	.7( )	.9( )	.4( )	.1( )	1.3(0)	.0( )	.0( )
		358.	83.	133.	608.	85.	240.	232.	142.	100.	54.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		58.	127.	58.	127.	139.	143.	5.	5.	33.	2.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.1(S)	.7(S)	1.1(S)	6.3(S)	1.3(S)
0	35.	272.	448.	536.	611.	292.	531.	149.	4.	2.	37.
		5.9( )	1.7( )	5.0( )	3.6( )	2.5( )	6.9( )	4.1( )	.6( )	.1( )	1.9( )
		63.	229.	165.	113.	55.	3.	5.	9.	490.	521.
		.2( )	4.5( )	1.3( )	.9( )	.9( )	.6( )	.1( )	2.2(0)	.0( )	.0( )
		429.	93.	158.	484.	48.	285.	243.	167.	118.	55.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		51.	116.	51.	116.	116.	170.	7.	7.	38.	4.
		.0( )	.0( )	.0( )	.0( )	.0( )	3.7(S)	1.3(S)	2.1(S)	9.8(S)	2.2(S)
0	40.	467.	645.	672.	686.	395.	470.	163.	6.	3.	41.
		6.5( )	2.1( )	5.3( )	3.8( )	2.9( )	6.8( )	5.3( )	.8( )	.2( )	2.1( )
		52.	228.	158.	111.	44.	4.	6.	9.	560.	422.
		.1( )	4.5( )	1.3( )	.9( )	.8( )	.7( )	.1( )	2.8(0)	.0( )	.0( )
		375.	84.	154.	322.	30.	269.	213.	153.	105.	44.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		40.	92.	40.	92.	84.	194.	9.	7.	42.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	5.2(S)	1.8(S)	3.1(S)	12.3(S)	2.8(S)
0	45.	625.	681.	674.	662.	414.	392.	176.	7.	4.	43.
		6.8( )	2.2( )	5.3( )	3.8( )	3.0( )	6.6( )	5.6( )	.9( )	.2( )	2.1( )
		41.	197.	134.	94.	35.	5.	6.	9.	544.	361.
		.1( )	4.4( )	1.2( )	.8( )	.8( )	.7( )	.1( )	3.2(0)	.0( )	.0( )
		302.	73.	141.	227.	22.	228.	174.	127.	87.	35.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		32.	74.	32.	74.	62.	210.	11.	8.	44.	6.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.2(S)	2.3(S)	4.0(S)	13.9(S)	3.4(S)
0	50.	653.	637.	619.	597.	391.	347.	191.	9.	6.	55.
		6.9( )	2.1( )	5.2( )	3.6( )	2.9( )	6.4( )	5.7( )	1.0( )	.2( )	2.4( )
		32.	163.	110.	78.	28.	6.	7.	9.	495.	330.
		.1( )	4.3( )	1.1( )	.7( )	.7( )	.8( )	.1( )	3.5(0)	.0( )	.0( )
		244.	64.	139.	173.	17.	186.	140.	104.	73.	28.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		26.	59.	26.	59.	48.	216.	12.	16.	59.	6.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.6(S)	2.7(S)	4.9(S)	14.9(S)	3.8(S)
0	55.	613.	572.	552.	531.	362.	322.	203.	11.	11.	68.

		6.8( )	2.0( )	5.1( )	3.4( )	2.8( )	6.4( )	5.8( )	1.0( )	.3( )	2.7( )
		26.	134.	91.	66.	23.	7.	7.	9.	447.	311.
		.1( )	4.2( )	1.0( )	.7( )	.7( )	.8( )	.1( )	3.8(0)	.0( )	.0( )
		201.	61.	141.	139.	16.	150.	115.	86.	62.	23.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		21.	48.	21.	48.	37.	217.	13.	35.	68.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.6(S)	3.0(S)	5.7(S)	15.6(S)	4.1(S)
1	0.	555.	512.	496.	478.	339.	307.	209.	12.	20.	74.
		6.7( )	1.9( )	5.0( )	3.2( )	2.7( )	6.3( )	5.9( )	1.1( )	.4( )	2.8( )
		23.	111.	76.	57.	18.	7.	8.	9.	410.	301.
		.1( )	4.1( )	.9( )	.6( )	.6( )	.9( )	.1( )	3.9(0)	.0( )	.0( )
		170.	64.	137.	123.	16.	125.	97.	72.	53.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		17.	40.	17.	40.	31.	214.	14.	51.	75.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.4(S)	3.4(S)	6.4(S)	16.0(S)	4.4(S)
1	5.	502.	465.	454.	440.	321.	298.	210.	13.	33.	79.
		6.6( )	1.8( )	4.9( )	3.0( )	2.6( )	6.3( )	5.9( )	1.2( )	.5( )	2.9( )
		20.	96.	65.	49.	15.	7.	8.	9.	383.	294.
		.1( )	4.0( )	.8( )	.6( )	.6( )	.9( )	.1( )	4.1(0)	.0( )	.0( )
		150.	72.	136.	116.	16.	109.	85.	63.	47.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		13.	35.	13.	35.	28.	208.	15.	65.	79.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.1(S)	3.7(S)	6.9(S)	16.3(S)	4.6(S)
1	10.	460.	432.	423.	413.	308.	290.	207.	15.	47.	82.
		6.5( )	1.7( )	4.8( )	2.9( )	2.6( )	6.3( )	5.9( )	1.2( )	.6( )	3.0( )
		19.	85.	58.	44.	12.	8.	8.	9.	363.	286.
		.1( )	3.9( )	.7( )	.5( )	.6( )	.9( )	.1( )	4.2(0)	.0( )	.0( )
		137.	82.	134.	113.	16.	98.	78.	56.	41.	12.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		11.	31.	11.	31.	28.	201.	17.	79.	83.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	5.7(S)	4.2(S)	7.4(S)	16.5(S)	4.8(S)
1	15.	429.	407.	400.	392.	298.	283.	203.	16.	64.	86.
		6.4( )	1.7( )	4.8( )	2.9( )	2.5( )	6.2( )	5.8( )	1.3( )	.7( )	3.1( )
		18.	78.	53.	39.	11.	8.	9.	9.	347.	279.
		.1( )	3.9( )	.7( )	.5( )	.5( )	.9( )	.1( )	4.3(0)	.0( )	.0( )
		130.	97.	133.	112.	16.	91.	73.	51.	37.	11.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		11.	28.	11.	28.	27.	194.	19.	106.	86.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	5.2(S)	4.6(S)	7.6(S)	16.7(S)	4.9(S)
1	20.	405.	388.	384.	378.	289.	275.	197.	18.	83.	88.
		6.4( )	1.6( )	4.8( )	2.8( )	2.5( )	6.2( )	5.8( )	1.3( )	.8( )	3.1( )
		17.	72.	48.	34.	10.	8.	9.	9.	336.	269.
		.1( )	3.8( )	.7( )	.4( )	.5( )	.9( )	.1( )	4.5(0)	.0( )	.0( )
		123.	113.	132.	107.	13.	84.	66.	46.	32.	10.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		10.	23.	10.	23.	26.	187.	20.	119.	88.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	4.8(S)	5.2(S)	7.8(S)	16.8(S)	5.0(S)
1	25.	387.	374.	369.	363.	279.	262.	191.	20.	100.	89.
		6.3( )	1.6( )	4.7( )	2.7( )	2.4( )	6.1( )	5.7( )	1.4( )	.9( )	3.1( )
		15.	65.	42.	30.	9.	8.	9.	9.	322.	250.
		.1( )	3.7( )	.6( )	.4( )	.5( )	.9( )	.1( )	4.6(0)	.0( )	.0( )
		113.	125.	128.	90.	10.	75.	57.	40.	28.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		8.	18.	8.	18.	23.	179.	23.	124.	89.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	4.3(S)	5.9(S)	7.8(S)	16.9(S)	5.1(S)
1	30.	371.	357.	351.	342.	267.	244.	184.	22.	110.	89.
		6.3( )	1.5( )	4.7( )	2.7( )	2.4( )	6.1( )	5.7( )	1.5( )	.9( )	3.1( )
		13.	57.	37.	26.	8.	8.	9.	9.	304.	233.
		.1( )	3.6( )	.6( )	.4( )	.5( )	1.0( )	.1( )	4.6(0)	.0( )	.0( )
		98.	130.	122.	75.	9.	65.	49.	35.	24.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		7.	15.	7.	15.	20.	172.	25.	125.	89.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	3.8(S)	6.6(S)	7.8(S)	16.9(S)	5.2(S)

1	35.	354.	337.	330.	320.	253.	229.	177.	24.	116.	87.
		6.2( )	1.5( )	4.6( )	2.6( )	2.3( )	6.0( )	5.6( )	1.6( )	1.0( )	3.1( )
		12.	50.	32.	23.	7.	9.	9.	9.	286.	220.
		.1( )	3.6( )	.5( )	.4( )	.4( )	1.0( )	.1( )	4.7(0)	.0( )	.0( )
		89.	132.	115.	68.	8.	58.	43.	31.	22.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	14.	6.	14.	18.	163.	28.	122.	87.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	3.3(S)	7.3(S)	7.8(S)	16.7(S)	5.2(S)
1	40.	335.	316.	309.	301.	239.	218.	171.	27.	117.	85.
		6.2( )	1.4( )	4.6( )	2.5( )	2.2( )	5.9( )	5.5( )	1.6( )	1.0( )	3.0( )
		11.	45.	29.	21.	6.	9.	9.	9.	269.	210.
		.1( )	3.5( )	.5( )	.3( )	.4( )	1.0( )	.1( )	4.8(0)	.0( )	.0( )
		85.	132.	108.	64.	8.	53.	40.	28.	20.	6.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	12.	6.	12.	17.	155.	30.	117.	85.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.8(S)	8.1(S)	7.8(S)	16.6(S)	5.2(S)
1	45.	316.	298.	292.	285.	227.	209.	165.	29.	116.	83.
		6.1( )	1.4( )	4.5( )	2.4( )	2.2( )	5.9( )	5.3( )	1.7( )	1.0( )	3.0( )
		10.	42.	26.	19.	6.	9.	9.	9.	256.	202.
		.1( )	3.4( )	.5( )	.3( )	.4( )	1.0( )	.1( )	4.8(0)	.0( )	.0( )
		83.	129.	103.	63.	8.	49.	37.	26.	18.	6.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	12.	5.	12.	16.	148.	32.	111.	83.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.4(S)	8.7(S)	7.7(S)	16.5(S)	5.3(S)
1	50.	299.	283.	279.	272.	217.	202.	161.	32.	113.	81.
		6.0( )	1.4( )	4.5( )	2.3( )	2.1( )	5.8( )	4.6( )	1.8( )	.9( )	3.0( )
		10.	39.	25.	18.	5.	9.	9.	9.	245.	198.
		.1( )	3.3( )	.5( )	.3( )	.4( )	1.0( )	.1( )	4.9(0)	.0( )	.0( )
		82.	125.	99.	62.	8.	46.	35.	24.	17.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	11.	5.	11.	16.	141.	34.	106.	81.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.9(S)	9.4(S)	7.6(S)	16.3(S)	5.3(S)
1	55.	285.	271.	267.	261.	208.	190.	138.	34.	109.	79.
		6.0( )	1.3( )	4.4( )	2.3( )	2.1( )	5.7( )	3.8( )	1.8( )	.9( )	2.9( )
		9.	37.	24.	17.	5.	9.	9.	9.	235.	174.
		.1( )	3.1( )	.4( )	.3( )	.4( )	1.0( )	.1( )	4.9(0)	.0( )	.0( )
		83.	121.	96.	60.	8.	44.	34.	23.	17.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	11.	5.	11.	16.	119.	36.	102.	79.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.6(S)	10.0(S)	7.6(S)	16.2(S)	5.3(S)
2	0.	272.	259.	255.	248.	196.	171.	115.	36.	105.	77.
		5.9( )	1.3( )	4.4( )	2.2( )	2.0( )	5.5( )	3.3( )	1.9( )	.9( )	2.9( )
		9.	35.	22.	16.	5.	9.	9.	9.	221.	148.
		.1( )	2.5( )	.4( )	.3( )	.4( )	1.0( )	.1( )	5.0(0)	.0( )	.0( )
		82.	116.	93.	55.	6.	41.	31.	22.	16.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		4.	10.	4.	10.	15.	104.	37.	98.	76.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.4(S)	10.6(S)	7.6(S)	16.1(S)	5.3(S)
2	5.	260.	246.	240.	228.	180.	149.	101.	37.	101.	74.
		5.8( )	1.3( )	4.3( )	2.1( )	1.9( )	4.1( )	3.0( )	1.9( )	.9( )	2.8( )
		8.	28.	20.	15.	4.	9.	9.	9.	202.	126.
		.0( )	2.1( )	.4( )	.3( )	.4( )	1.0( )	.1( )	5.0(0)	.0( )	.0( )
		77.	110.	88.	41.	2.	33.	25.	19.	14.	4.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		3.	7.	3.	7.	11.	94.	38.	94.	73.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.3(S)	11.1(S)	7.5(S)	15.9(S)	5.3(S)
2	10.	246.	227.	219.	199.	157.	107.	91.	38.	97.	70.
		5.8( )	1.2( )	4.2( )	2.0( )	1.8( )	3.1( )	2.8( )	2.0( )	.9( )	2.7( )
		6.	22.	17.	13.	3.	9.	9.	9.	173.	104.
		.0( ).	1.7( )	.4( )	.2( )	.3( )	1.0( )	.1( )	5.0(0)	.0( )	.0( )
		67.	104.	81.	20.	0.	24.	19.	15.	10.	3.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		2.	5.	2.	5.	6.	85.	39.	89.	69.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.2(S)	11.6(S)	7.5(S)	15.6(S)	5.3(S)

2	15.	228.	200.	187.	164.	133.	93.	82.	38.	93.	64.
		5.6( )	1.1( )	3.2( )	1.8( )	1.6( )	2.9( )	2.6( )	2.0( )	.9( )	2.6( )
		5.	16.	13.	10.	1.	9.	9.	9.	143.	88.
		.0( )	1.4( )	.3( )	.2( )	.2( )	1.0( )	.2( )	4.9(0)	.0( )	.0( )
		57.	98.	73.	10.	0.	16.	13.	11.	7.	1.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	3.	0.	3.	3.	76.	39.	83.	64.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.0(S)	12.0(S)	7.4(S)	15.2(S)	5.3(S)
2	20.	205.	151.	125.	136.	114.	79.	73.	39.	87.	59.
		5.2( )	1.0( )	2.4( )	1.6( )	1.5( )	2.6( )	2.5( )	2.0( )	.8( )	2.5( )
		4.	11.	9.	7.	0.	9.	9.	9.	120.	76.
		.0( )	1.2( )	.3( )	.2( )	.1( )	1.0( )	.2( )	4.9(0)	.0( )	.0( )
		51.	91.	65.	6.	0.	11.	9.	7.	5.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	2.	0.	2.	1.	67.	40.	76.	58.	9.
		.0( )	.0( )	.0( )	.0( )	.0( )	.9(S)	12.4(S)	7.3(S)	14.9(S)	5.2(S)
2	25.	148.	123.	125.	114.	99.	69.	65.	39.	82.	53.
		3.3( )	.9( )	2.3( )	1.4( )	1.4( )	2.4( )	2.3( )	2.0( )	.8( )	2.4( )
		3.	8.	6.	5.	0.	9.	9.	9.	102.	66.
		.0( )	1.0( )	.2( )	.1( )	.1( )	1.0( )	.2( )	4.8(0)	.0( )	.0( )
		47.	84.	58.	3.	0.	8.	6.	5.	3.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	1.	0.	1.	0.	60.	40.	72.	52.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.8(S)	12.7(S)	7.2(S)	14.5(S)	5.2(S)
2	30.	113.	107.	92.	96.	86.	61.	58.	40.	77.	48.
		2.8( )	.8( )	2.0( )	1.3( )	1.3( )	2.2( )	2.2( )	2.0( )	.8( )	2.2( )
		3.	6.	5.	4.	0.	8.	9.	9.	88.	58.
		.0( )	.8( )	.2( )	.1( )	.1( )	1.0( )	.2( )	4.8(0)	.0( )	.0( )
		45.	79.	51.	3.	0.	6.	5.	4.	2.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	54.	40.	70.	47.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.7(S)	13.0(S)	7.1(S)	14.2(S)	5.1(S)
2	35.	97.	89.	87.	82.	76.	55.	53.	40.	74.	44.
		2.5( )	.7( )	1.9( )	1.2( )	1.2( )	2.1( )	2.1( )	2.0( )	.8( )	2.1( )
		2.	4.	4.	3.	0.	8.	9.	9.	76.	53.
		.0( )	.7( )	.1( )	.1( )	.0( )	.9( )	.2( )	4.7(0)	.0( )	.0( )
		43.	74.	47.	2.	0.	4.	4.	3.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	50.	41.	66.	44.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.7(S)	13.2(S)	7.0(S)	13.9(S)	5.1(S)
2	40.	83.	79.	70.	72.	67.	51.	49.	40.	70.	43.
		2.3( )	.7( )	1.7( )	1.1( )	1.1( )	2.0( )	2.0( )	2.0( )	.8( )	2.1( )
		2.	3.	3.	2.	0.	8.	9.	9.	67.	49.
		.0( )	.6( )	.1( )	.1( )	.0( )	.9( )	.2( )	4.6(0)	.0( )	.0( )
		43.	70.	45.	2.	0.	3.	3.	2.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	47.	41.	63.	43.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	13.4(S)	6.9(S)	13.6(S)	5.0(S)
2	45.	73.	69.	67.	65.	61.	47.	47.	41.	67.	43.
		2.2( )	.6( )	1.6( )	1.0( )	1.1( )	1.9( )	1.9( )	2.0( )	.7( )	2.1( )
		2.	2.	2.	1.	0.	8.	9.	9.	61.	47.
		.0( )	.5( )	.1( )	.1( )	.0( )	.9( )	.2( )	4.6(0)	.0( )	.0( )
		39.	67.	41.	2.	0.	2.	2.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	45.	41.	60.	43.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	13.6(S)	6.7(S)	13.3(S)	4.9(S)
2	50.	66.	63.	58.	59.	56.	45.	44.	41.	64.	43.
		2.0( )	.6( )	1.5( )	1.0( )	1.0( )	1.9( )	1.9( )	2.1( )	.7( )	2.1( )
		1.	2.	1.	1.	0.	8.	9.	9.	56.	44.
		.0( )	.5( )	.1( )	.0( )	.0( )	.9( )	.2( )	4.5(0)	.0( )	.0( )
		43.	64.	44.	1.	0.	2.	1.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	43.	41.	57.	43.	8.

		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	13.8(S)	6.6(S)	13.1(S)	4.9(S)
2	55.	60. 1.9( )	57. .6( )	56. 1.5( )	54. .9( )	52. 1.0( )	43. 1.8( )	43. 1.8( )	41. 2.1( )	61. .7( )	42. 2.1( )
		1. .0( )	1. .4( )	1. .1( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.5(0)	52. .0( )	43. .0( )
		39. .0( )	61. .0( )	41. .0( )	1. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	41. 13.9(S)	55. 6.5(S)	42. 12.8(S)	8. 4.8(S)
3	0.	55. 1.9( )	53. .5( )	51. 1.4( )	51. .9( )	49. .9( )	42. 1.8( )	42. 1.8( )	41. 2.1( )	58. .7( )	42. 2.1( )
		1. .0( )	1. .3( )	1. .0( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.4(0)	49. .0( )	42. .0( )
		43. .0( )	58. .0( )	44. .0( )	1. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.1(S)	53. 6.4(S)	42. 12.5(S)	8. 4.8(S)
3	5.	52. 1.8( )	50. .5( )	49. 1.4( )	48. .9( )	47. .9( )	42. 1.8( )	42. 1.8( )	41. 2.1( )	56. .7( )	42. 2.1( )
		1. .0( )	1. .3( )	0. .0( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.3(0)	47. .0( )	42. .0( )
		39. .0( )	56. .0( )	40. .0( )	1. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.2(S)	51. 6.4(S)	41. 12.2(S)	8. 4.7(S)
3	10.	49. 1.7( )	48. .5( )	46. 1.3( )	46. .9( )	45. .9( )	42. 1.8( )	42. 1.8( )	42. 2.1( )	54. .7( )	41. 2.1( )
		1. .0( )	1. .3( )	0. .0( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.3(0)	45. .0( )	42. .0( )
		44. .0( )	54. .0( )	43. .0( )	1. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.3(S)	50. 6.3(S)	41. 11.9(S)	8. 4.7(S)
3	15.	47. 1.7( )	46. .5( )	45. 1.3( )	45. .8( )	44. .9( )	42. 1.8( )	42. 1.8( )	42. 2.1( )	52. .7( )	41. 2.0( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.2(0)	44. .0( )	42. .0( )
		40. .0( )	52. .0( )	39. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.3(S)	48. 6.3(S)	41. 11.7(S)	8. 4.6(S)
3	20.	45. 1.7( )	45. .5( )	44. 1.3( )	44. .8( )	43. .9( )	42. 1.8( )	42. 1.8( )	42. 2.1( )	50. .7( )	40. 2.0( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	8. .9( )	9. .2( )	9. 4.1(0)	43. .0( )	42. .0( )
		44. .0( )	50. .0( )	42. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.4(S)	47. 6.2(S)	40. 11.4(S)	8. 4.6(S)
3	25.	44. 1.6( )	44. .5( )	43. 1.3( )	43. .8( )	43. .9( )	42. 1.8( )	42. 1.8( )	42. 2.1( )	49. .6( )	40. 2.0( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	7. .9( )	9. .2( )	9. 4.1(0)	43. .0( )	42. .0( )
		40. .0( )	49. .0( )	38. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	42. .6(S)	42. 14.5(S)	46. 6.2(S)	40. 11.1(S)	7. 4.5(S)
3	30.	43. 1.6( )	43. .5( )	43. 1.3( )	43. .8( )	42. .9( )	42. 1.8( )	42. 1.8( )	42. 2.1( )	48. .6( )	40. 2.0( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	7. .9( )	9. .2( )	9. 4.0(0)	42. .0( )	42. .0( )
		44. .0( )	48. .0( )	41. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )

		0.	0.	0.	0.	0.	42.	42.	45.	39.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.5(S)	6.1(S)	10.8(S)	4.5(S)
3	35.	43.	43.	42.	42.	42.	42.	42.	42.	47.	39.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	2.0( )
		1.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.2( )	.0( )	.0( )	.0( )	.9( )	.2( )	4.0(0)	.0( )	.0( )
		40.	47.	37.	1.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	44.	39.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.5(S)	6.1(S)	10.6(S)	4.4(S)
3	40.	43.	42.	42.	42.	42.	42.	42.	42.	46.	39.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	2.0( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.9( )	.2( )	3.9(0)	.0( )	.0( )
		44.	46.	41.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	43.	39.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	6.0(S)	10.3(S)	4.4(S)
3	45.	42.	42.	42.	42.	42.	42.	42.	42.	45.	38.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	2.0( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.9( )	.2( )	3.8(0)	.0( )	.0( )
		40.	45.	37.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	43.	38.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	6.0(S)	10.0(S)	4.3(S)
3	50.	42.	42.	42.	42.	42.	42.	42.	42.	44.	38.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	2.0( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.9( )	.2( )	3.8(0)	.0( )	.0( )
		44.	44.	40.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	42.	38.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	6.0(S)	9.8(S)	4.3(S)
3	55.	42.	42.	42.	42.	42.	42.	42.	42.	43.	38.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	2.0( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.9( )	.2( )	3.7(0)	.0( )	.0( )
		40.	43.	36.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	41.	38.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	6.0(S)	9.5(S)	4.2(S)
4	0.	42.	42.	42.	42.	42.	42.	42.	42.	42.	37.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	1.9( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.8( )	.2( )	3.6(0)	.0( )	.0( )
		44.	42.	39.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	41.	37.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	5.9(S)	9.3(S)	4.2(S)
4	5.	42.	42.	42.	42.	42.	42.	42.	42.	42.	37.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	1.9( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.8( )	.2( )	3.6(0)	.0( )	.0( )
		40.	42.	35.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	42.	42.	40.	37.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	5.9(S)	9.0(S)	4.1(S)
4	10.	42.	42.	42.	42.	42.	42.	42.	42.	41.	37.
		1.6( )	.5( )	1.3( )	.8( )	.9( )	1.8( )	1.8( )	2.1( )	.6( )	1.9( )
		0.	0.	0.	0.	0.	7.	9.	9.	42.	42.
		.0( )	.1( )	.0( )	.0( )	.0( )	.8( )	.2( )	3.5(0)	.0( )	.0( )
		44.	41.	38.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )

0.	0.	0.	0.	0.	42.	42.	40.	36.	7.
.0( )	.0( )	.0( )	.0( )	.0( )	.6(S)	14.6(S)	5.9(S)	8.8(S)	4.1(S)

1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 10 YR STORM

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)	
111	112.	(DIRECT FLOW)		0	25.
11	63.	.2		0	35.
110	608.	(DIRECT FLOW)		0	30.
303	89.	.1	16.9	1	25.
10	89.	3.1		1	25.
109	158.	(DIRECT FLOW)		0	35.
302	125.	.1	7.8	1	30.
9	117.	1.0		1	40.
108	132.	(DIRECT FLOW)		1	35.
301	42.	.1	14.6	4	0.
8	42.	2.1		4	5.
107	429.	(DIRECT FLOW)		0	35.
300	217.	.1	6.6	0	55.
7	210.	5.9		1	5.
106	538.	(DIRECT FLOW)		0	30.
6	531.	6.9		0	35.
5	414.	3.0		0	45.
123	118.	(DIRECT FLOW)		0	35.
105	560.	(DIRECT FLOW)		0	40.
52	113.	.9		0	35.
4	686.	3.8		0	40.
122	167.	(DIRECT FLOW)		0	35.
104	686.	(DIRECT FLOW)		0	40.
51	165.	1.3		0	35.
3	674.	5.3		0	45.
140	127.	(DIRECT FLOW)		0	30.
131	58.	(DIRECT FLOW)		0	30.
121	243.	(DIRECT FLOW)		0	35.
150	139.	(DIRECT FLOW)		0	30.
2	681.	2.2		0	45.
320	9.	.1	5.3	2	0.
70	55.	.9		0	35.
50	229.	4.5		0	35.
91	9.	1.5	5.0	2	5.
1	653.	6.9		0	50.
80	9.	1.0		2	5.
130	55.	(DIRECT FLOW)		0	35.
120	285.	(DIRECT FLOW)		0	35.
90	9.	.2		4	10.
100	738.	(DIRECT FLOW)		0	50.

1

ENDPROGRAM PROGRAM CALLED

□

APPENDIX D - UDSWM2-PC - 100 YR

EXISTING HYDRAULIC CONDITIONS

```
   2   1   1   2
   3   4
WATERSHED   1
KNOLLWOOD DRAINAGE BASIN DESIGN PLAN    FMG INC.  MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS    100 YR STORM
        50  0 0  5.0                                                                    1
        01  100
        02    4
        03  105
        04  106
        05  107
        06  108
        07  109
        08  110
        09  111
        10  120
        11  121
        12  122
        13  123
        15  121
        20  131
        30  140
        40  150

    0  111   11    3              1.
    0   11  110    1   100.0    2970    .018      4.      4.    .016     5.0
    0  110  303    3              1.
    0  303   10 12 2     0.1      1.
        0         0         1         5       2.3        22         5        31
       14        44        17        91        21       138        25       163
       36       230        42       341        49       664        57      1301
    0   10  109    2     6.5     320    .002      0.      0.    .016     4.0
    0  109  302    3              1.
    0  302    9  8 2     0.1      1.
        0         0         0         1        .2         4        .8         5
      2.4         7       4.6         8       7.3        74      10.4       365
    0    9  108    1    20.0    1280    .008     50.     50.    .050    10.0
    0  108  301    3              1.
    0  301    8  9 2     0.1      1.
        0         0         0         3      10.2        37      14.5        42
     19.3        47      24.5        50      30.3        55      36.9        88
     44.2       192
    0    8  107    5     5.0    2541    .003      .0      .0    .016     5.0
                      1.0    2541    .003     20.     20.    .020    10.0
    0  107  300    3              1.
    0  300    7  3 2     0.1      1.
        0         0       1.9       140      17.9       400
    0    7  106    5     5.0    1922    .005      .0      .0    .016     5.0
                      1.0    1922    .005     20.     20.    .020    10.0
    0  106    6    3              1.
    0    6    5    5     5.0     945    .005      .0      .0    .016     5.0
                      1.0     945    .005     20.     20.    .020    10.0
    0    5  105    1    20.0    2400    .011      5.      5.    .063    20.0
    0  105    4    3              1.
    0    4  104    1    20.0     700    .015      3.      3.    .063    20.0
```

```
   0  104    3    3              1.
   0    3    2    5     4.0     600.    .027      .0      .0    .016     4.0
                         50.0     600    .027     25.     25.    .050    10.0
   0    2    1    1    50.0     450    .015     20.      8.    .063    10.0
   0    1  100    5     5.0    1766    .008      .0      .0    .016     5.0
                          1.0    1766    .008     20.     20.    .020    10.0
   0  100    0    3              1.
   0  150   91    3              1.
   0   91   90    2     1.5      50    .010      .0      .0    .016     1.5
   0   90    0    1   100.0    1000    .005     50.     50.    .050    10.0
   0  123   52    3              1.
   0   52  122    1    30.0     600    .033      4.      4.    .063    10.0
   0  122   51    3              1.
   0   51  121    1    20.0     500    .018      4.      4.    .044    10.0
   0  121   50    3              1.
   0   50  120    5     3.0     983    .004      .0      .0    .016     3.0
                          1.0     983    .004     20.     20.    .020    10.0
   0  120    0    3              1.
   0  131   70    3              1.
   0   70  130    4      .5     500    .005     12.     12.    .016      .5
                         10.0     500    .005     20.     20.    .020    10.0
   0  130    0    3              1.
   0  140  320    3              1.
   0  320   80  4 2     0.1      1.
        0         0       5.5         9        14        22        17        117
   0   80    0    2     2.0     450     .01      .0      .0    .016     2.0

   0
  40
   1    2    3    4    5    6    7    8    9   10   11   50   51   52   70   80
  90   91  105  106  107  108  109  110  111  120  121  122  123  130  131  140
 131  140  150  300  301  302  303  320
ENDPROGRAM
□□
```

1

ENVIRONMENTAL PROTECTION AGENCY - STORM WATER MANAGEMENT MODEL - VERSION PC.1

DEVELOPED BY METCALF + EDDY, INC.
UNIVERSITY OF FLORIDA
WATER RESOURCES ENGINEEERS, INC. (SEPTEMBER 1970)

UPDATED BY UNIVERSITY OF FLORIDA (JUNE 1973)
HYDROLOGIC ENGINEERING CENTER, CORPS OF ENGINEERS
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS (SEPTEMBER 1974)
BOYLE ENGINEERING CORPORATION (MARCH 1985, JULY 1985)

OTAPE OR DISK ASSIGNMENTS

JIN(1)	JIN(2)	JIN(3)	JIN(4)	JIN(5)	JIN(6)	JIN(7)	JIN(8)	JIN(9)	JIN(10)
2	1	0	0	0	0	0	0	0	0

JOUT(1)	JOUT(2)	JOUT(3)	JOUT(4)	JOUT(5)	JOUT(6)	JOUT(7)	JOUT(8)	JOUT(9)	JOUT(10)
1	2	0	0	0	0	0	0	0	0

NSCRAT(1)	NSCRAT(2)	NSCRAT(3)	NSCRAT(4)	NSCRAT(5)
3	4	0	0	0

1

WATERSHED PROGRAM CALLED

*** ENTRY MADE TO RUNOFF MODEL ***

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

ONUMBER OF TIME STEPS 50
OINTEGRATION TIME INTERVAL (MINUTES), 5.00

25.0 PERCENT OF IMPERVIOUS AREA HAS ZERO DETENTION DEPTH
1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

HYDROGRAPHS FROM CUHPE/PC ARE LISTED FOR THE FOLLOWING 17 SUBCATCHMENTS

TIME(HR/MIN)	1	2	3	4	5	6	7	8	9	10
	40	11	12	13	15	20	30			
0 0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 5.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.			
0 10.	2.	2.	2.	10.	4.	2.	1.	5.	3.	1.
	1.	2.	2.	1.	3.	2.	3.			
0 15.	11.	14.	14.	47.	24.	7.	7.	49.	22.	7.
	12.	10.	7.	8.	10.	6.	12.			
0 20.	36.	44.	44.	109.	72.	17.	19.	164.	44.	20.
	42.	23.	17.	24.	18.	14.	26.			
0 25.	77.	91.	96.	232.	163.	40.	47.	329.	93.	41.
	85.	47.	35.	51.	37.	34.	69.			
0 30.	155.	173.	190.	528.	367.	98.	113.	652.	194.	87.
	161.	100.	79.	105.	81.	91.	197.			
0 35.	263.	275.	313.	818.	669.	163.	198.	950.	156.	121.
	233.	132.	114.	178.	65.	122.	272.			
0 40.	291.	280.	347.	719.	804.	184.	241.	776.	102.	107.
	207.	114.	106.	213.	42.	111.	256.			
0 45.	257.	238.	305.	549.	733.	171.	233.	553.	71.	85.

		161.	89.	88.	199.	28.	94.	220.			
0	50.	216.	196.	253.	420.	618.	152.	211.	408.	52.	67.
		125.	70.	72.	174.	21.	79.	186.			
0	55.	179.	159.	209.	324.	513.	133.	187.	310.	40.	52.
		98.	53.	58.	150.	16.	65.	154.			
1	0.	148.	130.	172.	256.	424.	117.	165.	247.	36.	38.
		77.	40.	46.	128.	15.	54.	130.			
1	5.	125.	110.	145.	221.	358.	104.	147.	218.	35.	32.
		65.	34.	36.	111.	14.	46.	113.			
1	10.	107.	93.	125.	185.	307.	91.	130.	188.	22.	27.
		55.	28.	29.	96.	9.	32.	91.			
1	15.	84.	70.	99.	129.	248.	76.	110.	132.	17.	20.
		41.	21.	22.	80.	7.	23.	69.			
1	20.	62.	55.	74.	95.	193.	61.	91.	102.	11.	15.
		32.	15.	16.	62.	4.	17.	51.			
1	25.	46.	42.	56.	66.	147.	49.	75.	72.	9.	11.
		24.	11.	12.	45.	4.	12.	35.			
1	30.	36.	34.	44.	51.	111.	38.	61.	60.	8.	9.
		20.	9.	9.	34.	3.	9.	25.			
1	35.	30.	29.	37.	44.	85.	28.	50.	55.	8.	8.
		18.	8.	8.	28.	3.	7.	20.			
1	40.	26.	26.	32.	40.	69.	21.	40.	53.	8.	7.
		17.	7.	7.	23.	3.	6.	16.			
1	45.	24.	24.	30.	38.	60.	18.	30.	52.	8.	7.
		16.	7.	6.	20.	3.	5.	14.			
1	50.	22.	23.	28.	37.	55.	15.	25.	52.	8.	7.
		16.	7.	6.	19.	3.	5.	12.			
1	55.	21.	22.	27.	37.	51.	13.	21.	52.	8.	7.
		16.	7.	6.	17.	3.	5.	11.			
2	0.	21.	22.	27.	37.	49.	12.	19.	52.	8.	7.
		16.	7.	6.	16.	3.	5.	10.			
2	5.	19.	20.	25.	31.	45.	10.	16.	43.	3.	5.
		14.	5.	5.	15.	0.	4.	8.			
2	10.	14.	13.	18.	16.	34.	8.	13.	18.	0.	3.
		7.	3.	3.	12.	0.	2.	5.			
2	15.	9.	8.	11.	8.	22.	5.	9.	7.	0.	2.
		4.	1.	2.	8.	0.	2.	4.			
2	20.	6.	5.	7.	4.	14.	4.	7.	3.	0.	0.
		2.	0.	0.	6.	0.	0.	3.			
2	25.	4.	3.	4.	2.	9.	3.	5.	0.	0.	0.
		0.	0.	0.	4.	0.	0.	2.			
2	30.	2.	2.	3.	0.	6.	2.	4.	0.	0.	0.
		0.	0.	0.	3.	0.	0.	0.			
2	35.	0.	0.	1.	0.	4.	2.	3.	0.	0.	0.
		0.	0.	0.	2.	0.	0.	0.			
2	40.	0.	0.	0.	0.	2.	0.	2.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			
2	45.	0.	0.	0.	0.	1.	0.	1.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.			

1

KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES HORIZ TO VERT L	R	OVERBANK/SURCHARGE MANNING N	DEPTH (FT)	JK
111	11	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
11	110	0	1	CHANNEL	100.0	2970.	.0180	4.0	4.0	.016	5.00	0
110	303	0	3		.0	1.	.0010	.0	.0	.001	10.00	0
303	10	12	2	PIPE	.1	1.	.0010	.0	.0	.001	.10	0
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW										
		.0	.0	1.0 5.0	2.3	22.0	5.0	31.0	14.0	44.0	17.0 91.0	
		21.0	138.0	25.0 163.0	36.0	230.0	42.0	341.0	49.0	664.0	57.0 1301.0	
10	109	0	2	PIPE	6.5	320.	.0020	.0	.0	.016	6.50	0
109	302	0	3		.0	1.	.0010	.0	.0	.001	10.00	0

```
 302          9          8          2      PIPE              .1        1.     .0010       .0     .0       .001        .10        0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                          .0       .0        .0     1.0        .2      4.0       .8     5.0      2.4      7.0       4.6      8.0
                         7.3     74.0      10.4   365.0
   9        108          0          1      CHANNEL          20.0     1280.     .0080      50.0   50.0       .050      10.00        0
 108        301          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 301          8          9          2      PIPE              .1        1.     .0010       .0     .0       .001        .10        0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                          .0       .0        .0     3.0      10.2      37.0      14.5    42.0     19.3     47.0      24.5     50.0
                        30.3     55.0      36.9    88.0      44.2     192.0
   8        107          0          5      PIPE              5.0     2541.     .0030       .0     .0       .016       5.00        0
                                             OVERFLOW        1.0     2541.     .0030      20.0   20.0       .020      10.00
 107        300          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 300          7          3          2      PIPE              .1        1.     .0010       .0     .0       .001        .10        0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                          .0       .0       1.9   140.0      17.9     400.0
   7        106          0          5      PIPE              5.0     1922.     .0050       .0     .0       .016       5.00        0
                                             OVERFLOW        1.0     1922.     .0050      20.0   20.0       .020      10.00
 106          6          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
   6          5          0          5      PIPE              5.0      945.     .0050       .0     .0       .016       5.00        0
                                             OVERFLOW        1.0      945.     .0050      20.0   20.0       .020      10.00
   5        105          0          1      CHANNEL          20.0     2400.     .0110       5.0    5.0       .063      20.00        0
 105          4          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
   4        104          0          1      CHANNEL          20.0      700.     .0150       3.0    3.0       .063      20.00        0
 104          3          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
   3          2          0          5      PIPE              4.0      600.     .0270       .0     .0       .016       4.00        0
                                             OVERFLOW       50.0      600.     .0270      25.0   25.0       .050      10.00
   2          1          0          1      CHANNEL          50.0      450.     .0150      20.0    8.0       .063      10.00        0
   1        100          0          5      PIPE              5.0     1766.     .0080       .0     .0       .016       5.00        0
                                             OVERFLOW        1.0     1766.     .0080      20.0   20.0       .020      10.00
 100          0          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 150         91          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
  91         90          0          2      PIPE              1.5       50.     .0100       .0     .0       .016       1.50        0
  90          0          0          1      CHANNEL         100.0     1000.     .0050      50.0   50.0       .050      10.00        0
 123         52          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
  52        122          0          1      CHANNEL          30.0      600.     .0330       4.0    4.0       .063      10.00        0
 122         51          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
  51        121          0          1      CHANNEL          20.0      500.     .0180       4.0    4.0       .044      10.00        0
 121         50          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
  50        120          0          5      PIPE              3.0      983.     .0040       .0     .0       .016       3.00        0
                                             OVERFLOW        1.0      983.     .0040      20.0   20.0       .020      10.00
 120          0          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 131         70          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
  70        130          0          4      CHANNEL           .5      500.     .0050      12.0   12.0       .016        .50        0
                                             OVERFLOW       10.0      500.     .0050      20.0   20.0       .020      10.00
 130          0          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 140        320          0          3                         .0        1.     .0010       .0     .0       .001      10.00        0
 320         80          4          2      PIPE              .1        1.     .0010       .0     .0       .001        .10        0
                    RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW
                          .0       .0       5.5     9.0      14.0      22.0      17.0   117.0
  80          0          0          2      PIPE              2.0       450.     .0100       .0     .0       .016       2.00        0
OTOTAL NUMBER OF GUTTERS/PIPES,  40
1
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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

ARRANGEMENT OF SUBCATCHMENTS AND GUTTERS/PIPES

GUTTER	TRIBUTARY GUTTER/PIPE										TRIBUTARY SUBAREA										D.A.(AC)
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
3	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
4	105	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	808.3
5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
6	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	673.3
7	300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
8	301	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
9	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
10	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
11	111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24.3
50	121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	114.6
51	122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78.1
52	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.1
70	131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
80	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6

90	91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9
91	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9
100	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	875.5
104	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.3
105	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	748.8
106	7	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	673.3
107	8	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	514.6
108	9	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	321.3
109	10	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	267.5
110	11	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	193.3
111	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	24.3
120	50	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	138.9
121	51	0	0	0	0	0	0	0	0	0	11	15	0	0	0	0	0	0	0	0	0	114.6
122	52	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	78.1
123	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	53.1
130	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30.1
131	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	30.1
140	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	73.6
150	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	42.9
300	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	514.6
301	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321.3
302	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	267.5
303	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193.3
320	140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.6

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

HYDROGRAPHS ARE LISTED FOR THE FOLLOWING 40 CONVEYANCE ELEMENTS

THE UPPER NUMBER IS DISCHARGE IN CFS
THE LOWER NUMBER IS ONE OF THE FOLLOWING CASES:
( ) DENOTES DEPTH ABOVE INVERT IN FEET
(S) DENOTES STORAGE IN AC-FT FOR DETENSION DAM. DISCHARGE INCLUDES SPILLWAY OUTFLOW.
(I) DENOTES GUTTER INFLOW IN CFS FROM SPECIFIED INFLOW HYDROGRAPH
(D) DENOTES DISCHARGE IN CFS DIVERTED FROM THIS GUTTER
(O) DENOTES STORAGE IN AC-FT FOR SURCHARGED GUTTER

TIME(HR/MIN)	1 11 107 131	2 50 108 140	3 51 109 131	4 52 110 140	5 70 111 150	6 80 120 300	7 90 121 301	8 91 122 302	9 105 123 303	10 106 130 320
0 5.	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)	0. .0(S)
0 10.	0. .0( )	0. .0( )	0. .1( )	0. .0( )	0. .0( )	3. .5( )	0. .1( )	0. .1( )	0. .0( )	0. .1( )
	0. .0( )	2. .4( )	0. .0( )	0. .0( )	0. .1( )	0. .0( )	0. .0( )	1. .4( )	2. .0( )	10. .0( )
	4. .0( )	2. .0( )	1. .0( )	5. .0( )	3. .0( )	2. .0( )	6. .0( )	2. .0( )	1. .0( )	0. .0( )
	2. .0( )	3. .0( )	2. .0( )	3. .0( )	1. .0( )	1. .0(S)	2. .0(S)	1. .0(S)	0. .0(S)	0. .0(S)

0	15.	0.	0.	5.	7.	1.	30.	1.	0.	0.	0.
		.0( )	.0( )	.4( )	.3( )	.1( )	1.5( )	.3( )	.2( )	.0( )	.2( )
		1.	13.	3.	2.	3.	0.	1.	9.	15.	48.
		.0( )	1.3( )	.1( )	.1( )	.3( )	.1( )	.0( )	.0(0)	.0( )	.0( )
		24.	7.	7.	50.	22.	20.	23.	9.	8.	3.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	12.	6.	12.	12.	6.	3.	1.	1.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.1(S)	.0(S)	.0(S)	.2(S)	.1(S)
0	20.	4.	14.	44.	52.	12.	94.	8.	1.	0.	3.
		.5( )	.2( )	1.3( )	.9( )	.4( )	2.9( )	.8( )	.4( )	.0( )	.6( )
		7.	37.	17.	11.	10.	0.	2.	9.	56.	118.
		.0( )	3.1( )	.4( )	.2( )	.5( )	.2( )	.1( )	.1(0)	.0( )	.0( )
		73.	17.	22.	170.	44.	57.	59.	28.	24.	10.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		14.	26.	14.	26.	42.	23.	3.	3.	5.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.3(S)	.1(S)	.1(S)	.9(S)	.2(S)
0	25.	45.	92.	154.	168.	47.	183.	33.	2.	1.	18.
		1.7( )	.7( )	2.7( )	1.8( )	.9( )	5.6( )	1.6( )	.4( )	.1( )	1.3( )
		25.	72.	53.	35.	24.	1.	3.	9.	144.	265.
		.1( )	3.8( )	.7( )	.4( )	.7( )	.3( )	.1( )	.5(0)	.0( )	.0( )
		165.	40.	64.	355.	93.	114.	137.	70.	51.	24.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		34.	69.	34.	69.	85.	62.	4.	4.	23.	1.
		.0( )	.0( )	.0( )	.0( )	.0( )	.8(S)	.3(S)	.4(S)	2.7(S)	.5(S)
0	30.	165.	231.	282.	398.	142.	413.	92.	3.	1.	33.
		3.6( )	1.2( )	4.5( )	2.9( )	1.7( )	6.6( )	2.8( )	.5( )	.1( )	1.8( )
		77.	194.	132.	81.	68.	2.	4.	9.	331.	620.
		.2( )	4.4( )	1.2( )	.7( )	1.0( )	.4( )	.1( )	1.3(0)	.0( )	.0( )
		369.	99.	146.	729.	194.	282.	313.	160.	105.	68.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		91.	197.	91.	197.	161.	141.	5.	5.	33.	2.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.0(S)	.7(S)	1.1(S)	6.2(S)	1.4(S)
0	35.	289.	514.	646.	805.	361.	817.	153.	4.	2.	39.
		6.0( )	1.9( )	5.2( )	4.2( )	2.8( )	7.3( )	4.2( )	.7( )	.1( )	2.0( )
		131.	362.	244.	153.	115.	4.	5.	9.	674.	971.
		.3( )	4.9( )	1.7( )	1.1( )	1.2( )	.7( )	.1( )	2.6(0)	.0( )	.0( )
		673.	165.	238.	1081.	156.	483.	440.	267.	178.	115.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		122.	272.	122.	272.	233.	182.	8.	7.	41.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	4.5(S)	1.6(S)	2.4(S)	12.2(S)	3.0(S)
0	40.	636.	979.	1097.	1197.	637.	945.	173.	7.	3.	94.
		6.8( )	2.6( )	5.7( )	5.1( )	3.7( )	7.5( )	5.5( )	.8( )	.2( )	3.2( )
		130.	450.	309.	206.	117.	7.	6.	9.	984.	892.
		.3( )	5.0( )	1.9( )	1.3( )	1.2( )	.9( )	.1( )	4.0(0)	.0( )	.0( )
		811.	187.	335.	906.	102.	557.	464.	312.	213.	117.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		111.	256.	111.	256.	207.	241.	12.	8.	109.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	8.1(S)	2.7(S)	4.3(S)	18.5(S)	4.8(S)
0	45.	1072.	1284.	1312.	1322.	775.	814.	215.	10.	10.	150.
		7.4( )	3.0( )	5.9( )	5.4( )	4.1( )	7.3( )	5.9( )	1.0( )	.3( )	4.3( )
		105.	441.	300.	206.	99.	10.	6.	9.	1080.	764.
		.2( )	5.0( )	1.9( )	1.3( )	1.1( )	1.0( )	.1( )	5.2(0)	.0( )	.0( )
		743.	181.	383.	658.	71.	526.	417.	294.	199.	99.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		94.	220.	94.	220.	161.	298.	16.	55.	150.	10.
		.0( )	.0( )	.0( )	.0( )	.0( )	11.6(S)	3.9(S)	6.5(S)	23.0(S)	6.4(S)
0	50.	1277.	1299.	1278.	1251.	770.	719.	270.	14.	43.	165.
		7.6( )	3.0( )	5.9( )	5.2( )	4.0( )	7.2( )	6.2( )	1.2( )	.6( )	4.7( )
		81.	386.	262.	181.	84.	12.	7.	9.	1024.	690.
		.2( )	4.9( )	1.7( )	1.2( )	1.0( )	1.2( )	.1( )	6.2(0)	.0( )	.0( )
		632.	195.	376.	489.	52.	453.	352.	253.	174.	84.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		79.	186.	79.	186.	125.	339.	20.	173.	168.	12.

		.0( )	.0( )	.0( )	.0( )	.0( )	14.1(S)	5.0(S)	8.4(S)	25.8(S)	7.7(S)
0	55.	1246.	1190.	1159.	1125.	724.	661.	318.	18.	116.	178.
		7.6( )	2.9( )	5.8( )	5.0( )	3.9( )	7.1( )	6.4( )	1.3( )	1.0( )	5.0( )
		64.	325.	223.	157.	69.	14.	7.	9.	933.	641.
		.2( )	4.8( )	1.6( )	1.1( )	1.0( )	1.3( )	.1( )	6.9(0)	.0( )	.0( )
		531.	249.	366.	374.	40.	377.	292.	215.	150.	69.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		65.	154.	65.	154.	98.	365.	24.	270.	179.	14.
		.0( )	.0( )	.0( )	.0( )	.0( )	15.7(S)	6.4(S)	9.4(S)	27.6(S)	8.8(S)
1	0.	1136.	1066.	1038.	1008.	677.	621.	350.	23.	198.	184.
		7.4( )	2.7( )	5.7( )	4.7( )	3.8( )	7.0( )	6.5( )	1.5( )	1.2( )	5.1( )
		52.	272.	189.	135.	57.	15.	8.	9.	849.	606.
		.1( )	4.7( )	1.5( )	1.0( )	.9( )	1.4( )	.1( )	7.4(0)	.0( )	.0( )
		447.	314.	349.	298.	36.	310.	243.	181.	128.	57.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		54.	130.	54.	130.	77.	378.	30.	312.	185.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	16.5(S)	8.2(S)	9.8(S)	28.7(S)	9.6(S)
1	5.	1024.	962.	939.	915.	639.	597.	369.	29.	259.	189.
		7.3( )	2.6( )	5.6( )	4.5( )	3.7( )	7.0( )	6.5( )	1.7( )	1.3( )	5.3( )
		45.	230.	159.	116.	49.	16.	8.	9.	784.	590.
		.1( )	4.5( )	1.3( )	.9( )	.9( )	1.5( )	.1( )	7.8(0)	.0( )	.0( )
		387.	363.	336.	263.	35.	262.	208.	153.	111.	49.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		46.	113.	46.	113.	64.	382.	37.	327.	189.	16.
		.0( )	.0( )	.0( )	.0( )	.0( )	16.8(S)	10.3(S)	10.0(S)	29.3(S)	10.4(S)
1	10.	931.	881.	864.	845.	609.	574.	377.	35.	295.	191.
		7.2( )	2.5( )	5.5( )	4.3( )	3.6( )	7.0( )	6.5( )	1.9( )	1.4( )	5.3( )
		38.	195.	136.	101.	38.	17.	8.	9.	734.	561.
		.1( )	4.4( )	1.2( )	.8( )	.8( )	1.5( )	.1( )	8.2(0)	.0( )	.0( )
		341.	385.	321.	226.	22.	221.	172.	130.	96.	38.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		32.	91.	32.	91.	55.	380.	40.	328.	192.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	16.7(S)	12.6(S)	10.0(S)	29.7(S)	11.0(S)
1	15.	856.	812.	793.	771.	578.	531.	377.	38.	310.	192.
		7.1( )	2.4( )	5.4( )	4.1( )	3.5( )	6.9( )	6.5( )	2.0( )	1.4( )	5.4( )
		31.	162.	114.	86.	27.	18.	9.	9.	677.	505.
		.1( )	4.3( )	1.1( )	.8( )	.7( )	1.6( )	.1( )	8.4(0)	.0( )	.0( )
		287.	386.	302.	163.	17.	182.	141.	108.	80.	27.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		23.	69.	23.	69.	41.	373.	43.	320.	192.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	16.2(S)	15.0(S)	9.9(S)	29.7(S)	11.4(S)
1	20.	784.	737.	716.	691.	540.	484.	371.	42.	312.	190.
		7.0( )	2.3( )	5.3( )	3.9( )	3.4( )	6.8( )	6.5( )	2.1( )	1.5( )	5.3( )
		25.	132.	91.	69.	19.	18.	9.	9.	614.	466.
		.1( )	4.2( )	1.0( )	.7( )	.6( )	1.6( )	.1( )	8.6(0)	.0( )	.0( )
		234.	373.	282.	126.	11.	147.	111.	85.	62.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		16.	51.	16.	51.	32.	361.	45.	306.	190.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	15.5(S)	17.3(S)	9.8(S)	29.4(S)	11.7(S)
1	25.	711.	661.	641.	619.	500.	445.	360.	44.	304.	187.
		6.9( )	2.1( )	5.2( )	3.6( )	3.3( )	6.7( )	6.5( )	2.1( )	1.4( )	5.2( )
		20.	105.	71.	53.	14.	19.	9.	9.	556.	426.
		.1( )	4.0( )	.8( )	.6( )	.6( )	1.7( )	.1( )	8.8(0)	.0( )	.0( )
		191.	353.	262.	92.	9.	116.	85.	64.	45.	14.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		12.	35.	12.	35.	24.	345.	47.	289.	186.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	14.5(S)	19.5(S)	9.6(S)	28.8(S)	11.8(S)
1	30.	641.	594.	577.	557.	462.	411.	345.	46.	292.	183.
		6.8( )	2.0( )	5.1( )	3.4( )	3.1( )	6.6( )	6.4( )	2.2( )	1.4( )	5.1( )
		16.	83.	53.	39.	11.	19.	9.	9.	506.	397.
		.1( )	3.9( )	.7( )	.5( )	.5( )	1.7( )	.1( )	8.9(0)	.0( )	.0( )
		157.	330.	244.	76.	8.	92.	66.	49.	34.	11.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )

		9.	25.	9.	25.	20.	327.	48.	271.	182.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	13.4(S)	21.5(S)	9.4(S)	28.2(S)	11.9(S)
1	35.	579.	538.	524.	508.	429.	385.	328.	48.	276.	178.
		6.7( )	1.9( )	5.0( )	3.3( )	3.0( )	6.6( )	6.4( )	2.2( )	1.4( )	5.0( )
		14.	66.	42.	31.	8.	19.	9.	9.	466.	372.
		.1( )	3.7( )	.6( )	.4( )	.5( )	1.7( )	.1( )	8.9(0)	.0( )	.0( )
		133.	304.	228.	69.	8.	74.	53.	39.	28.	8.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		7.	20.	7.	20.	18.	308.	49.	254.	178.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	12.2(S)	23.3(S)	9.2(S)	27.4(S)	11.9(S)
1	40.	528.	494.	482.	469.	400.	362.	310.	49.	261.	174.
		6.6( )	1.8( )	5.0( )	3.1( )	2.9( )	6.5( )	6.3( )	2.3( )	1.3( )	4.9( )
		12.	55.	35.	26.	7.	19.	9.	9.	433.	350.
		.1( )	3.6( )	.5( )	.4( )	.5( )	1.7( )	.1( )	9.0(0)	.0( )	.0( )
		118.	282.	214.	65.	8.	62.	45.	32.	23.	7.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		6.	16.	6.	16.	17.	289.	50.	238.	173.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	11.0(S)	25.0(S)	9.0(S)	26.7(S)	11.9(S)
1	45.	487.	459.	449.	438.	376.	341.	292.	50.	245.	169.
		6.6( )	1.8( )	4.9( )	3.0( )	2.8( )	6.4( )	6.3( )	2.3( )	1.3( )	4.8( )
		11.	48.	30.	22.	6.	19.	9.	9.	405.	330.
		.1( )	3.5( )	.5( )	.3( )	.4( )	1.7( )	.1( )	9.0(0)	.0( )	.0( )
		111.	263.	200.	63.	8.	55.	40.	28.	20.	6.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	14.	5.	14.	16.	270.	52.	223.	169.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	9.9(S)	26.5(S)	8.9(S)	25.9(S)	11.9(S)
1	50.	454.	430.	422.	412.	354.	322.	275.	52.	230.	165.
		6.5( )	1.7( )	4.8( )	2.9( )	2.7( )	6.4( )	6.2( )	2.3( )	1.3( )	4.7( )
		10.	43.	27.	20.	5.	19.	9.	9.	381.	312.
		.1( )	3.4( )	.5( )	.3( )	.4( )	1.7( )	.1( )	9.1(0)	.0( )	.0( )
		106.	245.	190.	62.	8.	50.	37.	26.	19.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	12.	5.	12.	16.	253.	53.	209.	164.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	8.9(S)	27.9(S)	8.7(S)	25.2(S)	11.9(S)
1	55.	426.	406.	398.	390.	334.	305.	258.	53.	217.	161.
		6.4( )	1.7( )	4.8( )	2.8( )	2.7( )	6.3( )	6.1( )	2.4( )	1.2( )	4.6( )
		10.	40.	25.	18.	5.	19.	9.	9.	360.	295.
		.1( )	3.3( )	.5( )	.3( )	.4( )	1.7( )	.1( )	9.1(0)	.0( )	.0( )
		104.	230.	182.	62.	8.	47.	35.	24.	17.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	11.	5.	11.	16.	237.	54.	198.	160.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	7.9(S)	29.2(S)	8.6(S)	24.5(S)	11.8(S)
2	0.	403.	384.	378.	370.	315.	289.	243.	54.	205.	157.
		6.4( )	1.6( )	4.7( )	2.8( )	2.6( )	6.3( )	6.1( )	2.4( )	1.2( )	4.5( )
		9.	38.	23.	17.	5.	19.	9.	9.	342.	280.
		.1( )	3.2( )	.4( )	.3( )	.4( )	1.7( )	.1( )	9.2(0)	.0( )	.0( )
		103.	217.	175.	61.	8.	45.	34.	23.	16.	5.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		5.	10.	5.	10.	16.	223.	55.	188.	156.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	7.0(S)	30.3(S)	8.5(S)	23.9(S)	11.8(S)
2	5.	382.	365.	359.	351.	298.	272.	229.	56.	195.	152.
		6.3( )	1.6( )	4.7( )	2.7( )	2.5( )	6.2( )	6.0( )	2.5( )	1.2( )	4.4( )
		8.	34.	22.	16.	4.	19.	9.	9.	323.	260.
		.0( )	2.4( )	.4( )	.3( )	.4( )	1.7( )	.1( )	9.2(0)	.0( )	.0( )
		101.	205.	169.	51.	3.	40.	27.	21.	15.	4.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		4.	8.	4.	8.	14.	210.	61.	180.	152.	19.
		.0( )	.0( )	.0( )	.0( )	.0( )	6.2(S)	31.4(S)	8.4(S)	23.2(S)	11.7(S)
2	10.	362.	343.	335.	323.	280.	249.	217.	61.	186.	148.
		6.2( )	1.5( )	4.6( )	2.6( )	2.4( )	6.1( )	5.9( )	2.6( )	1.2( )	4.3( )
		7.	24.	19.	14.	3.	18.	9.	9.	298.	232.
		.0( )	1.9( )	.4( )	.3( )	.3( )	1.6( )	.1( )	9.2(0)	.0( )	.0( )
		94.	194.	160.	24.	0.	27.	21.	17.	12.	3.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )

		2.	5.	2.	5.	7.	198.	65.	173.	147.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	5.5(S)	32.3(S)	8.4(S)	22.4(S)	11.6(S)
2	15.	339.	316.	306.	291.	260.	227.	205.	65.	178.	142.
		6.2( )	1.4( )	4.5( )	2.4( )	2.3( )	6.0( )	5.8( )	2.7( )	1.1( )	4.2( )
		5.	19.	14.	11.	2.	18.	9.	9.	271.	213.
		.0( )	1.6( )	.3( )	.2( )	.3( )	1.6( )	.2( )	9.2(0)	.0( )	.0( )
		87.	183.	152.	13.	0.	20.	16.	12.	8.	2.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		2.	4.	2.	4.	4.	187.	69.	165.	142.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	4.8(S)	33.2(S)	8.3(S)	21.6(S)	11.5(S)
2	20.	313.	287.	277.	262.	241.	210.	194.	69.	169.	135.
		6.1( )	1.4( )	4.4( )	2.3( )	2.2( )	5.9( )	5.7( )	2.8( )	1.1( )	4.0( )
		4.	13.	10.	8.	1.	18.	9.	9.	248.	198.
		.0( )	1.3( )	.3( )	.2( )	.2( )	1.6( )	.2( )	9.2(0)	.0( )	.0( )
		83.	173.	142.	7.	0.	13.	10.	8.	6.	1.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	3.	0.	3.	2.	176.	73.	156.	134.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	4.1(S)	33.9(S)	8.2(S)	20.7(S)	11.4(S)
2	25.	287.	260.	252.	239.	223.	196.	184.	73.	161.	126.
		6.0( )	1.3( )	4.4( )	2.2( )	2.2( )	5.8( )	5.7( )	2.9( )	1.1( )	3.9( )
		3.	9.	7.	6.	0.	18.	9.	9.	228.	186.
		.0( )	1.0( )	.2( )	.2( )	.1( )	1.6( )	.2( )	9.1(0)	.0( )	.0( )
		82.	164.	131.	3.	0.	9.	7.	6.	4.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	2.	0.	2.	0.	166.	76.	146.	124.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	3.5(S)	34.6(S)	8.1(S)	19.8(S)	11.3(S)
2	30.	264.	239.	232.	220.	209.	185.	175.	76.	151.	116.
		5.9( )	1.2( )	4.3( )	2.1( )	2.1( )	5.7( )	5.5( )	3.0( )	1.1( )	3.7( )
		3.	6.	5.	4.	0.	18.	9.	9.	211.	175.
		.0( )	.9( )	.2( )	.1( )	.1( )	1.6( )	.2( )	9.0(0)	.0( )	.0( )
		82.	154.	120.	3.	0.	6.	5.	4.	3.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	157.	79.	136.	115.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	3.0(S)	35.1(S)	8.0(S)	19.0(S)	11.2(S)
2	35.	244.	222.	216.	203.	196.	176.	167.	79.	142.	107.
		5.7( )	1.2( )	4.1( )	2.0( )	2.0( )	5.5( )	5.4( )	3.0( )	1.0( )	3.5( )
		2.	5.	4.	3.	0.	18.	9.	9.	197.	167.
		.0( )	.8( )	.2( )	.1( )	.1( )	1.6( )	.2( )	9.0(0)	.0( )	.0( )
		83.	143.	110.	2.	0.	5.	4.	3.	2.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	149.	81.	126.	106.	18.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.5(S)	35.6(S)	7.8(S)	18.3(S)	11.1(S)
2	40.	229.	210.	206.	190.	185.	169.	162.	81.	132.	99.
		5.6( )	1.2( )	4.0( )	1.9( )	2.0( )	5.4( )	5.2( )	3.1( )	1.0( )	3.3( )
		2.	4.	3.	2.	0.	17.	9.	9.	185.	162.
		.0( )	.7( )	.1( )	.1( )	.0( )	1.6( )	.2( )	8.9(0)	.0( )	.0( )
		84.	132.	101.	2.	0.	4.	3.	2.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	142.	83.	116.	98.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	2.0(S)	36.0(S)	7.7(S)	17.6(S)	10.9(S)
2	45.	214.	189.	176.	180.	177.	162.	148.	83.	123.	91.
		5.4( )	1.1( )	3.0( )	1.9( )	1.9( )	5.2( )	4.0( )	3.1( )	1.0( )	3.2( )
		2.	3.	2.	1.	0.	17.	9.	9.	177.	148.
		.0( )	.6( )	.1( )	.1( )	.0( )	1.5( )	.2( )	8.8(0)	.0( )	.0( )
		85.	123.	93.	2.	0.	3.	2.	1.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	125.	85.	107.	90.	17.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.7(S)	36.3(S)	7.6(S)	17.0(S)	10.8(S)
2	50.	204.	174.	174.	170.	165.	136.	121.	85.	113.	83.
		4.7( )	1.0( )	3.0( )	1.8( )	1.8( )	3.7( )	3.4( )	3.2( )	.9( )	3.0( )
		1.	2.	1.	1.	0.	17.	9.	9.	165.	121.
		.0( )	.5( )	.1( )	.0( )	.0( )	1.5( )	.2( )	8.8(0)	.0( )	.0( )
		83.	113.	81.	1.	0.	2.	1.	1.	0.	0.

		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	108. 1.5(S)	86. 36.5(S)	97. 7.5(S)	81. 16.4(S)	17. 10.7(S)
2	55.	173. 3.8( )	163. 1.0( )	154. 2.7( )	154. 1.7( )	146. 1.7( )	108. 3.1( )	105. 3.1( )	86. 3.2( )	104. .9( )	74. 2.8( )
		1. .0( )	1. .4( )	1. .1( )	0. .0( )	0. .0( )	17. 1.5( )	9. .2( )	9. 8.7(0)	146. .0( )	105. .0( )
		87. .0( )	104. .0( )	76. .0( )	1. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	99. 1.3(S)	87. 36.6(S)	88. 7.4(S)	73. 15.9(S)	17. 10.6(S)
3	0.	153. 3.4( )	145. .9( )	140. 2.5( )	137. 1.6( )	129. 1.6( )	100. 3.0( )	97. 2.9( )	87. 3.2( )	95. .9( )	67. 2.7( )
		1. .0( )	1. .3( )	1. .1( )	0. .0( )	0. .0( )	17. 1.5( )	9. .2( )	9. 8.7(0)	129. .0( )	97. .0( )
		85. .0( )	95. .0( )	65. .0( )	1. .0( )	0. .0( )	1. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	94. 1.3(S)	87. 36.7(S)	79. 7.4(S)	66. 15.4(S)	17. 10.5(S)
3	5.	137. 3.1( )	130. .9( )	122. 2.3( )	122. 1.5( )	116. 1.5( )	94. 2.9( )	93. 2.9( )	87. 3.2( )	87. .8( )	60. 2.5( )
		1. .0( )	1. .3( )	0. .0( )	0. .0( )	0. .0( )	17. 1.5( )	9. .2( )	9. 8.6(0)	116. .0( )	93. .0( )
		88. .0( )	87. .0( )	61. .0( )	1. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	91. 1.2(S)	87. 36.8(S)	73. 7.3(S)	59. 15.0(S)	16. 10.4(S)
3	10.	122. 2.9( )	117. .8( )	113. 2.2( )	111. 1.4( )	107. 1.5( )	91. 2.8( )	90. 2.8( )	87. 3.2( )	81. .8( )	54. 2.4( )
		1. .0( )	1. .3( )	0. .0( )	0. .0( )	0. .0( )	16. 1.5( )	9. .2( )	9. 8.5(0)	107. .0( )	90. .0( )
		86. .0( )	81. .0( )	53. .0( )	1. .0( )	0. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	89. 1.2(S)	87. 36.7(S)	71. 7.2(S)	53. 14.6(S)	16. 10.3(S)
3	15.	112. 2.8( )	108. .8( )	104. 2.1( )	103. 1.4( )	100. 1.4( )	89. 2.8( )	89. 2.8( )	87. 3.2( )	76. .8( )	49. 2.2( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	16. 1.5( )	9. .2( )	9. 8.5(0)	100. .0( )	89. .0( )
		89. .0( )	76. .0( )	50. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	88. 1.2(S)	87. 36.7(S)	68. 7.0(S)	48. 14.2(S)	16. 10.1(S)
3	20.	104. 2.6( )	101. .8( )	99. 2.0( )	98. 1.3( )	96. 1.4( )	88. 2.8( )	88. 2.8( )	87. 3.2( )	72. .8( )	44. 2.1( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	16. 1.4( )	9. .2( )	9. 8.4(0)	96. .0( )	88. .0( )
		85. .0( )	72. .0( )	43. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	88. 1.2(S)	86. 36.6(S)	64. 6.9(S)	44. 13.9(S)	16. 10.0(S)
3	25.	98. 2.6( )	97. .7( )	95. 2.0( )	94. 1.3( )	93. 1.3( )	88. 2.8( )	88. 2.8( )	86. 3.2( )	68. .8( )	43. 2.1( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	16. 1.4( )	9. .2( )	9. 8.3(0)	93. .0( )	88. .0( )
		88. .0( )	68. .0( )	45. .0( )	1. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )
		0. .0( )	0. .0( )	0. .0( )	0. .0( )	0. .0( )	87. 1.2(S)	86. 36.5(S)	61. 6.8(S)	44. 13.6(S)	16. 9.9(S)
3	30.	95. 2.5( )	93. .7( )	92. 2.0( )	92. 1.3( )	91. 1.3( )	87. 2.7( )	87. 2.7( )	86. 3.2( )	65. .7( )	43. 2.1( )
		1. .0( )	0. .2( )	0. .0( )	0. .0( )	0. .0( )	16. 1.4( )	9. .2( )	9. 8.3(0)	91. .0( )	87. .0( )

		84.	65.	42.	1.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	87.	85.	58.	43.	16.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.2(S)	36.3(S)	6.7(S)	13.3(S)	9.8(S)
3	35.	92.	91.	90.	90.	89.	87.	87.	85.	62.	43.
		2.5( )	.7( )	1.9( )	1.3( )	1.3( )	2.7( )	2.7( )	3.2( )	.7( )	2.1( )
		1.	0.	0.	0.	0.	15.	9.	9.	89.	87.
		.0( )	.2( )	.0( )	.0( )	.0( )	1.4( )	.2( )	8.2(0)	.0( )	.0( )
		87.	62.	44.	1.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	86.	85.	56.	43.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.2(S)	36.2(S)	6.6(S)	13.0(S)	9.7(S)
3	40.	90.	90.	89.	89.	88.	86.	86.	85.	59.	42.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.7( )	3.2( )	.7( )	2.1( )
		0.	0.	0.	0.	0.	15.	9.	9.	88.	86.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.4( )	.2( )	8.1(0)	.0( )	.0( )
		83.	59.	41.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	86.	84.	54.	42.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.2(S)	36.0(S)	6.5(S)	12.8(S)	9.6(S)
3	45.	89.	89.	88.	88.	87.	86.	86.	84.	57.	42.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.7( )	3.1( )	.7( )	2.1( )
		0.	0.	0.	0.	0.	15.	9.	9.	87.	86.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.4( )	.2( )	8.1(0)	.0( )	.0( )
		85.	57.	43.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	85.	83.	52.	42.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.2(S)	35.9(S)	6.4(S)	12.5(S)	9.5(S)
3	50.	88.	88.	87.	87.	87.	85.	85.	83.	55.	41.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.7( )	3.1( )	.7( )	2.1( )
		0.	0.	0.	0.	0.	15.	9.	9.	87.	85.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.4( )	.2( )	8.0(0)	.0( )	.0( )
		81.	55.	40.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	84.	82.	50.	41.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.1(S)	35.7(S)	6.3(S)	12.2(S)	9.4(S)
3	55.	87.	87.	86.	86.	86.	84.	84.	82.	53.	41.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.7( )	3.1( )	.7( )	2.0( )
		0.	0.	0.	0.	0.	15.	9.	9.	86.	84.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.4( )	.2( )	8.0(0)	.0( )	.0( )
		83.	53.	43.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	84.	81.	49.	41.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.1(S)	35.5(S)	6.3(S)	11.9(S)	9.3(S)
4	0.	86.	86.	86.	86.	85.	84.	83.	81.	51.	41.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.7( )	3.1( )	.7( )	2.0( )
		0.	0.	0.	0.	0.	15.	9.	9.	85.	83.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.4( )	.2( )	7.9(0)	.0( )	.0( )
		80.	51.	39.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	83.	80.	48.	41.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.1(S)	35.3(S)	6.2(S)	11.6(S)	9.2(S)
4	5.	86.	85.	85.	85.	84.	83.	82.	80.	50.	40.
		2.4( )	.7( )	1.9( )	1.2( )	1.3( )	2.7( )	2.6( )	3.1( )	.7( )	2.0( )
		0.	0.	0.	0.	0.	15.	9.	9.	84.	82.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.3( )	.2( )	7.8(0)	.0( )	.0( )
		82.	50.	42.	0.	0.	0.	0.	0.	0.	0.
		.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
		0.	0.	0.	0.	0.	82.	79.	47.	40.	15.
		.0( )	.0( )	.0( )	.0( )	.0( )	1.1(S)	35.1(S)	6.2(S)	11.4(S)	9.1(S)
4	10.	85.	84.	84.	84.	84.	82.	81.	79.	48.	40.
		2.3( )	.7( )	1.9( )	1.2( )	1.3( )	2.6( )	2.6( )	3.0( )	.6( )	2.0( )
		0.	0.	0.	0.	0.	14.	9.	9.	84.	81.
		.0( )	.1( )	.0( )	.0( )	.0( )	1.3( )	.2( )	7.8(0)	.0( )	.0( )

78.	48.	38.	0.	0.	0.	0.	0.	0.	0.
.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )	.0( )
0.	0.	0.	0.	0.	81.	78.	46.	40.	14.
.0( )	.0( )	.0( )	.0( )	.0( )	1.1(S)	34.9(S)	6.1(S)	11.1(S)	9.0(S)

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KNOLLWOOD DRAINAGE BASIN DESIGN PLAN FMG INC. MARCH 1993
FURTURE HYDROLOGIC AND EXISTING HYDRAULIC CONDITIONS 100 YR STORM

*** PEAK FLOWS, STAGES AND STORAGES OF GUTTERS AND DETENSION DAMS ***

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME (HR/MIN)
111	194.	(DIRECT FLOW)		0 30.
11	131.	.3		0 35.
110	1081.	(DIRECT FLOW)		0 35.
303	192.	.1	29.7	1 15.
10	192.	5.4		1 15.
109	383.	(DIRECT FLOW)		0 45.
302	328.	.1	10.0	1 10.
9	312.	1.5		1 20.
108	386.	(DIRECT FLOW)		1 15.
301	87.	.1	36.8	3 5.
8	87.	3.2		3 10.
107	811.	(DIRECT FLOW)		0 40.
300	382.	.1	16.8	1 5.
7	377.	6.5		1 15.
106	971.	(DIRECT FLOW)		0 35.
6	945.	7.5		0 40.
5	775.	4.1		0 45.
123	213.	(DIRECT FLOW)		0 40.
105	1080.	(DIRECT FLOW)		0 45.
52	206.	1.3		0 40.
4	1322.	5.4		0 45.
122	312.	(DIRECT FLOW)		0 40.
104	1322.	(DIRECT FLOW)		0 45.
51	309.	1.9		0 40.
3	1312.	5.9		0 45.
140	272.	(DIRECT FLOW)		0 35.
131	122.	(DIRECT FLOW)		0 35.
121	464.	(DIRECT FLOW)		0 40.
150	233.	(DIRECT FLOW)		0 35.
2	1299.	3.0		0 50.
320	19.	.1	11.9	1 35.
70	117.	1.2		0 40.
50	450.	5.0		0 40.
91	9.	1.5	9.2	2 10.
1	1277.	7.6		0 50.
80	19.	1.7		1 35.
130	117.	(DIRECT FLOW)		0 40.
120	557.	(DIRECT FLOW)		0 40.
90	9.	.2		4 10.
100	1492.	(DIRECT FLOW)		0 50.

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ENDPROGRAM PROGRAM CALLED

□